Water Quality of the Upper West Branch Susquehanna River and Tributary Streams between Curwensville and Renovo, Pennsylvania, May and July 1984

by Robert A. Hainly and James L. Barker

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CONVERSION FACTORS AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
Length		
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
foot per mile (ft/mi)	0.1894	meter per kilometer
Area		
square mile (mi^2)	2.590	square kilometer
Flow		
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
ton per day (ton/d)	907.2	kilograms per day
Flow per Unit Area		
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer
Mass		
ton, short	907.2	kilograms
Temperature		
degree Fahrenheit (°F)	°C = 5/9 / (°F–32)	degree Celsius

Sea Level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first–order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

WATER QUALITY OF THE UPPER WEST BRANCH SUSQUEHANNA RIVER AND TRIBUTARY STREAMS BETWEEN CURWENSVILLE AND RENOVO, PENNSYLVANIA, MAY AND JULY 1984

by Robert A. Hainly and James L. Barker

ABSTRACT

The soils and rocks of the Upper West Branch Susquehanna River basin, from its headwaters downstream for 150 miles, are laden with pyritic materials that have the potential to produce acid mine drainage. The effects of mine drainage are severe, particularly in the reach between Curwensville and Renovo where present water quality cannot support viable populations of benthic macroinvertebrates or fish.

During base-flow periods in May and July 1984, streamflow and water quality were measured at four sites on the West Branch Susquehanna River and near the mouths of 94 tributaries. Water-quality constituents determined were temperature, specific conductance, pH, acidity, alkalinity, and concentrations of dissolved sulfate and the total and dissolved forms of iron, manganese, aluminum, and zinc.

The data collected for the study indicate that the predominant influence on water quality of the tributaries is land use. An area where few or no coal deposits or disturbed area were present was found to have relatively good surface-water quality (median pH was nearly 5.5 units), whereas areas where coal mining was active in the basin, or where large areas of unreclaimed mines were present, were found to have poorest water quality (median pH was generally less than 4.0 units).

In general, Moshannon, Sinnemahoning, Clearfield, and Kettle Creeks were found to be the largest tributary sources of acidity and total-recoverable iron to the river. During the May sampling, Moshannon, Sinnemahoning, and Clearfield Creeks contributed 63 percent of the 365 tons/day of acidity, and Moshannon and Clearfield Creeks contributed 76 percent of the 44.8 tons/day of total-recoverable iron that were discharged to the river. During the July sampling, Moshannon, Kettle, and Clearfield Creeks contributed 60 percent of the 131 tons/day of acidity, and Moshannon and Kettle Creeks contributed 51 percent of the 6.5 tons/day of total-recoverable iron discharged to the river.

The West Branch Susquehanna River was found to have pH ranging from 5.4 to 6.5 units and specific conductance ranging from 267 to 310 µS/cm (microsiemens per centimeter at 25 degrees Celsius) at the most upstream site at Curwensville. The water quality was most degraded at the site at Karthaus (pH 3.9 to 4.1 units, specific conductance 330 to 610 µS/cm). Quality gradually improved downstream to the site at Renovo (pH 3.8 to 4.6 units, specific conductance 200 to 392 µS/cm), although the quality did not recover to that found at Curwensville.

INTRODUCTION

The area drained by the Upper West Branch Susquehanna River, from its headwaters downstream for 150 mi (miles), has undergone substantial surface mining for coal. The soils and rocks disturbed by mining are laden with pyritic materials that have the potential to produce acid mine drainage. The effects of mine drainage are severe, particularly in the reach between Curwensville and Renovo (fig. 1), where present water quality cannot support viable populations of benthic macroinvertebrates or fish. According to a report by the Pennsylvania Department of Environmental Resources (PaDER)(1981), the acid mine drainage also is responsible for masking other forms of water pollution. Because of the general inaccessibility of the river between Curwensville and Renovo, little is known about the water quality of the numerous small tributaries and their effect on the water quality of the river.

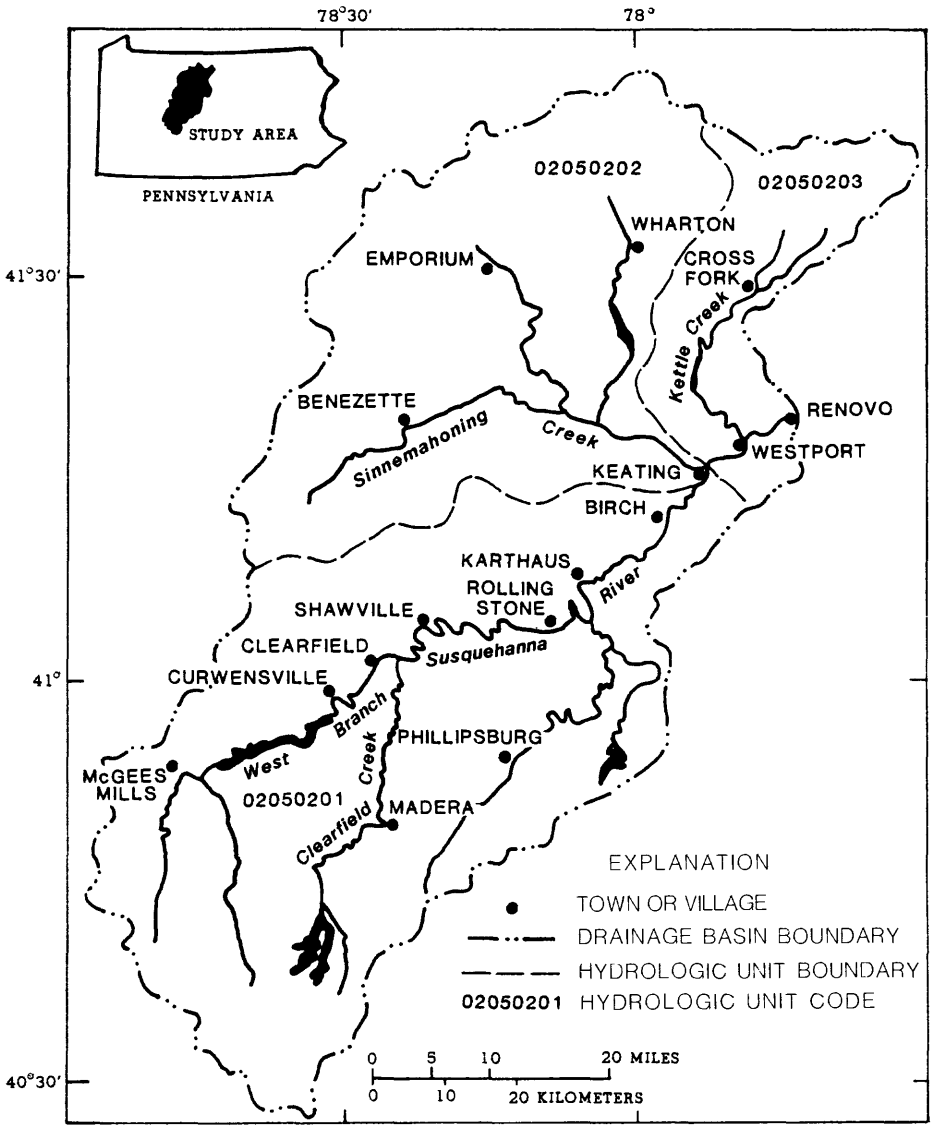


Figure 1.—Major streams, towns, and villages in the Upper West Branch Susquehanna River basin.

Purpose and Scope

This report presents streamflow and water-quality data collected at or near the mouths of 94 tributaries entering the 84-mi reach of the West Branch Susquehanna River between Curwensville and Renovo and at four sites on the river between Curwensville and Renovo in May and July 1984.

In addition to the presentation of instantaneous concentrations of constituents, the instantaneous loads for acidity and total-recoverable iron are computed and presented. These values are used to determine the tributaries' individual and cumulative effect on the water quality of the river.

Previous Studies

Previous water-quality studies of the West Branch Susquehanna River include a cursory report by the Susquehanna River Basin Study Coordinating Committee (1970), a report describing areal coal-hydrology water-quality studies by Herb and others (1983), and a report by Hainly and others (1985) that describes the areal and temporal variability of water quality in the West Branch Susquehanna River using long-term data collected at seven sites. In addition, the PaDER currently operates a water-quality network that includes six of the sites sampled in this investigation.

DATA COLLECTION

During May and July 1984, streamflow and water quality were measured in the Upper West Branch Susquehanna River basin. The sampling program was designed to include a spring and a summer base-flow period. The intent was to sample during flows when acid mine drainage was expected to have the most effect on the water quality of the river. Because of the inaccessibility of the reach investigated, most of the sampling was done by boat. This requirement limited the range of flows at which samples could be collected.

Each of the two sampling periods lasted five days; sampling began at the most upstream site and progressed downstream. Water-quality constituents determined were temperature, specific conductance, pH, acidity, alkalinity, and concentrations of dissolved sulfate and the total and dissolved phases of iron, manganese, aluminum, and zinc. All water-quality and streamflow data are published in the U.S. Geological Survey's annual report (U.S. Geological Survey, 1984).

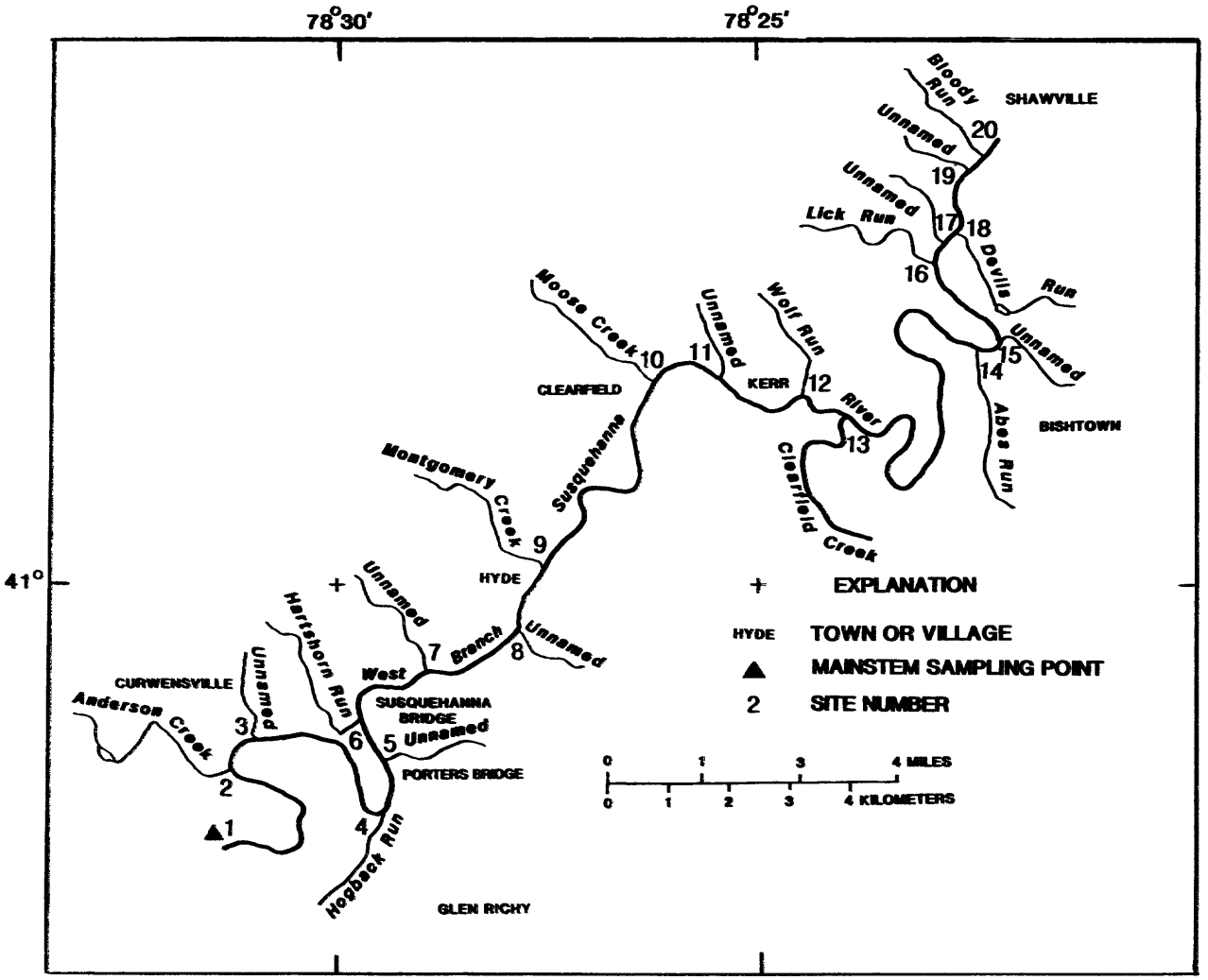


Figure 2.—Location of sampling sites 1 through 20, Curwensville to Shawville.

Sampling Network

All perennial tributaries between Curwensville and Renovo were sampled at or near their mouths. The sample locations included 94 tributary sites and four main-stem river sites (table 1). The drainage areas of the tributaries range from 0.19 to 1,035 mi^2 (square miles). About one-third of the tributaries have a drainage area less than 1.0 mi^2 and about two-thirds have a drainage area less than 5.0 mi^2. Only seven tributaries have drainage areas greater than 40 mi^2. The West Branch Susquehanna River at Renovo drains an area of 2,975 mi^2.

The study reach of the West Branch Susquehanna River has been divided into five 15- to 20-mi segments for ease of illustration. Figure 1 shows the entire study reach and includes major streams and reservoirs, towns, and villages. The five location maps (figs. 2–6) show the 98 sampling sites and some of the larger towns and villages.

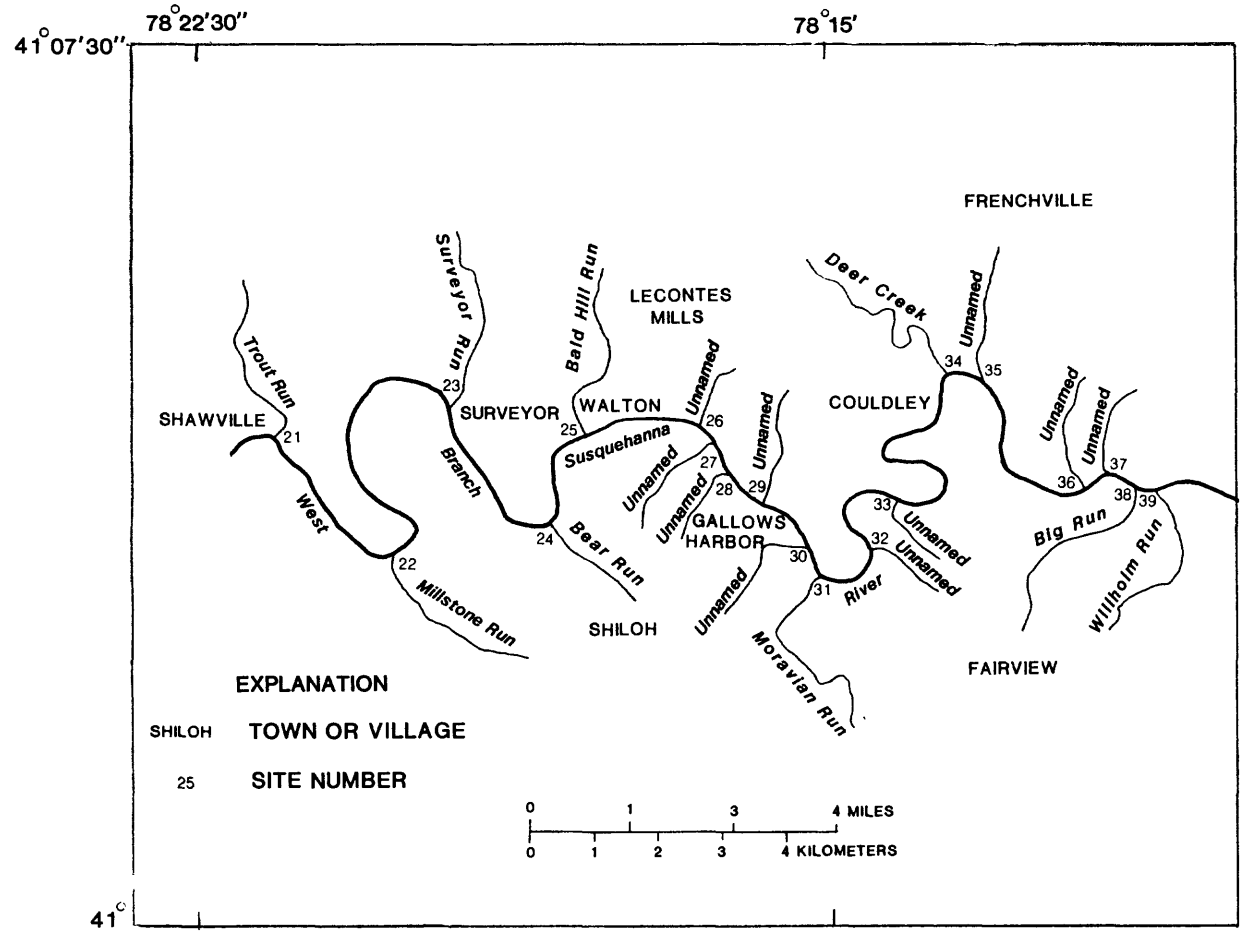


Figure 3.—Location of sampling sites 21 through 39, Shawville to Rolling Stone.

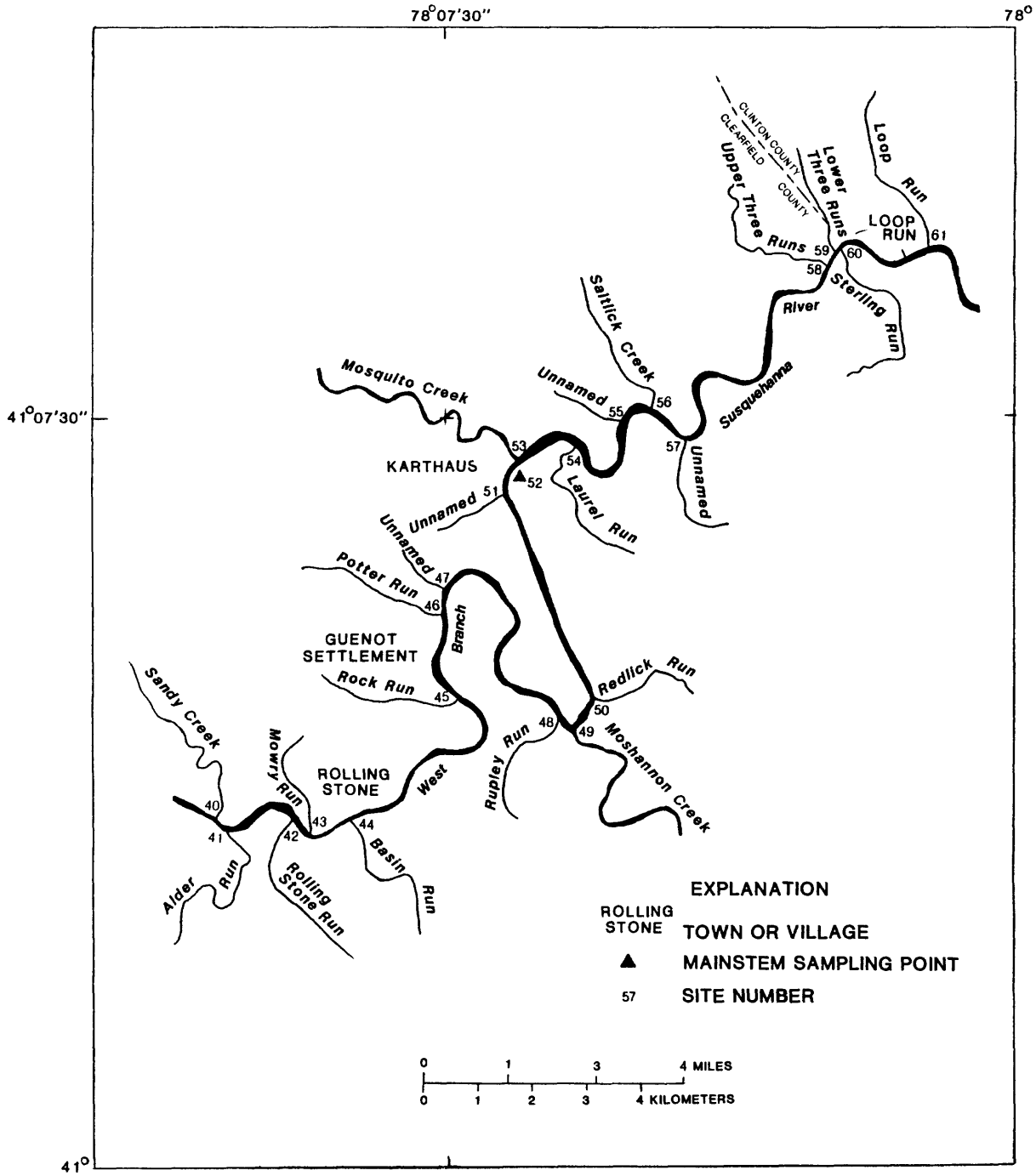


Figure 4.—Location of sampling sites 40 through 61, Rolling Stone to Loop Run.

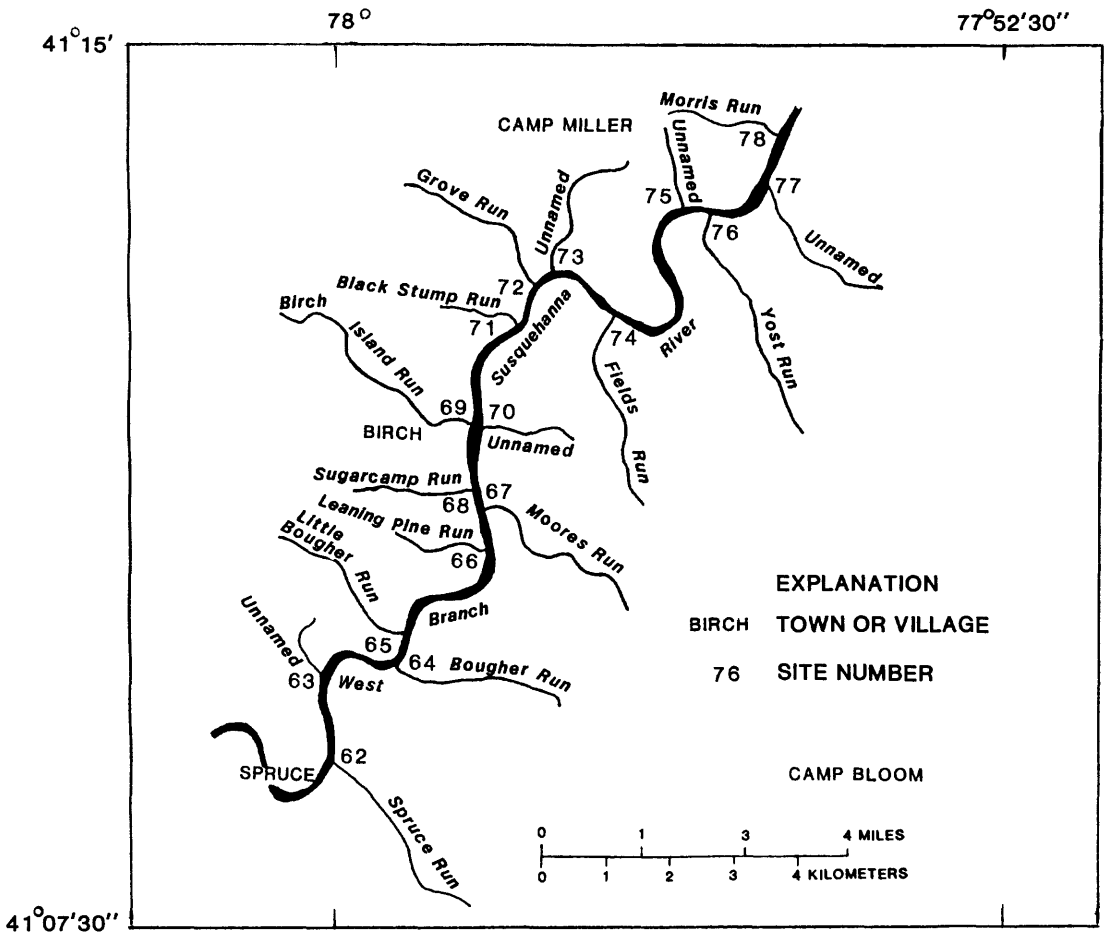


Figure 5.—Location of sampling sites 62 through 78, Loop Run to Camp Miller.

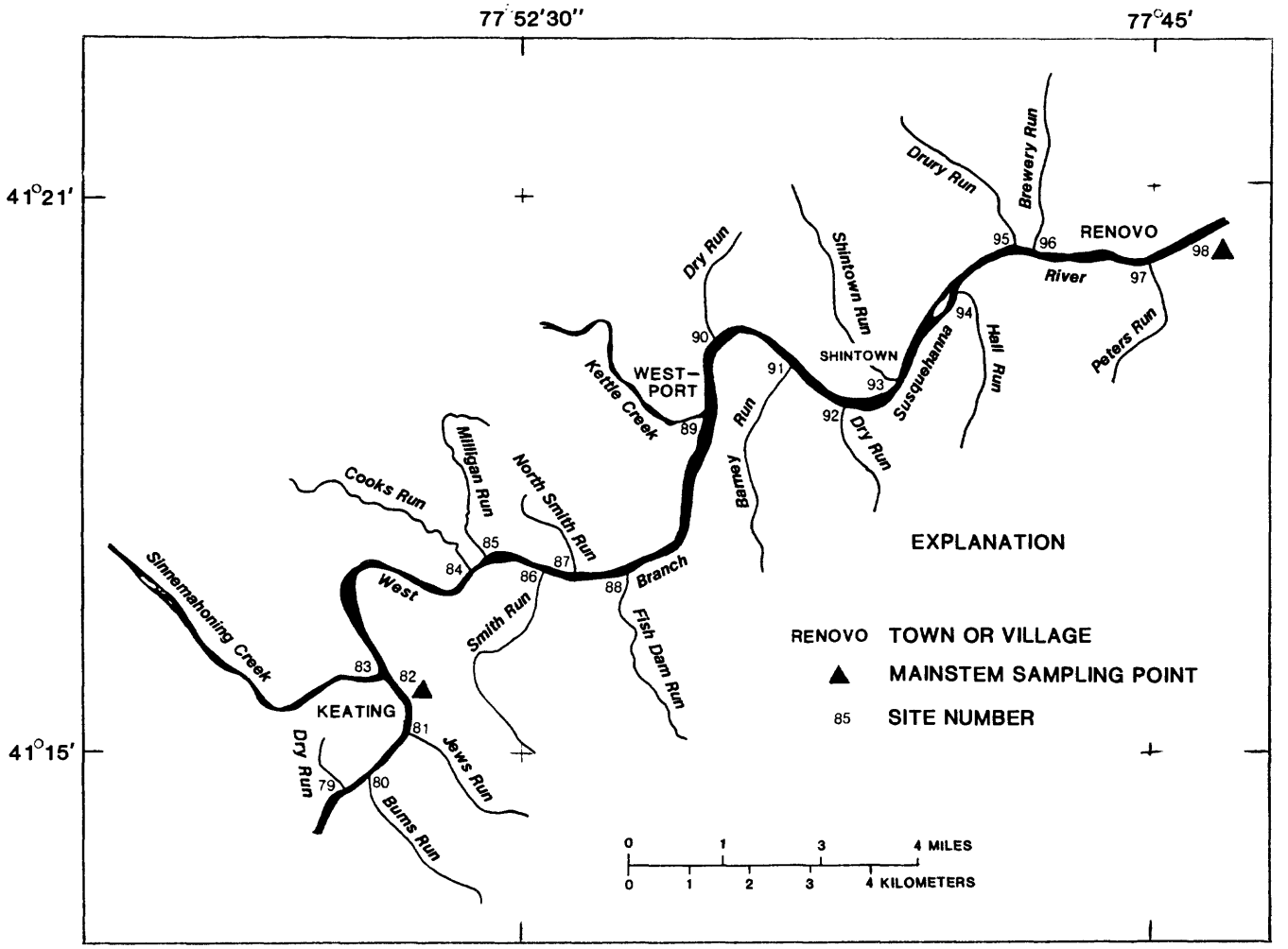


Figure 6.—Location of sampling sites 79 through 98, Camp Miller to Renovo.

Table 1.–List of station names, location, and drainage area

Site number	Station number	Station name	Station location Latitude	Station location Longitude	Drainage area (square miles)
1	01541200	West Branch Susquehanna River at Curwensville, Pa.	40°57'41"	078°31'10"	367
2	01541250	Anderson Creek at Curwensville, Pa.	40°58'19"	078°31'16"	77.8
3	01541253	Unnamed trib. to W. Br. Susquehanna River at Clearfield, Pa'	40°58'38"	078°30'58"	.42
4	01541254	Hogback Run near Glen Richey, Pa.	40°57'57"	078°29'26"	3.25
5	01541255	Unnamed trib. to W. Br. Susquehanna River at Porters Bridge, Pa.	40°58'24"	078°28'24"	.61
6	01541257	Hartshorn Run at Susquehanna Bridge, Pa.	40°58'46"	078°29'42"	4.60
7	01541260	Unnamed trib. to W. Br. Susquehanna River at Susquehanna Bridge, Pa.	40°59'13"	078°28'54"	2.67
8	01541262	Unnamed trib. to W. Br. Susquehanna River at Hyde, Pa.	40°59'35"	078°27'51"	.53
9	01541300	Montgomery Creek at Hyde, Pa.	41°00'14"	078°27'43"	16.5
10	015413051	Moose Creek at Clearfield, Pa.	41°01'49"	078°26'16"	12.3
11	015413053	Unnamed trib. to W. Br. Susquehanna River at Kerr, Pa.	41°01'52"	078°25'29"	.55
12	015413055	Wolf Run at Kerr, Pa.	41°01'42"	078°24'29"	1.71
13	01541552	Clearfield Creek at Clearfield, Pa.	41°01'29"	078°23'59"	393
14	01541555	Abes Run at Bishtown, Pa.	41°02'05"	078°22'24"	1.69
15	01541556	Unnamed trib. to W. Br. Susquehanna River at Bishtown, Pa.	41°02'14"	078°22'05"	.51
16	01541559	Lick Run near Kerr, Pa.	41°02'52"	078°22'58"	27.5
17	01541560	Unnamed trib. to W. Br. Susquehanna River near Shawville, Pa.	41°03'03"	078°22'50"	.39
18	01541562	Devils Run near Shawville, Pa.	41°03'10"	078°22'39"	.74
19	01541564	Unnamed trib. to W. Br. Susquehanna River at Shawville, Pa.	41°03'44"	078°22'31"	.35
20	01541565	Bloody Run at Shawville, Pa.	41°03'50"	078°22'22"	.79
21	01541700	Trout Run at Shawville, Pa.	41°04'09"	078°21'38"	41.8
22	01541710	Millstone Run near Shawville, Pa.	41°03'02"	078°20'21"	6.38
23	01541720	Surveyor Run at Surveyor, Pa.	41°04'25"	078°19'41"	6.01
24	01541722	Bear Run at Shiloh, Pa.	41°03'25"	078°18'32"	1.08
25	01541724	Bald Hill Run at Walton, Pa.	41°04'11"	078°18'10"	2.68
26	01541726	Unnamed trib. to W. Br. Susquehanna River at Lecontes Mills, Pa.	41°04'16"	078°16'54"	.62
27	01541727	Unnamed trib. to W. Br. Susquehanna River near Lecontes Mills, Pa.	41°04'06"	078°16'45"	.40
28	01541728	Unnamed trib. to W. Br. Susquehanna River near Gallows Harbor, Pa.	41°03'50"	078°16'35"	.29
29	01541729	Unnamed trib. to W. Br. Susquehanna River below RR bridge at Gallows Harbor, Pa.	41°03'36"	078°16'10"	.58
30	01541730	Unnamed trib. to W. Br. Susquehanna River at Gallows Harbor, Pa.	41°03'14"	078°15'43"	1.58
31	01541733	Moravian Run at Gallows Harbor, Pa.	41°02'57"	078°15'32"	18.5

Table 1.–List of station names, location, and drainage area–Continued

Site number	Station number	Station name	Station location Latitude	Station location Longitude	Drainage area (square miles)
32	01541734	Unnamed trib. to W. Br. Susquehanna River at Gallows Harbor, Pa.	41°03'11"	078°14'57"	0.28
33	01541735	Unnamed trib. to W. Br. Susquehanna River at Coudley, Pa.	41°03'35"	078°14'41"	.24
34	01541750	Deer Creek at Frenchville, Pa.	41°04'43"	078°14'07"	23.6
35	01541751	Unnamed trib. to W. Br. Susquehanna River at Coudley, Pa.	41°04'39"	078°13'46"	.89
36	01541752	Unnamed trib. to W. Br. Susquehanna River near Fairview, Pa.	41°03'42"	078°12'35"	.72
37	01541753	Unnamed trib. to W. Br. Susquehanna River near Rolling Stone, Pa.	41°03'51"	078°12'22"	.37
38	01541755	Big Run near Rolling Stone, Pa.	41°03'40"	078°12'00"	3.09
39	01541760	Willholm Run near Rolling Stone, Pa.	41°03'41"	078°11'49"	1.24
40	01541770	Sandy Creek at Rolling Stone, Pa.	41°03'30"	078°10'34"	17.3
41	01541850	Alder Run at Rolling Stone, Pa.	41°03'20"	078°10'24"	24.0
42	01541900	Rolling Stone Run at Rolling Stone, Pa.	41°03'29"	078°09'33"	1.73
43	01541950	Mowry Run at Rolling Stone, Pa.	41°03'20"	078°09'19"	1.01
44	01541955	Basin Run at Rolling Stone, Pa.	41°03'29"	078°08'45"	5.21
45	01541960	Rock Run near Guenot Settlement, Pa.	41°04'42"	078°07'22"	2.26
46	01541965	Potter Run near Keewaydin, Pa.	41°05'32"	078°07'33"	1.49
47	01541967	Unnamed trib. to W. Br. Susquehanna River near Keewaydin, Pa.	41°05'46"	078°07'33"	.42
48	01541970	Rupley Run near Karthaus, Pa.	41°04'27"	078°06'01"	.91
49	01542480	Moshannon Creek near Karthaus, Pa.	41°04'21"	078°05'50"	274
50	01542490	Redlick Run near Karthaus, Pa.	41°04'42"	078°05'31"	2.32
51	01542498	Unnamed trib. to W. Br. Susquehanna River at Karthaus, Pa.	41°06'44"	078°06'46"	.31
52	01542500	West Branch Susquehanna River at Karthaus, Pa.	41°07'03"	078°06'33"	1,462
53	01542513	Mosquito Creek at RR bridge at Karthaus, Pa.	41°07'33"	078°06'35"	71.2
54	01542515	Laurel Run at Karthaus, Pa.	41°07'12"	078°05'48"	2.80
55	01542517	Unnamed trib. to W. Br. Susquehanna near Karthaus, Pa.	41°07'27"	078°05'14"	.33
56	01542521	Saltlick Run at Belford, Pa.	41°07'35"	078°04'47"	4.86
57	01542522	Unnamed trib. to W. Br. Susquehanna River at Belford, Pa.	41°07'16"	078°04'21"	1.08
58	01542523	Upper Three Runs near Pottersdale, Pa.	41°09'01"	078°02'32"	17.6
59	015425239	Lower Three Runs near Pottersdale, Pa.	41°09'11"	078°02'24"	8.16
60	01542526	Sterling Run near Pottersdale, Pa.	41°09'10"	078°02'20"	15.8
61	01542530	Loop Run at Loop Run, Pa.	41°09'12"	078°01'11"	3.36
62	01542538	Spruce Run at Spruce, Pa.	41°08'54"	078°00'01"	5.98
63	01542540	Unnamed trib. to W. Br. Susquehanna River at Spruce, Pa.	41°09'39"	078°00'09"	.28
64	01542548	Bougher Run near Birch, Pa.	41°09'42"	077°59'19"	4.10
65	01542550	Little Bougher Run near Birch, Pa.	41°10'00"	077°59'12"	1.16

Table 1.–List of station names, location, and drainage area–Continued

Site number	Station number	Station name	Station location Latitude	Longitude	Drainage area (square miles)
66	01542553	Leaning Pine Run at Birch, Pa.	41°10'42"	077°58'18"	0.37
67	01542557	Moores Run at Birch, Pa.	41°11'04"	077°58'18"	1.66
68	01542560	Sugarcamp Run at Birch, Pa.	41°11'11"	077°58'26"	.97
69	01542565	Birch Island Run at Birch, Pa.	41°11'45"	077°58'28"	17.5
70	01542567	Unnamed trib. to W. Br. Susquehanna River at Birch, Pa.	41°11'46"	077°58'20"	.59
71	01542570	Black Stump Run at Birch, Pa.	41°12'38"	077°57'58"	.38
72	01542575	Grove Run near Birch, Pa.	41°12'57"	077°57'45"	4.59
73	01542577	Unnamed trib. to W. Br. Susquehanna River near Birch, Pa.	41°13'05"	077°57'32"	.80
74	01542588	Fields Run near Birch, Pa.	41°12'42"	077°56'53"	5.81
75	01542598	Unnamed trib. to W. Br. Susquehanna River near Camp Miller, Pa.	41°13'38"	077°56'07"	.28
76	01542603	Yost Run near Camp Bloom, Pa.	41°13'34"	077°55'48"	7.21
77	01542604	Unnamed trib. to W. Br. Susquehanna River near Camp Miller, Pa.	41°13'51"	077°55'08"	1.54
78	01542605	Morris Run near Camp Miller, Pa.	41°14'15"	077°55'01"	1.35
79	01542606	Dry Run near Camp Miller, Pa.	41°14'41"	077°54'39"	.19
80	01542607	Burns Run near Bloody Run Camp, Pa.	41°14'46"	077°54'20"	8.06
81	01542608	Jews Run at Keating, Pa.	41°15'10"	077°53'51"	1.62
82	01542609	West Branch Susquehanna River at Keating, Pa.	41°15'40"	077°54'06"	1,600
83	01544150	Sinnemahoning Creek at Keating, Pa.	41°15'41"	077°54'10"	1,035
84	01544210	Cooks Run near Keating, Pa.	41°16'39"	077°53'07"	25.6
85	01544212	Milligan Run near Keating, Pa.	41°16'45"	077°52'56"	1.35
86	01544214	Smith Run near Westport, Pa.	41°16'38"	077°52'13"	2.61
87	01544216	North Smith Run near Westport, Pa.	41°16'38"	077°51'51"	1.00
88	01544218	Fish Dam Run near Westport, Pa.	41°16'37"	077°51'14"	10.2
89	01545020	Kettle Creek at Westport, Pa.	41°18'02"	077°50'20"	246
90	01545024	Dry Run at Westport, Pa.	41°18'44"	077°50'11"	1.08
91	01545030	Barney Run at Westport, Pa.	41°18'28"	077°49'17"	4.92
92	01545035	Dry Run at Shintown, Pa.	41°18'06"	077°48'40"	.90
93	01545045	Shintown Run at Shintown, Pa.	41°18'21"	077°48'03"	6.95
94	01545065	Hall Run at Shintown, Pa.	41°19'07"	077°47'20"	10.6
95	01545492	Drury Run at Renovo, Pa.	41°19'33"	077°46'37"	18.5
96	01545494	Brewery Run at Renovo, Pa.	41°19'31"	077°46'25"	1.80
97	01545498	Peters Run at Renovo, Pa.	41°19'24"	077°45'04"	1.45
98	01545500	West Branch Susquehanna River at Renovo, Pa.	41°19'24"	077°45'02"	2,975

Methods

All streamflow and chemical-quality samples were collected and analyzed according to methods described in the "National Handbook of Recommended Methods for Water-Data Acquisition" (U.S. Department of the Interior, 1977) and "Techniques of Water-Resources Investigations" manuals (Buchanan and Somers, 1969; Skougstad and others, 1979). Depth-integrated samples were taken when the water depths were sufficient to have the potential for vertical stratification. Samples were collected from 3 to 4 verticals along cross-sections of the West Branch Susquehanna River and the larger tributaries and composited for analysis. Samples collected at or near the mouths of smaller tributaries were taken from the middle of the flow.

DESCRIPTION OF STUDY AREA

The study area in north-central Pennsylvania includes the West Branch Susquehanna River basin between Curwensville and Renovo, Pennsylvania. This part of the basin contains about 84 mi of the main stem and drains 2,975 mi^2 or 43 percent of the basin upstream of Renovo. The main stem flows northeasterly and includes Hydrologic Accounting Units 02050201, 02050202, and part of 02050203 currently in use for managing the U.S. Geological Survey's National Water Data Network.

Physiography

The study area is in the Appalachian Plateau physiographic province (Pennsylvania Department of Environmental Resources, 1979). The basin covers three sections of the province; the headwaters are in the Allegheny Mountain section, the center of the study area is in the Pittsburgh Plateau section, and the downstream part of the area is in the Allegheny High Plateaus section. The latter section is characterized by flat-topped mountains and deeply-incised streams with steep-walled valleys. The remaining sections of the province have more rounded mountains and the valleys are more open.

Elevations of the mountain tops are generally 2,000 to 2,200 ft (feet) above sea level, but some are as high as 2,500 ft. Valley elevations in the study area range from 1,125 ft at Curwensville to 635 ft at Renovo, Pennsylvania. The average slope of the river from Curwensville to Renovo is 5.8 ft/mi (feet per mile).

Land Use

Land use within the study area is about 87 percent forest, 6 percent agricultural or open land, 3 percent urban and suburban, and 4 percent disturbed by mining and logging operations (Pennsylvania Department of Environmental Resources, 1979). While the disturbed area is a relatively small part of the total area, it does involve about 105 mi^2, or slightly more than 67,000 acres. Most of this disturbed area is located near enough to a stream to potentially affect the water quality. Mining and logging activities in the basin today are not nearly as intense as they were at their peak, but the unreclaimed areas affected by these operations remain as a potential source of water-quality degradation.

Geology

The entire basin is underlain by sedimentary rocks of Pennsylvanian, Mississippian, and Devonian age. Extensive beds of minable bituminous coal are associated with the Pennsylvanian-age rocks in the Clearfield and Moshannon Creek basins (fig. 7). These two subbasins drain about three-fifths of the area covered by this study. Bituminous coal in Pennsylvania is classified into three groups by its level of volatility. Low volatile coal is characterized by a low sulfur content, high ash and carbon content, and relatively low marketability. Coal with high volatility has a relatively high sulfur content, low ash and carbon content, and relatively high marketability. The marketability of the coal with high volatility makes it the most desirable, but the sulfur content gives it the most potential for degrading the water quality of surrounding waterways.

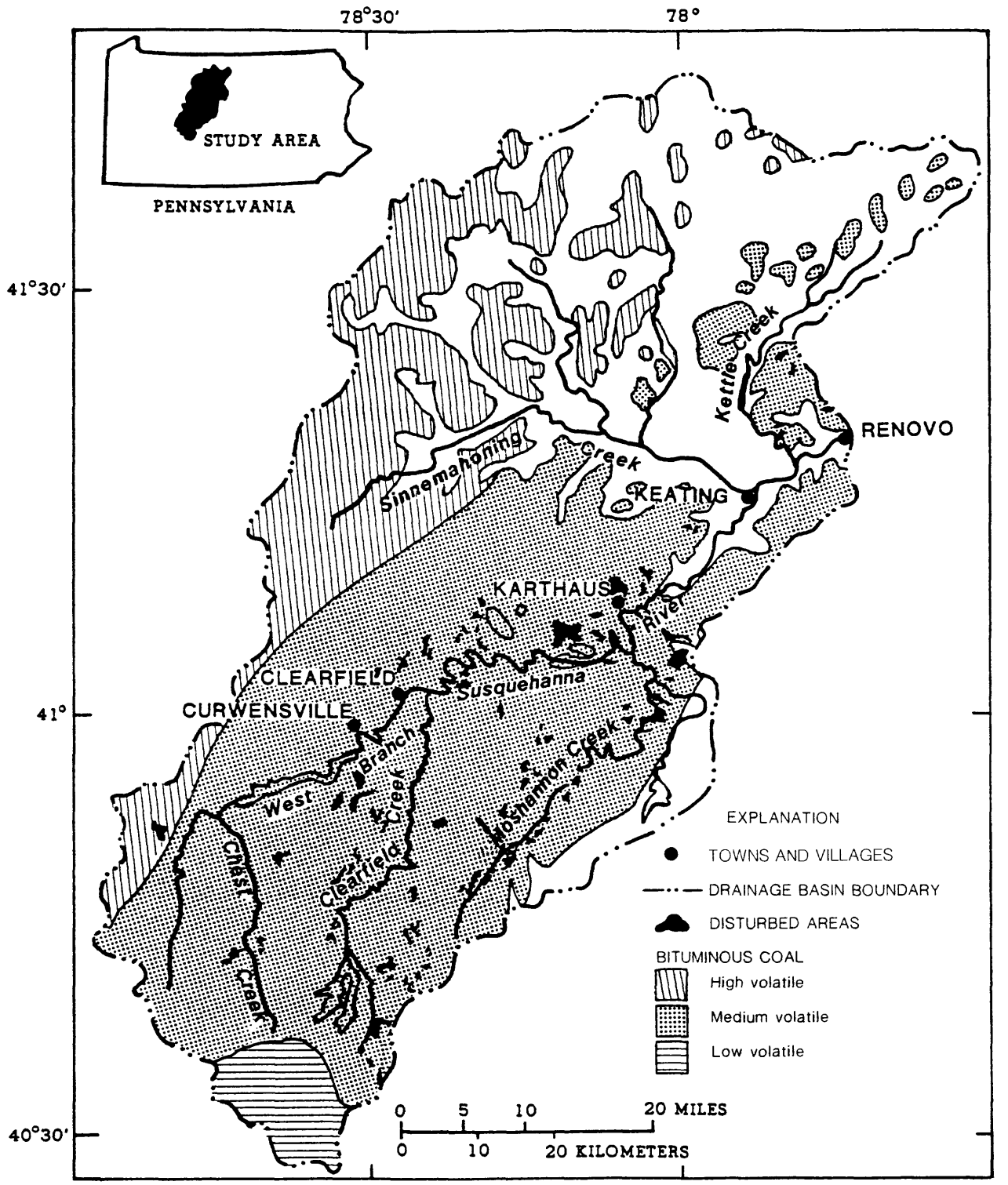


Figure 7.—Coal deposits and disturbed areas in the Upper West Branch Susquehanna River basin.

Hydrology

The U.S. Geological Survey has been operating streamflow–gaging stations on the West Branch Susquehanna River at Curwensville, Karthaus, and Renovo for more than 20 years. The gaging station at Renovo has been in operation since1907. Streamflow data for these and other stations in the West Branch Susquehanna River basin are published in the U.S. Geological Survey's annual report (U.S. Geological Survey, 1984). A brief description, and the duration of daily streamflow for the period of record through 1972 (Shaw and Page, 1977) for the three main–stem gaging stations, are presented in table 2.

Four reservoirs are located within the study area (fig. 1). All four are designed primarily for flood–control and recreational purposes, but the quality of the water stored behind the dams and the timing of the release do have an effect on the quality of the West Branch Susquehanna River.

Two reservoirs are located on tributaries of streams that were sampled for this study. Glendale Lake is located on a tributary to Clearfield Creek about 50 stream mi above its mouth. First Fork Sinnemahoning Creek Reservoir is located on First Fork Sinnemahoning Creek, a tributary to Sinnemahoning Creek. The reservoir is about 25 stream mi above the mouth of Sinnemahoning Creek and the sampling site. A third reservoir, Kettle Creek Lake, is located directly on a sampled tributary about 8.5 mi above the sampling site. The fourth reservoir, Curwensville Lake, is located directly on the West Branch Susquehanna River immediately upstream of sampling site number 1, the West Branch Susquehanna River at Curwensville. A secondary design purpose of this reservoir is the control of water quality.

STREAMFLOW OF THE UPPER WEST BRANCH SUSQUEHANNA RIVER

Hydrographs from the three streamflow–gaging stations in the study reach illustrate that streamflow in the basin was somewhat unstable during both sampling periods (fig. 8). The instability was the result of 0.5 in. (inches) of rain during the second and third day of sampling in May and 1.3 in. of rain during the fifth and last day of sampling in July (U.S. Department of Commerce, 1984). The rainfall had minor effect on the streamflows of the tributaries at the time of sampling. The rain that fell during the May sampling period had little or no effect on the river flows. However, in July, the flow sampled at Renovo, the most downstream river site, was affected substantially by the previous night's rainfall and therefore, did not represent a base-flow condition. The effects of regulation by Curwensville Reservoir are evident in figure 8, especially in May. The change in flow caused by the reservoir release in July occurred too late in the week to affect the river flow or the chemical composition of the samples.

Based on the flow durations for the three river sites with long–term record (table 2), streamflows during the May sampling period were in the 60– to 70–percent–duration range (sampled flows are exceeded 30 to 40 percent of the time) and the July flows were in the 10– to 20–percent–duration range (sampled flows are exceeded 80 to 90 percent of the time). The flows sampled were, generally, from the recession portion of the hydrograph. The exceptions were the tributaries and the river site at Renovo which were sampled on the last day of the July period. The unit discharges at Curwensville, Karthaus, and Renovo in May were 4.69, 2.93, and 2.91 $(ft^3/s)/mi^2$ (cubic feet per second per square mile), respectively. In July, the unit discharges at Curwensville, Karthaus, and Renovo were 0.46, 0.59, and 0.59 $(ft^3/s)/mi^2$, respectively.

Table 2.–Duration of daily streamflow for long-term record gaging stations on the West Branch Susquehanna River within the study area

[mi, miles; mi^2, square miles; ft^3/s, cubic feet per second]

01541200 WEST BRANCH SUSQUEHANNA RIVER AT CURWENSVILLE

LOCATION.--Latitude 40°57'41", longitude 78°31'10", Clearfield County, on left bank 30 ft downstream from bridge on State Highway 453, 0.85 mi downstream from Curwensville Lake, 1.1 mi south of Curwensville and 1.8 mi upstream from Anderson Creek.

DRAINAGE AREA.--367 mi^2.

TRIBUTARY TO.--Susquehanna River.

AVERAGE DISCHARGE.--17 years, 605 ft^3/s.

EXTREMES.--1955-72: Maximum discharge 15,700 ft^3/s, March 10, 1964; no flow at times.

DURATION OF DAILY FLOW.--PERIOD: 1956-72.

Discharge, in cubic feet per second, which was equaled or exceeded for indicated percent of time

Percent	2	5	10	20	30	40	50	60	70	80	90	95	98
ft^3/s	3,300	2,200	1,500	930	610	420	300	220	155	105	64	48	36

01542500 WEST BRANCH SUSQUEHANNA RIVER AT KARTHAUS

LOCATION.--Latitude 41°06'56", longitude 78°06'43", Clearfield County, on the left bank 900 ft upstream from bridge on State Highway 879 at Karthaus, 1,000 ft upstream from Mosquito Creek, and 3.3 mi downstream from Moshannon Creek. Records include flow of Mosquito Creek.

DRAINAGE AREA.--1,462 mi^2, includes that of Mosquito Creek.

TRIBUTARY TO.--Susquehanna River.

AVERAGE DISCHARGE.--32 years, 2,417 ft^3/s.

EXTREMES.--1918-20, 1940-72: Maximum discharge, 84,300 ft^3/s, June 23, 1972; minimum, 100 ft^3/s, September 26-27, 1964.

DURATION OF DAILY FLOW.--PERIOD: 1941-72.

Discharge, in cubic feet per second, which was equaled or exceeded for indicated percent of time

Percent	2	5	10	20	30	40	50	60	70	80	90	95	98
ft^3/s	12,000	8,200	5,800	3,700	2,600	1,800	1,300	960	690	460	280	220	170

Table 2.–Duration of daily streamflow for long-term record gaging stations on the West Branch Susquehanna River within the study area–Continued

[mi, miles; mi^2, square miles; ft^3/s, cubic feet per second]

01545500 WEST BRANCH SUSQUEHANNA RIVER AT RENOVO

LOCATION.--Latitude 41°19'28", longitude 77°45'03", Clinton County, on right bank at abandoned Eighth Street bridge abutment at South Renovo, 1 mi upstream from Paddy Run.

DRAINAGE AREA.--2,975 mi^2.

TRIBUTARY TO.--Susquehanna River.

AVERAGE DISCHARGE.--65 years, 4,881 ft^3/s (adjusted for storage since October, 1961).

EXTREMES.--1895-1903, 1905-1972: Maximum discharge, 236,000 ft^3/s, March 18, 1936; minimum, 80 ft^3/s, December 6, 1965.

REMARKS.--Flow regulated by First Fork Sinnemahoning Creek and Alvin R. Bush Reservoirs. Flow regulated since 1965.

DURATION OF DAILY FLOW.--PERIOD: 1908-55.

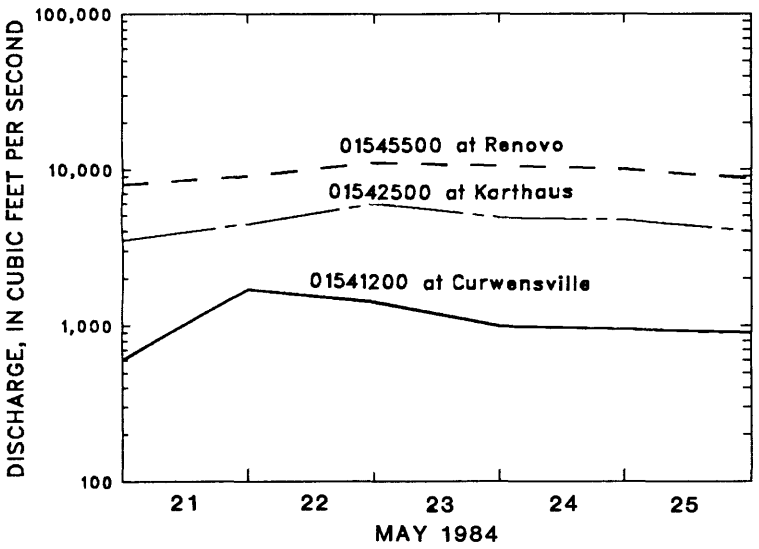
Discharge, in cubic feet per second, which was equaled or exceeded for indicated percent of time

Percent	2	5	10	20	30	40	50	60	70	80	90	95	98
ft^3/s	26,000	17,000	12,000	7,400	5,000	3,500	2,500	1,800	1,200	680	400	270	190

DURATION OF DAILY FLOW.--PERIOD: 1956-72.

Discharge, in cubic feet per second, which was equaled or exceeded for indicated percent of time

Percent	2	5	10	20	30	40	50	60	70	80	90	95	98
ft^3/s	24,000	16,000	11,000	7,300	5,000	3,400	2,400	1,800	1,200	750	440	320	230



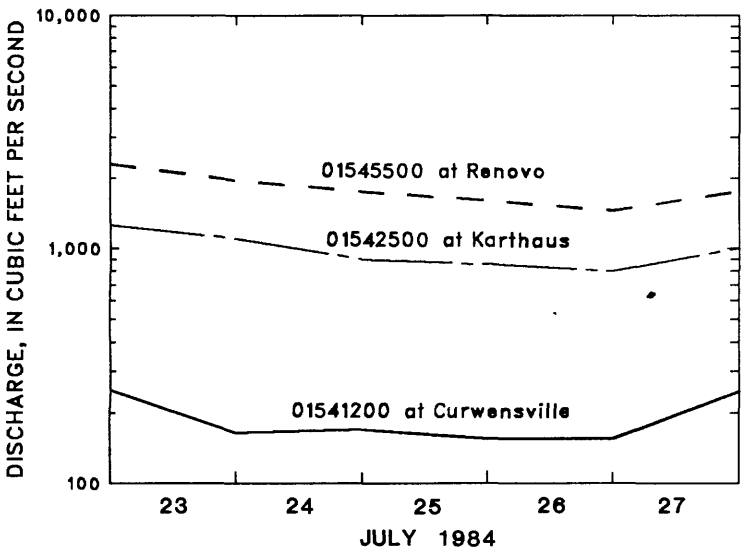


Figure 8.—Streamflow hydrographs at the gaging stations on the West Branch Susquehanna River, May 21–25 and July 23–27, 1984.

WATER QUALITY

The water quality of the tributaries and the West Branch Susquehanna River was evaluated by comparing the recommended limits for in-stream water quality used in the Commonwealth of Pennsylvania and the measurements of pH and acidity and total-recoverable iron concentrations made during this study. The individual and cumulative effects of the tributaries on the water quality of the river was determined using acidity and total-recoverable iron loads. The relative effect of each tributary must be based on the load it discharges to the river in comparison to the load already being transported by the river at the mouth of the tributary. The comparison of concentrations for this purpose is inappropriate because of the large range of tributary drainage areas and water discharges.

Constituent Concentrations

Extensive surface mining of medium- and high-volatile bituminous coal throughout the Upper West Branch Susquehanna River basin (fig. 7) has resulted in the degradation of water quality in the river (Pennsylvania Department of Environmental Resources, 1981). Although acid mine drainage is the major cause of degradation, it also is responsible for masking the effects of other forms of water pollution, such as sewage effluent and industrial wastes.

Specific standards for in-stream water quality for the West Branch Susquehanna River, as outlined by the PaDER (1984) are listed below:

Constituent	PaDER recommended limit
pH	not less than 6.0 units and not more than 8.5 units
alkalinity as $CaCO_3$	not less than 20 mg/L (milligrams per liter), except where natural conditions are less
total-recoverable iron	not more than 1,500 µg/L (micrograms per liter)
total-recoverable manganese	not more than 1,000 mg/L
sulfate	not more than 250 mg/L
total dissolved solids	not more than 750 mg/L.

Generally, recommended limits for one or more of the constituents are exceeded in those surface waters affected by acid mine drainage.

Specific measurement values and concentrations for each tributary for all the constituents analyzed can be found in table 3 (located at the end of the report). Because the standards established by the PaDER are based on total-recoverable concentrations, they were measured in this study and are used in the following analysis of data. Dissolved concentrations also were determined and are presented in table 3. Total-recoverable concentrations include the concentration of the constituent in both the suspended and dissolved phases. The following paragraphs describe the water quality of the 94 tributaries and four main-stem river sites in May and July 1984. The comparative water quality of the sites is shown by relating the measured pH, and concentrations of the acidity as $CaCO_3$ and total-recoverable iron, to PaDER standards for in-stream water quality. The tributary sites are described in groups using the segments of the West Branch Susquehanna River previously described and shown in figures 2-6.

Tributaries

Figures 9 and 10 show the water quality of sites 2 through 20 in May and July 1984, respectively. The areas drained by each of the tributaries are shown in table 1. The drainage areas of sites 2 through 20 range from 0.35 to 393 mi^2. In May, the pH measured at 13 of the 19 sites was below the recommended limit of 6.0; in July pH values less than 6.0 were measured at 11 of the sites. The pH measurements ranged from 3.2 to 7.9 in May and from 2.9 to 7.4 in July. The median pH values for May and July for stations 2 through 20 were 5.4 and 5.7, respectively.

The bar graphs for acidity and total-recoverable iron for both months indicate very little variability among the sites, except for sites 12 through 15. In May, all sites except sites 12, 14, and 15 had acidity concentrations less than or equal to 30 mg/L and total-

recoverable iron concentrations less than 1,100 µg/L. Acidity concentrations for sites 12, 14, and 15 were 263, 164, and 119 mg/L, respectively. Total-recoverable iron concentrations during the same period were 56,000, 4,400, 2,800, and 1,900 µg/L for sites 12, 13, 14, and 15, respectively.

In July, a pattern similar to that of May was found. At sites 12, 14, and 15, the acidity concentrations measured were 497, 223, and 243 mg/L, respectively. Concentrations at the other 16 sites were 50 mg/L or less. Sites 12, 14, and 15 were the only sites in the group that exceeded the recommended concentration limit for iron, 1,500 µg/L. Concentrations measured at these three sites were 110,000, 2,200, and 2,800 µg/L, respectively. The median concentrations of total-recoverable iron determined from tributaries along this segment of the river in May and July were 620 and 480 µg/L, respectively.

Figures 11 and 12 indicate the levels of pH, acidity, and total-recoverable iron found at sites 21 through 39 in May and July 1984. The drainage areas of the tributaries sampled along this river segment ranged from 0.24 to 41.8 mi^2. As the figures indicate, the pH values of nearly all of the tributaries were below the recommended limit of 6.0. Only at sites 25 and 38 was the pH greater than 6.0. In May, the minimum pH (3.2) was measured at site 26, the maximum pH (7.2) was measured at site 25, and the median pH for this group of tributaries was 4.2. In July, a similar pattern was found. The minimum pH (3.0) was measured at site 28, the maximum pH (6.2) was measured at site 38, and the median pH for this group of sites was 3.9. In July, site 33 had no flow.

The high and low acidity values measured at the sites along this segment were generally coupled with low and high pH measurements. In May, the maximum acidity measured was 199 mg/L at site 26 (where the minimum pH was measured). The minimum acidity measured (0 mg/L) was found at site 38, one of the two sites where the pH exceeded 6.0. Samples at four other sites had acidity values equal to 5 mg/L. The median acidity measured at the tributaries along this segment was 15 mg/L. In July, the maximum acidity measured was at site 24 (844 mg/L). A value of 5 mg/L (the minimum) was measured at sites 32, 38, and 39. The median acidity concentration measured in July from this group of tributaries is 104 mg/L.

Nearly all of the total-recoverable iron concentrations determined for the 19 sites in May and July were less than the 1,500 µg/L-level recommended by PaDER. In May, 5 sites had concentrations greater than 1,500 µg/L. The maximum concentration (8,600 µg/L) was measured at site 24. In July, concentrations exceeded 1,500 µg/L at 7 sites. The maximum concentration measured in July was 19,000 µg/L and was again found at site 24. The median iron concentrations measured in May and July along this segment were 660 and 640 µg/L, respectively.

The water quality of the tributaries sampled along segment 3 (site numbers 40 through 51 and 53 through 61) is indicated by the constituent measurements shown in figures 13 and 14. In both May and July, pH exceeded 6.0 at only one site (site 58). The minimum pH measured in May was 3.0; in July, 2.8. The median pH measurements at this group of tributaries in May and July were 3.8 and 3.4, respectively.

Although the pH of these streams was low, indicating a rather high hydrogen-ion activity, the concentrations of acidity as $CaCO_3$ that were measured were relatively low. The maximum concentration measured in May was 323 mg/L; in July, the maximum concentration was 397 mg/L. The medians of the acidity concentrations measured in May and July were 55 and 154 mg/L, respectively. The total-recoverable iron concentrations measured in segment 3 were some of the highest sampled. The maximum concentration determined in May was 20,000 µg/L; in July, the maximum concentration was 25,000 µg/L. Concentrations were less than the 1,500 µg/L recommended limit at only 5 of the 21 sites in May and 8 of the sites in July. The median concentrations for both May and July were 3,000 µg/L.

Figures 15 and 16 indicate that, compared to the previous three groups of tributaries, the streams along this segment have better quality water. Even though 7 of the 17 tributaries had a pH less than 6.0, the minimum pH value in May was 4.9, and pH exceeded 6.5 at seven sites. In July, 5 of the sites were dry. Of the remaining 12 sites, the minimum pH measured was 4.6 and the maximum was 7.2. The median pH for May and July was 6.4 and 5.1, respectively.

The area drained by the tributaries in this segment is relatively free of coal deposits and is only slightly disturbed by logging operations. The absence of acid mine drainage in the area is indicated by the low concentrations of acidity and total-recoverable iron found in the tributaries that enter the river between the towns of Birch and Keating. In May and July, acidity was not measurable at several sites; the maximum acidity concentration was 10 mg/L at sites 62 and 71. The median acidity concentration for both sampling periods was 5 mg/L. Total-recoverable iron concentrations also were relatively low. The maximum concentration measured in this group of tributaries was 420 mg/L and concentrations less than 100 mg/L were measured at several sites. The median total-recoverable iron concentrations measured in May and July were 200 and 90 µg/L, respectively. The water quality of this group of tributaries, because of the relatively undisturbed condition of the area, is assumed to reflect the "natural" water quality of the basin.

The final group of tributaries drains an area that is not completely disturbed by coal-mining activities. The water quality of several of the tributaries suggests that drainage from undisturbed areas and a few of the tributaries in the group contain water-quality constituents at concentrations indicative of a strong influence from acid mine drainage (figs. 17 and 18). The first four tributaries in the group, and most of the last ten tributaries have a pH of 4.0 to 7.8 units. Acidity concentrations generally are less than 30 mg/L and total-recoverable iron concentrations are less than 700 µg/L (most are less than 200 µg/L).

Three tributaries that enter the river near the villages of Keating and Westport (sites 84, 85, and 87), had pH and concentrations of acidity and total-recoverable iron that indicate a substantial influence of acid mine drainage. pH in all three was less than 4.0, and at one site was 2.8 and 2.7 in May and July, respectively. Acidity concentrations were not abnormally high, compared to other tributaries that were affected by acid mine drainage. The maximum acidity concentration measured at the three sites was 477 mg/L; the minimum was 25 mg/L. Total-recoverable iron concentrations at site 85 were 46,000 and 19,000 µg/L in May and July, respectively. Site 87 was the least affected of the three tributaries; total-recoverable iron concentrations were 440 and 420 µg/L in May and July, respectively.

The maximum acidity and total-recoverable iron concentrations measured during the two sampling periods were found at sites with drainage areas of less than 26 mi^2. During the May sampling period, the maximum acidity concentration measured was 477 mg/L at site 85, which has a drainage area of 25.6 mi^2. The next two highest values in May, 323 and 263 mg/L, were measured at sites with drainage areas of 1.49 and 1.71 mi^2, respectively. The three highest total-recoverable iron concentrations measured in May were 56,000, 46,000, and 20,000 µg/L. They were measured at sites 12 (1.71 mi^2), 85 (25.6 mi^2), and 46 (1.49 mi^2), respectively.

In July, some of the same tributaries had the highest concentrations. The maximum acidity concentration of 844 mg/L was measured at site 24, which has a drainage area of 1.08 mi^2. The next two highest concentrations, 546 and 497 mg/L were measured at sites 35 and 12, which have drainage areas of 0.89 and 1.71 mi^2, respectively. The maximum total-recoverable iron concentration measured in July was 110,000 µg/L at site 12 (1.71 mi^2). The next two highest concentrations (25,000 and 20,000 µg/L) were in tributaries with drainage areas of 24.0 and 1.49 mi^2 (sites 41 and 46).

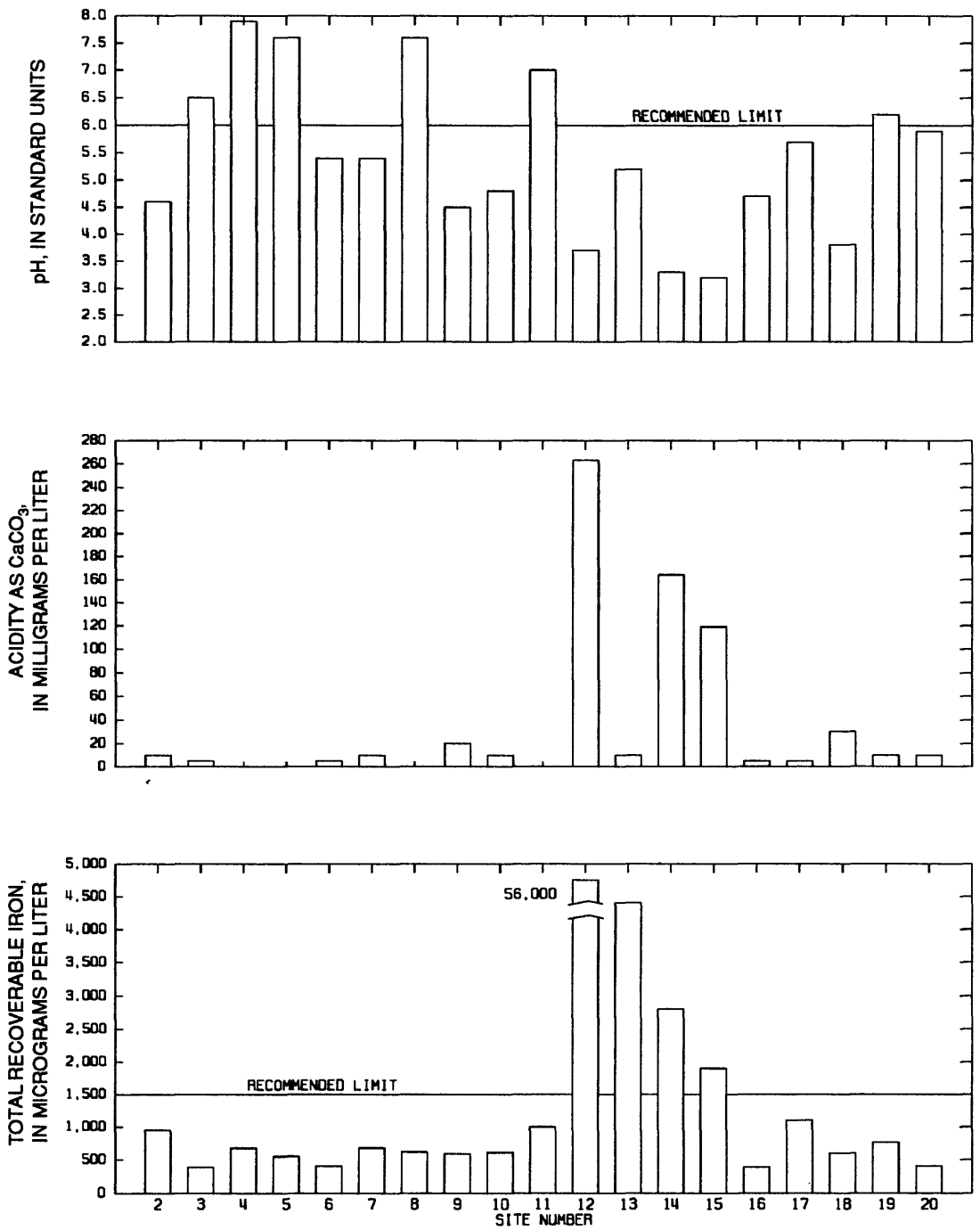


Figure 9.–Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 2 through 20, May 1984.
(Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

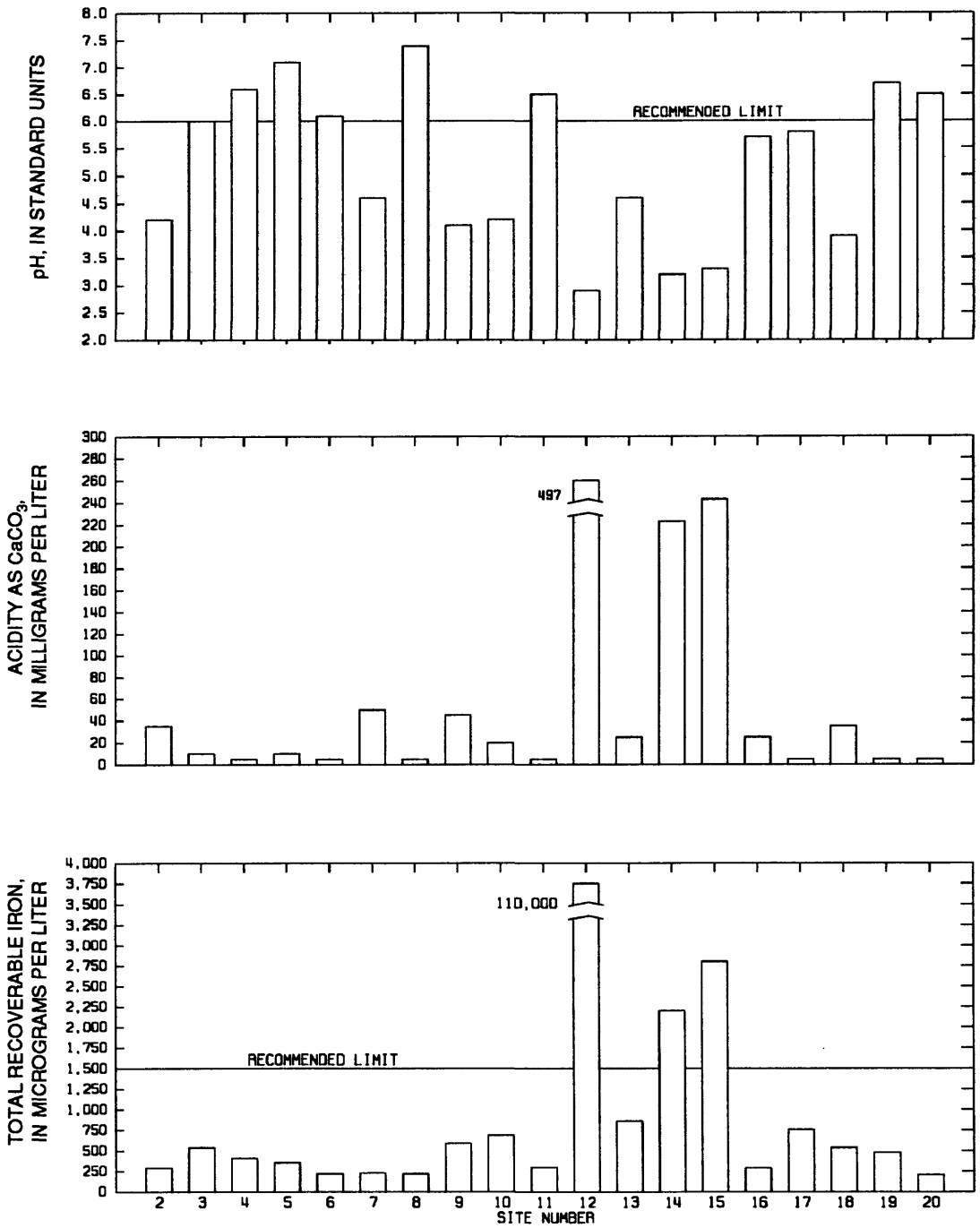


Figure 10.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 2 through 20, July 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

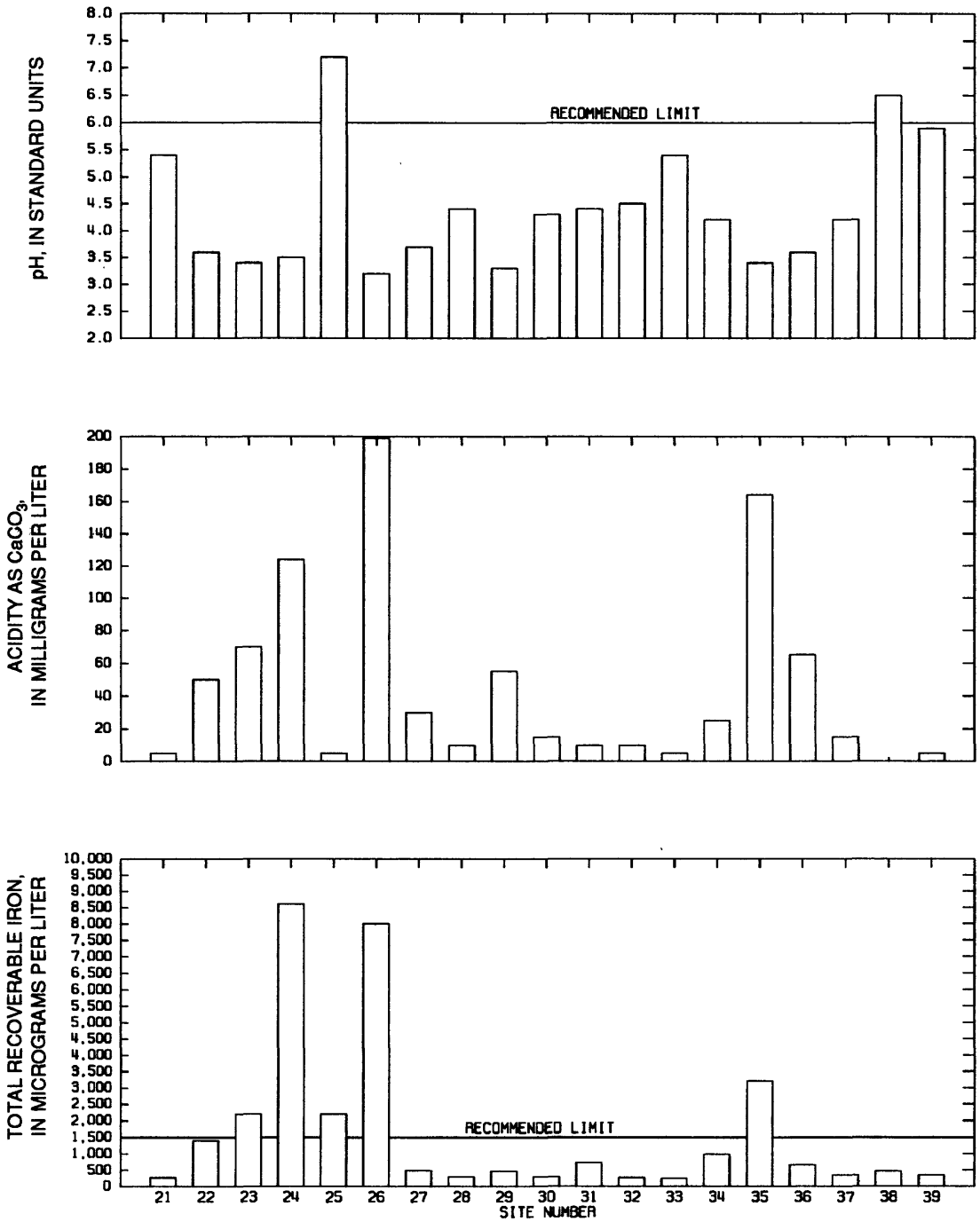


Figure 11.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 21 through 39, May 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

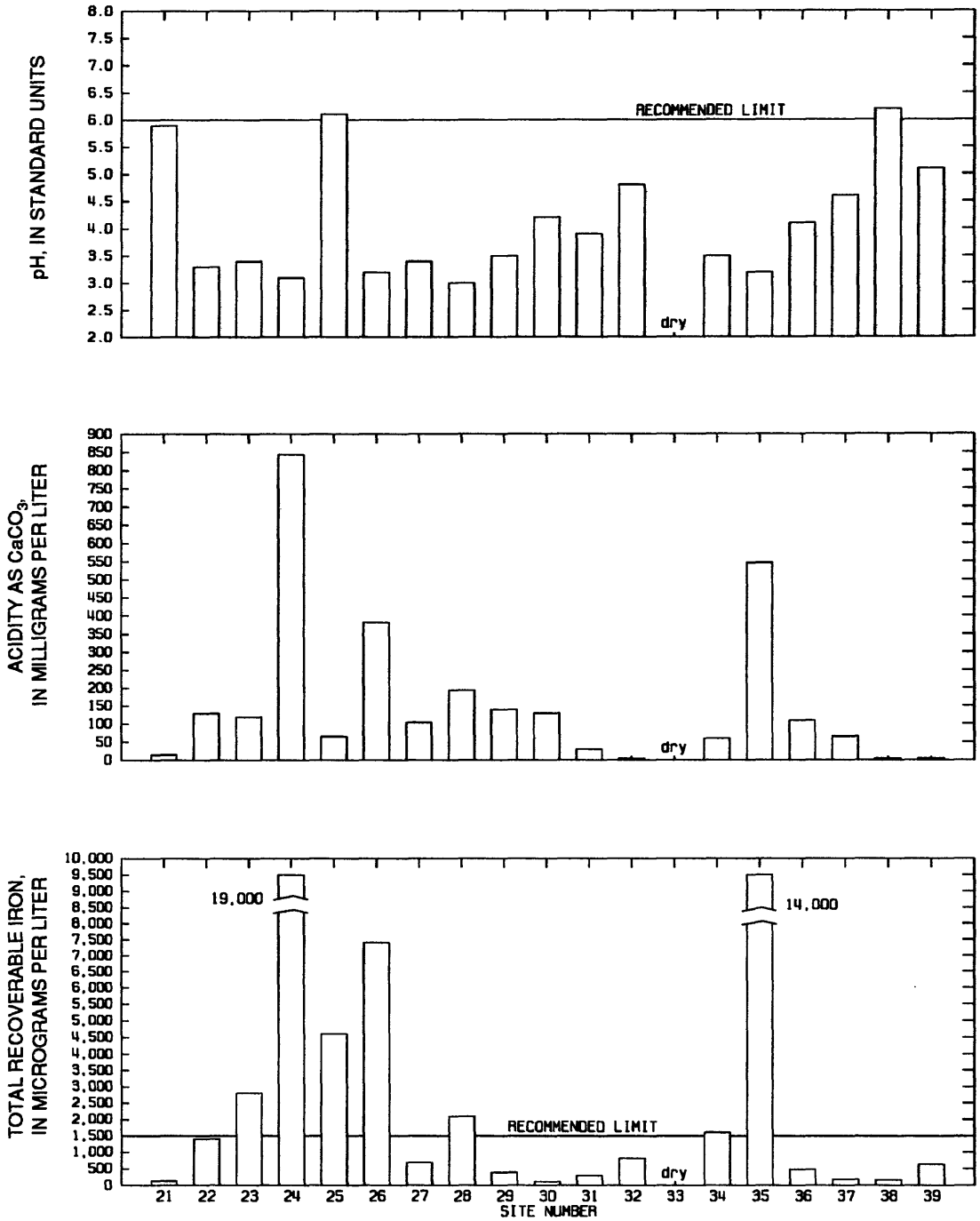


Figure 12.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 21 through 39, July 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

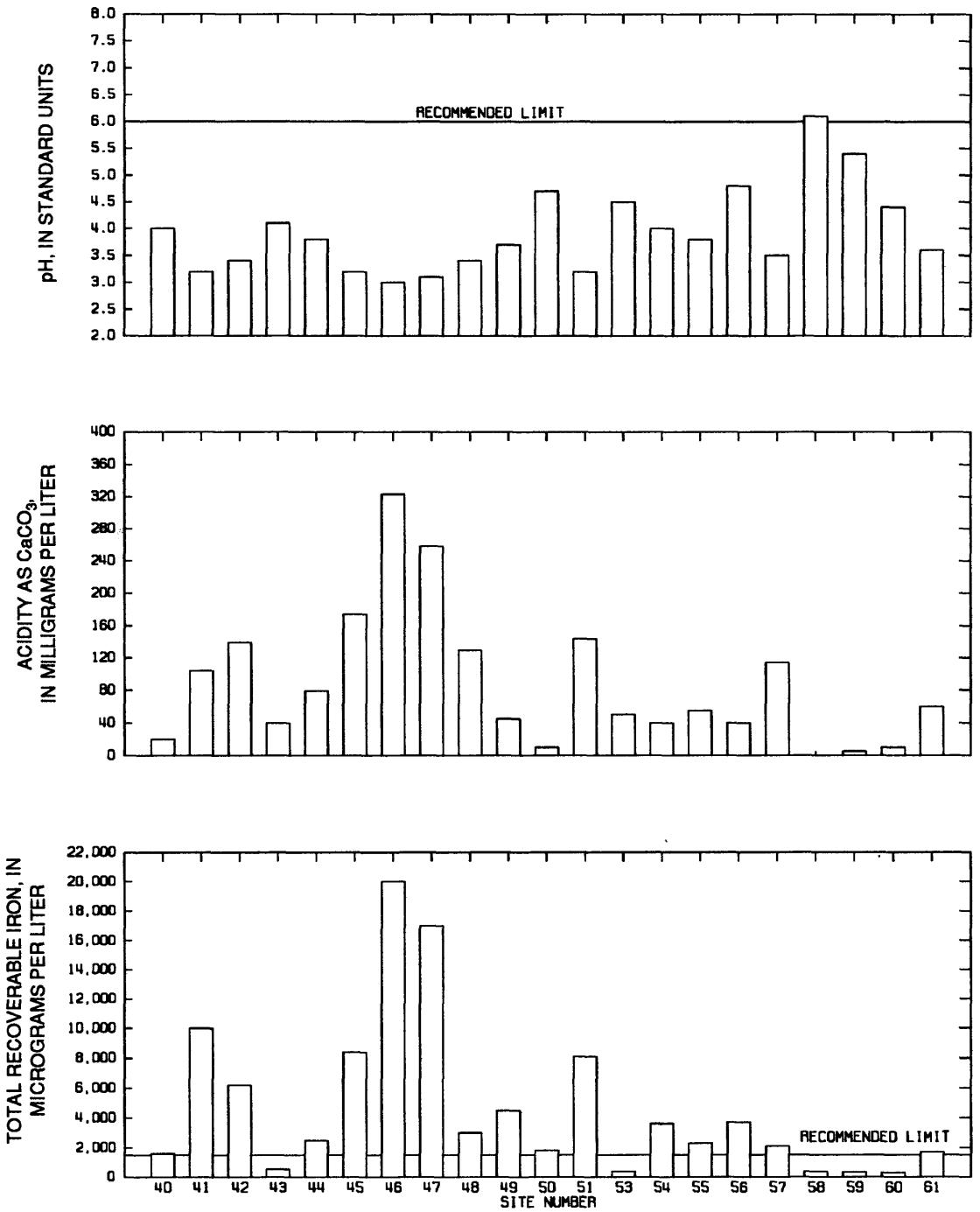


Figure 13.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 40 through 51 and 53 through 61, May 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

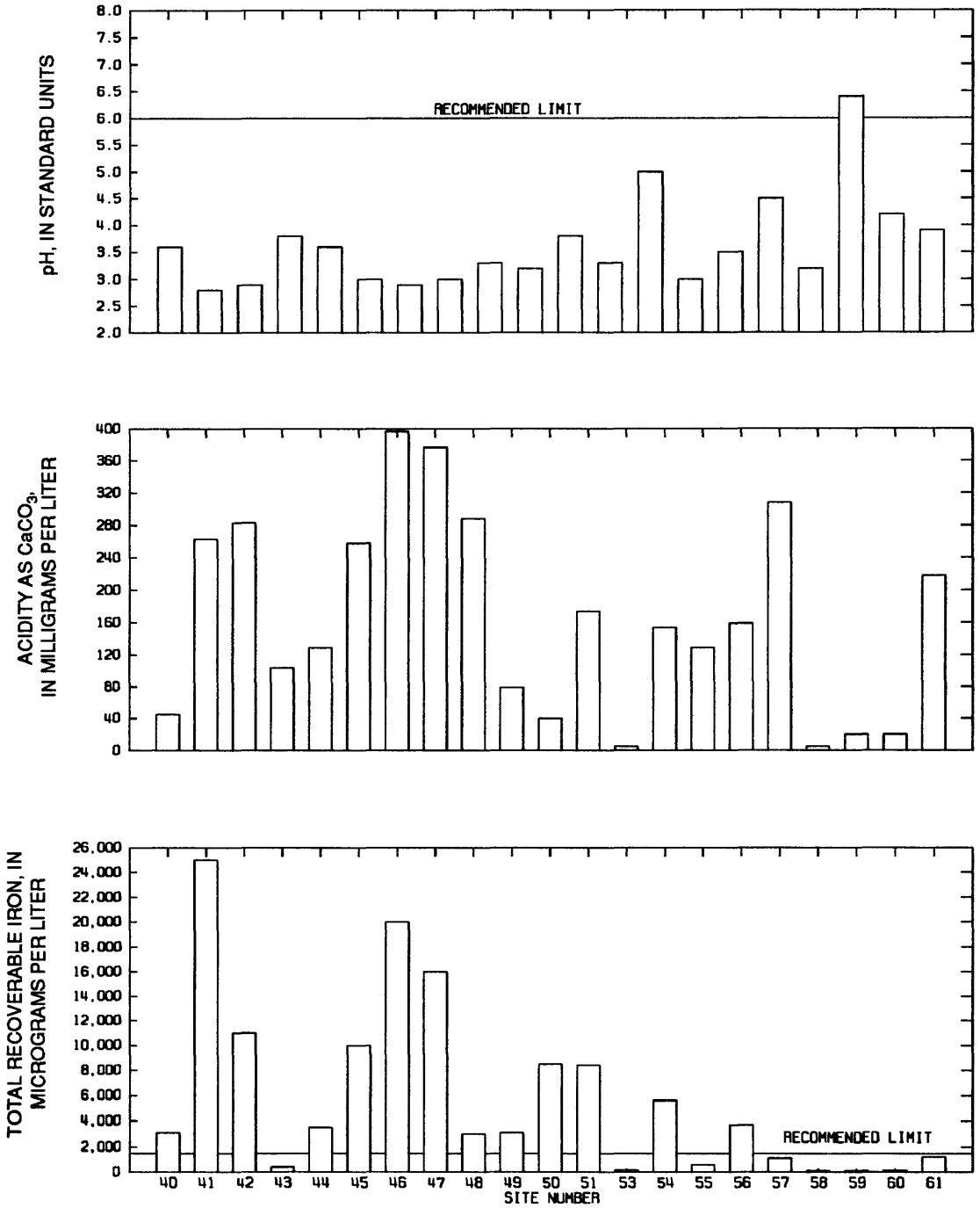


Figure 14.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 40 through 51 and 53 through 61, July 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

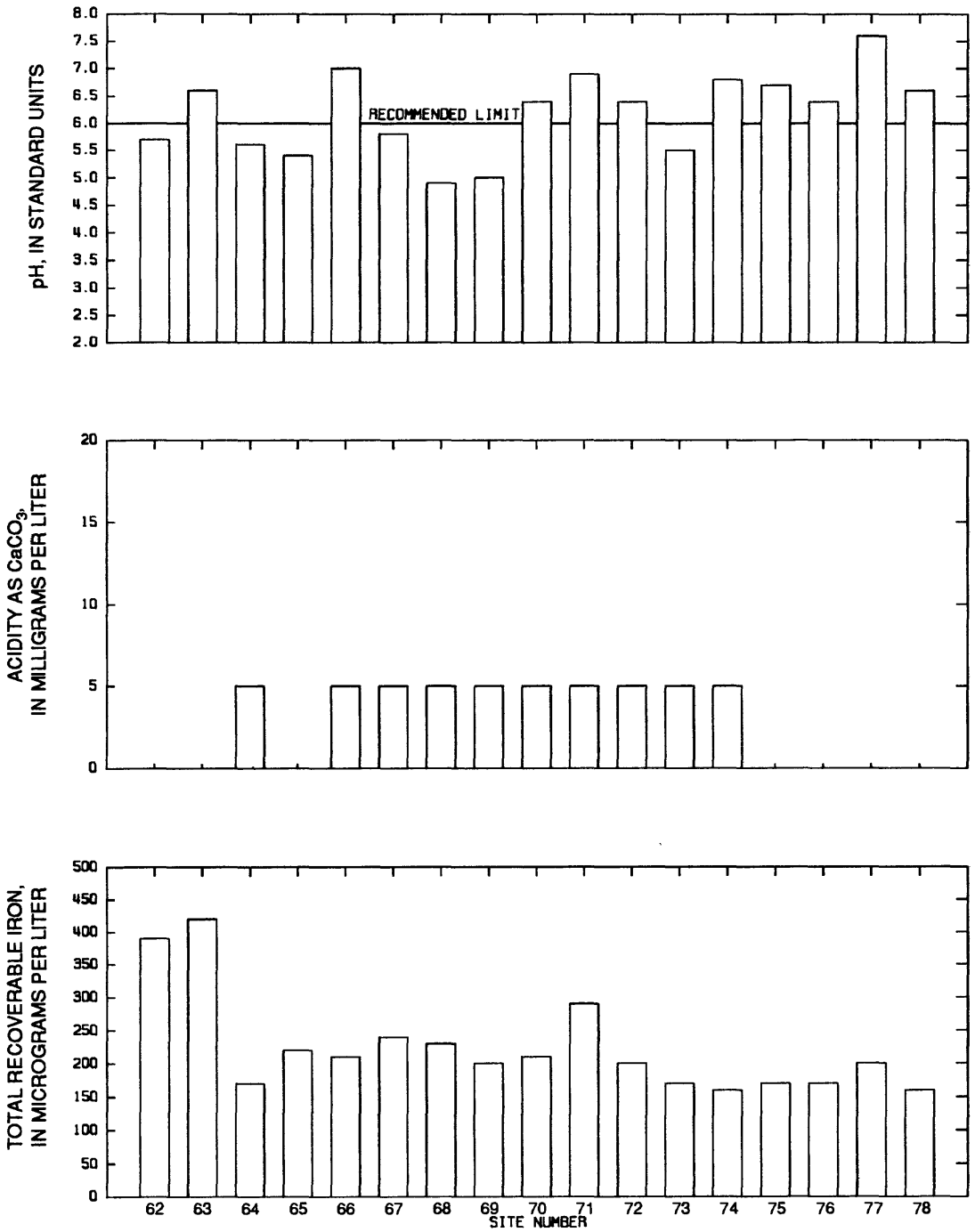


Figure 15.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 62 through 78, May 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

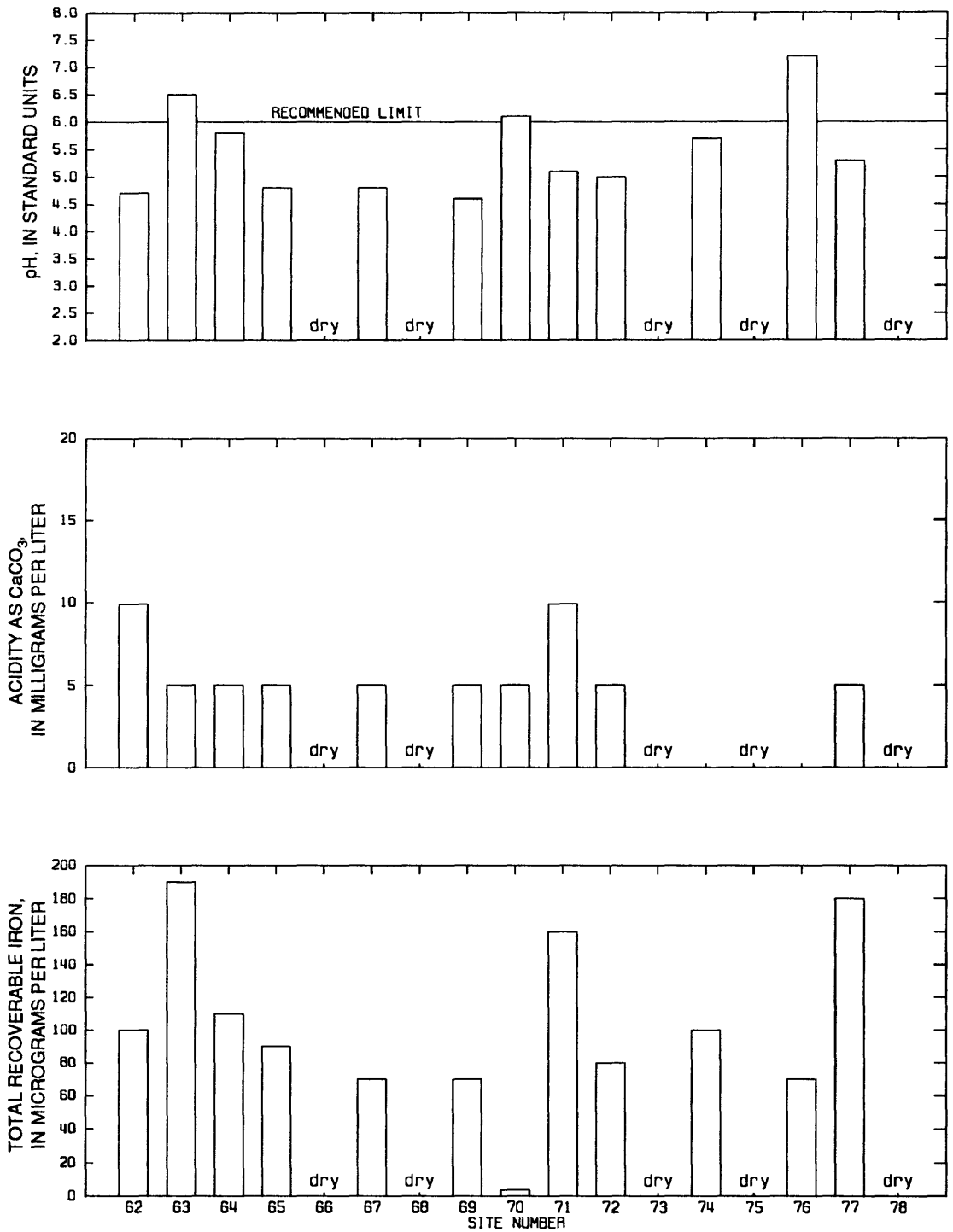


Figure 16.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 62 through 78, July 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

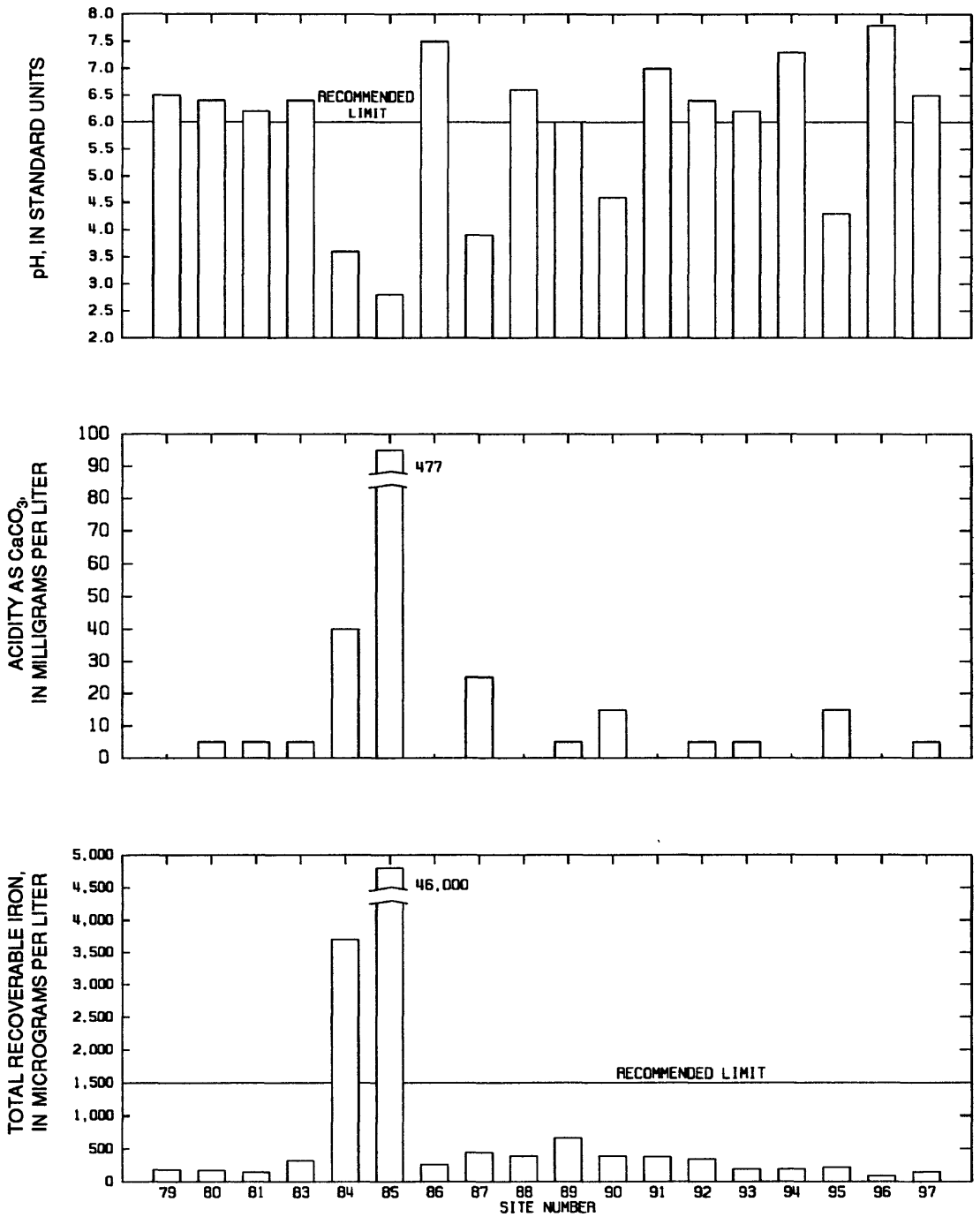


Figure 17.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 79 through 81 and 83 through 97, May 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

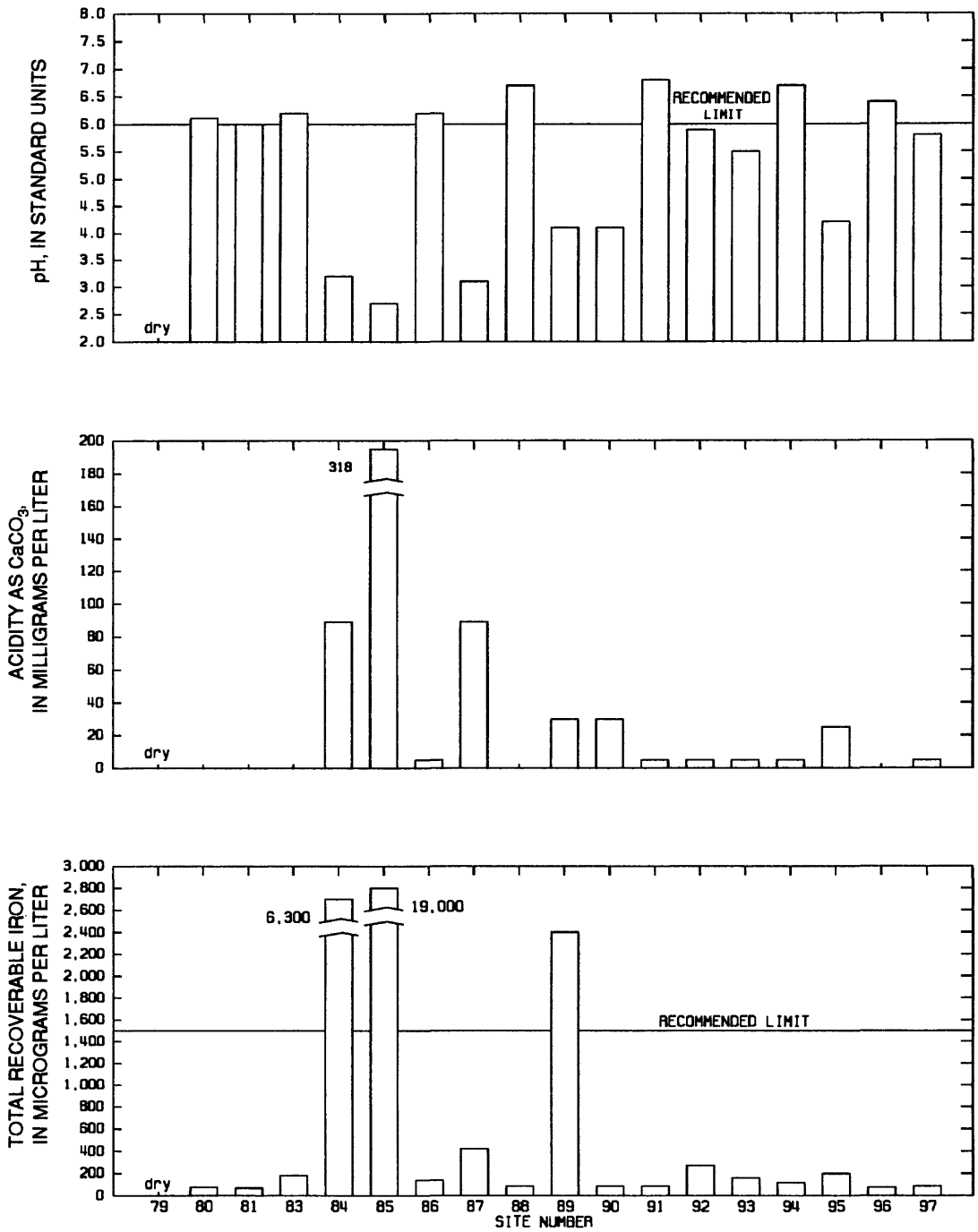


Figure 18.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites 79 through 81 and 83 through 97, July 1984. (Limits shown are those recommended by the Pennsylvania Department of Environmental Resources for in-stream water quality.

West Branch Susquehanna River

pH and concentrations of acidity and total-recoverable iron in the mainstem of the river in May and July are shown in figure 19. pH ranged from 6.5 to 3.8, acidity concentrations ranged from 5 to 30 mg/L, and total-recoverable iron concentrations ranged from 190 to 1,900 µg/L. The water quality of the reach of the river covered by this study was found to be the best at Curwensville and the worst at Karthaus; water quality gradually improved to Renovo, the most downstream site.

Table 4 is a summary of selected water-quality constituents measured at the sites on the West Branch Susquehanna River. Of the eight pH measurements at the four sites, only one meets the PaDER recommended limit of not less than 6.0 units (the site at Curwensville in May). Total-recoverable iron concentrations at all sites met the recommended limit except at the site at Karthaus in May. In addition, the alkalinity concentrations at Curwensville in May and July met the recommended limit of 20 mg/L. The table also indicates the pattern of water-quality change in the river described in the previous paragraph.

Constituent Loads

Although concentrations of various constituents are important from the regulatory standpoint, determination of the relative effect of the tributaries on the water quality of the river requires an examination of the constituent load. The calculation of load includes the constituent concentration and the instantaneous streamflow at the time of sample collection. The following section compares the tributaries and presents the calculated acidity and total-recoverable iron loads for the May and July samples. As will be shown, the most influential variable in the load calculation is streamflow. Generally, the maximum loads received from tributaries are not from those with the maximum concentrations, but those with the greater streamflow.

Tributaries

Figures 20 and 21 show the acidity loads calculated from the May and July samples. During the May sampling period, about 365 tons/day of acidity were discharged to the West Branch Susquehanna River by its tributaries. Five of the tributaries had acidity loads greater than 10 tons/day. They were site numbers 13, 41, 49, 53, and 83. Combined, these tributaries contributed 283 tons/day of acidity to the West Branch Susquehanna River, 78 percent of the total load. The remaining 89 tributaries contributed 82 tons/day collectively. The three largest contributors of acidity were site 49, Moshannon Creek (141 tons/day); site 83, Sinnemahoning Creek (45.5 tons/day); and site 13, Clearfield Creek (44.6 tons/day). Combined, these tributaries contributed 63 percent of the total acidity load. The median streamflow and acidity load for the May samples were 5.5 ft^3/s (cubic feet per second) and 0.18 ton/day.

During the July sampling period, about 131 tons/day of acidity were discharged by the tributaries. Sites 13, 41, 49, 84, and 89 had acidity loads greater than 5 tons/day and were the major contributors. Combined, these sites provided 92 tons/day of acidity, 70 percent of the total load. The three largest contributors were site 49, Moshannon Creek (41 tons/day); site 89, Kettle Creek (21.8 tons/day); and site 13, Clearfield Creek (15.5 tons/day). Combined, these tributaries contributed 60 percent of the total acidity load. The median streamflow and acidity load in July were 2.9 ft^3/s and 0.07 ton/day.

Figures 22 and 23 show the total-recoverable iron loads computed from the samples taken in May and July, respectively. As was found with the acidity loads, a relatively small number of tributaries provide the majority of the total load to the river. During the May sampling period, sites 13, 41, 49, 83, and 89 had loads greater than 1.0 tons/day and provided 39.8 tons/day, or 89 percent, of the total 44.8 tons/day of total-recoverable iron. Site 13, Clearfield Creek, and site 49, Moshannon Creek, contributed 19.8 and 14.1 tons/day, respectively. Their combined load represented 76 percent of the total.

During the July sampling period, sites 13, 41, 49, 84, and 89 had loads greater than 0.5 ton/day and provided 5 tons/day, or 77 percent, of the total 6.5 tons/day of total-recoverable iron. Site 89, Kettle Creek, and site 49, Moshannon Creek, contributed 1.7 and 1.6 tons/day, respectively. Their combined load represented 51 percent of the total. The median total-recoverable iron load for both sampling periods was 0.01 ton/day.

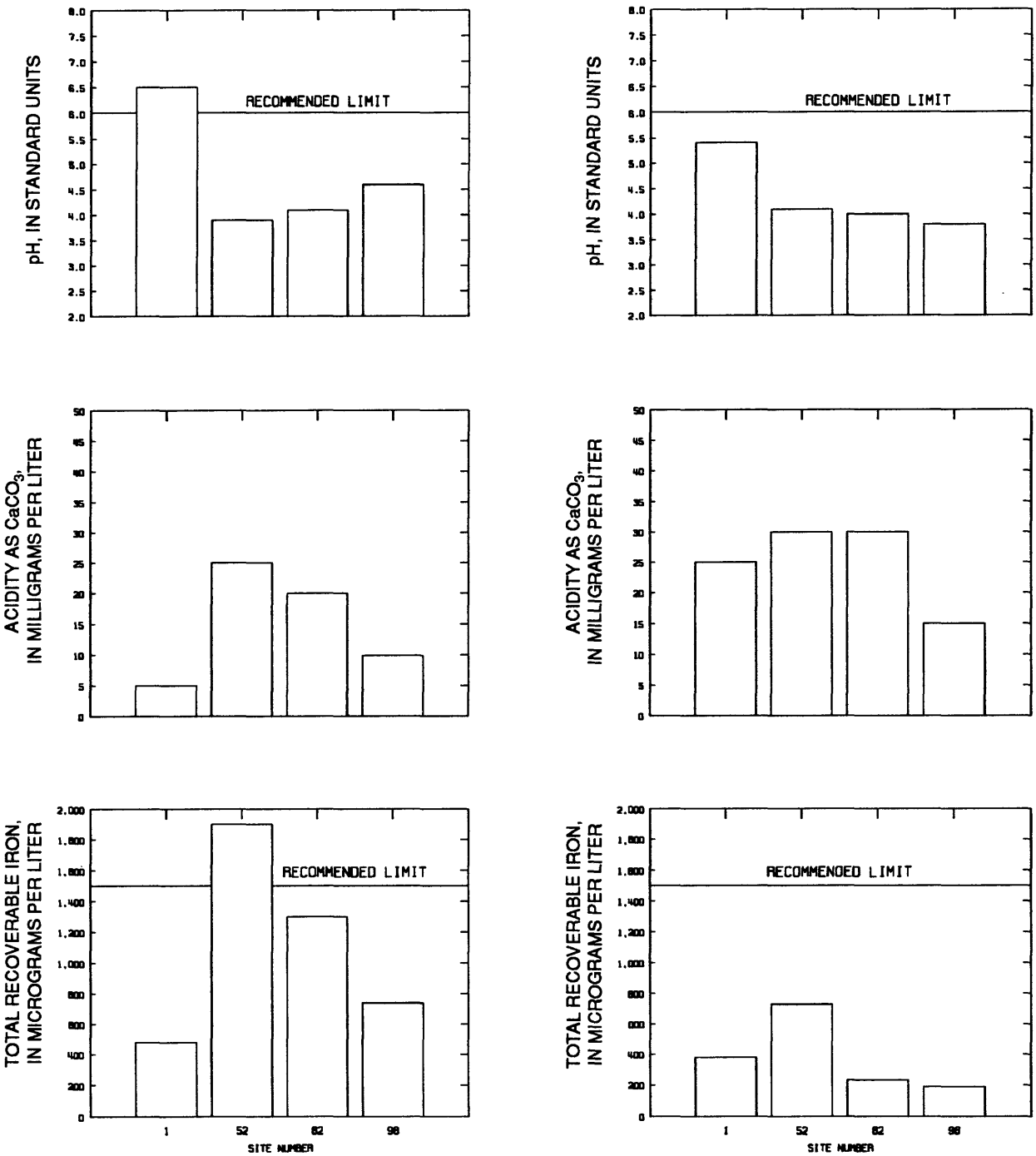


Figure 19.--Measurements of pH and acidity and total-recoverable iron concentration at sampling sites on the West Branch Susquehanna River, May and July 1984.

Table 4.--Summary of selected water-quality data collected from the West Branch Susquehanna River, May and July 1984

[µg/L, micrograms per liter; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius]

Sampling site	Site number	Date	pH (standard units)	Specific conductance (µS/cm)	Acidity (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)	Total recoverable iron (µg/L)	Total recoverable manganese (µg/L)	Total recoverable aluminum (µg/L)	Total recoverable zinc (µg/L)	Dissolved sulfate (mg/L)
Curwensville	1	May 21	6.5	267	5.0	23	480	350	100	20	91
Karthaus	52	May 23	3.9	330	25	0	1,900	2,300	1,700	[a]180	140
Keating	82	May 25	4.1	310	20	0	1,300	1,700	1,700	120	120
Renovo	98	May 25	4.6	200	9.9	0	740	900	900	80	72
Curwensville	1	July 23	5.4	310	25	26	380	390	200	10	110
Karthaus	52	July 25	4.1	610	30	0	730	4,100	3,000	[a]220	300
Keating	82	July 26	4.0	735	30	0	230	4,000	2,400	220	250
Renovo	98	July 27	3.8	392	15	0	190	2,600	2,100	140	160

[a] Dissolved zinc, in mg/L; total recoverable concentration not available.

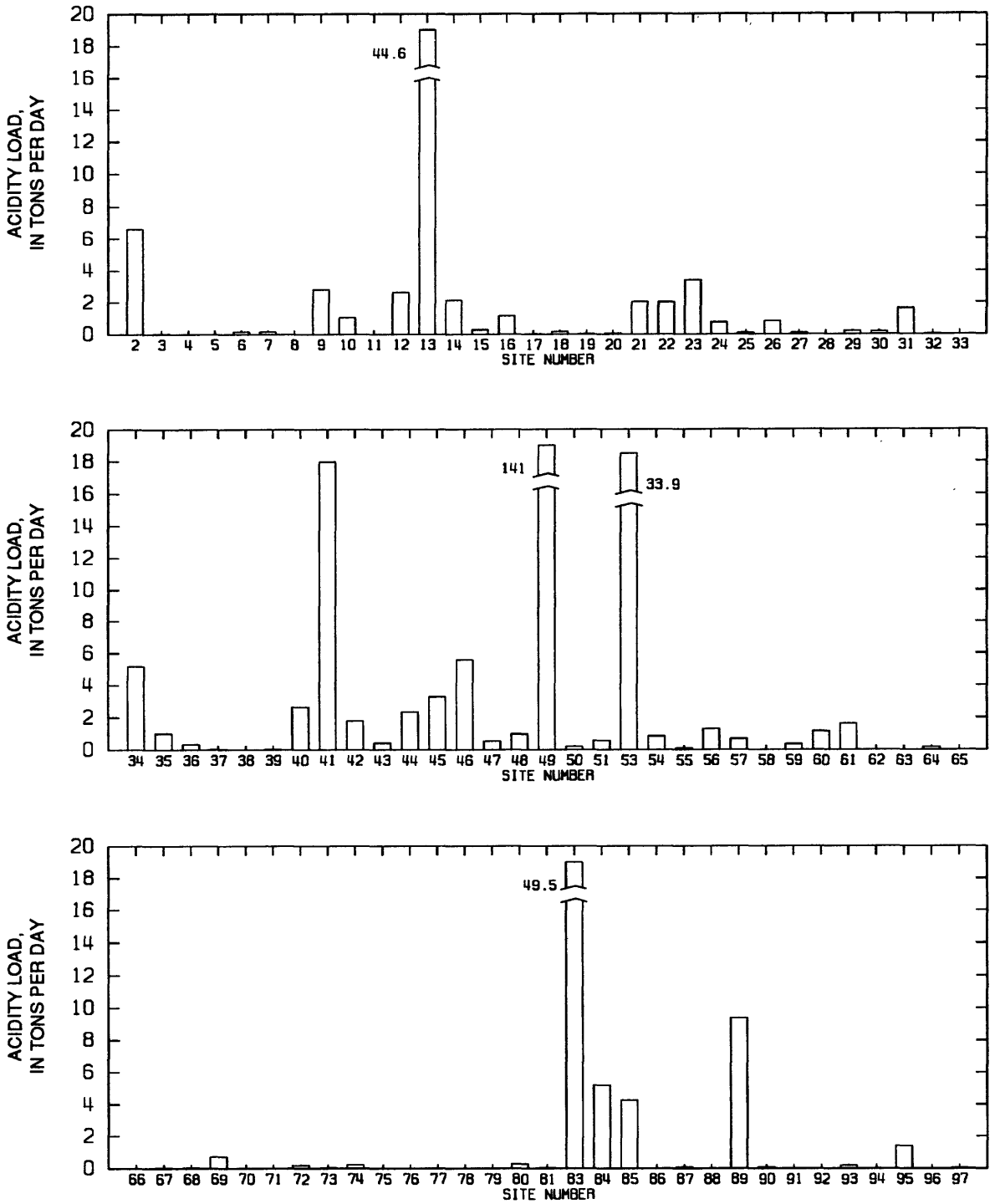


Figure 20.--Acidity load at tributary sampling sites, May 1984.

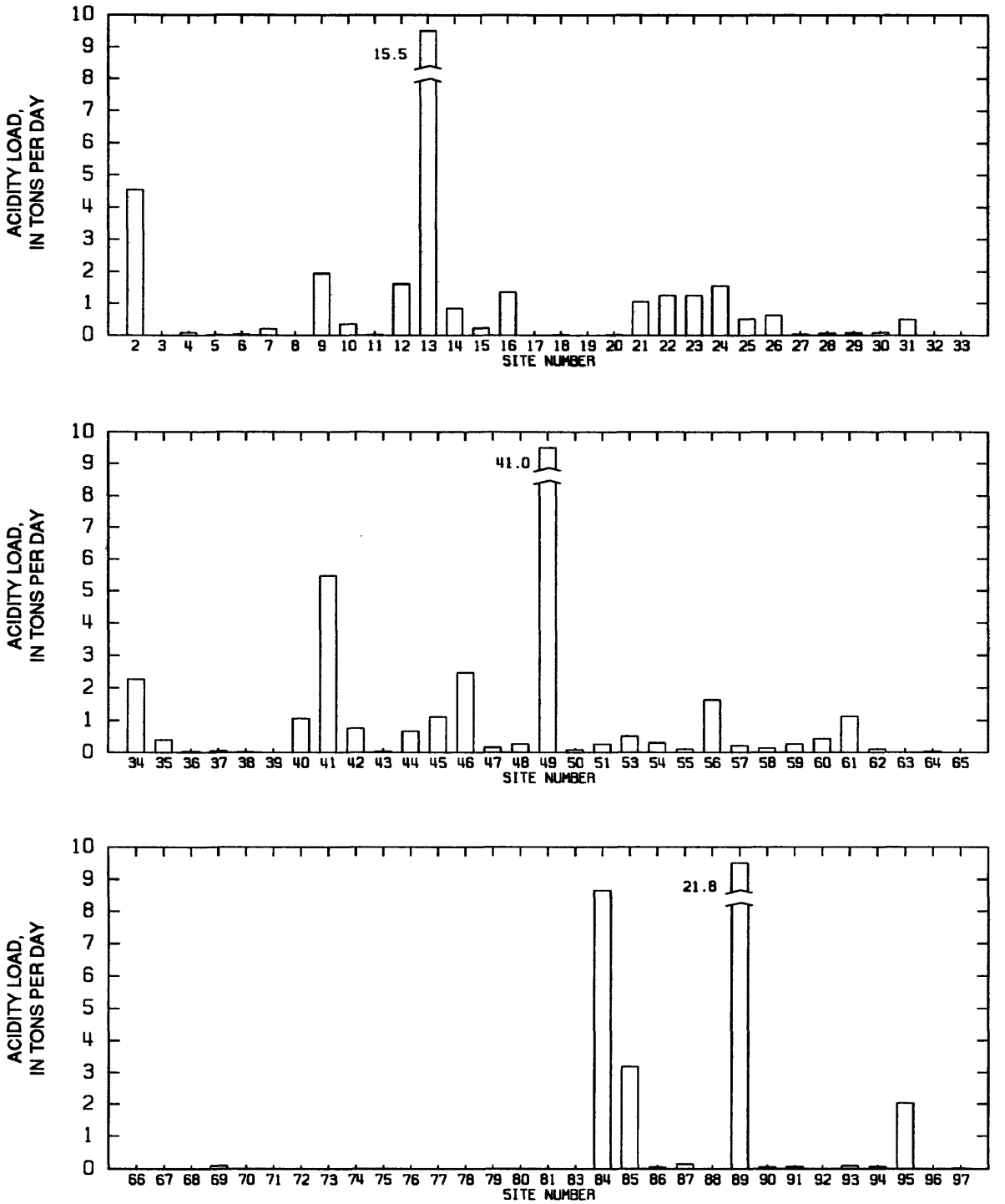


Figure 21.--Acidity load at tributary sampling sites, July 1984.

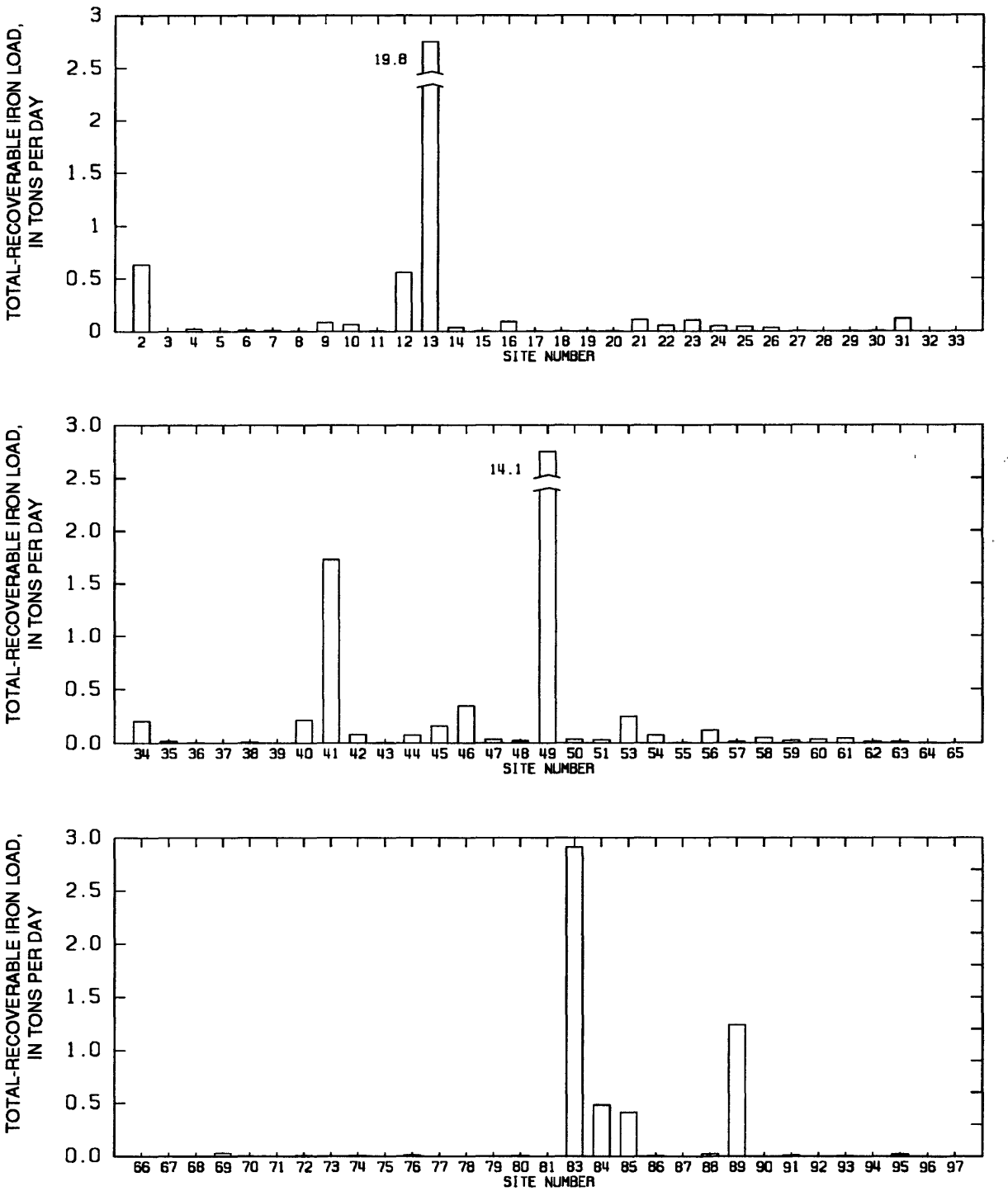


Figure 22.--Total-recoverable iron load at tributary sampling sites, May 1984.

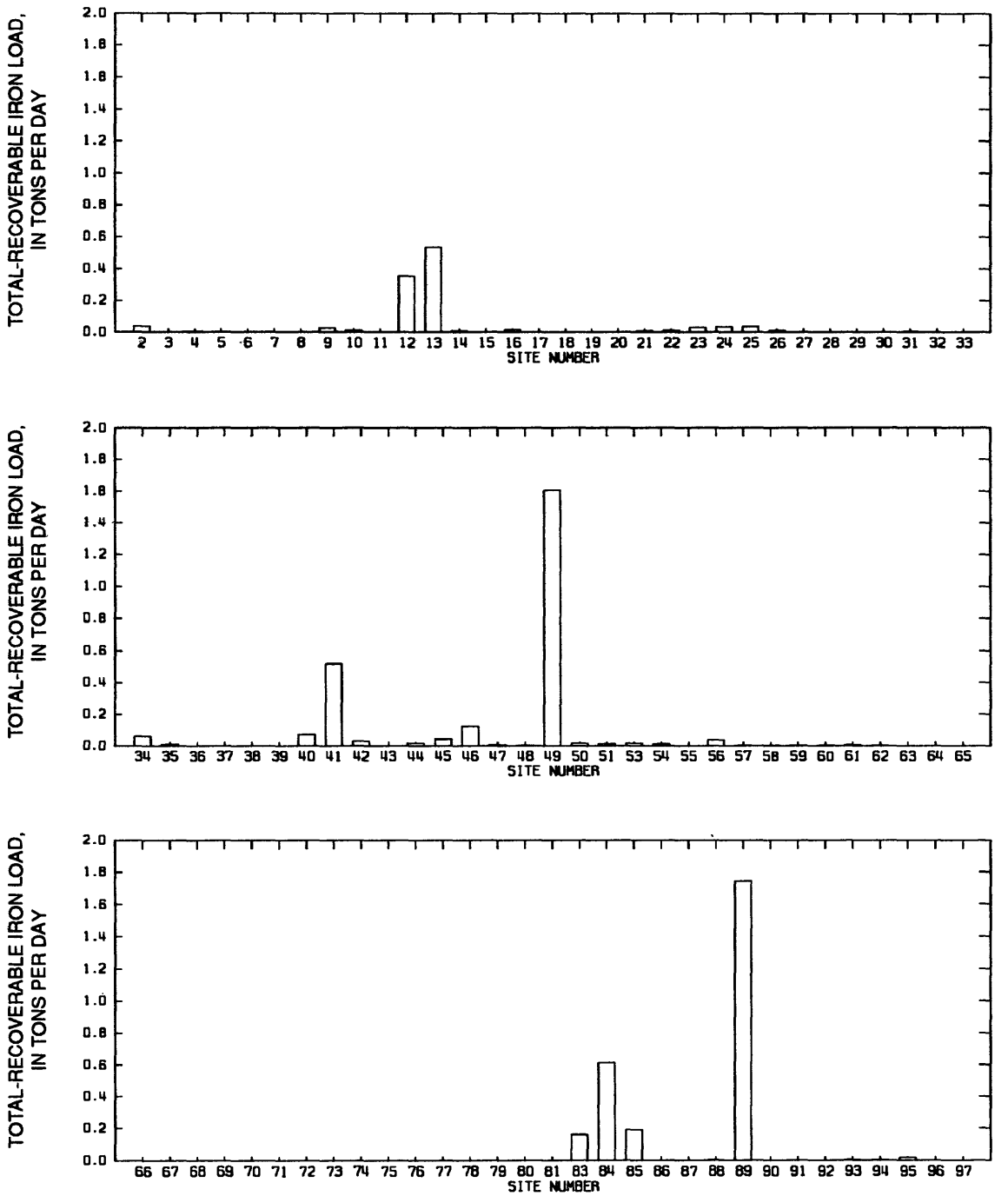


Figure 23.--Total-recoverable iron load at tributary sampling sites, July 1984.

EFFECT OF WATER QUALITY OF TRIBUTARIES ON THE WATER QUALITY OF THE UPPER WEST BRANCH SUSQUEHANNA RIVER

Figure 24 shows the cumulative tributary acidity and total-recoverable iron loads and the instantaneous loads sampled in the river in May. The figure has a dual purpose: (1) to indicate tributaries (and the areas they drain) where the quality of the water discharged by the tributary has little or no effect on the quality of the river, and (2) to indicate how a simple accumulation of the loads contributed by the tributaries compares to the instantaneous loads found at specific sites on the river.

The tributaries that have little or no effect on the water quality of the river are indicated by the areas covered by the relatively horizontal lines on both of the graphs. In general, the areas (and tributaries) that had little effect on the quality of the river in May were sites 2 through 11, 14 through 40, 50 through 81, and 90 through 97. The graphs support the conclusions of previous sections of this report which indicated that sites 12, 13, 41, 49, 83, 84, and 89 were major contributors of acidity and total-recoverable iron. A comparison of cumulative and instantaneous loads shows that the computed and observed loads agree only for acidity and only from Curwensville to Karthaus. Even though an estimate of cumulative loads would not be accurate because the sampling times did not account for travel time in the river, these data do indicate that chemical interaction among the constituents may be occurring, and that deposition and scour of the suspended phase is probably a part of the transport process.

Figure 25 shows that the data collected in July allow similar conclusions to be drawn, except that the computed and observed loads do not agree at any point along the river. The same groups of tributaries show either large or very small contributions of acidity and total-recoverable iron to the river.

SUGGESTIONS FOR FURTHER STUDY

Although the area and number of tributaries sampled in this study were quite extensive, additional data from the sites are needed to document further the water-quality conditions described in this report. In addition, separate studies, similar to this one, could evaluate the water quality and identify sources of acid mine drainage in the basins of the larger tributaries, such as Clearfield and Moshannon Creeks. This would allow the development of a model to estimate the cumulative effect of the tributaries. Such a model would have application in the design of an effective acid mine drainage abatement plan in each of these subbasins. If such abatement plans were implemented, they could have a substantial effect on the water quality of the West Branch Susquehanna River.

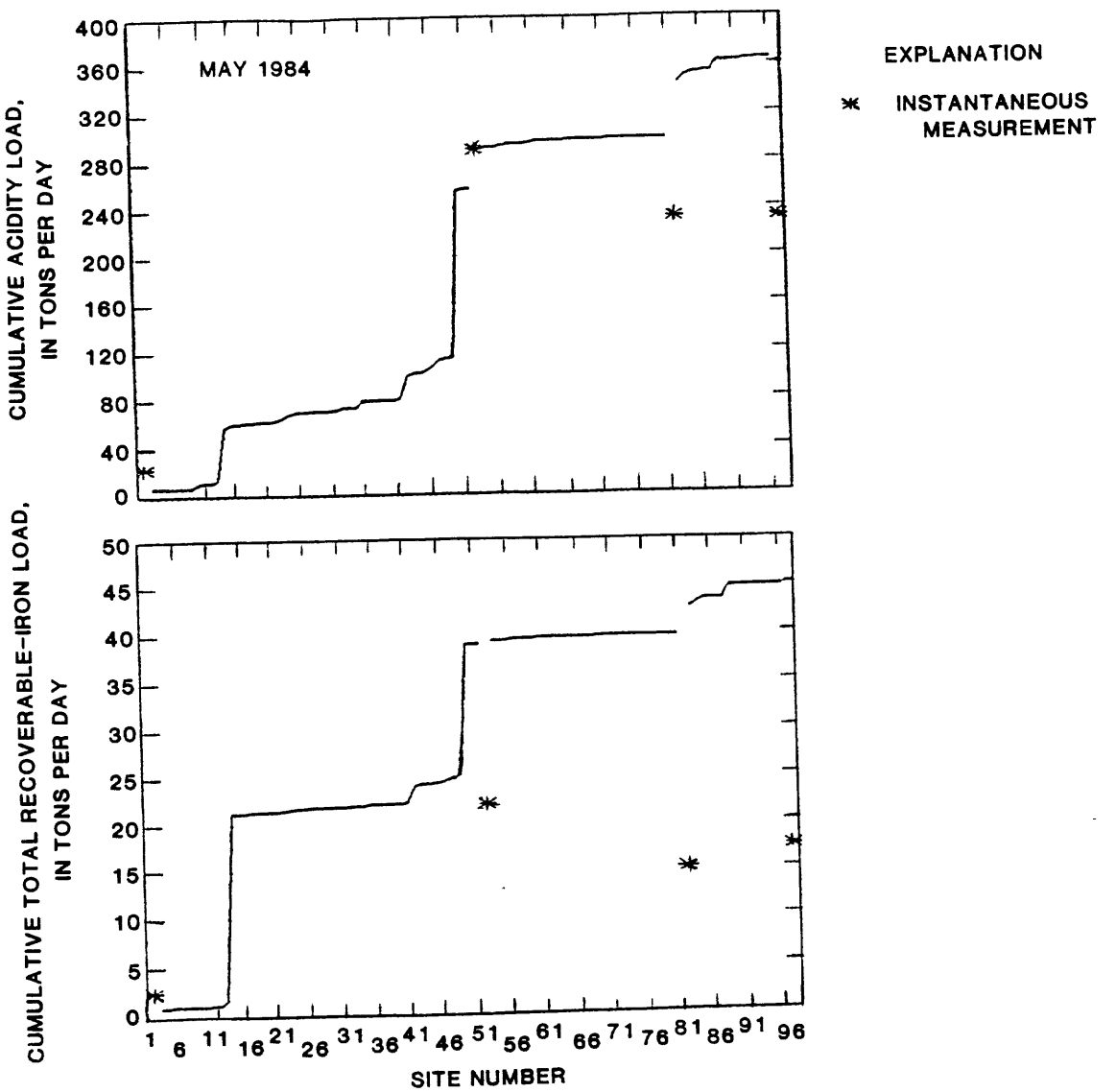


Figure 24.—Cumulative acidity and total-recoverable iron loads from tributaries and instantaneous loads at sampling sites on the West Branch Susquehanna River, May 1984.

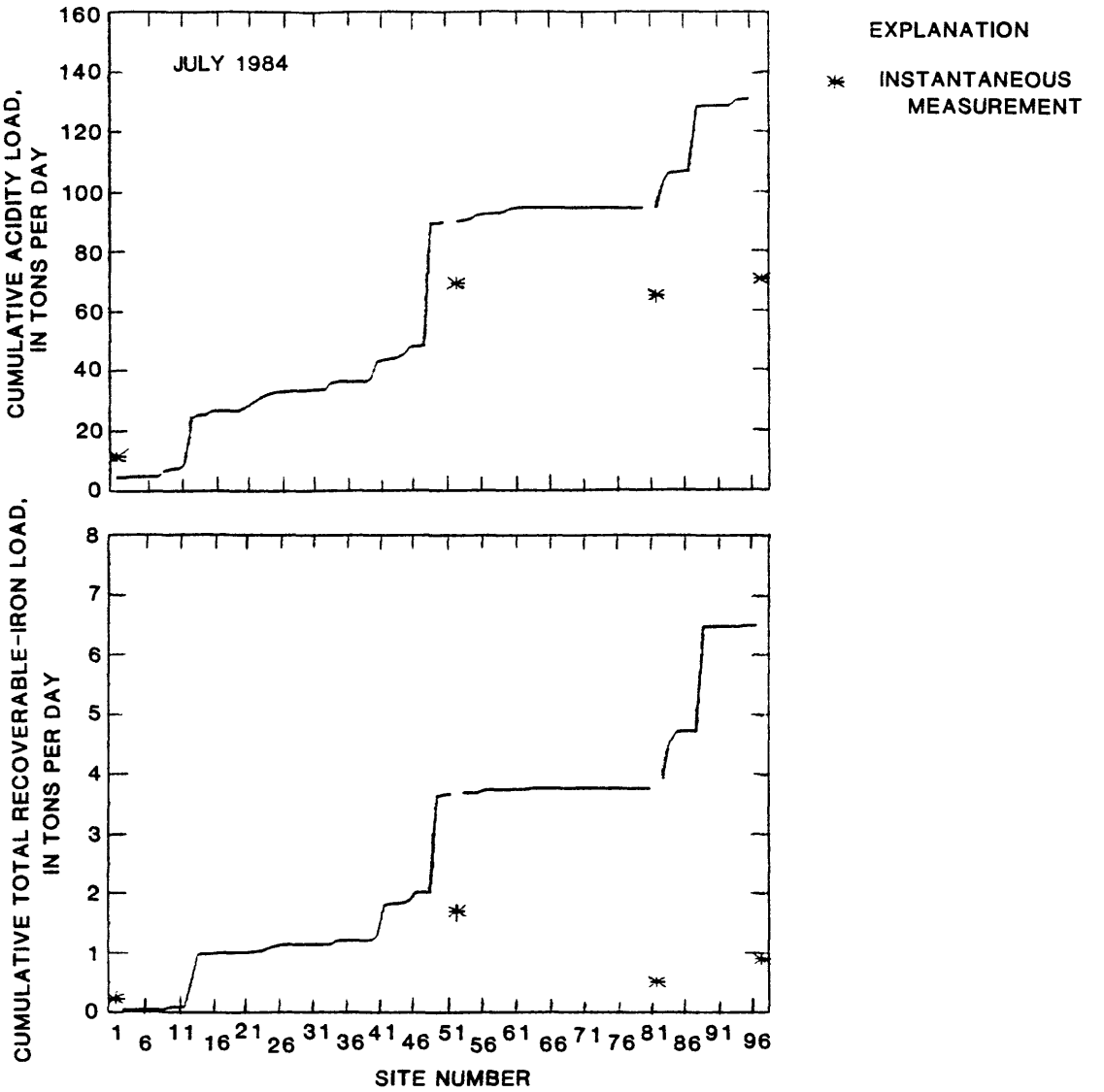


Figure 25.—Cumulative acidity and total–recoverable iron loads from tributaries and instantaneous loads at sampling sites on the West Branch Susquehanna River, July 1984.

SUMMARY

The water quality of the West Branch Susquehanna River and its tributaries appears to be directly related to the predominant land use in the area drained by the tributary. The background water quality of the area is suggested by the tributaries sampled at sites 62 through 81. The median pH measurement at these sites for the two sampling periods was 5.5 units and specific conductance values were generally less than 100 µS/cm. These tributaries drain areas that contain little, if any, coal deposits and disturbed areas.

The most degraded water quality of the tributaries was found at the sites where the sampled tributaries drained a large disturbed area. The pH values at these sites were generally less than 5.0, and the median pH was less than 4.0 units. Two of the larger tributaries (Clearfield and Moshannon Creeks) and several smaller tributaries that drain areas where mine spoils were collected, or where processing of the coal was done, appear to be severely affected by acid mine drainage.

In general, only a few of the 94 tributaries contributed most of the acidity and total-recoverable iron loads to the West Branch Susquehanna River. During the May sampling, Moshannon, Sinnemahoning, and Clearfield Creeks contributed 63 percent of the 365 tons/day of acidity; Moshannon and Clearfield Creeks contributed 76 percent of the 44.8 tons/day of total-recoverable iron that were discharged to the river. During the July sampling, Moshannon, Kettle, and Clearfield Creeks contributed 60 percent of the 131 tons/day of acidity, and Moshannon and Kettle Creeks contributed 51 percent of the 6.5 tons/day of total-recoverable iron discharged to the river.

The maximum acidity and total-recoverable iron concentrations measured during the two sampling periods were found at sites with drainage areas less than 26 mi^2. During the May sampling period, the maximum acidity concentration measured was 477 mg/L at site 85, which has a drainage area of 25.6 mi^2. The next two highest values in May, 323 and 263 mg/L, were measured at sites with drainage areas of 1.49 and 1.71 mi^2, respectively. The three highest total-recoverable iron concentrations in May were 56,000, 46,000, and 20,000 µg/L at sites 12 (1.71 mi^2), 85 (25.6 mi^2), and 46 (1.49 mi^2), respectively.

In July, some of the same tributaries had the highest concentrations. The maximum acidity concentration of 844 mg/L was measured at site 24, with a drainage area of 1.08 mi^2. The next two highest concentrations, 546 and 497 mg/L were measured at sites 35 and 12, with drainage areas of 0.89 and 1.71 mi^2, respectively. The maximum total-recoverable iron concentration measured in July was 110,000 µg/L at site 12, with a drainage area of 1.71 mi^2. The next two highest concentrations (25,000 and 20,000 µg/L) were measured at sites 41 and 46, with drainage areas of 24.0 and 1.49 mi^2, respectively. Although these concentrations are relatively high in comparison to the median concentration for each of the sampling periods, the small drainage areas provide very little water discharge, and the load to the river is relatively small. When combined with the loads of larger tributaries (those that drain areas greater than 200 mi^2) and the load in the river, these small loads from tributaries with high concentrations have little or no effect on the water quality of the river.

The West Branch Susquehanna River at the most upstream site at Curwensville had pH values ranging from 5.4 to 6.5, and specific conductance values ranging from 267 to 310 µS/cm. The most degraded water quality was found at the site at Karthaus (pH 3.9 to 4.1 units, specific conductance 330 to 610 µS/cm); the quality gradually improved downstream to the site at Renovo (pH 3.8 to 4.6 units, specific conductance 200 to 392 µS/cm), although the quality did not recover to that found at Curwensville. Of the eight pH measurements at the four main-stem sites, only one met the PaDER recommended limit of not less than 6.0 units (the site at Curwensville in May). The total-recoverable iron concentrations measured at all sites met the recommended limit except at the site at Karthaus in May. In addition, the alkalinity concentrations at Curwensville in May and July met the recommended limit of 20 mg/L.

REFERENCES CITED

Buchanan, T.J., and Somers, W.P., 1969, Discharge measurements at gaging stations: U.S. Geological Survey Techniques of Water Resources Investigations, book 3, chap. A8, 65 p.

Hainly, R.A., Truhlar, J.F., and Wetzel, K.L., 1989, Stream-water quality in the West Branch Susquehanna River basin, Pennsylvania: An appraisal of areal and temporal variability from 1962 to 1982 in Hydrologic Accounting Unit 020502: U.S. Geological Survey Water-Resources Investigations Report 85-4283, 40 p.

Herb, W.J., Brown, D.E., Shaw, L.C., and Becher, A.E., 1983, Hydrology of Areal, Eastern Coal Province, Pennsylvania: U.S. Geological Survey Water Resources Investigations 83-223, 89 p.

Pennsylvania Department of Environmental Resources, Bureau of Water Quality Management, 1981, Comprehensive Water Quality Management Plan - Central Susquehanna Area: Chapter XIII, draft copy, 50 p.

Pennsylvania Department of Environmental Resources, Office of Resource Management, 1979, The State Water Plan—Planning Principles: SWP-1,90 p.

Pennsylvania Department of Environmental Resources, Office of Resource Management, 1979, State Water Plan-Subbasin 8, Upper West Branch Susquehanna River, SWP-9, 146 p.

Pennsylvania Department of Environmental Resources, 1984, Title 25, Rules and Regulations, Part I, Subpart C, Article II, Water resources, chap. 93, 18 p.

Shaw, L.C. and Page, L.V., 1977, Low-flow characteristics of Pennsylvania streams: Water Resources Bulletin No. 12, Pennsylvania Department of Environmental Resources, 441 p.

Skougstad, M.W., Fishman, M.J., Friedman, L.C., Erdmann, D.E., and Duncan,S.S., 1979, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 626 p.

Susquehanna River Basin Study Coordinating Committee, 1970, Susquehanna River Basin Study: Appendix F—Water Supply and Water Quality, 251 p.

U.S. Department of Commerce, 1984, Climatological data summary - Pennsylvania: v. 89, no. 13, 34 p.

U.S. Department of the Interior, Geological Survey, Office of Water Data Coordination, 1977, National Handbook of Recommended Methods for Water-Data Collection, chaps. 1 and 5, p. 130 and 193.

U.S. Geological Survey, 1984, Water resources data for Pennsylvania, water year 1984--volume 2; U.S. Geological Survey Water-Data Report PA-84-2, 327 p.

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; ac-ft, acre foot; °, degree; ', minute; ", second; <, less than; E, estimated; --, no data]

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
01541200 West Branch Susquehanna River at Curwensville Site No. 1 (Latitude 40°57'41", Longitude 078°31'10")											
May 21	0920	1,720	267	6.5	13.0	0.1	5.0	23	14	91	199
July 23	0930	170	310	5.4	22.0	.5	25	26	200	110	211
01541250 Anderson Creek at Curwensville Site No. 2 (Latitude 40°58'20", Longitude 078°31'20")											
May 21	1330	247	180	4.6	15.5	.2	9.9	2	97	57	--
July 23	1045	48	240	4.2	18.0	.7	35	0	.0	87	--
01541253 Unnamed tributary to West Branch Susquehanna River at Curwensville Site No. 3 (Latitude 40°58'38", Longitude 078°30'58")											
May 21	1520	.58	197	6.5	13.0	.1	5.0	14	8.6	41	--
July 23	1130	.01	270	6.0	15.0	.2	9.9	15	29	36	--
01541254 Hogback Run near Glen Richey Site No. 4 (Latitude 40°57'57", Longitude 078°29'26")											
May 21	1135	13	520	7.9	12.0	--	--	86	2.1	190	--
July 23	0900	5.6	602	6.6	12.0	.1	5.0	130	63	240	--
01541255 Unnamed tributary to West Branch Susquehanna River at Porters Bridge Site No. 5 (Latitude 40°58'24", Longitude 078°29'24")											
May 21	1255	.98	175	7.6	13.5	--	--	22	1.1	42	--
July 23	1150	.16	278	7.1	18.5	.2	9.9	36	5.5	67	--
01541257 Hartshorn Run at Susquehanna Bridge Site No. 6 (Latitude 40°58'46", Longitude 078°29'42")											
May 21	0915	11	126	5.4	11.0	.1	5.0	2	15	39	--
July 23	0930	2.3	140	6.1	16.0	.1	5.0	3	4.6	56	--
01541260 Unnamed tributary to West Branch Susquehanna River at Susquehanna Bridge Site No. 7 (Latitude 40°59'13", Longitude 078°28'54")											
May 21	1615	5.5	640	5.4	15.0	.2	9.9	5	39	270	--
July 23	1215	1.4	1,040	4.6	18.0	1.0	50	2	97	630	--
01541262 Unnamed tributary to West Branch Susquehanna River at Hyde Site No. 8 (Latitude 40°59'35", Longitude 078°27'51")											
May 21	1345	.96	355	7.6	13.5	--	--	37	1.8	140	--
July 23	1420	.28	600	7.4	18.5	.1	5.0	70	5.4	270	--
01541300 Montgomery Creek at Hyde Site No. 9 (Latitude 41°00'14", Longitude 078°27'43")											
May 21	1100	52	330	4.5	12.5	.4	20	0	.0	130	--
July 23	1130	16	595	4.1	19.5	.9	45	0	.0	410	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; ac-ft, acre foot; °, degree; ', minute; ", second; <, less than; E, estimated; --, no data]

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01541200 West Branch Susquehanna River at Curwensville Site No. 1 (Latitude 40°57'41", Longitude 078°31'10")										
May 21	0.27	924	100	100	480	6	350	380	20	13
July 23	.29	97	200	200	380	6	390	350	10	4
01541250 Anderson Creek at Curwensville Site No. 2 (Latitude 40°58'20", Longitude 078°31'20")										
May 21	--	--	1,200	1,000	950	420	1,200	1,200	80	78
July 23	--	--	1,800	1,800	290	220	2,100	2,000	120	110
01541253 Unnamed tributary to West Branch Susquehanna River at Curwensville Site No. 3 (Latitude 40°58'38", Longitude 078°30'58")										
May 21	--	--	200	100	390	10	30	28	30	23
July 23	--	--	<100	<100	540	19	10	7	80	54
01541254 Hogback Run near Glen Richey Site No. 4 (Latitude 40°57'57", Longitude 078°29'26")										
May 21	--	--	300	100	680	14	60	28	40	14
July 23	--	--	300	200	410	4	50	18	20	8
01541255 Unnamed tributary to West Branch Susquehanna River at Porters Bridge Site No. 5 (Latitude 40°58'24", Longitude 078°29'24")										
May 21	--	--	200	<100	550	18	20	3	30	6
July 23	--	--	200	100	360	7	10	3	10	3
01541257 Hartshorn Run at Susquehanna Bridge Site No. 6 (Latitude 40°58'46", Longitude 078°29'42")										
May 21	--	--	500	400	410	65	[a]410	[a]440	60	52
July 23	--	--	300	200	220	110	750	720	80	47
01541260 Unnamed tributary to West Branch Susquehanna River at Susquehanna Bridge Site No. 7 (Latitude 40°59'13", Longitude 078°28'54")										
May 21	--	--	2,000	800	680	140	[a]4,600	[a]4,700	210	210
July 23	--	--	200	200	230	69	8,900	8,800	[a]300	[a]310
01541262 Unnamed tributary to West Branch Susquehanna River at Hyde Site No. 8 (Latitude 40°59'35", Longitude 078°27'51")										
May 21	--	--	300	200	620	15	60	16	40	30
July 23	--	--	100	100	220	<3	60	<1	30	<3
01541300 Montgomery Creek as Hyde Site No. 9 (Latitude 41°00'14", Longitude 078°27'43")										
May 21	--	--	2,200	2,100	590	350	[a]3,500	[a]3,600	190	190
July 23	--	--	5,100	5,100	590	440	10,000	10,000	[a]300	[a]310

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
	015413051 Moose Creek at Clearfield Site No. 10 (Latitude 41°01'49", Longitude 078°26'16")										
May 21	1455	39	245	4.8	13.5	0.2	9.9	1	31	79	--
July 23	1315	6.5	440	4.2	23.5	.4	20	0	.0	170	--
	015413053 Unnamed tributary to West Branch Susquehanna River at Kerr Site No. 11 (Latitude 41°01'52", Longitude 078°25'29")										
May 21	1620	1.4	200	7.0	14.5	--	--	8	1.5	76	--
July 23	1410	.30	273	6.5	21.5	.1	5.0	13	8.0	100	--
	015413055 Wolf Run at Kerr Site No. 12 (Latitude 41°01'42", Longitude 078°24'29")										
May 21	1745	3.7	1,670	3.7	15.0	5.3	263	0	.0	780	--
July 23	1555	1.2	2,940	2.9	21.0	10	497	0	.0	2,100	--
	01541552 Clearfield Creek at Clearfield Site No. 13 (Latitude 41°01'29", Longitude 078°23'59")										
May 21	1400	1,670	315	5.2	16.0	.2	9.9	1	12	140	--
July 23	1330	230	520	4.6	24.0	.5	25	0	.0	270	--
	01541555 Abes Run at Bishtown Site No. 14 (Latitude 41°02'05", Longitude 078°22'24")										
May 21	1515	4.8	1,400	3.3	14.5	3.3	164	0	.0	720	--
July 23	1645	1.4	1,620	3.2	18.5	4.5	223	0	.0	1,300	--
	01541556 Unnamed tributary to West Branch Susquehanna River at Bishtown Site No. 15 (Latitude 41°02'14", Longitude 078°22'05")										
May 21	1620	.86	1,180	3.2	13.0	2.4	119	0	.0	730	--
July 23	1745	.34	1,850	3.3	18.0	4.9	243	0	.0	1,300	--
	01541559 Lick Run near Kerr Site No. 16 (Latitude 41°02'52", Longitude 078°22'58")										
May 22	1030	86	126	4.7	11.5	.1	5.0	1	39	54	--
July 23	1600	20	220	5.7	19.5	.5	25	8	31	84	--
	01541560 Unnamed tributary to West Branch Susquehanna River near Shawville Site No. 17 (Latitude 41°03'03", Longitude 078°22'50")										
May 22	1145	.76	130	5.7	13.0	.1	5.0	2	7.7	50	--
July 24	0930	.06	160	5.8	17.5	.1	5.0	2	6.1	57	--
	01541562 Devils Run near Shawville Site No. 18 (Latitude 41°03'10", Longitude 078°22'39")										
May 21	1720	1.9	655	3.8	16.5	.6	30	0	.0	300	--
July 23	1840	.22	680	3.9	23.5	.7	35	0	.0	340	--
	01541564 Unnamed tributary to West Branch Susquehanna River at Shawville Site No. 19 (Latitude 41°03'44", Longitude 078°22'31")										
May 22	1230	.73	240	6.2	13.5	.2	9.9	15	18	74	--
July 24	1010	.16	385	6.7	18.0	.1	5.0	29	11	140	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
015413051 Moose Creek at Clearfield Site No. 10 (Latitude 41°01'49", Longitude 078°26'16")										
May 21	--	--	1,200	1,200	610	250	2,300	2,300	[a]110	[a]120
July 23	--	--	2,600	2,600	690	500	5,500	5,500	[a]170	[a]190
015413053 Unnamed tributary to West Branch Susquehanna River at Kerr Site No. 11 (Latitude 41°01'52", Longitude 078°25'29")										
May 21	--	--	400	100	1,000	43	220	210	90	33
July 23	--	--	200	<100	300	35	160	160	40	12
015413055 Wolf Run at Kerr Site No. 12 (Latitude 41°01'42", Longitude 078°24'29")										
May 21	--	--	10,000	10,000	56,000	55,000	[a]37,000	[a]38,000	--	1,300
July 23	--	--	22,000	22,000	110,000	100,000	[a]79,000	[a]81,000	[a]2,600	[a]2,800
01541552 Clearfield Creek at Clearfield Site No. 13 (Latitude 41°01'29", Longitude 078°23'59")										
May 21	--	--	2,300	400	4,400	150	[a]1,700	[a]1,800	[a]110	[a]140
July 23	--	--	2,400	2,400	860	550	3,700	3,500	[a]150	[a]190
01541555 Abes Run at Bishtown Site No. 14 (Latitude 41°02'05", Longitude 078°22'24")										
May 21	--	--	21,000	21,000	--	2,800	27,000	27,000	[a]1,000	[a]1,100
July 23	--	--	24,000	24,000	[a]2,200	[a]2,400	34,000	34,000	1,300	1,200
01541556 Unnamed tributary to West Branch Susquehanna River at Bishtown Site No. 15 (Latitude 41°02'14", Longitude 078°22'05")										
May 21	--	--	12,000	12,000	1,900	1,600	23,000	23,000	9,300	860
July 23	--	--	25,000	24,000	2,800	2,600	42,000	38,000	1,400	1,400
01541559 Lick Run near Kerr Site No. 16 (Latitude 41°02'52", Longitude 078°22'58")										
May 22	--	--	600	600	390	37	6,800	690	--	86
July 23	--	--	1,000	900	290	40	1,500	1,500	[a]60	[a]69
01541560 Unnamed tributary to West Branch Susquehanna River near Shawville Site No. 17 (Latitude 41°03'03", Longitude 078°22'50")										
May 22	--	--	500	200	1,100	8	180	130	[a]60	[a]81
July 24	--	--	<100	<100	760	150	[a]80	[a]90	30	10
01541562 Devils Run near Shawville Site No. 18 (Latitude 41°03'10", Longitude 078°22'39")										
May 21	--	--	3,000	3,000	600	380	[a]8,900	[a]9,600	290	320
July 23	--	--	2,100	1,900	540	410	[a]11,000	[a]12,000	130	92
01541564 Unnamed tributary to West Branch Susquehanna River at Shawville Site No. 19 (Latitude 41°03'44", Longitude 078°22'31")										
May 22	--	--	100	100	760	9	70	43	30	4
July 24	--	--	200	<100	480	16	30	25	30	11

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
	01541565 Bloody Run at Shawville Site No. 20 (Latitude 41°03'50", Longitude 078°22'22")										
May 22	1300	2.1	523	5.9	14.0	0.2	9.9	10	24	700	--
July 24	1045	.60	675	6.5	18.0	.1	5.0	12	7.3	390	--
	01541700 Trout Run at Shawville Site No. 21 (Latitude 41°04'09", Longitude 078°21'38")										
May 22	1430	152	50	5.4	15.0	.1	5.0	2	15	20	--
July 23	1445	26	105	5.9	20.0	.3	15	6	15	38	--
	01541710 Millstone Run near Shawville Site No. 22 (Latitude 41°03'02", Longitude 078°20'21")										
May 22	1530	15	633	3.6	15.5	1.0	50	0	.0	280	--
July 24	1125	3.6	1,400	3.3	19.5	2.6	129	0	.0	960	--
	01541720 Surveyor Run at Surveyor Site No. 23 (Latitude 41°04'26", Longitude 078°19'39")										
May 22	0930	18	792	3.4	11.5	1.4	70	0	.0	350	--
July 24	1050	3.9	1,230	3.4	18.0	2.4	119	0	.0	810	--
	01541722 Bear Run at Shiloh Site No. 24 (Latitude 41°03'25", Longitude 078°18'32")										
May 22	1000	2.2	1,040	3.5	11.0	2.5	124	0	.0	600	--
July 24	1110	.68	2,950	3.1	17.0	17	844	0	.0	2,300	--
	01541724 Bald Hill Run at Walton Site No. 25 (Latitude 41°04'11", Longitude 078°18'10")										
May 22	1100	7.5	945	7.2	13.0	.1	5.0	27	3.3	450	--
July 24	1215	2.9	1,300	6.1	18.0	1.3	65	50	77	800	--
	01541726 Unnamed tributary to West Branch Susquehanna River at Lecontes Mills Site No. 26 (Latitude 41°04'16", Longitude 078°16'54")										
May 22	1150	1.5	1,780	3.2	15.5	4.0	199	0	.0	1,100	--
July 24	1300	.61	2,500	3.2	20.0	7.7	382	0	.0	2,100	--
	01541727 Unnamed tributary to West Branch Susquehanna River near Lecontes Mills Site No. 27 (Latitude 41°04'06", Longitude 078°16'45")										
May 22	1230	.99	500	3.7	12.5	.6	30	0	.0	210	--
July 24	1330	.09	957	3.4	17.5	2.1	104	0	.0	540	--
	01541728 Unnamed tributary to West Branch Susquehanna River near Gallows Harbor Site No. 28 (Latitude 41°03'50", Longitude 078°16'35")										
May 22	1310	.14	300	4.4	8.0	.2	9.9	0	.0	120	--
July 24	1350	.12	1,310	3.0	18.5	3.9	194	0	.0	760	--
	01541729 Unnamed trib. to W. Branch Susquehanna R. blw RR bridge at Gallows Harbor Site No. 29 (Latitude 41°03'36", Longitude 078°16'10")										
May 22	1335	1.4	445	3.3	14.0	1.1	55	0	.0	170	--
July 24	1415	.18	765	3.5	19.5	2.8	139	0	.0	360	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01541565 Bloody Run at Shawville Site No. 20 (Latitude 41°03'50", Longitude 078°22'22")										
May 22	--	--	100	100	410	6	110	82	[a]50	[a]51
July 24	--	--	300	100	210	15	30	16	50	34
01541700 Trout Run at Shawville Site No. 21 (Latitude 41°04'09", Longitude 078°21'38")										
May 22	--	--	300	300	270	16	160	160	60	21
July 23	--	--	500	200	130	33	[a]310	[a]340	--	49
01541710 Millstone Run near Shawville Site No. 22 (Latitude 41°03'02", Longitude 078°20'21")										
May 22	--	--	3,600	3,300	1,400	1,400	4,900	4,900	[a]280	[a]290
July 23	--	--	5,900	5,900	[a]1,400	[a]1,700	14,000	14,000	610	580
01541720 Surveyor Run at Surveyor Site No. 23 (Latitude 41°04'26", Longitude 078°19'39")										
May 22	--	--	6,400	6,300	--	2,200	[a]7,000	[a]7,600	--	410
July 24	--	--	21,000	20,000	[a]2,800	[a]3,000	15,000	13,000	600	570
01541722 Bear Run at Shiloh Site No. 24 (Latitude 41°03'25", Longitude 078°18'32")										
May 22	--	--	13,000	13,000	--	8,600	23,000	23,000	1,000	950
July 24	--	--	38,000	37,000	19,000	18,000	[a]72,000	[a]75,000	[a]2,800	2,900
01541724 Bald Hill Run at Walton Site No. 25 (Latitude 41°04'11", Longitude 078°18'10")										
May 22	--	--	1,800	300	2,200	520	2,300	2,200	140	98
July 24	--	--	1,700	1,700	4,600	4	2,900	2,900	120	29
01541726 Unnamed tributary to West Branch Susquehanna River at Lecontes Mills Site No. 26 (Latitude 41°04'16", Longitude 078°16'54")										
May 22	--	--	21,000	20,000	--	8,000	[a]33,000	[a]34,000	1,300	1,300
July 24	--	--	30,000	30,000	7,400	7,000	[a]48,000	[a]49,000	1,900	1,800
01541727 Unnamed tributary to West Branch Susquehanna River near Lecontes Mills Site No. 27 (Latitude 41°04'06", Longitude 078°16'45")										
May 22	--	--	2,800	2,800	490	300	[a]3,600	[a]3,800	--	230
July 24	--	--	5,700	5,700	[a]700	[a]710	9,000	8,900	[a]430	[a]460
01541728 Unnamed tributary to West Branch Susquehanna River near Gallows Harbor Site No. 28 (Latitude 41°03'50", Longitude 078°16'35")										
May 22	--	--	1,000	1,000	290	18	2,200	2,100	190	180
July 24	--	--	22,000	22,000	2,100	1,900	25,000	24,000	1,100	1,100
01541729 Unnamed tributary to West Branch Susquehanna River below railroad bridge at Gallows Harbor Site No 29 (Latitude 41°03'36", Longitude 078°16'10")										
May 22	--	--	5,300	5,200	470	260	3,800	3,800	[a]520	[a]530
July 24	--	--	12,000	11,000	390	250	8,700	8,700	[a]880	[a]940

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
	01541730 Unnamed tributary to West Branch Susquehanna River at Gallows Harbor Site No. 30 (Latitude 41°03'14", Longitude 078°15'43")										
May 22	1415	4.2	200	4.3	12.5	0.3	15	0	0.0	73	--
July 24	1445	.24	650	4.2	16.0	2.6	129	0	.0	350	--
	01541733 Moravian Run at Gallows Harbor Site No. 31 (Latitude 41°02'57", Longitude 078°15'32")										
May 22	1450	61	180	4.4	13.0	.2	9.9	0	.0	52	--
July 24	1500	6.2	355	3.9	19.0	.6	30	0	.0	120	--
	01541734 Unnamed tributary to West Branch Susquehanna River at Gallows Harbor Site No. 32 (Latitude 41°03'11", Longitude 078°14'57")										
May 22	1530	.85	100	4.5	12.0	.2	9.9	0	.0	31	--
July 24	1530	.04	100	4.8	16.0	.1	5.0	1	31	29	--
	01541735 Unnamed tributary to West Branch Susquehanna River at Coudley Site No. 33 (Latitude 41°03'35", Longitude 078°14'41")										
May 22	1620	.12	70	5.4	10.0	.1	5.0	1	7.7	22	--
	01541750 Deer Creek near Frenchville Site No. 34 (Latitude 41°04'42", Longitude 078°14'11")										
May 22	1645	77	350	4.2	15.0	.5	25	0	.0	150	--
July 24	1245	14	827	3.5	19.5	1.2	60	0	.0	380	--
	01541751 Unnamed tributary to West Branch Susquehanna River at Coudley Site No. 35 (Latitude 41°04'39", Longitude 078°13'46")										
May 22	1645	2.3	1,000	3.4	15.0	3.3	164	0	.0	540	--
July 24	1610	.27	2,350	3.2	18.5	11	546	0	.0	1,500	--
	01541752 Unnamed tributary to West Branch Susquehanna River near Fairview Site No. 36 (Latitude 41°03'42", Longitude 078°12'35")										
May 22	1745	1.9	585	3.6	15.0	1.3	65	0	.0	270	--
July 24	1800	.13	1,300	4.1	20.0	2.2	109	0	.0	1,200	--
	01541753 Unnamed tributary to West Branch Susquehanna River near Rolling Stone Site No. 37 (Latitude 41°03'51", Longitude 078°12'22")										
May 22	1820	1.0	350	4.2	12.5	.3	15	0	.0	150	--
July 24	1830	E.30	702	4.6	17.0	1.3	65	0	.0	340	--
	01541755 Big Run near Rolling Stone Site No. 38 (Latitude 41°03'40", Longitude 078°12'00")										
May 22	1840	8.5	85	6.5	13.0	.0	.0	2	1.2	26	--
July 24	1835	.73	130	6.2	16.0	.1	5.0	4	4.9	45	--
	01541760 Willholm Run near Rolling Stone Site No. 39 (Latitude 41°03'41", Longitude 078°11'49")										
May 22	1900	2.5	80	5.9	13.0	.1	5.0	1	2.4	19	--
July 25	0920	.17	71	5.1	15.0	.1	5.0	1	15	21	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01541730 Unnamed tributary to West Branch Susquehanna River at Gallows Harbor Site No. 30 (Latitude 41°03'14", Longitude 078°15'43")										
May 22	--	--	2,000	2,000	290	23	3,100	3,100	260	260
July 24	--	--	13,000	12,000	100	21	20,000	18,000	--	1,300
01541733 Moravian Run at Gallows Harbor Site No. 31 (Latitude 41°02'57", Longitude 078°15'32")										
May 22	--	--	700	700	730	570	1,000	1,000	120	110
July 24	--	--	1,400	1,400	290	250	2,700	2,700	[a]110	[a]120
01541734 Unnamed tributary to West Branch Susquehanna River at Gallows Harbor Site No. 32 (Latitude 41°03'11", Longitude 078°14'57")										
May 22	--	--	500	500	270	5	290	280	160	84
July 24	--	--	600	<100	820	9	250	190	90	89
01541735 Unnamed tributary to West Branch Susquehanna River at Coudley Site No. 33 (Latitude 41°03'35", Longitude 078°14'41")										
May 22	--	--	<100	<100	240	34	30	19	[a]60	[a]61
01541750 Deer Creek near Frenchville Site No. 34 (Latitude 41°04'42", Longitude 078°14'11")										
May 22	--	--	[a]1,800	[a]1,900	980	850	3,400	3,400	[a]170	[a]190
July 24	--	--	3,300	3,300	--	1,600	9,100	8,800	[a]310	[a]330
01541751 Unnamed tributary to West Branch Susquehanna River at Coudley Site No. 35 (Latitude 41°04'39", Longitude 078°13'46")										
May 22	--	--	21,000	20,000	[a]3,200	[a]3,300	20,000	20,000	880	840
July 24	--	--	49,000	32,000	14,000	14,000	53,000	50,000	1,800	1,800
01541752 Unnamed tributary to West Branch Susquehanna River near Fairview Site No. 36 (Latitude 41°03'42", Longitude 078°12'35")										
May 22	--	--	6,200	6,200	660	540	[a]16,000	[a]17,000	--	520
July 24	--	--	14,000	14,000	490	150	60,000	57,000	1,300	1,200
01541753 Unnamed tributary to West Branch Susquehanna River near Rolling Stone Site No. 37 (Latitude 41°03'51", Longitude 078°12'22")										
May 22	--	--	[a]1,400	[a]1,500	340	23	[a]6,000	[a]6,100	200	190
July 24	--	--	6,000	5,800	170	76	15,000	15,000	420	420
01541755 Big Run near Rolling Stone Site No. 38 (Latitude 41°03'40", Longitude 078°12'00")										
May 22	--	--	100	100	460	76	--	120	50	41
July 24	--	--	200	200	160	9	--	78	[a]20	[a]24
01541760 Willholm Run near Rolling Stone Site No. 39 (Latitude 41°03'41", Longitude 078°11'49")										
May 22	--	--	100	100	340	24	50	46	[a]50	[a]58
July 25	--	--	200	200	640	36	60	44	40	26

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
01541770 Sandy Creek at Rolling Stone Site No. 40 (Latitude 41°03'30", Longitude 078°10'34")											
May 23	1045	49	270	4.0	12.5	0.4	20	0	0.0	110	--
July 25	1020	8.7	900	3.6	15.5	.9	45	0	.0	490	--
01541850 Alder Run at Rolling Stone Site No. 41 (Latitude 41°03'20", Longitude 078°10'24")											
May 23	1145	64	697	3.2	14.0	2.1	104	0	.0	260	--
July 25	1150	7.7	1,480	2.8	17.5	5.3	263	0	.0	850	--
01541900 Rolling Stone Run at Rolling Stone Site No. 42 (Latitude 41°03'25", Longitude 078°09'36")											
May 23	1015	4.8	935	3.4	12.5	2.8	139	0	.0	400	--
July 24	1730	1.0	1,600	2.9	21.0	5.7	283	0	.0	970	--
01541950 Mowry Run at Rolling Stone Site No. 43 (Latitude 41°03'23", Longitude 078°09'19")											
May 23	1130	3.9	280	4.1	12.5	.8	40	0	.0	110	--
July 24	1820	.11	735	3.8	18.0	2.1	104	0	.0	360	--
01541955 Basin Run at Rolling Stone Site No. 44 (Latitude 41°03'29", Longitude 078°08'45")											
May 23	0935	11	665	3.8	13.0	1.6	79	0	.0	290	--
July 25	0910	1.9	1,250	3.6	15.0	2.6	129	0	.0	770	--
01541960 Rock Run near Guenot Settlement Site No. 45 (Latitude 41°04'42", Longitude 078°07'22")											
May 23	1120	7.0	1,430	3.2	14.5	3.5	174	0	.0	710	--
July 25	1045	1.6	2,180	3.0	17.0	5.2	258	0	.0	1,800	--
01541965 Potter Run near Keewaydin Site No. 46 (Latitude 41°05'32", Longitude 078°07'33")											
May 23	1240	6.4	2,600	3.0	16.0	6.5	323	0	.0	1,300	--
July 25	1225	2.3	2,850	2.9	19.5	8.0	397	0	.0	2,400	--
01541967 Unnamed tributary to West Branch Susquehanna River near Keewaydin Site No. 47 (Latitude 41°05'46", Longitude 078°07'33")											
May 23	1340	.76	2,100	3.1	14.0	5.2	258	0	.0	1,000	--
July 25	1310	.16	2,690	3.0	17.0	7.6	377	0	.0	2,100	--
01541970 Rupley Run near Karthaus Site No. 48 (Latitude 41°04'27", Longitude 078°06'01")											
May 23	1400	2.8	617	3.4	12.0	2.6	129	0	.0	260	--
July 25	1440	.35	1,030	3.3	15.0	5.8	288	0	.0	670	--
01542480 Moshannon Creek near Karthaus Site No. 49 (Latitude 41°04'21", Longitude 078°05'50")											
May 23	1500	1,160	447	3.7	16.0	.9	45	0	.0	150	--
July 25	1500	192	900	3.2	23.0	1.6	79	0	.0	360	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
	01541770 Sandy Creek at Rolling Stone Site No. 40 (Latitude 41°03'30", Longitude 078°10'34")									
May 23	--	--	[a]1,800	[a]1,900	1,600	1,300	[a]2,800	[a]2,900	150	140
July 25	--	--	--	4,000	[a]3,100	[a]3,300	11,000	11,000	[a]320	[a]350
	01541850 Alder Run at Rolling Stone Site No. 41 (Latitude 41°03'20", Longitude 078°10'24")									
May 23	--	--	8,100	8,100	10,000	11,000	[a]4,600	[a]4,700	[a]290	[a]320
July 25	--	--	18,000	18,000	[a]25,000	[a]26,000	13,000	13,000	[a]670	[a]690
	01541900 Rolling Stone Run at Rolling Stone Site No. 42 (Latitude 41°03'25", Longitude 078°09'36")									
May 23	--	--	10,000	10,000	[a]6,200	[a]6,800	[a]9,300	[a]9,900	--	790
July 24	--	--	22,000	20,000	--	11,000	19,000	18,000	[a]940	[a]970
	01541950 Mowry Run at Rolling Stone Site No. 43 (Latitude 41°03'23", Longitude 078°09'19")									
May 23	--	--	3,100	3,100	540	260	[a]3,100	[a]3,300	--	210
July 24	--	--	13,000	13,000	430	240	[a]15,000	[a]16,000	[a]410	[a]420
	01541955 Basin Run at Rolling Stone Site No. 44 (Latitude 41°03'29", Longitude 078°08'45")									
May 23	--	--	6,800	6,700	[a]2,500	[a]2,700	6,400	6,400	430	430
July 25	--	--	[a]12,000	[a]13,000	--	3,500	13,000	13,000	[a]650	[a]700
	01541960 Rock Run near Guenot Settlement Site No. 45 (Latitude 41°04'42", Longitude 078°07'22")									
May 23	--	--	13,000	10,000	--	8,400	[a]18,000	[a]19,000	780	750
July 25	--	--	22,000	22,000	10,000	9,800	36,000	36,000	[a]1,200	[a]1,300
	01541965 Potter Run near Keewaydin Site No. 46 (Latitude 41°05'32", Longitude 078°07'33")									
May 23	--	--	23,000	22,000	20,000	19,000	20,000	20,000	840	740
July 25	--	--	30,000	29,000	20,000	20,000	28,000	25,000	1,000	1,000
	01541967 Unnamed tributary to West Branch Susquehanna River near Keewaydin Site No. 47 (Latitude 41°05'46", Longitude 078°07'33")									
May 23	--	--	18,000	17,000	--	17,000	[a]14,000	[a]15,000	--	670
July 25	--	--	25,000	25,000	16,000	15,000	23,000	23,000	850	850
	01541970 Rupley Run near Karthaus Site No. 48 (Latitude 41°04'27", Longitude 078°06'01"									
May 23	--	--	17,000	17,000	[a]3,000	[a]3,100	--	7,300	--	680
July 25	--	--	36,000	35,000	[a]3,000	3,000	[a]15,000	[a]16,000	1,300	1,300
	01542480 Moshannon Creek near Karthaus Site No. 49 (Latitude 41°04'21", Longitude 078°05'50")									
May 23	--	--	3,500	3,100	4,500	1,500	--	2,200	[a]140	[a]150
July 25	--	--	--	25,000	3,100	1,100	5,300	5,300	[a]280	[a]290

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
01542490 Redlick Run near Karthaus Site No. 50 (Latitude 41°04'42", Longitude 078°05'31")											
May 23	1550	7.5	105	4.7	12.5	0.2	9.9	--	--	30	--
July 25	1530	.77	365	3.8	15.0	.8	40	0	0.0	110	--
01542498 Unnamed tributary to West Branch Susquehanna River at Karthaus Site No. 51 (Latitude 41°06'44", Longitude 078°06'46")											
May 23	1250	1.5	1,760	3.2	13.0	2.9	144	0	.0	840	--
July 25	1330	.57	2,210	3.3	16.0	3.5	174	0	.0	1,500	--
01542500 West Branch Susquehanna River at Karthaus Site No. 52 (Latitude 41°07'03", Longitude 078°06'33")											
May 23	1400	4,290	330	3.9	17.0	.5	25	0	.0	140	249
July 25	1430	857	610	4.1	25.5	.6	30	0	.0	300	420
01542513 Mosquito Creek at railroad bridge at Karthaus Site No. 53 (Latitude 41°07'33", Longitude 078°06'35")											
May 23	1430	251	90	4.5	15.0	1.0	50	0	.0	36	--
July 25	1455	38	225	5.0	22.5	.1	5.0	3	58	93	--
01542515 Laurel Run at Karthaus Site No. 54 (Latitude 41°07'12", Longitude 078°05'48")											
May 23	1715	7.9	380	4.0	13.5	.8	40	0	.0	140	--
July 25	1710	.74	1,130	3.0	18.5	3.1	154	0	.0	590	--
01542517 Unnamed tributary to West Branch Susquehanna River near Karthaus Site No. 55 (Latitude 41°07'27", Longitude 078°05'14")											
May 23	1730	.72	625	3.8	13.5	1.1	55	0	.0	290	--
July 25	1700	E.30	1,120	3.5	17.0	2.6	129	0	.0	1,400	--
01542521 Saltlick Run at Belford Site No. 56 (Latitude 41°07'35", Longitude 078°04'47")											
May 23	1715	12	1,170	4.8	13.5	.8	40	1	31	610	--
July 25	1620	3.8	1,940	4.5	16.0	3.2	159	0	.0	1,400	--
01542522 Unnamed tributary to West Branch Susquehanna River at Belford Site No. 57 (Latitude 41°07'16", Longitude 078°04'21")											
May 23	1615	2.2	760	3.5	12.5	2.3	114	0	.0	--	--
July 26	0830	.26	1,000	3.2	14.0	6.2	308	0	.0	740	--
01542523 Upper Three Runs near Pottersdale Site No. 58 (Latitude 41°09'01", Longitude 078°02'32")											
May 24	0920	52	200	6.1	10.0	.0	.0	5	7.7	68	--
July 26	0900	9.5	336	6.4	14.0	.1	5.0	3	2.3	160	--
015425239 Lower Three Runs near Pottersdale Site No. 59 (Latitude 41°09'11", Longitude 078°02'24")											
May 24	0915	27	140	5.4	9.0	.1	5.0	2	15	54	--
July 26	0950	4.9	320	4.2	14.5	.4	20	0	.0	140	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01542490 Redlick Run near Karthaus Site No. 50 (Latitude 41°04'42", Longitude 078°05'31")										
May 23	--	--	300	300	[a]1,800	[a]1,900	[a]340	[a]360	70	36
July 25	--	--	400	400	[a]8,500	[a]8,700	2,200	2,100	[a]60	[a]66
01542498 Unnamed tributary to West Branch Susquehanna River at Karthaus Site No. 51 (Latitude 41°06'44", Longitude 078°06'46")										
May 23	--	--	8,600	8,500	--	8,100	[a]4,900	[a]5,000	310	310
July 25	--	--	13,000	13,000	8,400	8,000	5,900	5,800	370	[a]390
01542500 West Branch Susquehanna River at Karthaus Site No. 52 (Latitude 41°07'03", Longitude 078°06'33")										
May 23	0.34	2,800	1,700	1,700	1,900	580	2,300	1,700	--	180
July 25	.57	972	3,000	3,000	730	450	4,100	4,100	--	220
01542513 Mosquito Creek at railroad bridge at Karthaus Site No. 53 (Latitude 41°07'33", Longitude 078°06'35")										
May 23	--	--	400	400	370	60	[a]450	[a]470	80	71
July 25	--	--	300	300	170	72	1,300	1,300	70	55
01542515 Laurel Run at Karthaus Site No. 54 (Latitude 41°07'12", Longitude 078°05'48")										
May 23	--	--	2,900	2,900	3,600	2,700	[a]4,900	[a]5,300	[a]200	[a]220
July 25	--	--	6,300	5,000	5,600	5,600	27,000	24,000	630	620
01542517 Unnamed tributary to West Branch Susquehanna River near Karthaus Site No. 55 (Latitude 41°07'27", Longitude 078°05'14")										
May 23	--	--	7,200	7,100	2,300	650	[a]3,000	[a]3,200	[a]220	[a]250
July 25	--	--	11,000	10,000	[a]570	[a]600	6,500	6,500	[a]320	[a]340
01542521 Saltlick Run at Belford Site No. 56 (Latitude 41°07'35", Longitude 078°04'47")										
May 23	--	--	4,600	4,500	3,700	2,100	[a]9,400	[a]9,500	[a]440	[a]450
July 25	--	--	6,400	6,000	3,700	690	22,000	22,000	890	820
01542522 Unnamed tributary to West Branch Susquehanna River at Belford Site No. 57 (Latitude 41°07'16", Longitude 078°04'21")										
May 23	--	--	14,000	13,000	2,100	2,100	16,000	15,000	650	640
July 26	--	--	24,000	24,000	[a]1,100	[a]1,200	27,000	26,000	910	890
01542523 Upper Three Runs near Pottersdale Site No. 58 (Latitude 41°09'01", Longitude 078°02'32")										
May 24	--	--	300	300	360	23	[a]240	[a]260	50	40
July 26	--	--	<100	<100	120	21	[a]460	[a]480	40	39
015425239 Lower Three Runs near Pottersdale Site No. 59 (Latitude 41°09'11", Longitude 078°02'24")										
May 24	--	--	500	500	340	23	--	650	110	61
July 26	--	--	1,200	1,200	130	36	2,300	2,200	[a]170	[a]180

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
01542526 Sterling Run near Pottersdale Site No. 60 (Latitude 41°09'10", Longitude 078°02'20")											
May 24	1015	43	126	4.4	10.0	0.2	9.9	0	0.0	--	--
July 26	0950	8.0	262	3.9	14.0	.4	20	0	.0	90	--
01542530 Loop Run at Loop Run Site No. 61 (Latitude 41°09'12", Longitude 078°01'11")											
May 24	1040	10	985	3.6	10.0	1.2	60	0	.0	490	--
July 26	1000	1.9	2,180	3.4	15.5	4.4	218	0	.0	1,900	--
01542538 Spruce Run at Spruce Site No. 62 (Latitude 41°08'54", Longitude 078°00'01")											
May 24	1110	16	75	5.7	10.0	.0	.0	3	12	19	--
July 26	1100	3.7	40	4.7	13.0	.2	9.9	0	.0	17	--
01542540 Unnamed tributary to West Branch Susquehanna River at Spruce Site No. 63 (Latitude 41°09'39", Longitude 078°00'09")											
May 24	1125	11	57	6.6	11.0	.0	.0	2	1.0	16	--
July 26	1115	E.07	86	6.5	15.0	.1	5.0	14	8.6	17	--
01542548 Bougher Run near Birch Site No. 64 (Latitude 41°09'42", Longitude 077°59'19")											
May 24	1130	13	31	5.6	9.5	.1	5.0	2	9.7	10	--
July 26	1125	2.1	36	5.8	13.5	.1	5.0	3	9.2	17	--
01542550 Little Bougher Run near Birch Site No. 65 (Latitude 41°10'00", Longitude 077°59'12")											
May 24	1200	3.4	39	5.4	11.5	.0	.0	1	7.7	13	--
July 26	1200	.13	47	4.8	17.5	.1	5.0	1	31	13	--
01542553 Leaning Pine Run at Birch Site No. 66 (Latitude 41°10'42", Longitude077°58'18")											
May 24	1225	.52	35	7.0	11.0	.1	5.0	2	.4	10	--
01542557 Moores Run at Birch Site No. 67 (Latitude 41°11'04", Longitude077°58'18")											
May 24	1235	3.0	38	5.8	10.0	.1	5.0	3	9.2	25	--
July 26	1230	.17	37	4.8	14.5	.1	5.0	1	31	10	--
01542560 Sugarcamp Run at Birch Site No. 68 (Latitude 41°11'11", Longitude 077°58'26")											
May 24	1300	1.9	80	4.9	11.0	.1	5.0	1	24	20	--
01542565 Birch Island Run at Birch Site No. 69 (Latitude 41°11'45", Longitude 077°58'28")											
May 24	1315	52	60	5.0	12.0	.1	5.0	1	19	22	--
July 26	1310	7.6	83	4.6	15.5	.1	5.0	0	.0	28	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01542526 Sterling Run near Pottersdale Site No. 60 (Latitude 41°09'10", Longitude 078°02'20")										
May 24	--	--	1,000	1,000	300	26	1,300	1,300	90	88
July 26	--	--	1,700	1,700	140	18	[a]3,100	[a]3,300	[a]160	[a]180
01542530 Loop Run at Loop Run Site No. 61 (Latitude 41°09'12", Longitude 078°01'11")										
May 24	--	--	6,100	6,000	--	1,700	16,000	15,000	[a]610	[a]640
July 26	--	--	22,000	22,000	1,200	1,200	55,000	54,000	--	2,200
01542538 Spruce Run at Spruce Site No. 62 (Latitude 41°08'54", Longitude 078°00'01")										
May 24	--	--	200	200	390	7	10	3	30	10
July 26	--	--	<100	<100	100	6	40	9	10	10
01542540 Unnamed tributary to West Branch Susquehanna River at Spruce Site No. 63 (Latitude 41°09'39", Longitude 078°00'09")										
May 24	--	--	200	200	420	13	20	11	60	26
July 26	--	--	<100	<100	190	57	110	110	10	8
01542548 Bougher Run near Birch Site No. 64 (Latitude 41°09'42", Longitude 077°59'19")										
May 24	--	--	<100	<100	170	7	<10	5	50	17
July 26	--	--	<100	<100	110	14	40	17	20	13
01542550 Little Bougher Run near Birch Site No. 65 (Latitude 41°10'00", Longitude 077°59'12")										
May 24	--	--	100	<100	220	8	30	22	60	26
July 26	--	--	<100	<100	90	10	40	33	30	26
01542553 Leaning Pine Run at Birch Site No. 66 (Latitude 41°10'42", Longitude 077°58'18")										
May 24	--	--	100	100	210	5	<10	3	40	33
01542557 Moores Run at Birch Site No. 67 (Latitude 41°11'04", Longitude 077°58'18")										
May 24	--	--	200	100	240	6	<10	1	[a]10	[a]11
July 26	--	--	<100	<100	70	5	<10	<1	[a]30	[a]33
01542560 Sugarcamp Run at Birch Site No. 68 (Latitude 41°11'11", Longitude 077°58'26")										
May 24	--	--	<100	<100	230	9	[a]80	[a]84	40	35
01542565 Birch Island Run at Birch Site No. 69 (Latitude 41°11'45", Longitude 077°58'28")										
May 24	--	--	400	400	200	20	[a]200	[a]210	80	31
July 26	--	--	100	100	70	10	210	200	50	31

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
01542567 Unnamed tributary to West Branch Susquehanna River at Birch Site No. 70 (Latitude 41°11'46", Longitude 077°58'20")											
May 24	1330	0.07	38	6.4	9.0	0.1	5.0	6	4.6	11	--
July 26	1300	E.10	42	6.1	11.5	.1	5.0	5	7.7	10	--
01542570 Black Stump Run at Birch Site No. 71 (Latitude 41°12'38", Longitude 077°57'58")											
May 24	1345	1.0	94	6.9	11.5	.1	5.0	3	.7	23	--
July 26	1345	.05	100	5.1	16.0	.2	9.9	4	62	34	--
01542575 Grove Run near Birch Site No. 72 (Latitude 41°12'57", Longitude 077°57'45")											
May 24	1405	13	126	6.4	13.0	.1	5.0	2	1.5	44	--
July 26	1400	.23	272	5.0	16.5	.1	5.0	2	39	110	--
01542577 Unnamed tributary to West Branch Susquehanna River near Birch Site No. 73 (Latitude 41°13'05", Longitude 077°57'32")											
May 24	1515	2.0	32	5.5	11.5	.1	5.0	2	12	11	--
01542588 Fields Run near Birch Site No. 74 (Latitude 41°12'42", Longitude 077°56'53")											
May 24	1445	17	33	6.8	11.0	.1	5.0	3	.9	9.4	--
July 26	1425	2.9	36	5.7	14.5	.0	.0	2	7.7	9.4	--
01542598 Unnamed tributary to West Branch Susquehanna River near Camp Miller Site No. 75 (Latitude 41°13'38", Longitude 077°56'07")											
May 24	1530	.67	35	6.7	12.0	.0	.0	3	1.2	11	--
01542603 Yost Run near Camp Bloom Site No. 76 (Latitude 41°13'34", Longitude 077°55'48")											
May 24	1550	22	32	6.4	11.0	.0	.0	3	2.3	8.9	--
July 26	1515	3.0	37	7.2	14.5	.0	.0	5	.6	12	--
01542604 Unnamed tributary to West Branch Susquehanna River near Camp Miller Site No. 77 (Latitude 41°13'51", Longitude 077°55'08")											
May 24	1640	3.0	39	7.6	10.5	.0	.0	6	.3	8.8	--
July 26	1540	.33	40	5.3	15.0	.1	5.0	4	39	14	--
01542605 Morris Run near Camp Miller Site No. 78 (Latitude 41°14'15", Longitude 077°55'01")											
May 24	1620	3.1	33	6.6	12.0	.0	.0	4	1.9	12	--
01542606 Dry Run near Camp Miller Site No. 79 (Latitude 41°14'41", Longitude 077°54'39")											
May 24	1700	.26	60	6.5	10.5	.0	.0	5	3.1	13	--
01542607 Burns Run near Bloody Run Camp Site No. 80 (Latitude 41°14'46", Longitude 077°54'20")											
May 24	1715	19	41	6.4	12.0	.1	5.0	1	.8	9.1	--
July 26	1620	4.2	38	6.1	15.0	.0	.0	5	7.7	8.5	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day)	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn)	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01542567 Unnamed tributary to West Branch Susquehanna River at Birch Site No. 70 (Latitude 41°11'46", Longitude 077°58'20")										
May 24	--	--	<100	<100	210	3	<10	<1	[a]20	[a]23
July 26	--	--	<100	<100	--	4	20	<1	30	28
01542570 Black Stump Run at Birch Site No. 71 (Latitude 41°12'38", Longitude 077°57'58")										
May 24	--	--	100	100	290	21	<10	4	[a]30	[a]38
July 26	--	--	<100	<100	160	11	40	15	60	29
01542575 Grove Run near Birch Site No. 72 (Latitude 41°12'57", Longitude 077°57'45")										
May 24	--	--	200	200	200	11	[a]730	[a]740	--	100
July 26	--	--	200	200	80	6	710	670	[a]140	[a]170
01542577 Unnamed tributary to West Branch Susquehanna River near Birch Site No. 73 (Latitude 41°13'05", Longitude 077°57'32")										
May 24	--	--	<100	<100	170	5	50	35	60	17
01542588 Fields Run near Birch Site No. 74 (Latitude 41°12'42", Longitude 077°56'53")										
May 24	--	--	<100	<100	160	4	10	1	20	17
July 26	--	--	<100	<100	100	6	10	<1	20	6
01542598 Unnamed tributary to West Branch Susquehanna River near Camp Miller Site No. 75 (Latitude 41°13'38", Longitude 077°56'07")										
May 24	--	--	<100	<100	170	6	<10	<1	20	16
01542603 Yost Run near Camp Bloom Site No. 76 (Latitude 41°13'34", Longitude 077°55'48")										
May 24	--	--	<100	<100	170	5	10	<1	20	25
July 26	--	--	<100	<100	70	5	10	1	[a]20	[a]27
01542604 Unnamed tributary to West Branch Susquehanna River near Camp Miller Site No. 77 (Latitude 41°13'51", Longitude 077°55'08")										
May 24	--	--	<100	<100	200	17	<10	6	20	<3
July 26	--	--	<100	<100	180	22	20	7	20	3
01542605 Morris Run near Camp Miller Site No. 78 (Latitude 41°14'15", Longitude 077°55'01")										
May 24	--	--	<100	<100	160	8	<10	2	20	12
01542606 Dry Run near Camp Miller Site No. 79 (Latitude 41°14'41", Longitude 077°54'39")										
May 24	--	--	200	200	180	5	<10	<1	--	34
01542607 Burns Run near Bloody Run Camp Site No. 80 (Latitude 41°14'46", Longitude 077°54'20")										
May 24	--	--	100	100	170	5	10	<1	30	12
July 26	--	--	<100	<100	80	6	<10	<1	10	4

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
01542608 Jews Run at Keating Site No. 81 (Latitude 41°15'10", Longitude 077°53'51")											
May 24	1720	2.7	27	6.2	10.0	0.1	5.0	4	4.9	7.2	--
July 26	1635	.50	24	6.0	15.0	.0	.0	4	7.7	8.7	--
01542609 West Branch Susquehanna River at Keating Site No. 82 (Latitude 41°15'40", Longitude 077°54'06")											
May 25	1000	4,300	310	4.1	16.5	.4	20	0	.0	120	--
July 26	1700	804	735	4.0	15.0	.6	30	0	.0	250	402
01544150 Sinnemahoning Creek at Keating Site No. 83 (Latitude 41°15'41", Longitude 077°54'10")											
May 25	0915	3,370	91	6.4	13.0	.1	5.0	3	2.3	24	--
July 26	1730	331	190	6.2	25.5	.0	.0	4	4.9	49	--
01544210 Cooks Run near Keating Site No. 84 (Latitude 41°16'39", Longitude 077°53'07")											
May 25	1120	48	272	3.6	12.5	.8	40	0	.0	80	--
July 27	0935	36	500	3.2	15.5	1.8	89	0	.0	160	--
01544212 Milligan Run near Keating Site No. 85 (Latitude 41°16'45", Longitude 077°52'56")											
May 25	1115	3.3	1,620	2.8	13.5	9.6	477	0	.0	740	--
July 27	1010	3.7	1,720	2.7	16.0	6.4	318	0	.0	930	--
01544214 Smith Run near Westport Site No. 86 (Latitude 41°16'38", Longitude 077°52'13")											
May 25	1210	6.1	30	7.5	11.5	.0	.0	3	.2	21	--
July 27	1025	3.7	29	6.2	14.0	.1	5.0	3	3.7	7.0	--
01544216 North Smith Run near Westport Site No. 87 (Latitude 41°16'38", Longitude 077°51'51")											
May 25	1215	1.3	230	3.9	12.0	.5	25	0	.0	71	--
July 27	1200	.61	579	3.1	15.5	1.8	89	0	.0	360	--
01544218 Fish Dam Run near Westport Site No. 88 (Latitude 41°16'37", Longitude 077°51'14")											
May 25	1305	23	60	6.6	12.0	.0	.0	7	3.4	13	--
July 27	1100	7.5	66	6.7	15.0	.0	.0	7	2.7	11	--
01545020 Kettle Creek at Westport Site No. 89 (Latitude 41°18'02", Longitude 077°50'20")											
May 25	1315	694	82	6.0	17.5	.1	5.0	7	14	21	--
July 27	1255	269	197	4.1	19.5	.6	30	0	.0	72	--
01545024 Dry Run at Westport Site No. 90 (Latitude 41°18'44", Longitude 077°50'11")											
May 25	1430	2.2	220	4.6	12.5	.3	15	1	49	89	--
July 27	1335	.71	383	4.1	15.0	.6	30	0	.0	170	--

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01542608 Jews Run at Keating Site No. 81 (Latitude 41°15'10", Longitude 077°53'51")										
May 24	--	--	200	100	150	<3	10	<1	30	6
July 26	--	--	<100	<100	70	6	<10	2	--	14
01542609 West Branch Susquehanna River at Keating Site No. 82 (Latitude 41°15'40", Longitude 077°54'06")										
May 25	--	--	1,700	1,500	1,300	280	1,700	1,700	120	99
July 26	0.55	873	2,400	2,400	230	190	4,100	4,000	[a]220	[a]250
01544150 Sinnemahoning Creek at Keating Site No. 83 (Latitude 41°15'41", Longitude 077°54'10")										
May 25	--	--	500	400	320	28	150	140	20	15
July 26	--	--	100	100	180	9	270	250	20	14
01544210 Cooks Run near Keating Site No. 84 (Latitude 41°16'39", Longitude 077°53'07")										
May 25	--	--	4,000	3,800	[a]3,700	[a]4,000	--	920	110	110
July 27	--	--	5,000	4,700	6,300	6,300	2,100	2,100	--	210
01544212 Milligan Run near Keating Site No. 85 (Latitude 41°16'45", Longitude 077°52'56")										
May 25	--	--	29,000	29,000	--	46,000	12,000	12,000	9,600	990
July 27	--	--	9,000	6,000	--	19,000	[a]16,000	[a]17,000	1,000	990
01544214 Smith Run near Westport Site No. 86 (Latitude 41°16'38", Longitude 077°52'13")										
May 25	--	--	500	400	260	22	10	5	60	35
July 27	--	--	<100	<100	140	20	10	5	[a]20	[a]23
01544216 North Smith Run near Westport Site No. 87 (Latitude 41°16'38", Longitude 077°51'51")										
May 25	--	--	2,000	1,800	440	97	--	1,100	100	100
July 27	--	--	8,000	7,900	420	330	[a]5,000	[a]5,200	[a]320	[a]340
01544218 Fish Dam Run near Westport Site No. 88 (Latitude 41°16'37", Longitude 077°51'14")										
May 25	--	--	400	300	390	9	<10	1	40	20
July 27	--	--	100	100	90	11	20	4	--	20
01545020 Kettle Creek at Westport Site No. 89 (Latitude 41°18'02", Longitude 077°50'20")										
May 25	--	--	700	<100	660	39	270	260	40	26
July 27	--	--	1,800	1,800	2,400	240	1,500	1,400	90	87
01545024 Dry Run at Westport Site No. 90 (Latitude 41°18'44", Longitude 077°50'11")										
May 25	--	--	2,000	1,200	390	25	[a]1,500	[a]1,600	130	120
July 27	--	--	2,100	2,100	90	12	2,500	2,500	[a]180	[a]190

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Acidity (mg/L as H)	Acidity (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Carbon dioxide, dissolved (mg/L as CO_2)	Sulfate, dissolved (mg/L as SO_4)	Solids, residue at 180 °C dissolved (mg/L)
	01545030 Barney Run at Westport Site No. 91 (Latitude 41°18'28", Longitude 077°49'17")										
May 25	1345	11	28	7.0	12.0	0.0	0.0	4	0.8	8.3	--
July 27	1130	5.1	33	6.8	13.5	.1	5.0	7	2.1	7.9	--
	01545035 Dry Run at Shintown Site No. 92 (Latitude 41°18'06", Longitude 077°48'40")										
May 25	1425	.56	36	6.4	9.5	.1	5.0	4	3.1	12	--
July 27	1230	E.02	42	5.9	13.5	.1	5.0	4	9.8	13	--
	01545045 Shintown Run at Shintown Site No. 93 (Latitude 41°18'21", Longitude 077°48'03")										
May 25	1525	13	37	6.2	13.0	.1	5.0	2	2.4	13	--
July 27	1420	7.4	47	5.5	15.0	.1	5.0	2	12	16	--
	01545065 Hall Run at Shintown Site No. 94 (Latitude 41°19'07", Longitude 077°47'20")										
May 25	1440	21	52	7.3	14.0	.0	.0	8	.8	12	--
July 27	1250	5.1	70	6.7	15.0	.1	5.0	10	3.9	10	--
	01545492 Drury Run at Renovo Site No. 95 (Latitude 41°19'33", Longitude 077°46'37")										
May 25	1515	34	270	4.3	13.0	.3	15	0	.0	99	--
July 27	1340	30	408	4.2	15.5	.5	25	0	.0	180	--
	01545494 Brewery Run at Renovo Site No. 96 (Latitude 41°19'31", Longitude 077°46'25")										
May 25	1530	4.4	77	7.8	14.0	--	--	4	.1	26	--
July 27	1335	1.6	94	6.4	15.0	.0	.0	7	5.4	30	--
	01545498 Peters Run at Renovo Site No. 97 (Latitude 41°19'24", Longitude 077°45'04")										
May 25	1620	2.2	47	6.5	12.5	.1	5.0	2	1.2	11	--
July 27	1425	1.4	51	5.8	14.0	.1	5.0	8	25	11	--
	01545500 West Branch Susquehanna River at Renovo Site No. 98 (Latitude 41°19'28", Longitude 077°45'03")										
May 25	1600	8,670	200	4.6	17.5	.2	9.9	0	.0	72	134
July 27	1420	1,750	392	3.8	21.5	.3	15	0	.0	160	274

[a] Results within limits of analytical precision.

Table 3.–Water-quality data collected from West Branch Susquehanna River basin, May and July, 1984–Continued

Date	Solids, dissolved (tons per ac-ft)	Solids, dissolved (tons per day	Aluminum, total recoverable (µg/L as Al)	Aluminum, dissolved (µg/L as Al)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Manganese total recoveralbe (µg/L as Mn	Manganese, dissolved (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
01545030 Barney Run at Westport Site No. 91 (Latitude 41°18'28", Longitude 077°49'17")										
May 25	--	--	100	<100	380	7	10	1	[a]40	[a]52
July 27	--	--	<100	<100	90	9	10	<1	20	6
01545035 Dry Run at Shintown Site No. 92 (Latitude 41°18'06", Longitude 077°48'40")										
May 25	--	--	100	<100	350	5	10	<1	30	8
July 27	--	--	<100	<100	270	20	20	6	20	6
01545045 Shintown Run at Shintown Site No. 93 (Latitude 41°18'21", Longitude 077°48'03")										
May 25	--	--	100	<100	190	4	20	15	50	12
July 27	--	--	<100	<100	160	17	20	7	30	10
01545065 Hail Run at Shintown Site No. 94 (Latitude 41°19'07", Longitude 077°47'20")										
May 25	--	--	200	100	190	<3	<10	2	20	21
July 27	--	--	<100	<100	120	6	10	2	--	23
01545492 Drury Run at Renovo Site No. 95 (Latitude 41°19'33", Longitude 077°46'37")										
May 25	--	--	2,300	2,200	220	97	3,100	3,100	150	140
July 27	--	--	3,500	3,500	200	86	[a]6,000	[a]6,200	[a]220	[a]240
01545494 Brewery Run at Renovo Site No. 96 (Latitude 41°19'31", Longitude 077°46'25")										
May 25	--	--	<100	<100	90	<3	30	25	30	28
July 27	--	--	<100	<100	80	10	10	5	--	34
01545498 Peters Run at Renovo Site No 97 (Latitude 41°19'24", Longitude 077°45'04")										
May 25	--	--	300	300	150	11	20	2	50	24
July 27	--	--	100	100	90	19	20	2	[a]20	[a]18
01545500 West Branch Susquehanna River at Renovo Site No. 98 (Latitude 41°19'28", Longitude 077°45'03")										
May 25	.18	3,140	900	800	740	150	[a]900	[a]950	80	63
July 27	.37	1,290	2,100	2,100	190	110	2,600	2,500	140	130