RECONNAISSANCE OF MINE DRAINAGE IN THE COAL FIELDS

OF EASTERN PENNSYLVANIA

By Douglas J. Growitz, Lloyd A. Reed, and Mark M. Beard

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# FACTORS FOR CONVERTING INCH-POUND UNITS TO

# INTERNATIONAL SYSTEM UNITS (SI)

Multiply inch-pound units	By	<u>To obtain SI units</u>
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
acre	0.4047	hectare (ha)
ton (short)	0.9072	tonne (t)
cubic foot per second (ft <sup>3</sup> /s)	0.02832	cubic meter per second (m <sup>3</sup> /s)
ton per square mile (ton/mi <sup>2</sup> )	0.3502	megagram per square kilometer (Mg/km <sup>2</sup> )
cubic foot per second per square mile [(ft <sup>3</sup> /s)/mi <sup>2</sup> ]	0.01093	cubic meter per second per square kilometer [(m <sup>3</sup> /s)/km <sup>2</sup> ]

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#### RECONNAISSANCE OF MINE DRAINAGE IN THE COAL FIELDS

OF EASTERN PENNSYLVANIA

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#### ABSTRACT

Anthracite has been extensively mined in four areas of eastern Pennsylvania. Almost all underground mining in the four areas, the Northern, Eastern Middle, Western Middle, and Southern Fields, has been discontinued and many mines are abandoned and flooded. Precipitation on much of the 408 square miles of coal fields infiltrates to the underground mine complexes, and is discharged as mine drainage from tunnels, mine entrances, and boreholes.

Mine drainage was measured and sampled at 251 sites that had a total discharge of 918 cubic feet per second, a total sulfate load of 1,470 tons per day, and a total iron discharge of 79 tons per day. The largest sulfate yield was 5.4 tons per day per square mile from the Western Middle Field. The yields from the Northern, Eastern Middle, and Southern Fields were 4.6, 3.6, and 1.4 tons per day per square mile, respectively.

#### INTRODUCTION

Anthracite has been mined in east-central Pennnsylvania for more than 150 years. Most mining was done by deep-mining methods, creating vast underground voids. Through 1944, 3.5, 0.5, 1.6, and 1.3 billion tons of coal were produced in the Nothern, Eastern Middle, Western Middle, and Southern Anthracite Fields, respectively. To prevent flooding, water that entered the mines was pumped to the surface. Between 1930 and 1960, nearly all deep mines were abandoned, pumping was discontinued, and the mines filled with water. Surface overflows developed, and mine drainage has degraded many streams.

#### Purpose and Scope

A study was begun in 1975 to locate, measure, and sample the mine discharges and major streams (the Susquehanna and Delaware Rivers and their tributaries) in the four coal fields in east-central Pennsylvania. Data collected during this study were compared to data collected during 1941 and 1946 to determine if any large changes had occurred in acid discharge. Water discharge, temperature, pH, and specific conductance were measured at each site sampled. Alkalinity, acidity, dissolved iron, and sulfate concentrations were determined for samples collected from the mine discharges. The study was conducted in cooperation with the U.S. Department of Energy and the Pennsylvania Department of Environmental Resources. This report summarizes the results of this study.

#### Methods of Study

Locations of mine-water discharges were compiled from published reports and from information obtained from State and Federal agencies, and were verified in the field prior to sampling. Generally, sites having discharges of less than 0.1 ft<sup>3</sup>/s were not included in the 251 sites sampled during the study. Water-quality data were determined from unfiltered samples; except for dissolved iron, which was determined from filtered samples. Samples for laboratory analyses were collected and preserved following standard Geological Survey procedures. To supplement the sampling program, flow and water-quality data were collected monthly at 12 sites. The U.S. Bureau of Mines in Wilkes-Barre and Schuylkill Haven, and the Pennsylvania Department of Environmental Resources assisted with the data collection.

#### DESCRIPTION OF THE STUDY AREA

#### Coal Fields

The term "anthracite region" as used in this report includes the four anthracite fields and surrounding areas, as shown in figure 1. Anthracite has been extensively mined in four separate coal fields in east-central Pennsylvania--the Northern, Eastern Middle, Western Middle, and Southern. The coal fields underlie parts of 10 counties and extend from 20 mi northeast of Harrisburg to 20 mi northeast of Scranton. Their combined area is about 408 mi<sup>2</sup>.

The four coal fields are part of the Valley and Ridge physiographic province; the coal is found in the Llewellyn and Pottsville Formations of Pennsylvania age. Both formations contain sandstone, conglomerate, shale, and several coal seams. Generally, coal underlies the center of the valleys. In the western part of the Southern Field, coal underlies the ridges as well as the valleys. Large quantities of coal were removed by deep mining methods that, in some areas, extended to depths below sea level, and created extensive voids that have filled with water. Locally, small hills have been created by storage of mine waste, and surface depressions have formed where the land has subsided. Surface depressions also have been created by surface mining. In many areas, surface soils have been covered or mixed with mine waste, and vegetation is sparse. Infiltration rates have been increased significantly by surface depressions, by the large-grained mine wastes on the surface, and by the lack of vegetation.

#### Coal Production

Since 1808, the coal industry has shipped over 6 billion tons of processed anthracite from the fields in eastern Pennsylvania (Rhodes and Davis, 1968, p. 61). Mining reached a peak in 1917 when 99.6 million tons were produced. Production then declined before peaking again in the 1940's, when about 60 million tons per year were mined. Production has declined since then; during 1976, about 6 million tons were mined. Through 1944, 3.5, 0.5, 1.6, and 1.3 billion tons of coal were produced in the Northern, Eastern Middle, Western Middle, and Southern Anthracite Fields, respectively. Edmunds (1972) estimated that anthracite reserves were about 16 billion tons.

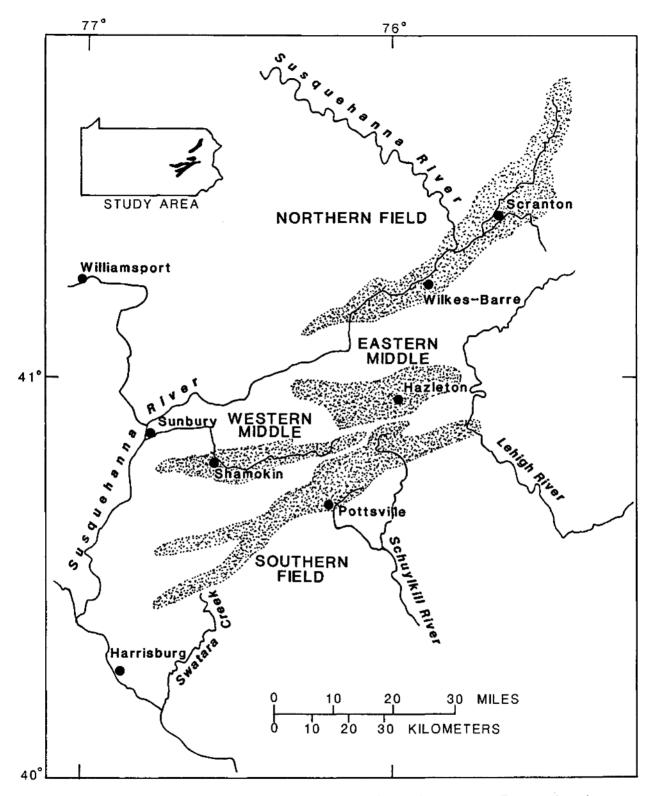


Figure 1.--Locations of the four coal fields in eastern Pennsylvania.

Through the 1800's, all coal was mined by underground methods. Strip mining of anthracite slowly increased from the early 1900's and peaked in 1948 when the output was 13.4 million tons--about one-fourth of the anthracite mined that year. Since 1961, surface mining has produced more coal than any other method.

#### MINE DRAINAGE

#### Sources

Precipitation percolates continuously from the surface to the voids left by the removal of coal. During active mining, the percolating water was removed by pumping. Pumping increased production costs and forced the closing of many deep mines as the demand for anthracite declined during 1930-60. When pumping stopped, water levels rose and filled the closed mines. Contiguous deep mines were separated along the property lines by barrier pillars, which are unmined columns about 160 ft wide. In some cases, the barrier pillars were not sufficient to withstand the buildup of water pressure between the abandoned and active mines. To maintain safe working conditions in the mines, water was pumped from the abandoned mines, or boreholes were drilled through the barrier pillars, and water levels were controlled by pumping from the active mines. The pumping increased operating costs; eventually, most underground operations were abandoned, and water levels rose until the water overflowed at the surface. The rate and direction of water movement through individual mines is controlled by precipitation continually percolating into the mines, the structure of the mined coal beds, mine tunnels, air shafts, boreholes, and local collapses.

#### Discharge and Water Quality

#### Northern Field

The Northern Field, an area of  $160 \text{ mi}^2$  in the Susquehanna River basin, includes parts of Wayne, Susquehanna, Lackawanna, and Luzerne Counties (fig. 2). The Northern Field includes the 80 mi<sup>2</sup> Lackawanna Basin northeast of Scranton and the 80 mi<sup>2</sup> Wyoming Basin in the Wilkes-Barre area. Mine-water discharge sites in the Northern Field are shown on figure 2 and the data that were collected are discussed in the following paragraphs.

#### Forest City to Carbondale

Forest City and Carbondale are along the Lackawanna River, northeast of Scranton. Table 1 lists the results of sampling six discharge sites in that area. The highest discharge in the Forest City area (4 ft<sup>3</sup>/s) was from the Vandling drift; the sulfate concentration was 92 mg/L. The upper Wilson Creek (Simpson) drift, and the lower Wilson Creek (Simpson) shaft are near Carbondale. The highest discharge in the Carbondale area (16 ft<sup>3</sup>/s) was from the lower Wilson Creek shaft. Water discharge from the six sites totaled 24 ft<sup>3</sup>/s; sulfate discharge totaled 8.9 tons/d. Dissolved iron concentrations at each of the six sites were less than 1 mg/L.

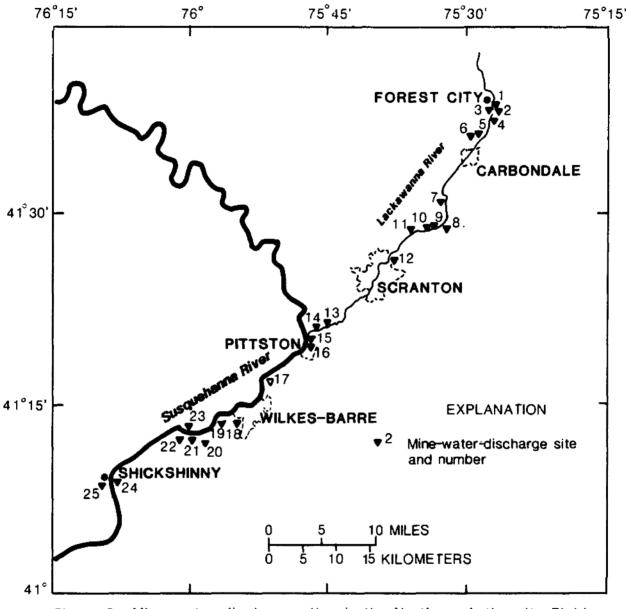


Figure 2.--Mine-water-discharge sites in the Northern Anthracite Field, east-central Pennsylvania.

Table 1.--Water-quality and discharge data from mine-drainage sites in the Northern Field between Forest City and Carbondale

							- 1510							Acidity to	8
R	Site	al	Location	Sampling	Discharge	water temperature	onductance		Concentration, in mg/L	, in mg/L	loads, in tons per day	na per day	AUKAUTULEY DO pH 4.5 AB	as CaOD, (mg/L	
	nunber Name	Description	Lat-Long.	date	(ft <sup>-3</sup> /a)	0.	(turhos)	Ŧ	aulfate	1co	Bulfate	ltan	Ca001 (mg/L)	7.0	8,3
1	Klondtke Nine	collapsed drift	41°38'33" 75°27'25"	4-15-75	0.6	7.5	<u>80</u>	4.2	33	4	0.05	0.0016	0	01	13
7	2 Klandike Mine	collapsed drift	-90, 23, 23, 22, 90, 19	4-15-75	Υ.	10.0	20	5.9	¥	₽	¥0."	1100"	7	4.0	5.0
۳ (	9 Klondike Mne	Vendiing drift	41*36*15" 75*27*35"	4-15-75	4-0	9.5	185	4.7	8	۶	6	110″	3	38	8
- <sup>-</sup> ₹	A Klandike Mine	Gray slope-buried	41*37'38" 75*27'31"	4-15-75	8.	8.5	115	4.8	8	Þ	80	.0022	2	3.0	5
	5 Coalbrock Mine	Upper Wilson Creek e (Sløpson) drift	-60,62,52 -11,96,19	4-15-75	2.6	0,01	450	6.3	190	¢	C,I	0200	*8	Ś	91
œ	6 Coalbrook Hine	Lower Wilson Creek e (Simpeon) shaft	-E1.62.52 -2019C.19	4-15-75	16	9.5	380	5.9	150	ų	6.4	.043	¥	82	07
Subc	Subtotal				24						8.9	990			

#### Carbondale to Scranton

Six mine-discharge sites were sampled between Carbondale and Scranton (table 2). Water discharge from the Jermyn slope (site 7) was estimated to be 39 ft<sup>3</sup>/s by measuring the flow of the Lackawanna River above and below the mine discharge. Water discharge from the six sites totaled 65 ft<sup>3</sup>/s, and the sulfate discharge was 35 tons/d. The mean water weighted concentration of sulfate was 200 mg/L.

#### Scranton to Pittston

Four mine-discharge sites were measured and sampled between Scranton and Pittston (table 3). The highest discharge was from the Old Forge borehole at Old Forge Mine. Water discharge was 97  $ft^3/s$  when the sample was collected, and concentrations of dissolved iron and sulfate were 40 and 780 mg/L, respectively. Water discharge from the four sites totaled 140  $ft^3/s$ , and sulfate discharge was 270 tons/d.

#### Wilkes-Barre

Seven mine-discharge sites were sampled in the Wilkes-Barre area (table 4). The largest water discharge, 39  $ft^3/s$ , was from the Solomon Creek boreholes at the South Wilkes-Barre Mine, and the concentrations of dissolved iron and sulfate were 190 and 1,800 mg/L, respectively. Water discharge from the seven sites at the time of sampling totaled 98  $ft^3/s$ , and the sulfate load was 410 tons/d.

#### Shickshinny

Two mine-discharges (table 5) were sampled near Shickshinny. The Macanaqua Tunnel drains the area east of Shickshinny, and the Salem Coal Company drift drains the area to the west. Water discharge from the two sites totaled 6.1 ft<sup>3</sup>/s and the sulfate discharge was 11 tons/d.

#### Summary and Discussion

Cumulative water discharge from the 25 mine-drainage sites (tables 1-5) was 333 ft<sup>3</sup>/s, the sulfate discharge was 740 tons/d, and the iron discharge was 51 tons/d. All mine discharges sampled in the Northern Field were gravity overflows; no pump discharges were known to exist at the time of sampling. Since 160 mi<sup>2</sup> are underlain by the coal field, the water, sulfate, and iron yields were 2.1 (ft<sup>3</sup>/s)/mi<sup>2</sup>, 4.6 (tons/d)/mi<sup>2</sup>, and 0.32 (tons/d)/mi<sup>2</sup>, respectively.

Felegy and others (1948) and Ash and others (1951) presented flow and water-quality data collected during 1941 from all known discharges in the Northern Field. Measured water discharge was 306 ft<sup>3</sup>/s (90 percent was pumped from deep mines) and the measured acid discharge (as  $CaCO_3$  to pH 8.3) was 390 tons/d (92 percent was pumped from deep mines). Total water and acid discharges during the sampling period in 1975 were 333 ft<sup>3</sup>/s and 240 tons/d (no discharges were pumped from deep mines). During the sampling period in 1975, water discharge was about 10 percent more, and the acid discharge was about 35 percent less than during the sampling period in 1941.

Site number 7						:								Acidity to	ŝ
			location	y	Di acharge	Viater bemperature	Specific conductance	:	Concentration, in ug/L	th mg/L	Loads, in tous per day	ms per day	Alkalinity to pH 4.5 as	Indicated pl as CaOD, (mg/L)	
1	ber Nane	Description	Lat-long.	date	(ft <sup>2</sup> /8)	(2)	(Softer)	E	sulfate	Tran	sulfate	Iron	Ce(U) (mg/L)	2	6.3
	Jennyn Hure	Jerayn slope	41°42'45" 75°32'49"	4-16-75	8	12.0	470	5.6	022	1.5	2	0,16	13	8	8
80	Riverside Mine	Mount Vermon ah	Mount Vermon whaft 41°28'54" 75°32'33"	4-16-75	r	10.5	210	4.6	16	₽	11.	6100*	2	3.0	91
0	Cravity Slope Mixe slope	e slope	41°28'52" 75°33'48"	4-16-75	ជ	11.5	300	5.3	170	-	п.	-062	13	8	ନ
01	Oravity Slope Mine 6" borehole	e 6" borehole	41°28'55" 75°33'55"	4-16-75	7	10.5	00	5.4	180	-	01.	\$000"	01	15	9
11	Lackwarms Mine	Jerone Shaft	41°28'44" 75°33'55"	4-16-75	2.4	12.0	00#	4,8	051	8	76*	сі.	2	0"E	8
12	Unierwood Mine	Pernsylvada Turnel	41°26'17" 75°38'29"	4-16-75		0*6	006	0"1	350	₽	.20	-000	24	I	3.8
Subtotal	otal				3						35	.35			
		Tabl	Table 3Water-quality and discharge data from mine-drainage sites in the Northern Field between Scranton and Pittston	quality a In Field	v and ( ld betv	und dischar; between Sci	arge data Scranton	a fro and	om mine-d Pittston	-drair on	age si	tes in	the		
Site	te Mano	Description	Locatton Lat-Long.	Sempling dete	Discharge (ft <sup>3</sup> /a)	Water temperature (*C)	Specific conductance (untroe)	Ŧ	Concentration, in mg/L withte iron	trun trun	Loadis, in tons per day mulfare iron	ns per day irran	Alkalialty to pi(4.5 as CaODo (ne/L)	Acidity to Indicated pi as CaOD <sub>3</sub> (mg/L) 7.0 8.3	/ to ed ri (mg/L)
1	Old Porge Mine	01d Porse borehole	14		16	. 16	1470	99	780	8	204		2	145	210
14	Seriece Mine	Duryes breech			æ	15.5	1400	5.7	92	뜡	3	4.4	72	163	នេ
15	Sereca Mine	aßetzee	-52,17*27 -60,02°14	4-15-75	10"	0.11	1350	4.6	009	Ś	8	1000"	I	155	0/1

43

贸

6.6

.059 15

6.2 274

2.5

365

4.9

8

10.5

8.7

41°19'36" 75°47'25" 4-15-75

Pittston (Butler) water burnel

> ló No.9 Mine Subtotal

Name         Description         Lations         data         (ft2)(s)         (ft2)         (lumbos)         ft1           South-Wilker Barre         Solmen Creek $41'13'3''$ $55'5'5''5''$ $41'5'5''5''5'''5'''5'''5'''5'''5'''5'''5$		Site		Ч	Location	Semplifung	Di echarge	Water temperature	Specific conductance		Concentration, in mg/L	th mg/L	loads, in	Loads, in tons per day	Alkalinity to pli 4.5 au	Acidity to Indicated pil as CaOD, (mc/L)	ty to ted pi ∭r/L
	-1	muther	Neite		lat-long.	date	(ft <sup>3</sup> /e)	- 1	(Justice)	-	sulfate	Ē	Bulfate	Tron	Ca003 (mg/L)	7.0	8
Both-Wilker Harre         Solution Creek         41'13'50' 75'55'20' $+14-75$ 39         16.0         3000         5.2         1800         190           19         Word Hime         Arrhaft #22         41'13'34' 75'55'13' $+15-75$ 21         17.0         2100         5.6         760         55           20         Truendate Hime         Archaft #22         41'13'34' 75'55'13' $+14-75$ 31         16.0         3000         5.6         760         55         700         700         700           21         No. 7 Hime         Ansame shuft horehole $41'12'37' 76'00'7'' + 14-75$ 3.5         12.5         2000         5.6         760         700         40           22         No. 7 Hime         Baspeelamae Him. 2 $41'12'27' 76'00'2'' + 14-75$ 3.5         12.5         2000         5.6         700         700           23         Clan Hum Hime         Charlet Weitlooke $41'12'27' 76'00'2'' + 14-75$ 3.5         3.1         300         5.0         700         700           24         Samplemare Him         Arren Himitooke $41'12'77' 76'00'2'' + 14-75$ $3.5$ $8.75$ $3.1$ 300 $5.00''''''''''''''''''''''''$			H.re	(Plainsville outled	.02,15 <b>,</b> 52 .00,21,30,	4-15-75	9.2	14.5	1700	6.1	1100	鸦	27	2.1	<b>6</b> 21	176	318
19       Wattingtome Button- wood Hime       Attinuet #22       41*13*34       75*56/13*       415-75       27       17.0       2100       5.6       760       75         20       Truesolate Mine       Anisma staft horehole 41*11*56       75*57*52*       4:4-75       11       16.5       2000       5.6       700       700         21       No. 7 Hime       Assem staft horehole 41*11*56*       75*57*52*       4:4-75       3.5       12.5       200       5.6       700       700         21       No. 7 Hime       Assemblanma No. 2       41*12*27*       76*00*22*       4:4-75       3.5       18.0       4600       6.0       200       700       700         22       No. 7 Hime       Suspendamma No. 2       41*12*27*       76*00*24*       4:4-75       3.5       18.0       4600       6.0       200       700         23       Clan Nm Hime       Watt Nemicroke       41*13*05*       76*00*24*       4:4-75       .3       8.5       8.7       3.1       200       7.0         24       Gan Nm Hime       Hatt Nemicroke       41*13*05*       76*00*24*       4:4-75       .3       8.5       8.7       3.1       200       7.0         24       Hime			South-Wilk <del>es Barre</del> Aine	Solomon Cr <del>eek</del> boreholes	41,13,20, 75,25,30,	4-14-75	R	16.0	000	5.2	0081	130	061	8	μ	420	750
20       Truesdale Mine       Askan staft borehole 41°11'58" 75"57"52" 4-14-75       11       16.5       300       5.6       2000       >100         21       No. 7 Mine       aserge       41"12"33" 76"00"0"       414-75       3.5       12.5       2200       5.5       1400       40         22       No. 7 Mine       Suspuelarma No. 2       41"12"27" 76"00"22" 4-14-75       8.5       18.0       4800       6.0       2000       >100         22       No. 7 Mine       Suspuelarma No. 2       41"12"27" 76"00"22" 4-14-75       8.5       18.0       4800       6.0       200       >100         23       Clen Nan Mine       Uset Nanticokes       41"13"05" 76"00"24" 4-14-75       8.5       18.0       4800       6.0       200       >0.2         24       Clen Nan Mine       Gravity overflow       41"13"05" 76"00"24" 4-14-75       8.5       18.5       11       20       0.2         25       Clen Nan Mine       Gravity overflow       41"13"05" 76"00"24" 4-14-75       3.5       8.75       3.1       300       3.1       300       3.1       300       3.1       300       3.1       300       3.1       300       3.1       300       3.1       300       3.1       300       3.1			Nottingl <del>um B</del> utton- wood Mine	Atrahaft #22	41°13'34" 75°56'13"	4-15-75	27	0"11	2100	5.6	- 192	ß	ß	6.9	23	276	80
21       No. 7 Hine       accorect       A1°12'33' 76'00'0' 414-75       3.5       12.5       220       5.5       1400       40         22       No. 7 Hine       Susperimenta Ho. 2       A1°12'27' 76'00'22' 4-14-75       8.5       8.5       18.0       4800       6.0       2800       >100         23       Clean Nam Mine       Heat Numicodes       A1'13'05' 76'00'24' 4-14-75       .3       8.5       875       3.1       320       0.2         23       Clean Nam Mine       Oravity overflow       A1'13'05' 76'00'24' 4-14-75       .3       8.5       875       3.1       320       0.2         Subtolat       Quantity overflow       A1'13'05' 76'00'24' 4-14-75       .3       8.5       875       3.1       320       0.2         Subtolat       Quantity overflow       A1'13'05' 76'00'24' 4-14-75       .3       8.5       875       3.1       320       0.2         Subtolat       Quantity overflow       A1'13'05' 76'00'24' 4-14-75       .3       8.7       875       3.1       320       0.2         Subtolat       Patter-quality       A1'13'05' 76'00'24' 4-14-75       .3       .3       30       0.2         Subtolat       Patter-quality       A1'13'05' 76'00'24' 4-14-75       .3 <td></td> <td></td> <td>Truesdale Mine</td> <td>Askem stuft boreho</td> <td>le 41°11'58° 75°57'52°</td> <td>4-14-75</td> <td>11</td> <td>16.5</td> <td>3000</td> <td>5.6</td> <td>0002</td> <td>2100</td> <td>\$</td> <td>3.0</td> <td>87</td> <td>127</td> <td>613</td>			Truesdale Mine	Askem stuft boreho	le 41°11'58° 75°57'52°	4-14-75	11	16.5	3000	5.6	0002	2100	\$	3.0	87	127	613
22       No. 7 Mine       Suspendiament Mo. 2       41°12'27' 36'00'22' 4-14-75       8.5       18.0       4600       6.0       2600       >100         23       Glan Nan Mine       Wast Kunitoke       41°13'05' 76'00'24' 4-14-75       .3       8.5       875       3.1       320       0.2         23       Glan Nan Mine       Wast Kunitoke       41°13'05' 76'00'24' 4-14-75       .3       8.5       875       3.1       320       0.2         Subtotal       96 <td></td> <td></td> <td>No. 7 Mine</td> <td>abedae</td> <td>41°12'33" 76°00'07"</td> <td>4-14-75</td> <td>3.5</td> <td>12.5</td> <td>2200</td> <td>5.5</td> <td>0071</td> <td>9</td> <td>13</td> <td>9C°</td> <td>13</td> <td>125</td> <td>174</td>			No. 7 Mine	abedae	41°12'33" 76°00'07"	4-14-75	3.5	12.5	2200	5.5	0071	9	13	9C°	13	125	174
23 Clean Num Water Namifooke At'13'05' 76'00'24' 4-14-75 <u>.</u> 3 8.5 875 3.1 320 0.2 Surveial 98 Surveal 98 Fable 5Water-quality and discharge data from mine-drainage sites in the N			vo. 7 Mine	Susquehama No. 2 shaft	41°12'27" 76°00'22"	4-14-75	8.5	18.0	0097	6.0	2800	>100	3	2.3	212	864	052
Sultional Sultional Cable 5Water-quality and discharge data from mine-drainage sites in the N Water Specific			Glen New Mine	West Nuntionke Gravity overflow	41°13'05" 76°00'24"	4-14-75	<b>.</b> .	8.5	875	3.1	320	0,25	.26	000	ł	155	165
Table 5Water-quality and discharge data from mine-drainage sites in the N Mater Specific	۵.	ubtotal					8						807	£			
		able	: 5Wate	r-quality a	und discharge	i data	from 1	mine-dr.	ainage	sit	es in t	he Nor	thern	Field 1	near Shi	Shickshinny	nnv
Site Rechards Samiling Machards merephysics Concentration. In w/l.		1						Mater	Specific		Concentration		tonde to	tonda in tone car day	Alkalinity to rit 4.5 m	Acidity to Indicated pli as Com. (mo(1)	of to

														Addity	v to
Silte		9	Location	Samplung	Discherge	water ; te temperature d	apectric re conductance		Concentration, in mg/L 1	th mg/L	Londa, in to	na per day	londs, in tons per day pil 4.5 as	undicated ps	ed per (mg/t)
nuber	Name	Description	Lat-Long.	date	date (ft <sup>3</sup> /s)	() ()	(techos)	Ħ	sulfate	1m	sulfate	1 ton	Ce003 (mg/L)	1.0	8.3
												n N			
24	24 Nest Byd Mine	Macanagua Tumel 41*09'01" 76*08'	-07-80-92 -10,60-19	4-14-75	5.8	0.11	1250	3.5	680	9	11	0.94	I	278	363
2	25 Salem Coal Co.	drift	41"06"36" 76"08"56"	4-14-75	ان	7.0	8	3.4	82	ŝ	.20	¥000*	ł	158	165
Subtotal	Ŧ				6.1						H	4.			

#### Eastern Middle Field

Hazleton is in the approximate center of the Eastern Middle Coal Field (fig. 3) that extends 10 mi east and west. Twenty-nine mine discharges from the Eastern Middle Field were sampled, there locations are shown on figure 3. Ten of the discharges drain into the Lehigh and Delaware River basin and nineteen into the Susquehanna River basin.

#### Freeland

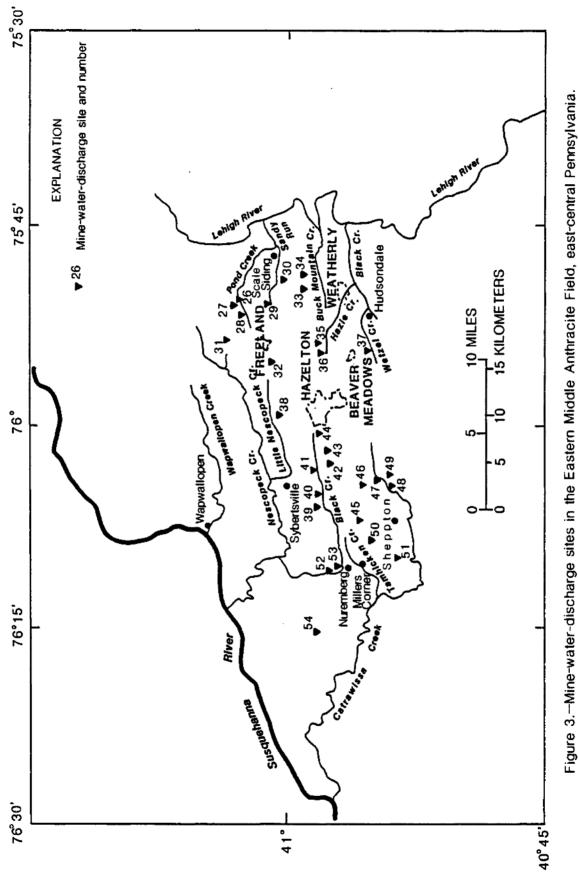
Seven mine-discharge sites (table 6) were sampled near Freeland--five are in the Lehigh River basin and two in the Susquehanna River basin. Discharge from five sites drains into the Lehigh River through Pond Creek and Sandy Run. Water discharge from these sites totaled 20 ft<sup>3</sup>/s, and sulfate discharge was 7.1 tons/d. Total water discharge from the two sites in the Susquehanna River basin, the McNair and Woodside Mines, was 0.6 ft<sup>3</sup>/s, and the sulfate discharge was 0.11 tons/d. The largest sulfate discharge, 4.7 tons/d, was from the Owl Hole Tunnel at the East Block Creek Mine, and the largest water discharge, 13 ft<sup>3</sup>/s, was from a strip mine pool overflow at the Pond Creek Mine.

#### Beaver Meadows

Five mine-discharge sites were sampled in the Beaver Meadows area; water quality and discharge data are listed in table 7. All drain into the Lehigh River. Water discharge from the five sites totaled 26 ft<sup>3</sup>/s, and sulfate discharge totaled 7.4 tons/d. The largest water discharge of the five sites,  $20 \text{ ft}^3/\text{s}$ , was from the tunnel at the Beaver Meadows Mine; the sulfate concentration was 100 mg/L and sulfate discharge was 5.4 tons/d.

#### Hazleton

Seven mine-discharge sites were sampled in the area north and west of Hazleton, all are in the Susquehanna River basin; discharge and water quality data are listed in table 8. The largest mine discharge in that area is from the Jeddo Tunnel. At the time of sampling, the discharge was  $65 \text{ ft}^3/\text{s}$ , and concentrations of dissolved iron and sulfate were 6 and 430 mg/L, respectively. Sulfate discharge was 75 tons/d. Water discharge from the Jeddo Tunnel was recorded continuously from December 1973 to September 1979. Figure 4 shows the variations in the rate of discharge from October 1, 1974 to September 30, 1975. Water discharge recorded from Wapwallopen Creek near Wapwallopen (about 10 mi north of the Jeddo discharge) for the same period, also is plotted. Wapwallopen Creek drains an area of 43.8 mi<sup>2</sup>; the measured mean discharge was 78 ft<sup>3</sup>/s. Figure 4 shows the response of the discharge from the Jeddo Tunnel to periods of precipitation is considerably less than the response of the flow of Wapwallopen Creek. From October 1, 1974, to September 30, 1975 discharge from the Jeddo Tunnel ranged from 36 to 230  $ft^3/s$ . Figure 4 shows that, during large storms, discharge from the Jeddo Tunnel peaked later than the stream discharge.





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a from adne-	
discharge dat	ld near Freel
ale 6Water-quality and d	<b>Eastern Middle Mel</b>
T.	

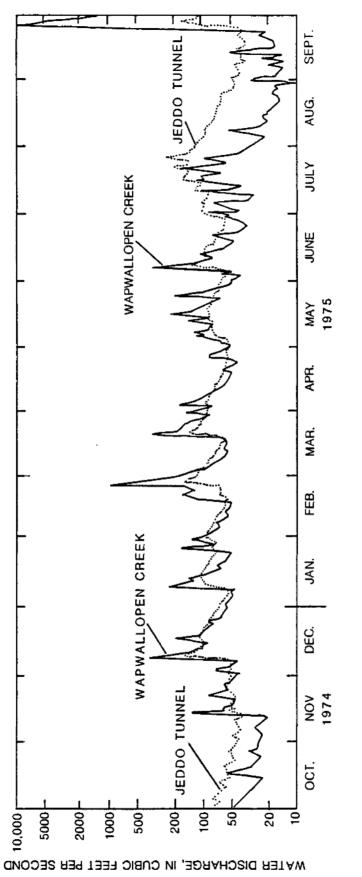
Lat-Long.         date         (tt-ling.)         (tt-ling.) <th>Site</th> <th><u>,</u></th> <th>ğ</th> <th>location</th> <th>Semplifing</th> <th>Di scharge</th> <th>Mater temperature</th> <th>Specific conductance</th> <th></th> <th>Concentration, in ag/L</th> <th>т. Т.</th> <th>loads, in tons per day</th> <th>ans per day</th> <th>Alkalinity to pH 4.5 as</th> <th>Acidity to indicated pH as CaOD, (mg/L)</th> <th>y to ed pi 19(1)</th>	Site	<u>,</u>	ğ	location	Semplifing	Di scharge	Mater temperature	Specific conductance		Concentration, in ag/L	т. Т.	loads, in tons per day	ans per day	Alkalinity to pH 4.5 as	Acidity to indicated pH as CaOD, (mg/L)	y to ed pi 19(1)
Prod Creek Hine       strip pool overflow       41'02'26' 75'90'44'       4-16-75       0.6       8.0       165       4.4       45       (1       0.01       0.0016        1         Prod Creek Hine       cullappool overflow       41'02'26' 75'90'44'       4-16-75       .1       7.5       150       4.3       37       (1       .01       .0003        1         Prod Creek Hine       strip pool overflow       41'02'14'' 75'51'100'       4-16-75       13.       7.0       140       5.6       42       (1       1,5       .035       1.6       5         Sendy Rn Hine       Sendy Rn Tunnel       41'00'0'56' 75'50'55'       4-16-75       2.3       8.5       3.7       130       (1       .15       .035       1.6       5         Sendy Rn Hine       Sendy Rn Tunnel       41'00'0'56'' 75'50'55''       4-16-75       2.3       8.5       3.7       130       (1       .16       .056        26         Mode       Like       7.0       620       3.5       3.05       1.6       .8       .06       .0       .0       .0       .0       .0       .0       .0       .0       .0       .0       .0       .0       .0       <			11	lat-long.	date			(Jushce)		Bulfate	EI.	sulfate	lital	CeODy (mg/L)	7.0	8.3
Prind Creek Huse         collapped tunnel         41°02'19'' 75°50'44''         4-16-75         1         7.5         150         4.3         37         (1         .01         .003          1           Prind Creek Huse         strtip pool overflow         41°02'14'' 75'51'00'' 4-16-75         13.         7.0         140         5.6         4.2         (1         1.5         .003          1           Sendy An Huse         Sendy Ran Tunnel         41°00'58' 75'50'55'         4-16-75         2.3         8.5         3.7         130         (1         1.5         .005          2           Make         Sendy Ran Tunnel         41°00'058' 75'50'55'         4-16-75         2.3         8.5         3.6         3.7         130         (1         13         .0062          2         2           Make         Make         41°00'058' 75'50'55'         4-16-75         7.0         6.20         3.5         300         30         4.7         .005          2         2           Make         Make         Make         41°00'058' 75'50'55'5'         4-16-75         5         9.0         300         30         4.7         .005         1.6         2	26			- <del>1</del> 4,05,52 _92,50, <del>14</del>	4-16-75	0.6	8.0	165	4.4	45	₽	10-0	9100°0	ł	8	8
Proof Creek Hine       strty proof overflaw       i*02*14** 75*51*00*       4-16-75       13.       7.0       140       5.6       42       <1       1.5       .035       1.6         Sendy An Mine       Sardy Rn Turnel       41*00*56* 75*50'55*       4-16-75       2.3       8.5       3.7       130       <1	27		collapsed turnel	41*02*29" 75*50*44"	4-16-75	Ŀ	7.5	150	4.3	37	٩	10 <b>°</b>	£000°	١	15	22
Seedy Run Hine       Serdy Run Turnel       41°00'38" 75"50'55"       4-16-75       2.3       8.5       3.7       130       <1	28		strip pool overflow	41°02'14" 75°51'00"	4-16-75	13.	7.0	140	5.6	74	₽	1.5	\$60*	1.6	9	8
Rest Black Creek         Out lb/e Turnel         4/100/02*         75'49'11*         4-16-75         4.5         7.0         6.20         3.5         390         3         4.7         .036          26           Mine         Mile Turnel         41'00'02*         75'49'11*         4-16-75         4.5         7.0         6.20         3.5         390         3         4.7         .036          26           Mile Turne         mile pool overflow         41'02'32*         75'53'52*         4-14-75         .5         9.0         380         3.0         84         1         .11         .0014          7           Holdside Mine         atrip pool overflow         41'00'37*         75'54'59*         4-14-75         .1         5.0         40         5.1         12         1         .00         .0003         1.6           Holdside Mine         atrip pool overflow         41'00'37*         75'4'59*         4-14-75         .1         5.0         40         5.1         12         1         .00         .001         1.6	2		Sardy Am Turnel	-55.05.28, 12.20.22	4-16-75	2.3	8.5	365	3.7	130	٥	18.	.0062	I	69	72
McNair Racin       McNair Racin       41.02132*       75*53*52*       4-14-75       .5       9.0       380       3.0       84       1       .11       .0014        7         Hodaide Mine       atrip pool overflow       41°02*32*       75*53*52*       4-14-75       .1       5.0       40       5.1       12       1       .00       .0003       1.6         Hodaide Mine       atrip pool overflow       41°00*37*       75*54*59*       4-14-75       .1       5.0       40       5.1       12       1       .00       .0003       1.6         Hodaide Mine       atrip pool overflow       41°00*37*       75*54*59*       4-14-75       .1       5.0       40       5.1       12       1       .00       .0003       1.6         21       21       21       21       21       7.2       .081	8		Owl thole Turnel	41,00,02" 75°49'11"	4-16-75	4.5	7.0	620	3.5	390	ſ	4.7	90.	ł	267	274
Hoodside Mine strip pool overflow 41°00'37" 75°54'59" 4-14-75 <u>.1</u> 5.0 40 5.1 12 1 <u>.00 .0003</u> 1.6 21 21 7.2 .081	я		McNair Basin strip pool overflow	41°02'32" 75°53'52"	4-14-75	ŝ	0.0	360	3.0	శ	4		\$100 <b>°</b>	ł	71	80
21 7.2	32		strip pool overflow	41°00'37" 75°54'59°	4-14-75	Ŀ	5.0	9	5.1	12	-	8	.000	1.6	7.5	c.
	Subtc	tal				21						1.2	180"			

Table ?.-Hater-quality and discharge data from mine-drainage sites in the Eastern Middle Rield near Beaver Meadows

Site		loci	Location	Sampling		Mater tenpersture	Specific conductance		Cancentratian, in mg/L Loads, in tans per day	, ta ng/L	Loads, in to	na per day	Actidity to Alkalinity to indicated pi pil 4.5 as as CaO3 (mg/	Actidity to Indicated pli as CaODy (mg/L)	y to ed pil (mg/L)
number	er Nane	Description	Lat-Long.	date	date (ft <sup>3/s)</sup>	(0)	(salar)	Ħ	Builfate	1 I I I I	sulfate	Iron		7.0	8.3
33	Hazle Brook Mine	Buck Hountain Tunnel 40°58'51" 75°49'27"	40°58'51" 75°49'27"	4-16-75	0.1	6.0	340	3,3	160	Ţ	0.0	0.0003	ł	011	011
A	Buck Hountain Nine	Buck Hountain Nine Buck Hountain Turnel 40°58'53" 75"48'49"	40°58'53" 75°48'49"	6-16-75	1.7	9.0	099	3.3	997	5	1.2	500	1	174	183
8	Stockton Mine	ahaf t	"ES'ES"ST "TO'BS"64	4-16-75	2.3	0"6	180	3,9	8	1	٤٤.	.0062	I	8	3
*	Hazle Brook Mine	Lehmen & Kovel strip pool overflow	letren & Kovel strip pool overflow 40°58'12" 75°53'51"	4-16-75	1.5	0"1	350	3.5	110	-	\$4.	1900'	ł	£	8
31	Beaver Yerdov Mine Turnel	Besver Meadows Turmel	40,22106. 12°54'07"	4-16-75	ន	0 <b>°6</b>	520	7.6	100	₽	5.4	50°	I	66	011
Subtotal	Ę				26						7.4	<b>9</b> 80			

Table 8.—Water-quality and discharge data from mine-drainage sites in the Eastern Middle Reid near Nazieton

ure         conductance         Concentration, in ag/L eulfate         Lotels, in trons per day inten         rds         rds         rds           873         3.6         4.30         6         75         1.1            873         3.6         4.30         6         75         1.1            875         3.6         4.30         6         73         .0033            725         5.6         66         12         .48         .008         21           225         5.6         66         12         .48         .0032            190         3.9         30          21         .0         .0032         -           70         4.1         9         1         .0         .001         -         -           70         4.1         150          .02         .0003         -         -           76         1.2         .06         .06         .02         .003         -         -							Mater	Specific						Alkalinity to	Actidity to Indicated d	y to et to
number         Name         Description         Lat-Long.         date         (te/No)         ('c')         (undots)         Hom         addictor         Lat-Long.         CorrOl         CorrOl <t< th=""><th>SI</th><th>te</th><th>Ĕ</th><th>atton</th><th>Sampling</th><th></th><th></th><th>conductance</th><th></th><th>Concentration</th><th>, in eg/l.</th><th>Loeds, in t</th><th>ons per day</th><th>pH 4.5 mg</th><th>as Ca001 (mg/L)</th><th>(T/2)</th></t<>	SI	te	Ĕ	atton	Sampling			conductance		Concentration	, in eg/l.	Loeds, in t	ons per day	pH 4.5 mg	as Ca001 (mg/L)	(T/2)
38       Jocho Mue       Jeeho Turnei       41'00'07' 75'93'36'       4-16-75       65       10.0       875       3.6       430       6       75       1.1          39       Delnty Stope Mine       collapsed alope       40'39'12' 76'05'30'       4-16-75       1.6       9.0       505       4.5       8       0.0       8       71       1.0       0.03       1.0 <th1.0< th=""> <th1.0< th="">       1.0<th></th><th></th><th>Description</th><th>Lat-Long.</th><th>date</th><th>(tt3/e)</th><th>() )</th><th>(Ind to 1</th><th>퓍</th><th>sulfate</th><th>E I</th><th>Bulfate</th><th>Iter</th><th>CaOD (mg/L)</th><th>0.7</th><th>8.3</th></th1.0<></th1.0<>			Description	Lat-Long.	date	(tt3/e)	() )	(Ind to 1	퓍	sulfate	E I	Bulfate	Iter	CaOD (mg/L)	0.7	8.3
39       Dativy Stope Wine       collapsed alope       40°59'12" $\%'06'30'$ 416-75       1.6       9.0 $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ $<0$ <	8		Jeddo Turnel	41*00*09" 75*59*38"		3	0.01	878	3.6	<b>8</b> 5	9	75	11	i	8	168
	6			40°58'12" 76°06'30"	52-91-4	1.6	0"6	8	<b>S</b> .4	æ	¢	8	CM00"	1	<b>e</b> -	~
41       Hack Ridge Hise       Ittig pool overflow       40°58'11° %'02'54"       4-15-75       1.2       8.0       180       3.9       30       (1       .10       .0032       -1         42       Story Creek Hise       Story Creek and seconde       40°51'39" 76'02'19"       4-15-75       4.0       5.5       <50	3		strip pool overflow	40°57'55" 76°05'30"	4-15-75	2.7	8.5	ផ	5.6	28	12	48,	<b>990</b> °	21	8	8
42       Story Creek Mile       Story Creek and becpage       40°57'39" 16"02'19" 4-15-75       4.0       5.5       50       4.4       9       1       .10       .011       -         43       Story Creek Mile       strip pool overflow       40°57'41" 76"01'52" 4-14-75       .3       5.5       70       4.2       21       .02       .0008       -         44       West Hazleton Mile       strip pool overflow       40"58"21" 76"00"33" 4-15-75       .1       5.0       305       4.1       150       .02       .0003       -         50       Mest Hazleton Mile       strip pool overflow       40"58"21" 76"00"33" 4-15-75       .1       5.0       305       4.1       150       .06       .0003       -         50       Mest Hazleton Mile       strip pool overflow       40"58"21" 76"00"33" 4-15-75       .1       5.0       305       4.1       150       .06       .0003       -         51       A       Mest Hazleton Mile       strip pool overflow       40"58"21" 76"00"33" 4-15-75       .1       5.0       305       4.1       150       .06       .0003       -			strip pool overflow	40"58"21" 76"02"54"	4-15-75	1.2	8.0	<b>19</b> 0	3.9	8	\$	01.	<b>2£00</b> *	1	125	8
Stary Creek Mine at the pool overflow 40°53'41" 76°01'52" 4-14-753 5.5 70 4.2 21 <102028			Stony Creek and seepage	61,20 <u>.</u> 9£6E,£5.09	4-15-75	4.0	5.5	2	4.4	6	1	.10	110	I	Ś	ف
West Hazleton Mine atrip pool overflow 40°58'21" 76°00'33" 4-15-75 <u>.</u> 1 5.0 305 4.1 120 <1 <u>.04 .003</u> -	£4		strip pool overflow	40°57'41" 76°01'52"	4-14-75	ŗ	5.5	8	4.2	21	₽	<b>707</b>	8000*	I	<b>~</b>	<b>8</b> 0
76	\$		e strip pool overflow	40*58'21" 76*00'33"	4-15-75		5.0	8	4.1	051	₽	20.	.000	I	13	<u>8</u>
	Subc	otal				75						<b>3</b> 2	1.2			





#### Sheppton

Seven mine-discharge sites were sampled near Sheppton; all drain into the Susquehanna River basin. Water quality and discharge data are listed in table 9. The largest discharge, 19 ft<sup>3</sup>/s, was from the Audenreid Tunnel. Water discharge from the seven sites totaled 38 ft<sup>3</sup>/s, and the sulfate discharge was 17 tons/d. Continuous water-discharge data were collected from Oneida Mine Tunnel No. 3 near Oneida from July 1974 to October 1976. From October 1, 1975, to September 30, 1976, maximum daily mean discharge was 67 ft<sup>3</sup>/s, and the minimum was 3.4 ft<sup>3</sup>/s. Continuous water-discharge data were also collected from Catawissa Tunnel near Sheppton from July 1974 to September 1976; the minimum and maximum daily mean discharges were 0.55 and 6.2 ft<sup>3</sup>/s, respectively.

#### Nuremberg

Three mine-discharge sites were sampled in the area near Nuremberg; all drain into the Susquehanna River basin. Water quality and discharge data are listed in table 10. Water discharge from the three sites totaled 16  $ft^3/s$ , sulfate discharge was 8.7 tons/d. The largest discharge, 8.8  $ft^3/s$ , was from the Derringer Mine tunnels.

#### Summary and Discussion

A total of 29 mine sites were sampled in the Eastern Middle Field. Water discharge totaled 176 ft<sup>3</sup>/s, sulfate discharge was 120 tons/d, and iron discharge was 2.1 tons/d. Mine water discharge to the Lehigh River basin totaled 46 ft<sup>3</sup>/s and the sulfate discharge totaled 14 tons/d; the rest drained to the Susquehanna River basin. Water yield from the entire 32 mi<sup>2</sup> coal field was 5.5 (ft<sup>3</sup>/s)/mi<sup>2</sup>, significantly more than the 2.1 (ft<sup>3</sup>/s)/mi<sup>2</sup> measured for the Northern Field. Sulfate yield was 3.6 (tons/d)/mi<sup>2</sup>, slightly less than the 4.6 (tons/d)/mi<sup>2</sup> measured in the Nothern Field.

Apparently, the high water yield from the mined area is due to water that enters the mines from other areas. The extra water does not seem to contribute to the sulfate yield, which was  $3.6 (tons/d)/mi^2$ . All of the discharges sampled in the Eastern Middle Field were from drainage tunnels or natural overflows. No pumps were known to be in operation at the time of sampling.

Felegy and others (1948) and Ash and others (1951) collected flow and water-quality data during 1941 from all known discharges in the Eastern Middle Field. Total measured water discharge was 102 ft<sup>3</sup>/s (20 percent was pumped from deep mines), and the measured acid discharge (as CaCO<sub>3</sub> to pH 8.3) was 190 tons/d (20 percent was pumped from deep mines). During the sampling period in 1975, water discharge was 176 ft<sup>3</sup>/s (none was pumped), and acid discharge was 52 tons/d. Water discharge during 1975 was about 70 percent greater than 1941, but the discharge of acid was about 70 percent less. Water and acid discharges from the Jeddo Tunnel were measured and sampled on June 12, 1941, and on October 31, 1946. Water discharges were 26.4 and 25.3 ft<sup>3</sup>/s, respectively, and acid discharges were 67 and 58 tons/d, respectively. On April 16, 1975, water discharge from the Jeddo Tunnel was 65 ft<sup>3</sup>/s,

1	1	<u>.</u>	and for	the second s	N arberta	Water	Specific		Concentration	to any	Toole in true per dev	the net day	Albalinity to	Addity to Indicated pli	s it j
munder	ber Name	Description	Lat-1.008.		(ft <sup>3/8)</sup>	(0.)	(Jurthol)	푽	Bulfate from		Bulfate		Ca001 (mg/L)	7.0	8.3
45	Oneida Mine	Oveida Turnel 1	*0°55'32" 76°07'25	4-15-75	6.4	0.1	202	3.7	69	1	1.2	0.02	I	8	45
<b>%</b>	Humboldt Mine	strip pool overflow	strip pool overflow 40°55'24" 76°04'03"	4-15-75	4.	8.0	ষ্ঠ	5.0	s	ą	10"	1100*	£		4
41	ilaney Brook Green Mountaln	Ontawisses Turnel	-65,00 <u>,</u> 92, -56,155,09,	4-15-75	8,	0.7	175	3.9	53	e	<b>tı.</b>	,0065	ł	8	3
87		Green Munitain Mine Green Munitain Turnel40°53'52" 76°04'03"	rel40°53'52" 76°04'03"	4-15-75	2.1	0.9	210	3.6	76	-	64.	.0057	I	£ł	<b>8</b> 7
49	Audenteld Mine	Autometd Turnel	40°53'52" 76°03'59"	4-15-75	19	0'01	009	3.3	<b>092</b>	2	14	01-	. 1	108	118
8	Onetde Mine	Onetda Turnel 3	40*55*06* 76*08*50*	4-16-75	1-6	8.0	170	4.3	ß	.2	1.3	6900"	I	8	9
5	OneIds Mine	strip puol overflow	strip pool overflow 40°53'30" 76°09'38"	4-15-75	7	1,0	07	4.1	13	\$	10.	5000-	1	4	9
Subtotal	otal				R						11	.14			
			Tahle		quality and n Middle Me	Water-quality and diochurge data fn Eastern Middle Pield near Nuradorg	la from mine therp	-dratnag	10.—Water-quality and diechurge data from mine-drainage aitee in the Eastern Middle Pield near Nurenberg	9					
Site mmber	te Der Name	lo beerfption	location Lat-long.	Sempling date	Di echenge (ft <sup>3/g</sup> )	Hater temperature (*C)	Specific ornductance (unitos)	뿬	Concentration, in ng/L aufate iron	<u>1 tron</u>	Loeds, in tons per day sulfate iton	1 . 1	Alkalinity to pli 4.5 as CaCO <sub>1</sub> (ng/L)	Acidity to Indicated pl as CaOO1 (mg/ 7.0 8.	y to ed ⊒l 8.3
22	Goven Mine	Goven Turnel		4-15-75	6.6	8.0	00	3.8	110	2	2.0	960"	ł	55	3

Table 9.—Mater-quality and discharge data from mine-drainage sites in the

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53 Derringer Mine Derringer Turnel 40°56'48" 76°10'43" 4-15-75

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40\*58'27" 76"15'17" 4-14-75

McCauley Mountain Southeast stripping 54 Basin seepage

Subtotal

and acid discharge was 29 tons/d. Water discharge was about 150 percent greater, and acid discharge was about 60 percent less than the discharges during 1941 and 1946.

#### Western Middle Field

The Western Middle Field (fig. 5) extends from east of Mahanoy City to just southwest of Trevorton and is entirely within the Susquehanna River Basin. About 75 mi<sup>2</sup> are underlain with coal; the total drainage area is about 100 mi<sup>2</sup>. Most of the area that is not underlain with coal is along the top of the ridges, and the drainage is toward the coal measures. Forty-six mine discharges were measured and sampled; their locations are shown on figure 5, and the discharges are discussed by regions in the following paragraphs.

#### Mahanoy City

Three sites were sampled in the vicinity of Mahanoy City (table 11) during April 1975. All three are associated with the Vulcan-Buck Mountain Mine. Water discharge totaled 11 ft<sup>3</sup>/s, sulfate discharge totaled 4.6 tons/d, and the mean concentration of sulfate was 160 mg/L. The largest discharge was from the Vulcan-Buck Mountain boreholes. Water discharge from the boreholes was 9.8 ft<sup>3</sup>/s, and the sulfate discharge was 4.2 tons/d.

#### Shenandoah

Three mine-discharge sites were sampled near Shenandoah (table 12). The largest discharge was from the Gilberton pump. The pump was installed to prevent water levels from rising and flooding basements, and operates about 40 percent of the time. The discharge is 23 ft<sup>3</sup>/s when the pump is operating, however, because the pump operates 40 percent of the time, the average discharge is about 9.2 ft<sup>3</sup>/s. Samples of the discharge were collected and the concentrations of dissolved iron and sulfate were 54 and 1,000 mg/L, respectively.

Total water discharge from the three sites, assuming the pump operates 40 percent of the time, was 14 ft<sup>3</sup>/s; sulfate discharge was 40 tons/d; and mean concentration of sulfate was 1,100 mg/L. The other two discharges in the Shenandoah area also have relatively high dissolved iron (20 mg/L) and sulfate concentations (1,200 and 1,300 mg/L).

#### Girardville

Seven mine-discharge sites were sampled in the Girardville area (table 13). The largest discharge, 45 ft<sup>3</sup>/s, was from a breach and borehole at the the Packer No. 5 mine; the sulfate concentration was 1,300 mg/L and the sulfate discharge was 160 tons/d. Discharge from the Packer No. 5 mine probably originates from several mine complexes north and east of Girardville. A second large discharge near Girardville was from several seepages along the base of a spoil pile at the Girard mine, total discharge was 8.0 ft<sup>3</sup>/s. Water discharge from the seven sites totaled 58 ft<sup>3</sup>/s, and sulfate discharge was 180 tons/d.

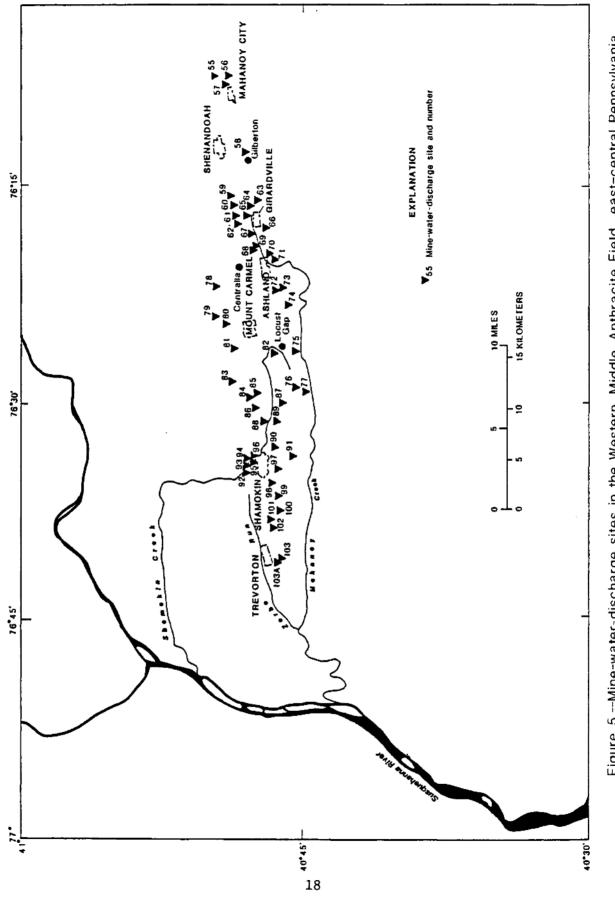


Figure 5.--Mine-water-discharge sites in the Western Middle Anthracite Field, east-central Pennsylvania.

		Tahle il	Table IIHater-quality and	discharge dat	ta fron alne-	dratnage at te	ee in the Vie	stem X	discharge data from mine-drainage sites in the Vestern Middle Field near Nahanoy Ciry	sar Mahanoy	GLY				
Site			location	Sampling	Discherge	Water temperature	Specific onductance		Concentration, in mg/b	, in mo/t	Loads, in tons per day	ons per day	Alkalinity to pii 4.5 ae	Acidity to indicated pH as CaOD, (mg/	Acidity to adicated pH CaOD <sub>1</sub> (mg/L)
naber	ur Name	Description	Lat-fong.	date	(ft]/s)	().	(jethos)	ŧ	sulfate	1 ren	sulfate	Iton	Ca001 (mg/l.)	7.0	6.9
8	Vulcan-Buck Hountain Mine	Morris Turnel	#0.\$\$.19. <u>5</u> 0.01.12	r" 4-18-75	<b>6.</b> 0	9.5	440	3.3	0%1	2	ч.	9100*	ł	302	011
8	Vulc <del>an B</del> uck Mountain Mine	aßedate	<b>40°48'38" 76°</b> 07'25"	5" 4-18-75	<b>9</b> -	10.0	99	4.0	160	æ	.26	£10 <b>.</b>	I	8	8
5	Vulcan-Buck Mountain Mine	Vulcar-Buck Kuntaln borekoles	uta 40°48'55" 76°07'35"	5" 4-16-75	<u>9.8</u>	9.5	375	6.4	160	0	4.2	.26	ł	3	5
Subtotal	E,				n						4.6	-27			
		Table 1	Table 12.—Water-quality and discharge data from whe-drainage aites in the Western Middle Field near Shenardosh	l discherge de	ita frus sine	न्तेत्व्यक्षेत् बा	tes in the W	leetern	Middle Meid n	eer Shenard	<b>de</b> h				
120			location	Samifice	1	Mater temerature	Specific conductance	_	Concentration. In w/l.	, to <b>e</b> /L	Loefs. In tons ner day	the text day	Alkalinity to di 4.5 m	Acidity to Indicated pil Ac CoCD, (mo/	ty to feed rit
number	r Name	Description	Lat-Long.	date	(ft3/a)	3	(Juthos)	Æ	Bulfate	Iron	Bulfate	TEI I	ca01 (={/L)	7.0	7.0 8.3
8	Gilberton Mine	Gilberton Rup	<b>40°48'01" 76°12'34</b> " <b>4-18-75</b>	;******	23	14.0	1800	6.1	1000	R	62	3.4	102	8	240
		operates 40 per- cent of the time			9,2						8.12	96.1			
65	Weston Mine	Meston aurface areas seepage	ees 40°48'30" 76°14'49"	)" 4-16-75	3.7	15.0	1900	6.1	1200	8	12	<b>0</b> 7	62	65	811
99	Nexton Mine	Lost Creek borehol	Lost Creek borehole 40°48'25" 76°14'49"	r: 4-16-75	1.0	16+0	2150	<b>6.</b> 1	0001	8	3,51	-02	111	132	20
Subtotal	T I				28						78	3.6			
Subtot	al with Gilberton p	Subtotal with Gilberton part in operation 40 percent of time	percont of the		41						9				

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						Water	Southe						Alkalinity to		Acidity to
Site		đ	location		Sempling Discharge	g		_	Concentration, in mg/L	1, in mg/L	Loads, in tons per day	ons per day	pH 4.5 mg	-	as (a00, (mg/L)
number	r Name	Description	Lat-Long.		(ft <sup>3/8</sup> )	(_C)	(Jatros)	Ħ	aulfate	Iron	Bulfate	Iga	CeO01 (mg/L)	7.0	8.3
19	61 Hamond Mine	Connection VIII.age boreholes	40°48'06" 76°16'04"	4-16-75	LJ	15.0	0561	6.3	0071	9	5,5	81.	205	82	210
62	Namond Milme	Seepage	40°48'05" 76"16'20"	4-17-75	ŗ	13.0	0077	6.3	0011	8	.59	110.	138	5	61
63	Girard Mine	agebooks	40°47'30" 76°16'26"	4-16-75	8.0	12.0	<b>23</b>	5.9	094	8	6*6	43	11	105	155
3	Packer No. 5 Mine	breach and borehole	breach and horeholes 40°47'40" 76°16'22"	4-18-75	S.	15.0	2400	5.8	0001	9	158	4.9	167	53	174
8	Preston Mine	Preston No. 3 water Level drift	Preston No. 3 water- 40°47'44" 76°16'13" Level drift	4-16-75	4	16.5	2020	6.3	1300	8	4.1	£0 <b>.</b>	5	8	111
38	Preston Mine	tumel	40°27'25" 76°17'34"	4-17-75	2.2	0.01	23	5.6	200	8	1.2	-12	<b>4</b> 6	ş	8
67	Bast Mine	turnel	-80,81,92 <u>76</u> ,18,08	4-17-75	6.	12.0	0081	3.4	006	9	2.3	.10	I	174	213
Subtotal					8						180	5.8			

#### Ashland

Nine mine-discharge sites were sampled in the Ashland area (table 14). Water discharge from three sites, one from the Centralia Mine, one from the Bast Mine, and one from the Tunnel Mine enter Mahanoy Creek above Ashland. Water discharge from these three sites totaled 19  $ft^3/s$ , and the sulfate load was 31 tons/d. The largest discharge was from the Centralia Mine drainage tunnel; water discharge was 11  $ft^3/s$ , and sulfate discharge was 17 tons/d. Discharge from the remaining six sites enters Mahanoy Creek below Ashland. Discharge from these sites totaled 21  $ft^3/s$ , and the sulfate load was 41 tons/d.

#### Mount Carmel

Four mine-discharge sites were sampled near Mount Carmel (table 15). The highest discharge (5.9 ft $^3$ /s) was from a tunnel at the Mid-Valley Mine. The other discharges listed in table 15 are relatively small.

#### Shamokin

Eighteen mine-discharge sites were sampled in the area around Shamokin (table 16). The two largest discharges were from the Rock Tunnel at the Scott Ridge Mine (15 ft<sup>3</sup>/s) and a strip pool overflow at the Excelsior Mine (13 ft<sup>3</sup>/s). Total water discharge from the 18 sites near Shamokin was 60 ft<sup>3</sup>/s, and the average concentration of sulfate was 560 mg/L. Sulfate discharge was 91 tons/d.

#### Trevorton

Two mine discharges were sampled near Trevorton (table 17). Water discharge from the North Franklin Mine airshaft and borehole was 8.3 ft<sup>3</sup>/s, and the concentrations of dissolved iron and sulfate were 22 and 560 mg/L, respectively. The mined area is about 3 mi<sup>2</sup>. Water and sulfate yields were about 2.6 (ft<sup>3</sup>/s)/mi<sup>2</sup> and 4.3 (tons/d)/mi<sup>2</sup>.

#### Summary and Discussion

The Western Middle Field contains 75 mi<sup>2</sup> of coal measures. Water discharge from the mine drainage sites totaled 198 ft<sup>3</sup>/s, the sulfate load was 410 tons/d, and the iron discharge was 19 tons/d. Water yield from the 75 mi<sup>2</sup> underlain by coal was 2.6  $(ft^3/s)/mi^2$  and the sulfate yield was 5.5  $(tons/d)/mi^2$ . The sulfate yield was about 50 percent greater than the yields measured from the Northern and Eastern Middle Fields. Table 18 lists a summary of water and sulfate discharges from the Western Middle Field by drainage areas.

Felegy and others (1948) and Ash and others (1951) collected flow and water-quality data during 1941 and 1946 from all known discharges in the Western Middle Field. Measured water discharge during the sampling in 1941 was 120 ft<sup>3</sup>/s (78 percent was pumped from deep mines) and measured acid discharge, as  $CaCO_3$  to pH 8.3, was 229 tons/d (62 percent was pumped from deep mines). Measured water and acid discharges were considerably less when samples were collected in 1946. Water discharge was 61 ft<sup>3</sup>/s (80 percent

Site		Ϋ́	Location	Sampling	Discharge	Viater temperature	Specific conductance		Orncentration, in m/L	t, tn mc/t.	loeds, in t	loeds, in tons per day	Alkalinity to pi 4,5 86	Actd Indic CeO	Actidity to indicated pi s CaODA (mg/L)
nunber	ar Name	Description	Lat-Long.	date	(ft <sup>3/s</sup> )	() (	(jethos)	Ħ	aulfate	1 Tu	sulfate	Itan	Ca003 (mg/L)	7.0	7.0 8.3
89	Centralia Mine	burnel	40°47'27" 76°19'26"	4-16-75	11	0.11	056	3.5	280	9	11	0.10	1	133	145
69	Bast Mine	Overflow afte	-60.61.92 -11.27.07	4-11-15	8	I	I	I	I	I	Ι	I	ļ	I	I
2	Bast Mine	Oakland Turnel	<b>.\\$</b> .61.92 <b>.</b> 90.2 <b>\.0</b> 7	4-11-75	6.6	I4.0	1400	6.3	660	କ୍ଷ	12	ж.	118	窝	011
۲	Turnel Mine	dratn pool area and seepage	40*46*45" 76*20*12"	5 <i>1</i> 114	1.3	17.0	1250	6.5	640	8	2.2	II.	8	ជ	87
72	Potta Mine	Nest breach	40°46'34" 76°22'19"	4-17-75	ů	12.0	950	6.8	240	2	.19	9100*	\$	•	18
5	Potts Mine	East breach	40°46'24" 76°22'15"	4-17-75	3.2	15.0	2400	6.6	096	9	8.3	.35	328	88	0/1
74	izvelle Mine	Lavelle slope	40°45'58" 76"24'05"	4-17-75	r,	10.5	460	3.3	230	2	61.	9100.	I	45	8
35	Locust Gap Mine	Helfenstein turnel	40°45'04" 76°26'12"	4-17-75	3.9	13.5	1200	1.2	019	OĮ	1.1	п.	R	I	45
76	Locust Cap Mine	strip pool overflow	strip pool overflow 40°45'31" 76°28'29"	4-21-75	:	12.0	530	3.6	220	7	.14	1100"	ļ	8	00
11	Locust Gep Mine	<b>Doutyville turnel</b>	40°44'35" 76°28'38"	4-18-75	13	0.61	1280	3.6	700	ĩ	25	.42	I	106	561
Subtotal	la				9						72	1.7			
			Table		-quality and m Middle Pi	Water-quality and diachange data from Western Hiddle Reld near Hount Carmel	ata from min at Carmel	e-drain	15.—Water-quality and discharge data from mine-drainage sites in Us Western Hiddle Rield rear Mourt Carmel	e Li					
						Water	Sourfile						Alkalinity to	Actd	Acidity to Indicated di
Site number	r Naue	loc Description	location Lat-Long.	Semp14 ng date	Di scharge (ft <sup>3</sup> /s)	temperature (*C)	conductance (junitoo)	Ŧ	Concentration, in m2/L sulfate iron	1, in mg/l. Iron	Loads, in tons per day sulfate from	ons per day Iron	rii 4.5 as Ca003 (mg/L)	7.0 7.0	as (a00, (mg/L) 7.0 8.3
38	Hid-Valley Mine	agedaaa	40°49'17" 76°22'21"	4-11-75	0.2	17.5	1600	2.8	870	9	29*0	0.0054	I	395	429
62	Mid-Vailey Mine	Mid-Valley Tunnel 4	Mid-Valley Tunnel & 40°49'05" 76°23'55"	4-17-75	4.	12.5	280	3.3	264	-	<b>5</b> 7	1100"	ļ	9	87
8	Mid-Valley Mine	turnel	40°48'48" 76°24'24"	4-17-75	5.9	10.5	009	3.3	280	15	4.5	.24	I	071	155
81	Kicharda's Shaft Mine	delft	40°48'17" 76°26'12"	4-17-75	8	1	1	I	ł	I	1	ļ	ļ	I	l
8	Alaska Mne	agedaag	40°46'56" 76°26'50"	4-11-75	÷	8.0	80	2.7	990	2	<u>0</u>	7100°	I	188	502
Subtotal	al				<b>6.</b> 6						5.4	.25			

Table 14.—Mater-quality and dischenge data from mine-drainage sites in the Western Middle Field near Ashiand

	~[	l ocari (au	See 14 au	M acharao	Vater	Specific		Concentration for Moli.	ter mo/l.	India fu F	lode in tone ner dev	Alkalinity to #1 6.5 se	Indicated pH	8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
atte Runder Name	Description	Lat-Long.	date	(ft <sup>3/a</sup> )	(2)	(acrine)	电	sulfate	1 uu	sulfate		CaOD (mg/L)	7.0 8.3	8.3
Natalie Mine	dirl ft	40"48'40" 76"28'10"	4-[7-75	0,00	ì	I	I	ţ	i	ł	I	I	ı	I
Scott Ridge Mine	breach	-61,62 <b>,</b> 92	61-71-4	2.8	12.7	8	5.3	1190	8	9.0	0.36	16	165	210
Scott Ridge Mine	rock turnel	40*47+39" 76*29+19"	4-17-75	15	12,7	<b>096</b>	5.3	490	45	8	1.8	91	115	165
Colbert Mine	breach	40*47'26" 76°29'41*	4-11-4	6.	12.0	8	5.3	510	ş	1.2	01.	6	811	138
Exceletor Mine	strip pool overflow	40*46'25" 76*29'37"	4-18-75	ព	12.0	018	4.9	8	4	14	1.5	ŝ	128	185
Mey <b>s</b> ville Mine No. 1 & 2	borehole		4-16-75	3.3	11.2	0001	6,3	99 <b>3</b>	8	4.1	.45	133	125	200
Corbin Mine	Corbin water Level drift	40.46.46° 76° 30' 53"	4-16-75	0°1	12.0	810	4.1	669	9	11	11.	ł	210	230
Royal Osk Mine	aßedaag	40*46'57" 76*32'05"	4-16-75	۰.	12.5	021	5.3	07E	R	01.	1900"	35	115	135
Big Nountain Mine	No. 1 atope	40.46'19" 76°32'19"	4-16-75	2.0	11.5	700	3.4	8	8	1.6	II.	1	05T	160
Cameron Mine	atr shaft	40.47.44" 76"33'59"	4-16-75	4,0	12.2	1470	3.4	06/	8	8.5	.65	l	355	ŝ
Cameton Muse	drift	40*47'37" 76"33'55"	4-16-75	4.7	14.0	1700	4.I	1100	130	14	1.9	ţ	629	4/4
Caneron Mine	interal ttent putp	-96.66.92 -26.27.94	5131-4	8	ł	I	I	I	I	I	I	ι	ı	I
Caneron Mine	aðledærø	40"47'30" 76"33'52"	4-16-75	10'	12.5	1000	4.7	550	33	Ş	0000'	s	23	255
Ceneron Mune	drift and brunel	-94'56'37 -16'74'04	4-16-75	1.1	14.5	1300	5.5	920	93	2.7	81.	ጽ	185	210
Henry Clay Stirting Mine	etabe	-10.96.91 -16.04.04	4-16-75	11	0.61	056	5.6	470	8	51	1.5	63	591	0/1
Henry Clay Stirting Mine	collapsed drift,		4-16-75	7	0.11	355	6.1	16	9	<b>.</b> 0	<b>%00</b> .	62	я	65
Bear Valley Mine	agadaas	40°46'14" 76°35'11"	4-16-75	٦	0"11	00	3.3	990	H	01.	6000	ł	120	123
Bear Valley Mine	North Mountain turnel collapsed	-65.9E. 18. 19.38	4-15-75	ġ.	5.6	405	5.6	981	R	.29	260"	58	8	102
Bear Valiey Mine	adadaas	40*47'54" 76"37'28"	4-15-75	ľ.	7.0	160	5.7	61	1	20.	.000	'n	\$	80
Bear Valiey Mine	strip pool overflow	40*46'42" 76°37'30"	4-15-75	8	0.6	180	5.5	82		10.	1000	1	5	80
Subtotal				8						9	8.7			
	Colbert Mine Excelator Mine Heryarulile Mine No. 1 & 2 Corthin Mine Rig Hountalin Mine Rig Hountalin Mine Carerron Mine Carerron Mine Carerron Mine Carerron Mine Carerron Mine Carerron Mine Miney Clay Mine Henry Clay Stirting Mine Bear Valley Mine Bear Valley Mine Bear Valley Mine Bear Valley Mine Bear Valley Mine Bear Valley Mine	<u> </u>	treach strip pool overflow borehole Corthin water level drift Bevel drift expanse the Ko. 1 alope drift drift drift drift drift drift drift atr atat here the the the the the the the the the th	Ineach         40°4/1'26'         76°29'3/'           strip pool overflow         40°4/1'26'         76°29'3/'           borehole         40°4/1'03'         76°30'52'           borehole         40°4/1'03'         76°30'52'           corthin water         40°4/1'03'         76°30'52'           corthin water         40°4/1'03'         76°30'52'           corthin water         40°4/1'03'         76°30'52'           level dirft         40°4/1'31'         76°33'55'           dirft         40°4/1'41	Treach       40°4,°26°       76°29°4,°       4-13-75         strip pool overflow       40°4,°135°       76°29°3,°       4-16-75         borehole       40°4,°103°       76°30°53°       4-16-75         borehole       40°4,°103°       76°30°53°       4-16-75         corthin water       40°4,°103°       76°30°53°       4-16-75         corthin water       40°4,°103°       76°30°53°       4-16-75         lewel dirft       40°4,°137°       76°33°53°       4-16-75         dirft       40°4,°137°       76°33°55°       4-16-75       1         parp elope       40°4,°137°       76°33°55°       4-16-75       1         dirft       40°4,°137°       76°33°55°       4-16-75       1         diret       attrit       40°4,°137°       76°33°55°       4-16-75       1         diret       attrit       40°4,°137°56°       4-16-75       1 <td>breach       40°4/'26' 76°29'41'       4-17-75       -9       1         attip pool overflow       40°4/'03'' 76°30'52'       4-16-75       3.3       1         breehole       40°4/'03'' 76°30'52'       4-16-75       3.3       1         Corthin water       40°4/'03'' 76°30'53'       4-16-75       3.3       1         Corthin water       40°4/'03'' 76°30'53'       4-16-75       1.0       1         Beepage       40°4/'13'' 76°33'55'       4-16-75       1.0       1       1         Itematifie       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1         dift       4164       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1         dift       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       att       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       att       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       att       40°4/'13'' 76°33'55'       4-16-75       1.1       <td< td=""><td>breach         <math>0^{4} 4^{1} 7 5^{2} 7 6^{2} 9^{3} 4^{1}</math> <math>-13^{-1} 5</math> <math>-3</math> <math>12.0</math>           articlp pool overtion         <math>40^{4} 4^{1} 7 5^{2} 7 6^{2} 9^{2} 9^{2} 7^{2}</math> <math>+16^{-1} 5</math> <math>-3</math> <math>11.2</math> <math>1</math>           borehole         <math>40^{4} 4^{1} 0 5^{2} 7 6^{2} 9^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{1} 6^{-7} 5</math> <math>-3.3</math> <math>11.2</math> <math>1</math>           conthin water         <math>40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 5^{2} 5^{2} 4^{1} 6^{-7} 5</math> <math>-1</math> <math>22.0</math> <math>11.2</math> <math>1</math>           conthin water         <math>40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{1} 6^{-7} 5</math> <math>-1</math> <math>22.5</math> <math>11.2</math> <math>1</math>           benepage         <math>40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{-1} 6^{-7} 5</math> <math>-1</math> <math>12.5</math> <math>11.5</math>           drift         <math>40^{4} 4^{1} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{-1} 6^{-7} 5</math> <math>-1</math> <math>12.5</math> <math>11</math>           drift         <math>40^{4} 4^{1} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 5^{2} 1^{2} </math></td><td>treach         40°47'35' 76°30'41'         417-35         3         1         2         0         00           ette pool overtios         60°47'35' 76°30'37'         6-18-35         13         1         12.0         800           borehole         60°47'01' 76°30'37'         6-16-35         3.3         11.2         100           borehole         60°47'01' 76°30'37'         6-16-35         1.0         12.0         800           corthin witter         60°46'6' 76°30'37'         6-16-35         1.0         12.0         800           beel diff         60°46'17' 76°30'37'         6-16-35         1.0         12.0         800           diff         80°1         1.00         12.0         12.0         800           diff         60°40'40' 76°30'35'         6-16-35         4.1         12.0         100           diff         80°47'40' 76°30'35'         6-16-35         4.1         12.0         100           diff         400         16°30'46' 76°30'35'         6-16-35         4.1         12.0         100           diff         80°47'40'76'76'30'35'         6-16-35         4.1         14.0         12.0         100           diff         80°47'40'76'76'30'35'6'40'50'5'5'5'5'5'5'5'5'5'5'</td><td>breach         <math>Q^{4}y^{1}'y^{2}' / \gamma^{2}y^{1}' + \sqrt{1}^{-1}'^{-3}</math> <math>y^{2}</math> <math>y^{</math></td><td>Insertion         Q<sup>4</sup>Q<sup>4</sup>/3<sup>2</sup>G<sup>2</sup>/3<sup>6</sup>/3<sup>2</sup>G<sup>2</sup>/3<sup>2</sup>         Lip 20         S         <th< td=""><td>Insertion         60<sup>4</sup>1<sup>1</sup>78<sup>4</sup> 76<sup>2</sup>9<sup>4</sup>1<sup>4</sup>         4.1<sup>2</sup>.3         .9         12.0         90         5.3         510         60         14           Introperious         40<sup>4</sup>10<sup>2</sup>75 76<sup>2</sup>9<sup>3</sup>1<sup>3</sup>         4.18<sup>-7</sup>3         13         11.2         100         6.3         6.0         6.4         14           Interline         40<sup>4</sup>10<sup>2</sup>75 76<sup>2</sup>9<sup>3</sup>1<sup>3</sup>7         4.16<sup>-7</sup>3         3.3         11.2         100         6.3         6.0         6.4         14         14           Interline         40<sup>4</sup>10<sup>2</sup>7 76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>76<sup>2</sup>76<sup>2</sup>76<sup>2</sup>         4.16<sup>-7</sup>3         1.1         12.2         100         6.1         6.0         20         1           Interlift         40<sup>4</sup>6<sup>1</sup>76<sup>2</sup>76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>         4.16<sup>-7</sup>3         1.1         12.2         100         3.1         100         30         30         10         100         10         10         10         10         10         10         10         10         10         11         10</td><td>Invention         (0°41'73'' 76'39'')         (1')73         (1')73''         (1')73''         (1')73''         (1')73'''         (1')73'''''''''''''''''''''''''''''''''''</td><td>Imatch         (674)'26' 76' 29'1'         (1-)-7         3         120         80         5.3         510         60         1.2         1.0           etcp pool meetine         (674)'26' 76' 29'7'         (16-7)         13         11.2         100         6.3         60         4.4         1.4         1.5         1.0           Inversion         (674)'76' 76' 29'7'         (16-7)         1.3         11.2         100         6.3         60         4.4         1.4         1.5           Inversion         (674)'76' 76' 29'7         (16-7)         1.1         12.0         100         6.3         60         7.1         1.5           Inversion         (674)'76' 76' 29'76' 29'75'         (16-7)         1.1         12.3         100         5.1         60         7.1         1.5         1.5           Inversion         (674)'76' 76' 79' 76' 79' 76' 79' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 76' 70' 76' 76' 70' 76' 70' 76' 76' 76' 76' 76' 76' 76' 76' 76' 76</td><td></td></th<></td></td<></td>	breach       40°4/'26' 76°29'41'       4-17-75       -9       1         attip pool overflow       40°4/'03'' 76°30'52'       4-16-75       3.3       1         breehole       40°4/'03'' 76°30'52'       4-16-75       3.3       1         Corthin water       40°4/'03'' 76°30'53'       4-16-75       3.3       1         Corthin water       40°4/'03'' 76°30'53'       4-16-75       1.0       1         Beepage       40°4/'13'' 76°33'55'       4-16-75       1.0       1       1         Itematifie       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1         dift       4164       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1         dift       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       att       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       att       40°4/'13'' 76°33'55'       4-16-75       1.1       1       1       1         dift       att       40°4/'13'' 76°33'55'       4-16-75       1.1 <td< td=""><td>breach         <math>0^{4} 4^{1} 7 5^{2} 7 6^{2} 9^{3} 4^{1}</math> <math>-13^{-1} 5</math> <math>-3</math> <math>12.0</math>           articlp pool overtion         <math>40^{4} 4^{1} 7 5^{2} 7 6^{2} 9^{2} 9^{2} 7^{2}</math> <math>+16^{-1} 5</math> <math>-3</math> <math>11.2</math> <math>1</math>           borehole         <math>40^{4} 4^{1} 0 5^{2} 7 6^{2} 9^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{1} 6^{-7} 5</math> <math>-3.3</math> <math>11.2</math> <math>1</math>           conthin water         <math>40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 5^{2} 5^{2} 4^{1} 6^{-7} 5</math> <math>-1</math> <math>22.0</math> <math>11.2</math> <math>1</math>           conthin water         <math>40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{1} 6^{-7} 5</math> <math>-1</math> <math>22.5</math> <math>11.2</math> <math>1</math>           benepage         <math>40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{-1} 6^{-7} 5</math> <math>-1</math> <math>12.5</math> <math>11.5</math>           drift         <math>40^{4} 4^{1} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{-1} 6^{-7} 5</math> <math>-1</math> <math>12.5</math> <math>11</math>           drift         <math>40^{4} 4^{1} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 5^{2} 1^{2} </math></td><td>treach         40°47'35' 76°30'41'         417-35         3         1         2         0         00           ette pool overtios         60°47'35' 76°30'37'         6-18-35         13         1         12.0         800           borehole         60°47'01' 76°30'37'         6-16-35         3.3         11.2         100           borehole         60°47'01' 76°30'37'         6-16-35         1.0         12.0         800           corthin witter         60°46'6' 76°30'37'         6-16-35         1.0         12.0         800           beel diff         60°46'17' 76°30'37'         6-16-35         1.0         12.0         800           diff         80°1         1.00         12.0         12.0         800           diff         60°40'40' 76°30'35'         6-16-35         4.1         12.0         100           diff         80°47'40' 76°30'35'         6-16-35         4.1         12.0         100           diff         400         16°30'46' 76°30'35'         6-16-35         4.1         12.0         100           diff         80°47'40'76'76'30'35'         6-16-35         4.1         14.0         12.0         100           diff         80°47'40'76'76'30'35'6'40'50'5'5'5'5'5'5'5'5'5'5'</td><td>breach         <math>Q^{4}y^{1}'y^{2}' / \gamma^{2}y^{1}' + \sqrt{1}^{-1}'^{-3}</math> <math>y^{2}</math> <math>y^{</math></td><td>Insertion         Q<sup>4</sup>Q<sup>4</sup>/3<sup>2</sup>G<sup>2</sup>/3<sup>6</sup>/3<sup>2</sup>G<sup>2</sup>/3<sup>2</sup>         Lip 20         S         <th< td=""><td>Insertion         60<sup>4</sup>1<sup>1</sup>78<sup>4</sup> 76<sup>2</sup>9<sup>4</sup>1<sup>4</sup>         4.1<sup>2</sup>.3         .9         12.0         90         5.3         510         60         14           Introperious         40<sup>4</sup>10<sup>2</sup>75 76<sup>2</sup>9<sup>3</sup>1<sup>3</sup>         4.18<sup>-7</sup>3         13         11.2         100         6.3         6.0         6.4         14           Interline         40<sup>4</sup>10<sup>2</sup>75 76<sup>2</sup>9<sup>3</sup>1<sup>3</sup>7         4.16<sup>-7</sup>3         3.3         11.2         100         6.3         6.0         6.4         14         14           Interline         40<sup>4</sup>10<sup>2</sup>7 76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>76<sup>2</sup>76<sup>2</sup>76<sup>2</sup>         4.16<sup>-7</sup>3         1.1         12.2         100         6.1         6.0         20         1           Interlift         40<sup>4</sup>6<sup>1</sup>76<sup>2</sup>76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>         4.16<sup>-7</sup>3         1.1         12.2         100         3.1         100         30         30         10         100         10         10         10         10         10         10         10         10         10         11         10</td><td>Invention         (0°41'73'' 76'39'')         (1')73         (1')73''         (1')73''         (1')73''         (1')73'''         (1')73'''''''''''''''''''''''''''''''''''</td><td>Imatch         (674)'26' 76' 29'1'         (1-)-7         3         120         80         5.3         510         60         1.2         1.0           etcp pool meetine         (674)'26' 76' 29'7'         (16-7)         13         11.2         100         6.3         60         4.4         1.4         1.5         1.0           Inversion         (674)'76' 76' 29'7'         (16-7)         1.3         11.2         100         6.3         60         4.4         1.4         1.5           Inversion         (674)'76' 76' 29'7         (16-7)         1.1         12.0         100         6.3         60         7.1         1.5           Inversion         (674)'76' 76' 29'76' 29'75'         (16-7)         1.1         12.3         100         5.1         60         7.1         1.5         1.5           Inversion         (674)'76' 76' 79' 76' 79' 76' 79' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 76' 70' 76' 76' 70' 76' 70' 76' 76' 76' 76' 76' 76' 76' 76' 76' 76</td><td></td></th<></td></td<>	breach $0^{4} 4^{1} 7 5^{2} 7 6^{2} 9^{3} 4^{1}$ $-13^{-1} 5$ $-3$ $12.0$ articlp pool overtion $40^{4} 4^{1} 7 5^{2} 7 6^{2} 9^{2} 9^{2} 7^{2}$ $+16^{-1} 5$ $-3$ $11.2$ $1$ borehole $40^{4} 4^{1} 0 5^{2} 7 6^{2} 9^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{1} 6^{-7} 5$ $-3.3$ $11.2$ $1$ conthin water $40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 5^{2} 5^{2} 4^{1} 6^{-7} 5$ $-1$ $22.0$ $11.2$ $1$ conthin water $40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{1} 6^{-7} 5$ $-1$ $22.5$ $11.2$ $1$ benepage $40^{4} 6^{1} 5^{2} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{-1} 6^{-7} 5$ $-1$ $12.5$ $11.5$ drift $40^{4} 4^{1} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 4^{-1} 6^{-7} 5$ $-1$ $12.5$ $11$ drift $40^{4} 4^{1} 7 5^{2} 3^{2} 5^{2} 5^{2} 3^{2} 5^{2} 5^{2} 1^{2} $	treach         40°47'35' 76°30'41'         417-35         3         1         2         0         00           ette pool overtios         60°47'35' 76°30'37'         6-18-35         13         1         12.0         800           borehole         60°47'01' 76°30'37'         6-16-35         3.3         11.2         100           borehole         60°47'01' 76°30'37'         6-16-35         1.0         12.0         800           corthin witter         60°46'6' 76°30'37'         6-16-35         1.0         12.0         800           beel diff         60°46'17' 76°30'37'         6-16-35         1.0         12.0         800           diff         80°1         1.00         12.0         12.0         800           diff         60°40'40' 76°30'35'         6-16-35         4.1         12.0         100           diff         80°47'40' 76°30'35'         6-16-35         4.1         12.0         100           diff         400         16°30'46' 76°30'35'         6-16-35         4.1         12.0         100           diff         80°47'40'76'76'30'35'         6-16-35         4.1         14.0         12.0         100           diff         80°47'40'76'76'30'35'6'40'50'5'5'5'5'5'5'5'5'5'5'	breach $Q^{4}y^{1}'y^{2}' / \gamma^{2}y^{1}' + \sqrt{1}^{-1}'^{-3}$ $y^{2}$ $y^{$	Insertion         Q <sup>4</sup> Q <sup>4</sup> /3 <sup>2</sup> G <sup>2</sup> /3 <sup>6</sup> /3 <sup>2</sup> G <sup>2</sup> /3 <sup>2</sup> Lip 20         S <th< td=""><td>Insertion         60<sup>4</sup>1<sup>1</sup>78<sup>4</sup> 76<sup>2</sup>9<sup>4</sup>1<sup>4</sup>         4.1<sup>2</sup>.3         .9         12.0         90         5.3         510         60         14           Introperious         40<sup>4</sup>10<sup>2</sup>75 76<sup>2</sup>9<sup>3</sup>1<sup>3</sup>         4.18<sup>-7</sup>3         13         11.2         100         6.3         6.0         6.4         14           Interline         40<sup>4</sup>10<sup>2</sup>75 76<sup>2</sup>9<sup>3</sup>1<sup>3</sup>7         4.16<sup>-7</sup>3         3.3         11.2         100         6.3         6.0         6.4         14         14           Interline         40<sup>4</sup>10<sup>2</sup>7 76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>76<sup>2</sup>76<sup>2</sup>76<sup>2</sup>         4.16<sup>-7</sup>3         1.1         12.2         100         6.1         6.0         20         1           Interlift         40<sup>4</sup>6<sup>1</sup>76<sup>2</sup>76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>76<sup>2</sup>9<sup>2</sup>76<sup>2</sup>         4.16<sup>-7</sup>3         1.1         12.2         100         3.1         100         30         30         10         100         10         10         10         10         10         10         10         10         10         11         10</td><td>Invention         (0°41'73'' 76'39'')         (1')73         (1')73''         (1')73''         (1')73''         (1')73'''         (1')73'''''''''''''''''''''''''''''''''''</td><td>Imatch         (674)'26' 76' 29'1'         (1-)-7         3         120         80         5.3         510         60         1.2         1.0           etcp pool meetine         (674)'26' 76' 29'7'         (16-7)         13         11.2         100         6.3         60         4.4         1.4         1.5         1.0           Inversion         (674)'76' 76' 29'7'         (16-7)         1.3         11.2         100         6.3         60         4.4         1.4         1.5           Inversion         (674)'76' 76' 29'7         (16-7)         1.1         12.0         100         6.3         60         7.1         1.5           Inversion         (674)'76' 76' 29'76' 29'75'         (16-7)         1.1         12.3         100         5.1         60         7.1         1.5         1.5           Inversion         (674)'76' 76' 79' 76' 79' 76' 79' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 76' 70' 76' 76' 70' 76' 70' 76' 76' 76' 76' 76' 76' 76' 76' 76' 76</td><td></td></th<>	Insertion         60 <sup>4</sup> 1 <sup>1</sup> 78 <sup>4</sup> 76 <sup>2</sup> 9 <sup>4</sup> 1 <sup>4</sup> 4.1 <sup>2</sup> .3         .9         12.0         90         5.3         510         60         14           Introperious         40 <sup>4</sup> 10 <sup>2</sup> 75 76 <sup>2</sup> 9 <sup>3</sup> 1 <sup>3</sup> 4.18 <sup>-7</sup> 3         13         11.2         100         6.3         6.0         6.4         14           Interline         40 <sup>4</sup> 10 <sup>2</sup> 75 76 <sup>2</sup> 9 <sup>3</sup> 1 <sup>3</sup> 7         4.16 <sup>-7</sup> 3         3.3         11.2         100         6.3         6.0         6.4         14         14           Interline         40 <sup>4</sup> 10 <sup>2</sup> 7 76 <sup>2</sup> 9 <sup>2</sup> 76 <sup>2</sup> 76 <sup>2</sup> 76 <sup>2</sup> 76 <sup>2</sup> 4.16 <sup>-7</sup> 3         1.1         12.2         100         6.1         6.0         20         1           Interlift         40 <sup>4</sup> 6 <sup>1</sup> 76 <sup>2</sup> 76 <sup>2</sup> 9 <sup>2</sup> 76 <sup>2</sup> 76 <sup>2</sup> 9 <sup>2</sup> 76 <sup>2</sup> 4.16 <sup>-7</sup> 3         1.1         12.2         100         3.1         100         30         30         10         100         10         10         10         10         10         10         10         10         10         11         10	Invention         (0°41'73'' 76'39'')         (1')73         (1')73''         (1')73''         (1')73''         (1')73'''         (1')73'''''''''''''''''''''''''''''''''''	Imatch         (674)'26' 76' 29'1'         (1-)-7         3         120         80         5.3         510         60         1.2         1.0           etcp pool meetine         (674)'26' 76' 29'7'         (16-7)         13         11.2         100         6.3         60         4.4         1.4         1.5         1.0           Inversion         (674)'76' 76' 29'7'         (16-7)         1.3         11.2         100         6.3         60         4.4         1.4         1.5           Inversion         (674)'76' 76' 29'7         (16-7)         1.1         12.0         100         6.3         60         7.1         1.5           Inversion         (674)'76' 76' 29'76' 29'75'         (16-7)         1.1         12.3         100         5.1         60         7.1         1.5         1.5           Inversion         (674)'76' 76' 79' 76' 79' 76' 79' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 70' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 70' 76' 76' 76' 70' 76' 76' 70' 76' 70' 76' 76' 76' 76' 76' 76' 76' 76' 76' 76	

Table 16.—Hater-quality and discharge data from mina-drainage aftes in the Western Middle Field near Shamokin

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Si te Ruuber N	Neme	loc	Location Lat-Long.	Sampling date	biacharge (ft <sup>3</sup> / <sub>6</sub> )	Mater Sampling Discharge temperature date (f:1/s) (°C)	Specific conductance (juritos)	Έ	Concentration, in ag/l. sulfate iron	1 In mg/L	Loads, in tu sulfate	one per day iron	Alkalinity to Loeis, in tone per day pil 4.5 as a sulfate iton CaOD (ug/L)		Acidity to Indicated pH us CaOO3 (mg/L) 7.0 8.3
03 N. Frank	itta Mine	103 N. Pranktin Nine drift and borehole 40°46'17" 76°40'44"		4-18-75	1.3	12.5	086	3.7	280	ห	11	67'0	ł	051	175
DJA N. Frank	din Mine	includes 103 and 103A N. Franklin Mine additional seeps	.85,07,9296,39	4-18-75	8,3	12.5	0011	3.5	995	ä	ព	67.	1	522	ର୍ଯ
Subtotal					8.3						1	67.			

# Table 17.—Hater-quality and discharge data from adme-drainage attes in the Western Middle Field near Trevorton

Table 18.—Summary of water and sulfate discharge from mine-drainage aften in the Mestern Hiddle Field

	with coel measures (m(2)	Total water discharge (ft <sup>-3</sup> /6)	Sulfate discharge (ton/d)	Hater yfeld (ft <sup>3</sup> /a)/ <u>mf</u> 2	Heter Sulfate yield yield (ft <sup>3</sup> /a)/mi <sup>2</sup> (cons/d)/mi <sup>2</sup>
Mahanoy Creek at Ashland	LC	102	380	2.8	6.9
Lower Mahanoy Creek	6	21	17	2,3	4.5
Treverton	~	8.3	ព	2.8	4.3
Mahanoy Cr <del>eek</del> Total	67	161	310	2.7	6.5
Shamdda Creek Mine drairuge sitee	я	6	8	2.6	3.7
Western Middle Meld Total	75	96I	904	2.6	5.4

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was pumped from deep mines), and acid discharge was 98 tons/d (62 percent was pumped from deep mines). Apparently, some deep mines had stopped operating and the mines were filling with water during 1946. During the sampling in 1975, water discharge was 198 ft<sup>3</sup>/s (78 percent more than 1941), and acid discharge was 93 tons/d (55 percent less than 1941). About 95 percent of the discharge in 1975 was from gravity overflows or drainage tunnels.

#### Southern Field

The Southern Coal Field (fig. 6) contains about 141 mi<sup>2</sup> of coal measures and extends from Jim Thorpe to Lykens, a distance of 56 miles. The larger part of coal fields, about 77 mi<sup>2</sup>, drains toward the Delaware River. Drainage from the remaining 64 mi<sup>2</sup> flows toward the Susquehanna River. About 129 mi<sup>2</sup> are upslope from the coal fields, and the total drainage area is about 270 mi<sup>2</sup>. The locations of the mine-discharge sites sampled in the Southern Coal Field are shown on figure 6, and they are discussed by areas in the following paragraphs.

#### Jim Thorpe

The Nesquehoning Tunnel, the only mine-discharge site sampled near Jim Thorpe, flows into the Lehigh River. At the time of sampling (table 19), the water discharge was 11 ft<sup>3</sup>/s and the concentrations of dissolved iron and sulfate were 7 and 560 mg/L, respectively. The area underlain by coal measures is about 2.3 mi<sup>2</sup>.

#### Coaldale

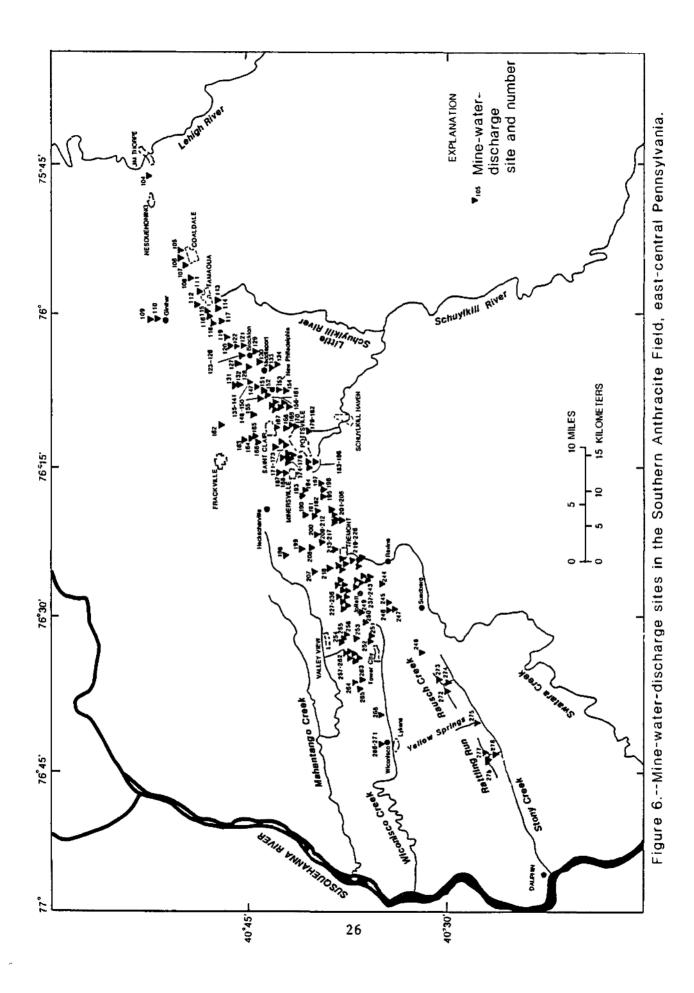
Three mine-discharge sites were sampled near Coaldale (table 20). The highest discharge was the pump discharge of the Greenwood Mine. Water discharge was 7.7 ft<sup>3</sup>/s, and the concentrations of dissolved iron and sulfate were 33 and 1,600 mg/L, respectively. If pumping from the Greenwood Mine would be discontinued, discharges from other sites would increase or new discharges would develop. All three discharges drain to the Little Schuylkill River.

#### Ginther

Two mine-discharge sites were sampled in the vicinity of Ginther (table 21). Both sites drain the Silverbrook Mine. The higher discharge  $(4.2 \text{ ft}^3/\text{s})$  was from a buried mine opening. Both sites discharge into a tributary of the Little Schuylkill River.

#### Tamaqua

Seven mine-discharge sites were sampled near Tamaqua (table 22); all drain to the Little Schuylkill River Basin. The highest discharge  $(2.2 \text{ ft}^3/\text{s})$  was from the South Dip Tunnel at the Reevesdale Mine. The concentrations of dissolved iron and sulfate in the discharge from the South Dip Tunnel were 2 and 120 mg/L, respectively. A pump at the Tamaqua Mine was not in operation at the time samples were collected.



Site		Loca		Sampling		- I	Specific conductance		Concentration, in mg/L	, in mg/L	Loads, in tons per day	tus per day	Alkalinity to pH 4.5 as	indicated pi as CaOO <sub>3</sub> (mg/L)	y <sup>10</sup> ed p <sup>11</sup> (mg/L)
nuber	ac Neare	Description	Lat-Long.		(ft <sup>3</sup> /s)		(Indhos)	Ŧ	sulfate	1m	sulfate	ET I	C=001 (mg/L)	0.7	8.3
104		Nesquehonding Mine: Nesquebonding Tunnel 40°52'29- 76°45'49	40°52'29" 76°45'49"	4-22-75	=	12.5	1090	6.4	99	~	11	0.21	ጽ	11	84
			Tabi	20. Hater Southe	quality and im Pield ne	l discharge d sar Coeldale	ata from min	e-drain.	Table 20.—Hater-quality and discharge data from mine-drainage aites in the Southern Pield near Conddale	£					
1			location	Smoltos		Mater transerature	Specific		Omomitration. In we/L	. in se/t.	loada, in tona ner dav	na nar dav	Alkalinity to nit 4.5 ac	Acidity to indicated pil as CaOD (mo/)	y to at 1
number	er Nome	Description	Lat -Ing.	1	(ft <sup>3/a</sup> )	( <u></u> ]	(sortros)	Ŧ	sulfate	E E	sulfate	E E	CaCO-1 (mg/L)	7.0 8.3	àœ
102	Coeldale Mine	No. 9 water level burnel 40°49'44 75°53'49	-67.ES_S1 +74.67.04	4-23-75	0.1	12.0	025	6.9	8	₽	10*0	0.000	ß	5	12
<u>10</u>	Coaldale Mine	No. 8 water level turnel 40°49'43" 75°54'15	-51, 95, 22,	4-23-75	-	10.5	8	<b>6.</b> Å	110	1	CO.	£000*	ł	8	69
107	Coaldale Mine	aSectores	.01.55.52	4-23-75	8	1	1	I	I	I	8	0000*	I	1	1
8		Greenwood Mine Greenwood purp	40,48,08. 12°56'00'	4-23-75	1.1	16.5	2200	6.7	1600	ß	33	69.	I	ş	33
Subtotal	le.				6.1						8	69.			
			Table	21,	Mater-quality and discharge Southern Field near Canther	l discherge d er Ginther	ata from olo	e-drativ	Table 21Water-quality and discharge data from whoe-drainage mites in the Southern Field near Canther	2					
Site		+ I		Sampling	Diecharge	Mater temperature (sc)	Specific conductance		Concentration, in myl.	1/20 UT	Loads, in tons per day	ns per day	Alkalinity to pit 4.5 as	Actidity to indicated pil se CaOD, (mg/L)	3 2 3
		1	- 2001-1971	4 10 TC	(12-/8)					<b>1</b>	antrace		(1/20) (mg/r)	0. 10	z j
5			11.m 9/ C7.7C mb		7-0		0011	<b>N</b> .C	20	0	97*0	0.0040	I	6/2	8
10	Silverbrock Mine	Ine wine opening burled	40"52"24" 76"00"17"	. 4-18-75	4.2	9"6	ŝ	3.8	110	0	1.2	=	1	8	8
Subtotal	r I				4.4						1.5	.11			

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Table 19.—Mater-quality and discharge data from mine-drainage aftes in the Southern Field near Jim Thorpe

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number     Newer     Description       111     Tamoqua Mine     Tamoqua No. 14 purp       112     Fartley Mine     collapsed after opening       113     Statth Bear Mine drifts and collapse       114     Newkirk Mine     Newkirk branel       115     Mine     Newkirk branel       116     Newkirk branel     Newkirk branel       115     Mine     Newkirk branel       115     Mine     Newkirk branel       116     Haskirk Mine     Newkirk branel       118     Reevestala Mine     South Dip       118     Reevestale Mine     South Dip       118     Reevestale Mine     South Dip			Second for the	Marchae M	Water	Specific and other	_	Omcentration	to mo/l.	Inde, in true ret day	na net d		Alkalinity to ni 4.5 ms
Tamequa Mine Fariley Mine Shith Bear Mine Newicirk Mine Mine Mine Newicirk Mine Reevesdale Mine Reevesdale Mine	1 1		date	(ft <sup>3</sup> /s)	(3.)	(jurtros)	퓐	alfate irm	Louit	eulfate		(1/3m) (000)	CaOn (mg/L) 7.0 8.3
Farley Mine Smith Bear Mine Newicitk Mine Mine Mine Newicitk Mine Reevesdale Mine Reevesdale Mine		-16.12- 75-57:31-	4-23-75	0.0	I	ł	1	ł	I	I	I	I	! 
113     Smith Bear Hine drifts and collapse       114     Newkirk Hine     Newkirk brnei       115     Remetus Lends     Insektirk brnei       115     Hine     Newkirk brnei       116     Neskirk Hine     Neskirk brnei       118     Neskirk brnei     Neskirk brnei       118     Neskirk Hine     South Dip       118     Neskirk brnei     North Rip Turnei       118     Revestala Mine     South Dip Turnei       118     Revestala Mine     South Dip Turnei       118     Revestala Mine     South Dip Turnei		40.48.29- 75.58.24-	4-23-75	e.	10.0	230	3.8	8	1	0.08	0,0008	I	- 125
Meddirk Mine Tamequa Lands Mine Meddirk Mine Reevesdale Mine Reevesdale Mine		40.41126" 75"58'03"	4-14-75	4	n.5	1400	3.0	800	8	8	.076	I	- 552
Tamequa Lands Mane Medd rh: Mine Reevesdale Mine Reevesdale Mine	nel	40-47128- 75-59109-	4-23-75		9.5	750	3.1	86	11	69.	900,	I	83
Neddrick Hine Roevesdale Hine Reevesdale Hine	-06.14.04	-67.65.51 -06.14.04	4-24-75	e,	10.5	360	5.8	116	2	60.	.0016	16	16 22
Roevesdale Mine Reevesdale Mine		-65.66. 12.43.28-	4-24-75		10.5	380	5.1	071	5	<b>C</b> 7	5600"	'n	5 I B
118 Reveatale Mine South Dip Turnel Subtotal		-14.00.94 -94.94.94	4-18-75	4	15.8	8	3.4	061	Ś	01.	.002	I	- 22
Subtotal		40*47'05" 76*00'32	4-i8-75	2.2	10.0	260	3.7	130	3	<u>u:</u>	.012	I	1
				5.2						3.0	.14		
			,										

## Brockton

Eleven mine discharges were sampled near Brockton (table 23). Water discharge from the 11 sites totaled 7.6  $ft^3/s$  and the sulfate discharge was 3.2 tons/d. All discharges drain to tributaries of the Schuylkill River.

#### Middleport

Fifteen mine-discharge sites were sampled in the Middleport area (table 24). Water discharge from the 15 sites totaled 8.3 ft<sup>3</sup>/s and sulfate discharge was 1.5 tons/d. The highest water discharge, 2.2 ft<sup>3</sup>/s, was from a strip pool overflow; however, the concentration of sulfate was only 28 mg/L.

#### New Philadelphia

Thirteen mine-discharge sites were sampled in the vicinity of New Philadelphia (table 25). Water discharge from the 13 sites totaled 12.0  $ft^3/s$ , and the discharge of sulfate was 10 tons/d. The largest discharge (4.6  $ft^3/s$ ) was from a tunnel at the Silver Creek Mine.

#### Frackville

One mine-discharge site was sampled on the southern side of Broad Mountain near Frackville (table 26). Water discharge was 15 ft<sup>3</sup>/s, concentrations of dissolved iron and sulfate were 10 and 140 mg/L, respectively, and sulfate discharge was 5.7 tons/d.

#### Pottsville and St Clair

Seventeen mine-discharge sites were sampled in the Pottsville-St Clair area (table 27). Water discharge from the 17 sites totaled 22 ft<sup>3</sup>/s, sulfate discharge was 38 tons/d. Two of the discharges sampled were pumps operated on an intermittent basis. A pump at the Pine Forest Mine had a discharge of 14 ft<sup>3</sup>/s, and a pump at the Wadesville Mine had a discharge of 2.3 ft<sup>3</sup>/s; the concentrations of dissolved iron were 5 and 1 mg/L, and the concentrations of sulfate were 780 and 630 mg/L, respectively. The percentage of the time the pumps operate is not known.

#### Minersville

Fifteen mine-discharge sites were sampled in the vicinity of Minersville (table 28). Water discharge from the 15 sites totaled 44 ft<sup>3</sup>/s; the discharge of sulfate was 49 tons/d. All the discharges listed on table 28 drain to the West Branch of the Schuylkill River. The largest discharge, 26 ft<sup>3</sup>/s, was from the Pine Knot Mine drainage tunnel. Discharge from the Oak Hill Mine was not sampled until November 11, 1975.

# Heckscherville

One mine-discharge site was sampled near Heckscherville. The discharge was from a pump at the M & M Mine (table 29). The percentage of time the pump was operated is not known. Discharge from the Heckscherville site is to Hans Yost Creek, a tributary of the Mahantango Creek.

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Site			location	Semultar	Discharge	Water trenerature	Specific conductance		Concentration. In me/L	. to me/L	Loade, in tons ner day		Alkalinity to di 4.5 as	Indicated	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Table	Notes in the second sec	Description	Lat-Long.		(ft <sup>3/a</sup> )	(°°)	(jurtros)	₹	aulfate	121	sulfate	E	Ca001 (mg/l.)	1.0	8.3
119	119 Mary D Mine	etrip pool overflow	-96,10 <u>-</u> 92 -21,99,09	4-18-75	0.1	11.5	255	6.2	120	4	0.32	110'0	5	z	26
120	Tamqua Mine	2 strip pool overflows	-\$0.54.03- 36.02.54-	4-18-75	8	0.11	315	4.2	071	-	8	1000	1	8	8
121	Bell Mine	Bell water level burnel 40°45'12" 76°02'55	40°45'12" 76°02'55"	4-21-75	2.1	5.6	86	3.6	140	2	67.	110"	ļ	35	38
122	Tuscators	Tuscarore sinkhole	-/5,20,9/ -16,65,2/-	4-21-75	2,5	0"11	8	6.4	160	10	1.1	•068	6	24	¥
123	Mary D Mine	strip pool overflow	40*45'25" 76*03'13"	4-21-75	7	9.5	8	5.1	051	-	80.	•000	9	6	6
124	Mary D Mine	agadaaa	40°45'24" 76°03'25"	4-21-75	ŗ	0*01	302	۲.	051	<b>"</b>	20°	9100*	e	21	8
125	Mary & Mine	borehole	40*45'23" 76*03'27"	4-21-75	r.	0*6	8	5.1	130	\$	52	5600°	£	55	69
126	Mary D Mine	seepage	40*45*22" 76*03*30"	4-21-75	Ŀ	9.0	ŝ	5.3	130	4	Ą.	1100*	£	35	45
127	Mary D Mine	Mary D drift	-61,10,9203,94.04	4-21-75	ġ	0.6	8	4.5	n	-	8	1000"	I	8	8
128	Mary O Mine	strip pool oveflow	40°45'24" 76°03'52"	4-21-75	۲	0.21	8	4.2	110	1	.12	1100*	ļ	8	z
129	Brockton Mine	Brockton water level turnel	-10-44,43- 24-03,21-	4-22-75	L	12.0	1150	3.4	230	8	6	0000	ł	01	350
Subtotal	Ţ				7.6						3.2	.10			

Stte		9	location	Sampling		Mater temperature	Specific conductance		Concentration, in ⊯√L	, to we/L	Losis, in tons per day	ns per day	Alkalinity to pi 4.5 as	Indice for the card	Actanty to Indicated pil is CaCOn (mg/L
naber	Name	Description	lat-log.	date	(ft <sup>3</sup> /s)		(indhos)	Ŧ	aulfate	5	sulfate	121	Ca003 (mg/L)	7.0 8.3	2
130	Brockton Mine	Upper Withtefield turnel	40,42,03" 76°05'05"	05" 4-21-75	0.1	0.01	021	4.1	8	2	10"0	0.005	I	81	8
131	Brockton Mine	strip pool overfilow	-66,90-92 -38, 36-04	39" 4-21-75	2.2	11.5	8	4.5	ŝ	₽	<i>L</i> 1"	<b>.</b> 0059	I	01	14
132	Brockton Mine	strip pool overfilow	40°45'38" 76°06'37"	37" 4-21-75	<b>E.1</b>	8.0	9	<b>5.4</b>	8	٩	8	-0035	I	Ś	80
133	Lovel Mine	drift	40.43.23" 76"04'18"	18" 4-21-75	4	8.0	8	4.7	8	1	ą	1100'	-	18	20
ĸI	Lovel Mine	stream through etrip pit	40°43'59" 76°04'21"	21" 4-21-75	6.	7.5	3	5.2	¥	-1	80	,0024	ſ	ŝ	9
135	Kacku Mine	Steinberg tunnel, collapsed	40°44'48" 76°05'38"	.38" 4-21-75	2	0.6	092	3.6	8	ŝ	<b>30</b> .	1200,	1	8	\$
136	Kaska Mine	Clem Jones borehole	40°44'25" 76°05'53"	53" 4-22-75	r,	12.0	094	6.3	071	0	н.	1900*	130	8	8
137	Kaska Mine	shaft burnel	40°44'25" 76°05'53"	53- 4-55-15	7	12.0	490	6.4	150	<b>6</b> 0	ą	.0022	112	8	74
138	Kaska Mine	shaf t	40*44'33" 76°05'50"	50" 4-22-75	8	I	١	ſ	1	I	1	ł	1	I	1
601	Kaska Mine	ehaft, buried	40°44'16" 76°05'48"	48" 4-22-75	e,	0.01	011	6.1	057	¢	¥.	,0022	18	01	କ
041	Kaska Mine	sbandoned settling pord	-97:02:10.01	48" 4-22-75	8	1	I	I	I	I	ł	i	I	I	ł
141	Kaska Mne	a Stechano	40.43.28 76.06.00	00" 4-22-75	ų,	12.0	099	3.5	952	2	8.	9100*	I	8	35
142	Midleport Mine seepage	agedace a	06.90.9261,69.09	30" 4-22-75	ŝ	11.5	8	6.1	18	₽	<b>2</b> 0°	,0014	CI	\$	10
143	Rocktown wer Middleport Mine level tunnel	Rodstown water e level turnel	40*43'21" 76*04'30"	30" 4-22-75	7	8.5	155	4.2	69	\$	.03	.000	I	ŝ	8
141	Baachel Tu Middleport Mine collaped	Basquel Tunnel, e collapsed	40°43'13" 76°04'43"	43" 4-22-75	æ,	10.5	92	5.8	æ	15	81,	.032	51	8	Ş
145	Mddleport Mine	Mddleport Mine strip pool overflow	40°43'15" 76°04'48"	48" 4-22-75		0.61	990	7	<b>6</b> £	m	g	9000.	ł	57	5
146	Gerenty Dr Middleport Mine collapsed	Gerenty Drift, e collapsed	<i>40.</i> 43,53 76°04'49"	49" 4-22-75	<del>.</del>	9.2	ŝ	3.9	011	2	10'	£000°	1	33	35
Subtotal											1				

Table 24.—Mater-quality and discharge data from mine-drainage mites in the Southern Field near Middlaport

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Table 25 Mater-quality	Southern Pield

Interlang.         data $(t_1^3/a)$ $(v_2)$ $(ual hold)$ $p_1$ anifatio $1500$ 1'5* 76'00''3* $t_22-75$ 0.4         14.5         675         4.0         400         15           1'00' 76'0''3* $t_22-75$ 0.4         14.5         673         4.0         400         15           1'00' 76'0''3* $t_22-75$ 0.5         10.5         740         3.5         270         20           1'02' 76'0''2* $t_22-75$ .05         10.5         740         3.5         310         20           1'28' 76'0''2* $t_22-75$ .01         10.5         740         3.5         300         1           1'28' 76'0''3*' $t_22-75$ .01         12.0         800         3.5         40         1           1'28' 76'0''3*' $t_22-75$ .01         12.0         800         3.5         40         1           1'28' 76'0''3*' $t_22-75$ .01         12.0         800         3.6         0         0           1'28' 76'0''3*' $t_22-75$ .00         11.0         3.9         4.0         0         0 <th>Site</th> <th></th> <th></th> <th></th> <th>Sampling</th> <th></th> <th>Mater temperature</th> <th>Specific conductance</th> <th>-</th> <th>Concentration, in mg/L</th> <th>, 11 mg/t</th> <th>Loeds, in tons per day</th> <th>tte per day</th> <th>Alkalinity to pH 4.5 am</th> <th>Acter find tea</th> <th>Acidity to indicated pi s CaCD3 (mg/L)</th>	Site				Sampling		Mater temperature	Specific conductance	-	Concentration, in mg/L	, 11 mg/t	Loeds, in tons per day	tte per day	Alkalinity to pH 4.5 am	Acter find tea	Acidity to indicated pi s CaCD3 (mg/L)
Bitway Casel the energy         energy         Q*43'5* % 60'46'         -22-3         0.4         11.5         4.0         15         0.43         0.016          100           Bitway Casel the energy         every         Q*44'0* % 70'3'         -22-3         0.5         11.5         0.01         0.01         0.01         0.01         2         28           Bitway Casel the energy         every         Q*44'0* % 70'3'         -22-3         0.5         15.0         20			1 1	Lat-Long.		(ft <sup>3/8</sup> )	( <b>_</b> C)	(Jurthos)	Ħ	oulfate	no.	Bulfate	lron	Ca003 (mg/L)	0.7	8.3
Stitue Greek life         energy         6"4(10" %"U"3"         2.273         4.5         15         4.5         15	(91		aßedaas	40°43'54" 76°06'48"	4-22-75	<b>9.4</b>	14.5	675	4.0	005	ม	0.43	0.016	I	100	110
Ilbur Cook Mus         enel         0"440" % 0"70"         1-22-15         4.6         12.3         50         4.5         7.0         7.0         7.3         5	146		aðigdasas	40°44'03" 76°07'24"	4-22-75	8	18.5	003	4.8	190	9	<b>60</b>	<b>9100</b>	2	8	1E
Bit we can be detined overlaps         det	149		turnel	*0°44°03" 76°07'24"	4-22-75	<b>4.6</b>	12.5	8	4.5	270	8	3.35	ĸ	I	8	£?
Rev Fulladeliation         Anomatication         Ano	ន្ម		settling pond overflow	40°43'52" 76°07'28"	4-22-75	6	10.5	04/	3.5	310	8	8	.0027	ł	105	130
Rev         Huldweilptik         energe         60*43257 % '0'11'         4:2-75         0.1         12.0         500         1         .00          125           Hune         collapsed drift         40*2'427 % '0'126'         4:22-75         .01         12.0         500         0         1.1         .000          125           Brockron Hine         collapsed drift         40*4'2'7 % '0'126'         4:22-75         .00         1	121		aßetaas	40*43'28" 76*51'22"	4-22-75	10.	10.5	410	4.5	180	0	8	6000	ł	<b>6</b>	\$
Brooktion Hule         Oillapped drift         Q <sup>4</sup> Q <sup>4</sup> Q <sup>4</sup> Z <sup>4</sup> 670735         4.22-75         13.0         13.0         11.0005         11.0005         17.000	152		afistana	40°43'28" 76°07'11"	4-22-75	10'	0.21	609	3.5	990	T	6	0000.	ł	125	20
Rooktun Mine         Onligeed drift         40°42'14"         76'0'130"         4:22-75        00         -         10         0.005         0.001         -         -         10         0.005         0.001         -         -         -         -         -         -         -         21         22         22         13         13.0         100         10         23         10         23         10         23         10         23         10         10         10         10         10         10         10         10	153		collapsed drift	40°42'42" 76"07'28"	4-2275		18.0	099	5.6	002	٩	п.	<b>5000</b> .	7	÷	5
SLiver Creek Hire         drainage tunnel         60*4/127         76*0/155*         4-22-75         0.05         11.0         16         3.9         46         7         0.0055         0.0001          20           Port Carbon Hire         seepage         40*4/127         76*01'55*         4-22-75         3         14.0         1000         4.6         500         10         .45         0001         5         80           Rot Carbon Hire         seter Level drift         40*2'58*         76*09'05*         4-22-75         1.8         12.5         880         5.4         430         6         2.1         0.29         16         60           Port Carbon Hire         water Level drift         40*2'52*         76*09'05*         4-22-75         .00         -	2		collapsed drift	40"42"44" 76"07"30"	4-22-75	8	I	I	ł	1	1	I	1	I	I	Ι
Drt Carbon Hue         seepage         40°43'04' 76'08'51'         4.22-75         .3         14.0         16.6         550         10         .45         .081         5         88           Rage Hill Hue         steri level drff         60°43'04' 76'08'51'         4.22-75         1.8         12.5         880         5.4         430         6         2.1         .039         16         60           Rage Hill Hue         steri level drff         60°42'57' 76'09'01'         4-22-75         1.8         12.5         880         5.4         430         6         2.1         .029         16         60           Rate View Hue         collapsed slope         40°42'57' 76'09'05'         4-22-75         .00         -	33		drainage turnel	40°44'22" 76°07'55"	21-21-1	0.05	0.11	091	9.6	87	٩	0-0065		1	8	23
Road Hill Hine         Mater Level drift         6"42'55" 8"09'01"         4-22-75         1.8         12.5         850         5.4         430         6         2.1         0.29         16         60           Port Carbon Hine         40"42'52" 8"09'05"         4-22-75         0.0         -	3		agebage	40*43*04" 76*08*51"	4-22-75	ċ	14.0	0%01	4.6	220	0	64.	1800'	s	88	135
Port Carbon Mine       40°42'52" /6'09'05"       4-22-75       .00       -<	3		water level drift		4-22-75	1.8	12.5	82	5.4	430	ę	2.1	620"	16	5	8
Palaer View Mire         collapsed slope         60°42'38" 76'08'44"         4-23-75         .2         10.6         5.1         10         2         .06         .001         66         24           Port Carbon Mire         Luciarre water         40°42'17" 76'08'27"         4-23-75         2.7         12.0         750         5.3         430         30         3.1         .22         13         110           Reyrolds Mire         alope         40°41'43" 76'09'10"         4-23-75         11.6         10.5         390         6.2         120         13         22         265         79         38           Reyrolds Mire         alope         40°41'43" 76'09'10"         4-23-75         1.6         10.5         390         6.2         120         15         265         79         38	8			40"42"52" 76"09'05"	4-22-75	8	I	I	l	I	I	1	I	I	ł	I
Dert Carbon Hine         Luctiane water         40°421/77         76°08'227         4-23-75         2.7         12.0         750         5.3         430         30         3.1         .22         13         110           Reyrolds Mine         alope         40°42'1/77         76°09'107         4-23-75         2.7         12.0         750         5.3         430         30         3.1         .22         13         110           Reyrolds Mine         alope         40°41'437         76°09'107         4-23-75         1.6         10.5         390         6.2         120         15         .22         .055         79         38           12.0         12.0         12.0         12.0         12.0         15         .52         .055         79         38	5		collapsed micpe	40°42'38" 76°08'44"	4-23-75	i	10.6	340	6.3	110	2	8	1100*	38	9Z	<b>\$</b>
Reyrolds Mine elope 40°41'43" 76°09'10" 4-23-75 <u>1.6</u> 10.5 390 6.2 120 15 <u>.52 .065</u> 79 38	93		Luciarna water Level burnel	<b>40°</b> 42'1 <i>]</i> " 76°08'22"	4-23-75	2.7	12.0	750	5.3	069	8	3.1	7	ព	110	125
10.2	191		edote	_01,60_9/ _E*,17_0*	4-23-75	1.6	10.5	966	6.2	120	15	.52	.065	62	8	8
	ê	ital Vial				12.0						10.2	65.			

22	Si te number Name	Loca Description	Location Lat-Long.	Sampling data	Discharge (ft <sup>3/6</sup> )	Mater temperature (°C)	Specific conductance (judnos)	1	oncentration, in ng/L sulface iron	Loads, in tons per day sulfate iron	Alkalinity to r day rii 4.5 aa r CaOO <sub>1</sub> (mg/L)	1 1	Actidity to indicated pil as CaOO (mc/L) 7.0 8.3
	162 Horea Mine	strip pool overflow 40°46'57" 76°10'	\$	4-16-75	.s	8.0	640	3.2	140 10	5.7 0.41	1	8	ጽ

Table 26.—Mater-quality and discharge data from adme-drainage aites in the Southern Field near Frackville Table 27.—Mater-quality and discharge data from mine-drainage sites in the Southern Field near Pottaville and St Clair

1			Locatifica	Samoltre	Discharbe	Mater Lesserature	Specific conductance		Concentration in molt.	fa ef	Loade. In tons per dav	one per dev	Alkalinity to rdi 4.5 ac		Actidity to indicated pil a CaODa (me/L)
a de la	er Name	Description	Lat-Long	date	(ft <sup>3</sup> /s)	(C)	(terhos)	Ŧ	sulfate	Iton	Bulfate	Iron	Ca003 (mg/L)		7.0 8.3
163	Repplier Mine	pool turnel	40°44'25" 76"11'52"	4-23-75	1.3	6.9	8	3.9	8	٩	01.0	0.0035	1	я	8
191	Reppider Mine	collapsed drift	.95,11,92 .12, <del>44</del> ,0 <del>4</del>	4-23-75	8	1	ł	1	1	I	1	1	I	I	I
165	Reppiter Mine	collapsed drift	_95,11,92 _90,97,0 <del>7</del>	4-23-75	8	8.7	<b>9</b> 3	3.6	110	4	10'	1000'	ł	8	ß
166	Repliet Mine	Repplier water Level turnel	40*44'06" 76"12'02"	4-23-75	2.4	11.5	99	5.8	310	8	2.0	.052	8	9	74
167	Pine Forest Mine	Putp in borehole intermittent	40*43'20" 76*10'32"	4-23-75	14	13.0	1400	3.25	780	Ś	62	61.	ł	105	125
168	Eagle Hill Mine	Diamond water Jevel drift	40*42'34" 76"10'30"	4-23-75	ŝ	11.5	900	6.2	270	ង	¥,	.020	105	8	£
691	Port Carbon Mine	Snyder'o water Jevel drift	40*42'14" 76*10'30"	4-23-75	.2	11-5	202	6.0	ୟ	-	.14	5000.	я	R	55
170	Salem NLL1 Mine	drainage turnel	40*42'16" 76"10'39"	4-23-75	ņ	11.6	99	6.8	160	1	8	.000	711	4	9
171	Wadesville Mine	interaittent punp	40.42'5!" 76"12'2!"	4-22-75	2.3	14.0	1500	1.1	630	1	3.9	.0062	9 <del>8</del> 7	1	8
172	Pottsville Mine	agetase	40.42'36" 76"11'50"	4-23-75	ŗ	7.8	470	6.3	8	7	8	.000°	<b>E</b> 11	R	55
5/1	Pottsville Mine	ehaft	40°42'30" 76°11'49"	4-23-75	0.1	0.6	990 780	4.5	621	٩	0.03	0.003	Ι	12	z
174	Diamond Bed Mine	acturke	40*42'33" 76°13*44"	4-23-75	8	9.6	1700	4.7	0%	10	εi.	<b>*</b> 100*	Ŷ	140	164
175	Diacond Bed Ntre	abardoned gangaay and borehole	40°42'28" 76°13'44"	4-23-75	<b>.</b>	5.9	2400	6.6	0061	8	02.	.032	4	110	125
176	Diamond Bed Hine	aðadaaa	40"42'26" 76"13'44"	4-23-75	10.	1	ł	I	I	I	I	I	ł	1	ł
177	Seltzer Mine	Peach Overland atrip pool, seepage	40*42'08" 76"13'26"	4-54-75	ŗ	14.0	087	4.0	360	4	-21	8000"	I	n	8
178	Seltzer Mine	adadaaaa	40*45*52" 76*13*20"	4-24-75	۲.	11.5	350	6.0	140	9	ş	9100*	\$	32	55
179	Sheroan Mine	Mammoth bad seepage	40°40'50" 76°11'21"	4-24-75	e,	0.11	700	7.0	<b>9</b> 87	4	£7.	.0032	102	I	18
180	Shernan Mine	overflow	40°40'46" 76°11'32"	4-24-75	(not sampled)	l R	ł	1	1	I	I	1	1	1	1
181	Sherman Hine	Stdmre bed seepage	Skidmure bed seepage 40°40145" 76°11°12"	4-24-75	ŀ.	19.5	<u>8</u>	5.8	8	2	10.	-000	ន	80	24
182	Sherman Mine	Ruck Hun. bed seeps	ßick Min. bed seepage 40°40'46" 76°11'23"	4-24-75	7	12.5	99X	6.5	52	5	.14	.0027	220	ŝ	9
Subtotal	a				22.4						37.5	ĸ.			

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Table

7		2	Icention	Samiltra	Districts	Mater temerature	Specific conductance		Concentration, in w/i.	to tech.	loate, in tone per day	Der dav	Alkalinity to th 4.5 as	Acidity to Indicated pi as CaOD, (mu	Acidity to Indicated pl a CaOD (mv/l.)
runber	er Name	Description	Lat-Long.	date	(ft <sup>3/6</sup> )	( <b>.</b> C)	(jetros)	Æ	sulfate	Iton	Bulfate	Itan	Ca00-1 (ng/L)	1.0	7.0 8.3
183	Salen Mire	drift	40*41'28" 76°14'41"	4-24-75	0.5	10.2	805	6.1	76	4	0.10	0.0054	8	33	<b>S</b>
184	Pottsville	Connecticut shaft	40*40*43" 76*14*02"	4-24-75	8	10.0	150	5.8	¥	₽	9400"	1000*	R	n	8
185	Cove Chal Ch.	water level turnel 16° aulvert		4-24-75	e,	10.5	011	3.8	240	æ	.19	,0065	I	я	33
<u>8</u>	Core Coal O.	water level turnel collapsed	.00.31.21. 20.14.00.	4-24-75		10.5	140	6.4	x	₽	.015	£000 <b>.</b>	ł	61	8
187	Pine Knot Mine	Pine Knot drainage turnei	40°42'24" 76°15'06"	4-21-75	×	10.5	021	5.2	370	6	26	<b>(9</b>	2	65	8
188	Oak Rill Mine	6 boreholes, <b>sha</b> ft ard seepage	40°42'12" 76"15'16"	11-19-75	7.8	16.0	1200	6.15	650	45	14	se.	153	6[]	127
189	Otto Mine	aged bage	40*40'33" 76"19*44"	4-23-75	4.	14,0	008	4.9	450	8	64.	-023	\$	8	100
190	Otto Hine	Otto etralueft	.91,61,9785,6607	4-23-75	6.4	10.5	008	4.7	63	26	7.4	-45	9	[2]	163
161	Otto Mine	Stein's Pool strip pool overflow	Stein's Pool strip pool overflow 40°40'20" 76"18'54"	4-23-75	ŗ	14.0	0261	6.3	001	8	.07	.0070	ŀ	e	æ
192	Otto Mine	mukly drift		4-23-75	sî S	0.11	8	6.7	140	4	Ŗ	.0022	100	4	13
661	Proenix Pack Mine	3 strip wine overflows	90,81 <b>.</b> 9416,07.07	4-23-75	Ŀ	14.0	084	6.7	80	₽	<b>50</b> ,	£000°	31	ĩ	æ
<b>%</b> ]	Proentx Pack Mine	shaft diverted to a culvert		4-23-75	10.	8,5	965	6.5	<b>1</b> 90	-	8	000	ß	5	01
561	Blue Socks Mine	drift	40°38'59" 76°17'12"	4-24-75	s,	10.5	22	5.9	5	₽	60 <sup>-</sup>	\$100°	45	Ś	92
961	Blue Socks Mine	collapsed drift	#0.33,02. ¥.16,21.	4-24-75	r,	10 <b>-0</b>	230	4.4	<b>0</b> 57	e	2	-0024	I	8	ж
197	Silverton Mine	collapsed drift	40°39'26" 76" [5'53"	4-24-75		0.01	320	6.1	021	8	01.	.016	67	窝	55
Subtotal	tal				44.2						48.84	2,129			
		Table 2	Table 29.—Hater-quality and discharge data from mine-drainage attes in the Southern Pield near Nederville	discharge d	lata from mir	ve-drainage a	ites in the	Souther	n Meld near	Heddednervl.	عاا				
Si te number	e Mane	Description	location Lat-long.	Sampling date	Di scharge (ft3/s)	Water temperature (°C)	Specific conductance (uninoe)	뛷	Concentration, in mg/L sulfate iron	n, in mg/L iron	Loads, <u>in true per dey</u> Bulfate 1ron	rie per day 1ron	Alkalinity to pH 4.5 ms CaOD (mg/L)	Act At Indice as Ca00	Acidity to indicated pl as CaO1 (mg/L) 7.0 8.3
196	M 6 M Mine	interaction purp	40°42'06" 76°23'55"	4-22-75	0.1	10.0	071	6.5	84	₽	10'0	£000*0	8	-	ſ

#### Tremont

Twenty-five mine-discharge sites were sampled near Tremont (table 30). Discharge from the 25 sites totaled 20 ft<sup>3</sup>/s and the discharge of sulfate was 8.4 tons/d. The largest discharge (9.8 ft<sup>3</sup>/s) was from an overflow at a strip mine pool at the Middle Creek Mine. The Kembel tunnel enters Pine Creek, a tributary to Mahantango Creek. The other 23 sites discharge to Swatara Creek. Four of the discharges are from pumps, but only two were operating at the time samples were collected. Water discharge from the two pumps totaled 0.06 ft<sup>3</sup>/s.

# Joliett

Fourteen mine-discharge sites were sampled in the vicinity of Joliett (table 31). Water discharge from the 14 sites totaled 11  $ft^3/s$  and the mean concentration of sulfate was 160 mg/L. Sulfate discharge was 4.8 tons/d. The largest discharge (6.4  $ft^3/s$ ) was from the Rowe drainage tunnel at the Lincoln Mine. All the discharges sampled in the Joliett area drain to the Swatara Creek.

## Suedberg

Four mine-discharge sites were sampled in the Suedberg area (table 32). Total water discharge from the four sites was 0.8  $ft^3/s$ , and the sulfate discharge totaled 0.17 tons/d. All four discharges drain into Swatara Creek.

### Tower City

Three mine-discharge sites were sampled in the vicinity of Tower City (table 33). The largest discharge (1.5  $ft^3/s$ ) was from the tunnel at the Tower City No. 1 Mine. The three discharges drain into Wiconisco Creek, the total water discharge was 3.1  $ft^3/s$ , and sulfate discharge was 2.3 tons/d.

#### Valley View

Nine mine-discharge sites were sampled near Valley View (table 34). Three of the discharges were pumped. Water discharge from the pumps totaled 4.6 ft<sup>3</sup>/s and the sulfate discharge was 8.1 tons/d. Total water discharge measured from the nine sites in the vicinity of Valley View was 16 ft<sup>3</sup>/s, and the measured sulfate discharge was 14 tons/d. The largest discharge (7.2 ft<sup>3</sup>/s) was from the Valley View Mine tunnel. All the discharges from the Valley View area enter Rausch Creek, a tributary to Mahantango Creek.

#### Wiconisco

Six mine-discharge sites were sampled in the vicinity of Wiconisco (table 35). The largest discharge (6.7 ft<sup>3</sup>/s) was from the Big Lick Tunnel at the Lykens-Williamstown Mine. The concentration of sulfate in the discharge from the Big Lick Tunnel was 160 mg/L, and the concentration of dissolved iron was 15 mg/L. All six discharges drain into Wiconisco Creek. Water discharge from the six sites totaled 17 ft<sup>3</sup>/s, and the discharge of sulfate was 8.0 tons/d.

Table 3).-Hater-quality and discharge data from une-drainage sites in the Southern Field near Trennit

Stre	•	2	loostion	Semiline	Diacharge	Water t <del>ran</del> erature	Specific onductance	д	Crossitration. in mall.	a. tn me∕L	Losda, in tuns per dav	me per dev	Alkalinity to nii 4.5 am		Acidity to indicated pH a CaOba (me/L)
Tradet	er Name	Description	Lat-Long.	date	(ft <sup>3</sup> /s)	().		, II	sulfate		eulfate		Ca001 (mg/L)	1.0	7.0 8.3
661	Middle Creek Mine	aßadace	40.40.32" 76"22'24"	4-24-75	0.6	10.0	8	4.6	£	ş	0,15	0.065	6	118	155
200	Middle Creek Mine	collapsed drift	40*39'52" 76"21'22"	4-24-75	7	9.5	620	3.45	310	-	11.	2000,	ł	100	123
Ĩ	Blackwood Mine	strip pool overflo	strip pool overflow 40°38'58" 76°18'40"	4-24-75	ŗ	0.61	9	5.2	12	₽	8	E000"	7	11	ĸ
202	Blackwod Mine	Bladoood water level turnel	.96,61,92.3. 16,16,09	4-25-75	2.6	0.61	98	5.8	0/1	₽	1.2	0/00"	17	8	74
203	Pantler Creek	discharge from settling pords	40°38'28" 76°19'44"	4-24-75	6,	2.11	65	6.25	71	\$	£0 <b>.</b>	,0024	2	77	8
20	Bladwool Mine	strip pool overfile	strip pool overflow 40°38'12" 76°20'44"	4-24-75	٦	12.0	170	6.1	38	1	8.	000,	6	13	23
205	Bladwood Mine	strip pool overfik	strip pool overflow 40°38'02" 76°21'10"	4-24-75	L.	10.5	<b>5</b>	5.0	8	1	07	8000*	11	13	74
206	Tremont Mine	Everett's tunnel collapsed slope	-16,12,92 -96,21,91-	4-24-75	۲.	0.11	D9K	3.6	120	-	£0 <b>.</b>	£000°	į	23	115
202	Tremont Mine	Kemble turnel	40°39'51" 76°25'12"	4-23-75	s,	8.0	125	3.65	ន	₽	S.	,0022	ł	80	Q
ĝ	Tremont Mine	strip pool overfik	strip pool overflow 40°40'12" 76°22'45"	4-23-75	÷	0'11	200	5.6	8	₽	20.	(UQU"	S	e	ø
8	Treant Hine	intermittent pump	40*40*04" 76*22*42"	4-23-75	10.	12.0	195	6.3	8	₽	8	0000*	s	1	<b>~</b>
210	Hatter Coal Co.	intermittent pump	-E0,EZ-9/ -IS16E-09	4-23-75	8	ł	I	I	1	I	ł	1	ł	ł	I
211	Buck Min. Mine	drift	40*39'21" 76*22*33"	4-23-75	5	8.5	85	4.7	27	٩	8	1000"	-	e	Ś
212	Middle Greek Mine	Hiddle Creek water level turnel	r 40"39'11" 76"22'35"	4-23-75	8	ł	I	I	ł	ł	I	ł	l	ı	ł
213	Hiddle Creek Hine	adadaas	40°38'12" 76°22'56"	4-23-75	ŗ	9.5	200	4.1	63	1	£0°	\$000°	ł	9	R
214	Middle Greek Mine	strip pool overfik	strip pool overflow 40°38'36" 76°23'02"	4-23-75	r	10.5	75	6.45	21	Þ	10.	\$000°	01	۳	01
215	Middle Creek Mine	strip pool overfik	strip pool overflow 40°38'20" 76°22'45"	4-23-75	9.8	9.5	069	4.2	8	₽	<b>4.</b> .b	°026	I	63	100
216	Hiddle Creek Hine	strip pool overfik	strip pool overflow 40°38'25" 76°22'48"	4-23-75	ŝ	5.01	525	6.25	210	e	.28	1,000.	44	15	9
217	Middle Creek Mine	aðedaas	40°38'22" 76°22'38'	4-23-75	e,	11.0	8	5.8	82	EI	1.5	£Z0*	33	8	8
218	Eureka Mine	delft	40"38'41" 76"24'30"	4-22-75	1:1	12.0	0/1	6.4	<u>8</u> 21		2	6900*	I	13	51
Subtotal	tal				18.8						8.1	.146			

Site		2	location	Sempling	Diecharge	Water berpersture	Specific conductance		Concentration, in mg/L	, the mg/L	toads, in tons per day	xus per day	Alkaltníty to pli 4.5 as	Acidity Indicate as CaOD	Acidity to indicated pH s CaODy (mg/L)
number	r Nine	Description	Lat-Long.	date	(ft <sup>3</sup> /s)	() ()	(terhos)	Ħ	sulfate	Iron	sulfate	1ron	(1/3m) (008)	1.0	8.3
219	Coliket Hine	Colket water løvel drift	"CZ'+25" 76*24	4-22-75	<b>9</b> -0	11.5	011	5.4	081	ន	0.19	0.022	01	6	и
220	Colket Mine	drift	40°38'07" 76°25'59"	4-22-75		14.0	180	4.1	42	2	10"	<b>,000</b>	I	2	18
221	Doveldeon Mine	dund	40°38'21" 76°24'12"	4-22-75	8	I	I	i	I	1	I	I	1	1	I
22	Tremont Mine	udechage	40"38'02" 76"24'01"	4-22-75	s.	0*11	061	5.6	11	â	01.	*100°	1	80	5
នេ	Echo Valiey Mine	Upper Laux slope, seepage	0E.7Z.91E0.1E.04	4-22-75	8	6.5	S	5.1	ų	۵	8	1000"	2		4
224	Ecto Valley Mne	Lower Laux drift. and seepage	40°36'59" 76°22'28"	4-22-15	50	0"1	105	6.3	8	₽	8	1000	5	-	n
522	Echo Valley Mine	3 strip mine pool overflows	61,182°37 "22136°34	4-24-75	ų	16.0	051	6.3	ĸ	4	<b>60</b> -	.0022	23	×	65
226	Ecto Valley Mine	interactions purp	05+67.9/16+96.09	4-22-75	8	7.0	087	1.3	210	₽	8	1000*	82	ł	5
Subtotal	I				1.3						34.	-026			

Table 30.-Hater-quality and diacharge data from adve-drainage attes in the Southern Field near Treatnt, Pannylvania-(continued)

Table 31.—Mater-quality and discharge data from mina-drainage sites in the Southern Field near Joilett

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Stte			Location	Smpling	Discharge	Water temperature	Specific conductance		Concent ration,	on, in ng/L	Loads, in tons per day	xns per day	Alkalinity to pH 4.5 ms	Actd Indic As CaO	Acidity to Indicated pH as Ca003 (mg/L)
naber	r Nane	Description	Lat-Long.		(ft <sup>3/8</sup> )	().	(Harting)	Ŧ	sulfate	Iron	sulfate	E.	(1/31) [008]	7.0	8.3
227	Good Spring Mine	strip pool overflox	strip pool overflow 40°37'38" 76°28'08"	4-22-75	10.0	1	210	5.3	<b>6</b> 6	4	0.0	0,000	7	10	16
228	Good Spring Mine	Tracy alrshaft interuittent pump	_E0,8Z_9/ _80, (E_0 <del>)</del>	4-22-75	e;	0.11	375	5+85	150	15	21.	.012	21	28	63
52	Good Spring Mine	air eheft	61,12,92 _\$4,2E,04	4-22-75	Ŀ.	11.5	330	6.15	140	10	:26	610.	Я	8	65
230	Good Spring Mine	3 strip pool overficues	01+(Z.9205+(E.09	4-22-75	-05	15.5	185	6.85	ន	Q	10.	1000.	R	1	10
231	Donaldson Mine	strip pool overflo	strip pool overflow 40°37'49" 76"27'01"	4-22-75	8	I	1	ł	ł	1	I	1	1	1	1
232	Donaldson Mine	2 strip pool overflows	65.92 <u>.</u> 92£9.16.07	4-22-75	10.	15.0	495	3.65	00	φ	10.	0000	I	8	8
233	Donaldson Mine	strip pool overflow	strip pool overflow 40°37'33" 76°26'46"	4-22-75	ň	15.5	850	3.4	350	£	.47	1900-	I	\$	65
234	Donaldson Mine	strip pool overflox	strip pool overflow 40°39'50" 76°26'47"	4-22-15	8	1	I	1	1	I	I	1	I	Ι	Ι
235	Donaldson Mine	strip pool overflow	strip pool overflow 40°37'45" 76°26'21"	4-22-75	Ş	1	I	1	I	I	I	I	1	1	ł
28	Colket Mine	strip pool overflo	strip pool overflow 40°38'12" 76°26'08"	4-22-75	8	I	1	ł	1	ł	1	ł	1	I	I
27,	New Lincoln Mine	New Lincoln drainage turnel	_61,92,92 _20,20,20,	<del>4-</del> 21-75	6.	0'6	115	6.0	*	4	ŝ	.0024	12	4	0
238	Rausch Creek East Franklin Mine	Lower Paolil Turnel	_0E,SZ,9/0%,9E_0%	4-21-75	4.1	0.11	625	3.45	OIE	35	1.2	£1.	1	112	120
536	Jewel Ridge Coal Company	Holmes drift	_IE,5Z_9/ _/E,9E_07	4-21-75	ņ	12.0	<b>4</b> 80	7.0	001	4	ц.	8000'	157	I	24
240	Ravine Mine	culvert	"61'36'19" 76°25'13	4-21-75	ŗ.	12.0	077	6.4	160	15	ü	-012	и	45	65
241	Ravine Mine	Knorr Turnel diverted to culvert	Knorr <b>Turre</b> l. diverted to advert   40°35'16"  76°25'27"	4-21-75	ç	0.11	490	5.9	062	0	61.	.0081	12	8	69
242	Ravine Mine	đrlft	40°36'16" 76°25'19"	4-21-75	8	0'11	061	3.15	250	35	<b>1</b> 0.	.0047	I	611	120
243	Ravine Mine	drlft	40°36'16" 76°25'14"	4-21-75		13.0	561	6.0	я	Ē	10'	9000"	13	11	8
244	Lincoln Mine	Rose drafrage turnel	Rowe drainage tunnel 40°35'42" 76°26'32"	4-21-75	6.4	0.11	0%	4.5	061	10	2.2	.17	ł	22	62
Subtotal	ı				11.3						4.77	•365			

25			location	Sampling	Discharge	Water temperature	Specific conductance		Concentration, in mg/L	a, in mg/L	Loads, in tons per day	the per day	Alkalintry to pH 4.5 as	the coo	Acidity to Indicated pH as CaCO, (mg/L)
number	er Name	Description	Lat-Long.	- F	(ft <sup>3/s</sup> )	(°C)	(juttos)	E.	aulfate	lītan	sulfate	1 Tot	CaOD1 (mg/L)	7.0	80
245	Franklin Stump Hine	ક્ષ્ભાગ્યણ બાદ ભી ભાર્તિક્રક્કાં વેર્દાદિ	40°34'16" 76°23'49"	4-21-75	0.1	<b>8.</b> 0	65	6.1	=	₽	0.0	0*0001	1	ť.	Υ.
246	Dubhe and I letaback Mine	drift	40°34'09" 76°28'46"	4-21-75	ŗ,	0.11	315	3.4	110	1	<b>60</b> *	8000*	ł	89	8
247	Interry Mne	aftectaog	40*34*03" 76*28*45"	4-21-75	7	0.11	995	2.9	120	e	90°	9100*	ł	8	011
248	Cold Hine	ವರಿಸಿಸುವ	.£7,0£.9210,2E.04	4-54-75		10.5	115	5.35	*	5	8	.0027	п	3	2
Subtotal	tal				e,						-11	<b>9500</b> .			
			Table 1	13Water- Southe	quality and an Pield rea	Water-quality and discharge dat Southern Pield rear Tower City	ta from etne	rdratna	Table 3.—Water-quality and discrenge data from olne-drainage sites in the Southern Field rear Tower City	2					
Site				Sampling	Discharge	Vater berperature	Specific conductance		Concentration, in mg/L	Jan melle	Loade, in tons per day	ns per day	Alkalinity to pH 4.5 as	Act d Indic	Acidity to indicated pli as CaCD3 (mg/L)
mather	er Name	Description	Lat-Long.		(ft <sup>3</sup> /=)	() ()	(Justros)	€	sulfate	Iron		1 con	Ca001 (mg/L)	7.0	
249	Tower City Mine	Keffers water Level burnel		4-21-75	0.7	12.0	ĝ	3.45	001	۲	0.19	0,013	I	8	8
250	Porter Mine	Porter water level turnel	1 40°36'14" 76°30'23"	4-54-75	8	I	ł	I	I	I	I	I	I	I	I
251	Porter Mine	dischunge from turnel	-50,16,32,1 <b>6,</b> 31,02,	4-24-75	e;	10.5	0211	2.95	550	8	<b>C.1</b>	.12	I	\$Z	92
252	Tower CLEY AL Mine	turnel	-90,16,92 -69,96-04	4-25-75	<u>1.5</u>	13-0	630	2.9	210	æ	-8 <del>.</del>	.032	I	8	413

-16

2.3

3.1

Subtotal

Table 32.—Mater-quality and disciences data from mine-drainage attes in the Southern Field near Suedburg

e data from mine-drainage afres in the	View
Table 34Water quality and discharge	Southern Field near Valley V

Ste		ā	Location	Sampling		Water temperature	Specific conductance		Concentration, in mg/L	a, in mg/l	Loads, in tons per day	ans per day	Alkalinity to pii 4.5 as		inficated pli s CaOD, (mg/L)
number	r. Name	Description		date	(tr <sub>3</sub> /e)	() ()	(Justice)	۶.	sulfate	1tton	sulfate	uu 1	Ca001 (mg/L)	7.0	7.0 8.3
23	Erdmen Cost Company	interdittent purp		4-25-75	2.1	0.61	1200	3.9	98	হ	5.0	0.28	I	231	424
254	Good Spring Al Mine collapsed drift	collapsed drift	40,31,16, 36,31,30,	4-23-75	8	9.5	522	6.6	£	~	8	1000"	\$	Ś	18
255	Cool Spring #1 Mine buried borehole	buried borehole	_CE.IC.9/ _91,/E_07	4-23-75	1.0	0711	95	5.8	20	2.5	-62	190*	33	88	115
256	Gool Sprivg Al Mine buried airshaft	buted sinduft		\$7-62-4	s,	0-11	570	6.35	270	2.5	36.	0:0	12	63	82
257	Valley View Mine	interalitient purp	21,16.9214,96.04	4-24-75	2.4	0.61	925	3.5	670	9	3.0	-26	I	201	115
228	Valley View Mine	Valley View turnel	Valley View turnel 40°36'50" 76°33'07"	4-24-75	1.2	12.0	320	1.9	110	2.5	2.1	¥.	69	<b>65</b>	18
259	Markson Mine	Markson Columnay	40°37'09" 76°33'02"	6-13-75	2.4	0.11	956	3.6	410	я	2.6	12.	I	182	210
260	Markeon Mine	intermittent pump	40°37'10" 76°32'28"	4-25-75	8	ł	ł	ł	I	1	ł	ł	I	1	1
261	Markson Mine	aĝudace	40°37'16" 76°32'28"	4-25-75	8	1	ł	ł	l	1	İ	1	1	1	1
262	H & R Chal Co.	interal ttent pusp	40°37'22" 76°32'26"	4-25-75	7	12.0	221	3.2	20	s	۰0°	<b>\$100</b> *	I	202	374
263	Valley View Mine	strip pool overflow	strip pool overflow 40°36'39" 76°34'53"	4-24-75	8	I	ł	l	I	ļ	1	ł	1	ł	1
264	8 6 H Mne	active drift	40*36'48" 76*35'26"	4-24-75	ş	0.11	00 <del>7</del>	3.4	140	s	23	1800"	I	3	63
265	D. & R. Mune	alope	40°36'42" 76°35'50"	4-54-25	8	ł	1	1	ł	I	I	1	ł	I	I
 Subtotal	7				91						14	1.1			

						Water	Specific						Alkalinity to	Acidity to Indicated pl	y to ed pi
Site	e er Nøne	Leecription	location Lat-Long.	Sampling date	Discharge (ft <sup>3</sup> /s)	temperature (°C)	conductance (junice)	E.	Concentration sulfate	n, <u>in ng/L</u>	Concentration, in mg/L Loads, in tons per day sulfate iron sulfate iron	ans per day fron	pH 4.5 as CaOD (mg/L)	as CaCD1 (mg/L) 7.0 8.3	(mg/L) 8.3
266	Lykens- Williamstown Mine	ling Lick tunel	-20106-36 -26109-	4-17-75	6.7	11.8	262	6.2	60	51	2.9	0.27	115	45	20
267	lyk <del>ens-</del> Williamstown Mine	Lykens witer Jevel drift	85117.92L015E.07	4-17-75	2.1	10.5	280	5.2	011	15	.62	.085	01	2	8
268	lykens- Willianstown Mine	abelses	40°42'00" 76°35'04"	4-11-75	<b>30</b>	13.0	145	6.1	Ш	R	20'	.002	×	69	8
269	Lykens- Willfærstown Nine	atrainatt and pump station	.65.14.9115.46.04	4-17-75	6.0	13.6	059	6,2	300	8	3.2	64*	136	8	001
270	Lykene- Millianstown Mine	aßectore	40°34'48" 76°42'00"	51-11- <del>1</del> 5	2.2	13.8	570	<b>6.</b> 4	210	8	1.2	21.	134	Q	501
1/2	Lykens- Willismtown Mine	water level drift collapsed	40°34'48" 76°41'57"	4-17-75		14.5	630	6.6	នា	8	8	500,	131	\$2	22
Subtotal	le				17						8.0	.97			

Table 35.-Water quality and discharge data from whe drainage aftes in the Southern Field near Wichnisco

### Stony Creek near Dauphin

Most coal mining in the Stony Creek basin occurred between 1840 and 1860 (Taylor 1981). Areas in the headwaters of Rausch Creek, Yellow Springs, and Rattling Run were affected but the extent of the affected area is not known. Five sites that are affected by mine drainage were sampled in April 1981. Two of the sites are on Rausch Creek, one is on Yellow Springs, and two are on Rattling Run (table 36). Samples were also collected from Rausch Creek and Rattling Run (table 36).

### Summary and Discussion

The Southern Coal Field has a total drainage area of about 270 mi<sup>2</sup> of which about 141 mi<sup>2</sup> are coal measures, and about 129 mi<sup>2</sup> are upslope from the coal fields. The Southern Field can be subdivided into seven drainage areas. Water and sulfate yields are listed in table 37 for each of the seven drainage areas. Some of the variations in table 37 could be caused by pumps which operated on an intermittent basis to control mine water elevations. Steady-state conditions may not exist at these sites. Samples were collected from 152 sites in the Southern Field, water discharge totaled 210 ft<sup>3</sup>/s, sulfate discharge was 200 tons/d, and iron discharge was 7.2 tons/d. Table 38 lists water, sulfate, acid, and iron yields from the four coal fields.

Felegy and others (1948) and Ash and others (1951) collected flow and water-quality data during 1941 and 1946 from all known discharges in the Southern Field. During the period when samples were collected in 1941, water discharge was 141 ft<sup>3</sup>/s (86 percent was pumped), and acid discharge was 150 tons/d (94 percent was pumped). Data collected during 1946 indicated water and acid discharges of 42 ft<sup>3</sup>/s and 46 tons/d, respectively, significantly less than the 1941 data. During the period of sample collection in 1975, water discharge was 206 ft<sup>3</sup>/s (30 percent greater than 1941), and acid discharge was 55 tons/d (60 percent less than 1941).

### EFFECTS OF MINE DRAINAGE ON STREAMS

Most of the mine discharge from the four coal fields enters the Susquehanna River. The Northern and Western Middle Fields are entirely within the Susquehanna River basin, as is most of the Eastern Middle Field. A small part of the Eastern Middle Field and most of the Southern Field are in the Delaware River basin. When samples of the mine discharges were collected, samples also were collected from a few of the receiving streams, downstream from the mine drainage. At some locations samples were collected from the receiving stream above and below the mine drainage inflows.

# The Susquehanna River and its Tributaries

Samples were collected from the Susquehanna River above and below the Northern Field when the mine discharges were sampled. Water discharge in the Susquehanna River above the coal field was  $14,500 \text{ ft}^3/\text{s}$ , the pH was 7.7, the alkalinity as CaCO<sub>3</sub> was 59 mg/L, the concentration of sulfate was 18 mg/L, and the sulfate discharge was 700 tons/d.

Table 36.—Mater-quality and discharge data from mine-drainage aftes in the Southern Nield near Dauphin

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												Alkalintry to	Acidity to Indicated p	of to
number	r. Name	Description Lat-long.	date	(ft <sup>3</sup> /s)	() (°C)	(partos)	J.	eulfate inn mg/L	1000	Bulfate iron	1 mm	Cric01 (mg/L)	7.0 8.3	8.3 8.3
272	Rausch Creek	Above East Branch 40"30'16" 76"36'13"	4-21-81	3.3	7,0	51	4.4	12	0,02	11.0	0,0012	ł	I	61
273	East Branch Rausch Greek	At lbrsehoe Trad 1 40°30'18" 76°36'05"	4-21-81	1.6	7.5	將	4.8	8.7	10,	Š.	000	ł	I	16
274	Rausch Greek	At fibrseathce Trail (includes 291, 292) 40*29'54" 76*35'52"	4-21-81	5.4	8.0	48	4.6	8	<b>3</b> 0	61.	9000"	ł	I	11
275	275 Yellow Springe	At Story Creek Boat 40°21'41" 76°39'57"	18-01-+	8	0*6	9	4.5	9.2	8	.02	1000"	I	I	12
276	Rattling Run	At Stage Coach Road 40°26'51" 76°43'29"	1 <del>8-6-</del> 9	.22	0*6	ĸ	4.4	67	<b>2</b> 0,	8	0000*	I	ł	6
111	Devils Race Course	At Stage Orach Roal 40"26'53" 76"43'20"	1 <del>8-6-1</del>	ŗ	9.5	8	4.3	6.7	10"	Į0,	0007	ł	ł	62
278	278 Rattling Run	At Story Creek Road (Includes 295, 296) 40°26'09" 76°43'01"	4 <del>-9-8</del> 1	2.7	9.5	8	4.2	8.4	ş	8	1000.	ł	I	9
Subtotal	el			6.2						81.	£000"			

Basin of receiving stream	Drainage area underlain by coal measures (mi <sup>2</sup> )	Number of mine drainage sites	Yields of water (ft <sup>3</sup> /s)/mi <sup>2</sup>	Yields of sulfate (tons/d)/mi <sup>2</sup>
Lehigh	2.3	1	4.8	7.2
Little Schuylkill	13	12	1.3	2.9
Main Stem Schuylkill River	36	57	1.8	1.6
West Branch Schuylkill River	34	15	1.3	1.4
Swatara Creek	33	43	1.0	.4
Mahantango Creek	10	10	1.6	1.4
Wisconisco	11	9	1.8	1.0
Stony Creek above Dauphin	2(Est)	5	3.1	.09
Total	141	152	1.5	1.4

Table 37.--Summary of water and sulfate discharge from minedrainage sites in the Southern Field.

Table 38.—Summary of coal production, water, sulfate, acid, and iron yields from the four anthracite fields in eastern Pennsylvania.

	Coal production	Area of coal	Coal		Yields	of	
Field	to 1944 in 10 <sup>6</sup> tons	measures (mi <sup>2</sup> )	production in 10 <sup>6</sup> tons/mi <sup>2</sup>	Water (ft <sup>3</sup> /s)/mi <sup>2</sup>	Sulfate (t	Acid cons/d)/mi <sup>2</sup>	Iron
Northern	3.5	160	21.9	2.1	4.6	1.5	0.32
Eastern Middle	•50	32	15.6	5.5	3.6	1.6	.066
Western Middle	1.6	75	21.3	2.6	5.4	1.2	.25
Southern	1.3	141	.93	1.5	1.4	.38	.051

Water discharge in the Susquehanna River below the Northern Coal Field was 15,000  $ft^3/s$ , the pH was 7.4, the alkalinity as CaCO<sub>3</sub> was 50 mg/L, the concentration of sulfate was 40 mg/L, and the sulfate discharge was 1,620 tons/d. The sulfate discharge in the Susquehanna River below the Northern Field was close to the expected discharge of 1,440 tons/d--the sum of the discharge above the coal field (700 tons/d), and the discharge from the 25 mine drainage sites (740 tons/d). The difference between the measured and expected discharges, 180 tons/d, could be from measuring and sampling errors or from unsampled mine discharges. It is possible that such discharge could go unnoticed if it occurred in the bottom of the Lackawanna or Susquehanna Rivers; however, in the winter it would produce an ice-free condition.

The concentration of dissolved iron was the same in both samples, 0.6 mg/L. The concentration of total iron in the Susquehanna River above the Northern Field was not determined, but samples collected from the Susquehanna River below the Northern Field during April 1975 had a total iron concentration of 2.2 mg/L. The suspended iron concentration was, therefore, 1.6 mg/L, and the suspended iron discharge, 65 tons/d. The measured iron discharge from mines in the Northern Field was 51 tons/d.

# Nescopeck Creek

Nescopeck Creek is a tributary to the Susquehanna River and receives mine drainage from eight sites in the Eastern Middle Field. The Jeddo Tunnel discharges to the Little Nescopeck Creek and seven sites discharge to Black Creek; both tributaries to Nescopeck Creek. Little Nescopeck Creek was measured and sampled at Sybertsville, about 5 miles below the Jeddo Tunnel. Water discharge was 81 ft<sup>3</sup>/s, the pH was 3.4, the concentrations of dissolved iron and sulfate were 5 and 400 mg/L, respectively; and the acidity was 152 mg/L. The sulfate discharge was 87 tons/d, 12 tons/d more than measured from the Jeddo Tunnel.

Black Creek receives mine drainage from seven sites, the largest of which are the Gowen and Derringer Tunnels. Water discharge from the two tunnels totaled 15 ft<sup>3</sup>/s, and the sulfate discharge was 8.7 tons/d. Water discharge from the other five sites totaled 9.8 ft<sup>3</sup>/s, the sulfate discharge was 0.73 ton/d. Black Creek was measured and sampled near Rock Glen; the water discharge was 50 ft<sup>3</sup>/s and the pH was 6.6. Nescopeck Creek was not sampled but the sulfate load discharged to it by Little Nescopeck and Black Creek totaled 96 tons/d.

#### Catawissa Creek

Catawissa Creek receives mine drainage from Tomhicken Creek and from four mine drainage sites near Sheppton (fig. 3). Oneida Tunnels No. 1 and No. 3 discharge to Tomhicken Creek. Water discharge from the tunnels totaled 16 ft<sup>3</sup>/s and the sulfate discharge was 2.5 tons/d. Tomhicken Creek was measured and sampled near Millers Corner. Water discharge was 26 ft<sup>3</sup>/s, the pH was 4.3, and the concentrations of dissolved iron and sulfate were 0.25 and 40 mg/L, respectively. Sulfate discharge was 2.8 tons/d.

The largest mine discharge that enters Catawissa Creek directly is from the Audenreid Tunnel. When samples were collected, water discharge from the tunnel was 19 ft<sup>3</sup>/s and the sulfate discharge was 14 tons/d. Water discharge from all four sites was 22 ft<sup>3</sup>/s, and sulfate discharge was 15 tons/d. Catawissa Creek was measured and sampled 2 mi above the Tomhicken Creek inflow. Water discharge was 41 ft<sup>3</sup>/s, the pH was 3.7, and the concentrations of dissolved iron and sulfate were 1 and 120 mg/L, respectively. Sulfate discharge was 13 tons/d.

# Shamokin Creek

All 18 sites sampled in the Shamokin area, (table 16), the 4 sites near Mount Carmel (table 15), and 1 small discharge from the Locust Gap Mine (table 14), drain into Shamokin Creek. The water discharge from the 23 minedrainage sites that drain into Shamokin Creek was 67 ft<sup>3</sup>/s, the sulfate discharge was 96 tons/d, and the discharge of dissolved iron was 9.0 tons/d. Shamokin Creek was measured and sampled near Shamokin (fig. 5). Water discharge was 117 ft<sup>3</sup>/s, the pH was 4.2, sulfate discharge was 130 tons/d, and the discharge of dissolved iron was not determined. Some of the difference in water discharge could be from unsampled mine discharges or from surface streams in the area west of Shamokin that are not affected by mine drainage. The difference in sulfate discharge could be unsampled mine discharges.

### Mahanoy Creek

Sixteen mine discharges (tables 11-14) that drain the 37 mi<sup>2</sup> coal fields above Ashland enter Mahanoy Creek. Water discharge from the sixteen sites totaled 116 ft<sup>3</sup>/s, sulfate discharge totaled 290 tons/d, and the iron discharge totaled 10 tons/d. Mahanoy Creek was measured and sampled at Ashland, the water discharge was 140 ft<sup>3</sup>/s, sulfate concentration was 880 mg/L, sulfate discharge was 330 tons/d, the concentration of dissolved iron was 18 mg/L, and the discharge of dissolved iron was 6.8 tons/d.

Mahanoy Creek and several of its tributaries originate upslope from the mined area. Some tributaries flow across the mined area in defined channels, and some infiltrate into the mine workings. The tributaries that flow across the mined area in defined channels account for the additional water discharge of Mahanoy Creek at Ashland. The sampled mine discharges account for nearly all of sulfate discharge measured at Ashland.

Drainage from a 9 mi<sup>2</sup> area mined near Locust Gap enters Mahanoy Creek just below Ashland, and drainage from a 3 mi<sup>2</sup> area near Trevorton enters Mahanoy Creek near the Susquehanna River. Water discharge from the Locust Gap area was 21 ft<sup>3</sup>/s, the sulfate discharge was 41 tons/d, and the iron discharge was 1.0 ton/d. Water discharge from the mines in the Trevorton area enters Zerbe Run at Trevorton. Zerbe Run was measured and sampled below Trevorton; the water discharge was 17 ft<sup>3</sup>/s, the sulfate and dissolved iron concentrations were 330 and 25 mg/L, respectively, and the pH was 3.6. The loads of sulfate and dissolved iron were 15 and 0.38 ton/d, close to the loads measured from the mine discharges at Trevorton (table 17). Mahanoy Creek was not measured or sampled near the Susquehanna River, but the water discharge from the 49 mi<sup>2</sup> mined area in the Western Middle field totaled 131 ft<sup>3</sup>/s, the sulfate discharge totaled 310 tons/d and the discharge of dissolved iron totaled 9.9 tons/d.

#### Mahantango Creek

Mahantango Creek, a tributary to the Susquehanna River, receives mine drainage from three areas, one near Heckscherville, a second north of Tremont, and a third near Valley View. Rausch Creek, a tributary that drains the Valley View area, was sampled above and below a treatment plant. Above the plant, the pH was 4.1 and the concentration of dissolved iron was 16 mg/L. Below the plant, the pH was 6.7 and the concentration of dissolved iron was 0.05 mg/L. Above the plant the water discharge was 18 ft<sup>3</sup>/s and the concentration of dissolved sulfate was 270 mg/L; the sulfate discharge of 13 tons/d almost equals the sulfate discharge measured for the mine-discharges that enter Rausch Creek (table 34).

Mine-water discharge from the three areas was 19  $ft^3/s$ , and the sulfate discharge was 16 tons/d. As most of the mine discharge is from the Valley View area and is treated, the impact of mine drainage on Mahantango Creek is probably small.

#### Wiconisco Creek

Measured water discharge from the nine mine drainages that flow into Wiconisco Creek near Tower City and Wiconisco totaled 20  $ft^3/s$  and the sulfate discharge was 10 tons/d. About 11 mi<sup>2</sup> have been affected by mining in the Wiconisco Creek basin. Wiconisco Creek was sampled at Lykens, and the water discharge was 71  $ft^3/s$ , the pH was 6.2, and the concentrations of dissolved iron and sulfate were 2 and 94 mg/L, respectively. The sulfate discharge was 18 tons/d.

### Stony Creek near Dauphin

Samples were collected from three tributaries to Stony Creek, Rausch Creek (a different Rausch Creek from the one in the Mahantango Creek basin), Yellow Springs, and Rattling Run. Rausch Creek was measured and sampled at the Appalachian Trail. The water discharge was  $5.4 \text{ ft}^3/\text{s}$ , the pH was 4.6, and the concentrations of sulfate and iron were 13 and 0.04 mg/L, respectively. Yellow Springs was measured and sampled at Stony Creek Road. The water discharge was  $0.80 \text{ ft}^3/\text{s}$ , the pH was 4.5, and the concentrations of sulfate and sampled at Stony Creek Road. The water discharge was  $0.80 \text{ ft}^3/\text{s}$ , the pH was 4.5, and the concentrations of sulfate and iron were 9.2 and 0.06 mg/L, respectively. Rattling Run also was measured and sampled at Stony Creek Road. The water discharge was  $2.7 \text{ ft}^3/\text{s}$ , the pH was 4.2, and the concentrations of sulfate and iron were 8.4 and 0.04 mg/L, respectively.

# Swatara Creek

Forty-three mine discharges that drain to Swatara Creek were sampled. Water discharge totaled 32 ft<sup>3</sup>/s and the discharge of sulfate was 14 tons/d. Swatara Creek was measured and sampled at Ravine. Water discharge was 54 ft<sup>3</sup>/s, the pH was 5.1, and the concentrations of dissolved iron and sulfate were 1.2 and 110 mg/L, respectively. Sulfate discharge was 16 tons/d.

### The Delaware River and its Tributaries

Mine drainage from 10 sites in the Eastern Middle Field discharges to tributarles of the Lehigh River. One site in the Southern Field discharges directly to the Lehigh River, and 84 sites from Coaldale to Minersville discharge to tributaries of the Schuylkill River.

#### Lehigh River

Pond Creek (fig. 3) receives discharge from three mine-drainage sites at the Pond Creek Mine in the Eastern Middle Field. Water discharge from the three sites totaled 14 ft<sup>3</sup>/s, the largest discharge, 13 ft<sup>3</sup>/s, was from a strip pool overflow. Sulfate discharge from the three sites totaled 1.6 tons/d. Pond Creek was measured and sampled near Scale Siding. The water and sulfate discharges were 16 ft<sup>3</sup>/s and 1.7 tons/d, the pH was 4.8, and the concentration of dissolved iron was 1 mg/L.

Sandy Run receives mine drainage from two sites, the Owl Hole tunnel and the Sandy Run tunnel. Water and sulfate discharge from the two sites totaled 6.8 ft<sup>3</sup>/s and 5.5 tons/d. Sandy Run was measured and sampled near Scale Siding; the water discharge was 17 ft<sup>3</sup>/s, the pH was 5.1, and the concentrations of dissolved iron and sulfate were 1 and 140 mg/L, respectively. Sulfate discharge was 6.4 tons/d.

Buck Mountain Creek receives mine drainage from two sltes; both discharge from the Buck Mountain tunnel. Water discharge from the two sltes was  $1.8 \text{ ft}^3/\text{s}$ , and the sulfate discharge was 1.2 tons/d. Buck Mountain Creek was measured and sampled near Weatherly, about 2 mi downstream from the tunnels. Water discharge was  $8.0 \text{ ft}^3/\text{s}$ , the pH was 6.0, and the concentrations of dissolved iron and sulfate were less than 1 and 65 mg/L, respectively. Sulfate discharge was 1.4 tons/d.

Wetzel Creek, a tributary to Black Creek, receives mine drainage from one site, the Beaver Meadows tunnel. Water and sulfate discharge from the tunnel totaled 20 ft<sup>3</sup>/s and 5.4 tons/d. Wetzel Creek was measured and sampled at Hudsondale. Water discharge was 19 ft<sup>3</sup>/s, the pH was 3.4, and the concentrations of dissolved iron and sulfate were 1 and 170 mg/L, respectively. Sulfate discharge was 5.0 tons/d. Two sites, a shaft at the Stockton Mine and a strip mine pool at the Hazle Brook Mine discharge to Hazle Creek, also a tributary to Black Creek. Water discharge from these two sites totaled 3.8 ft<sup>3</sup>/s and the sulfate discharge was 0.78 ton/d.

The Nesquehoning tunnel, in the Southern Field, discharges directly to the Lehigh River near Jim Thorpe. Its water discharge was 11 ft<sup>3</sup>/s, and the concentrations of dissolved iron and sulfate were 7 and 560 mg/L, respectively. Sulfate discharge was 17 tons/d. Total water and sulfate discharge from mines in the Lehigh River basin was 57 ft<sup>3</sup>/s and 31 tons/d.

## Schuylkill River

The Schuylkill River receives discharge from 83 mi<sup>2</sup> of coal measures in the Southern field. The drainage area of the Little Schuylkill River at Tamaqua is about 50 mi<sup>2</sup>, and the area containing coal measures is 13 mi<sup>2</sup>. Water discharge from the 12 sampled mine-drainage sites near Coaldale, Ginther, and Tamaqua totaled 18 ft<sup>3</sup>/s, and the sulfate load was 38 tons/d. The Little Schuylkill River was measured and sampled below Tamaqua. The water discharge was 79 ft<sup>3</sup>/s, the pH was 5.4, the concentration of sulfate was 240 mg/L, and the sulfate discharge was 51 tons/d. Most of the difference in water discharge (61 ft<sup>3</sup>/s), and some of the difference in sulfate discharge (13 tons/d), is due to discharges from the 37 mi<sup>2</sup> area outside the coal field, but some is probably due to unsampled discharges in the coal field.

The drainage area of the main stem of the Schuylkill River above Pottsville is 53 mi<sup>2</sup> about 36 mi<sup>2</sup> of which contain coal reserves. Mine drainage was measured and sampled at 55 sites. Water discharge totaled 65 ft<sup>3</sup>/s, and the sulfate discharge was 58 tons/d. About half the sulfate discharge came from the pump discharge at the Pine Forest Mine near St Clair.

The West Branch of the Schuylkill River drains an area of about 34 mi<sup>2</sup> that is underlain by coal measures. Mine water discharge was measured and sampled at 15 sites that drain to the West Branch Schuylkill River. Water discharge from the 15 sites totaled 44 ft<sup>3</sup>/s; the discharge of sulfate was 49 tons/d. The Schuylkill River at Schuylkill Haven was measured and sampled when samples were collected from the mine discharges. The water discharge was 167 ft<sup>3</sup>/s, the concentration of sulfate was 250 mg/L, and the discharge of sulfate was 110 tons/d. Water discharge from the 72 mine discharges above Schuylkill Haven was 109 ft<sup>3</sup>/s, and the measured sulfate discharge was 110 tons/d. The sulfate discharge measured from the mines almost equals the discharge measured at Schuylkill Haven.

### SUMMARY

Anthracite has been mined in east-central Pennsylvania for more than 150 years. Most mining was done by deep mining methods, creating vast underground voids. Through 1944, 3.5, 0.5, 1.6, and 1.3 billion tons of coal were produced in the Northern, Eastern Middle, Western Middle, and Southern Anthracite Fields, respectively. To prevent flooding, water that entered the mines was pumped to the surface. Between 1930 and 1960, nearly all deep mines were abandoned, pumping was discontinued, the mines filled with water, and surface overflows developed. Most of the mine discharge from the four coal fields enters the Susquehanna River. The Nothern and Western Middle Fields are entirely within the Susquehanna River basin, as is most of the Eastern Middle Field. A small part of the Eastern Middle Field, and most of the Southern Field is in the Delaware River basin.

Cumulative water discharge from 25 mine-drainage sites in the Northern Anthracite Field was 333 ft<sup>3</sup>/s, the sulfate discharge was 740 tons/d, and the iron discharge was 51 tons/d. All mine discharges sampled in the Northern Field were gravity overflows; no pump discharges were known to exist at the time of sampling. As 160 mi<sup>2</sup> are underlain by the coal field, the water and sulfate yields were 2.1 (ft<sup>3</sup>/s)/mi<sup>2</sup> and 4.6 (tons/d)/mi<sup>2</sup>, respectively.

Measured water discharge from mines in the Northern Field in 1941 was  $306 \text{ ft}^3/\text{s}$  (90 percent was pumped from deep mines) and the measured acid discharge was 390 tons/d (92 percent was pumped from deep mines). Total water and acid discharges during sampling in 1975 were 333 ft<sup>3</sup>/s and 240 tons/d (no discharges were pumped from deep mines). During the sampling period in 1975, water discharge was about 10 percent more, and the acid discharge was about 35 percent less than during the sampling period in 1941.

A total of 29 mine sites were sampled in the Eastern Middle Field. Ten of the discharges drain into the Lehigh and Delaware River basin, and 18 into the Susquehanna River basin. Water discharge totaled 176 ft<sup>3</sup>/s, the sulfate discharge was 120 tons/d, and the iron discharge was 2.1 tons/d. Mine water discharge to the Lehigh River basin totaled 46 ft<sup>3</sup>/s and the sulfate discharge totaled 14 tons/d; the rest drained to the Susquehanna River basin. Water yield from the entire 32 ml<sup>2</sup> coal field was 5.5 (ft<sup>3</sup>/s)/mi<sup>2</sup>, significantly more than the 2.1 (ft<sup>3</sup>/s)/mi<sup>2</sup> measured for the Northern Field. Sulfate yield was 3.6 (tons/d)/mi<sup>2</sup>, slightly less than the 4.6 (tons/d)/mi<sup>2</sup> measured in the Nothern Field. Apparently, the high water yield is due to water that enters the mines from areas outside the coal measures. The extra water does not seem to contribute to the sulfate yield.

Total measured water discharge from mines in the Eastern Middle Field in 1941 was 102 ft<sup>3</sup>/s (20 percent was pumped from deep mines), and the measured acid discharge (as  $CaCO_3$  to pH 8.3) was 190 tons/d (20 percent was pumped from deep mines). During the sampling period in 1975, water discharge was 176 ft<sup>3</sup>/s (none was pumped), and acid discharge was 52 tons/d. Water discharge during 1975 was about 70 percent greater than 1941, but the discharge of acid was about 70 percent less.

The Western Middle Field is entirely within the Susquehanna River Basin. About 75 mi<sup>2</sup> are underlain with coal; the total drainage area is about 100 mi<sup>2</sup>. Forty-five mine discharges were measured and sampled. Water discharge from the mine-drainage sites totaled 198 ft<sup>3</sup>/s, the sulfate load was 410 tons/d, and the iron discharge was 19 tons/d. Water yield from the 75 mi<sup>2</sup> underlain by coal was 2.6 (ft<sup>3</sup>/s)/mi<sup>2</sup> and the sulfate yield was 5.4 (ton/d)/mi<sup>2</sup>. The sulfate yield was about 50 percent greater than the yields measured from the Northern and Eastern Middle Fields.

Measured water discharge from mines in the Western Middle Field during the sampling in 1941 was 120 ft<sup>3</sup>/s (78 percent was pumped from deep mines) and measured acid discharge, as  $CaCO_3$  to pH 8.3, was 229 tons/d (62 percent was pumped from deep mines). Samples were also collected in 1946 and measured water and acid discharges were considerably less. Water discharge was 61 ft<sup>3</sup>/s (80 percent was pumped from deep mines) and acid discharge was 98 tons/d (62 percent was pumped from deep mines). Apparently, some deep mines had stopped operating and the mines were filling with water during 1946. During the sampling in 1975, water discharge was 198 ft<sup>3</sup>/s (78 percent more than 1941) and acid discharge was 93 tons/d (55 percent less than 1941). About 95 percent of the discharge in 1975 was from gravity overflows or drainage tunnels.

The Southern Coal Field contains about 141 mi<sup>2</sup> of coal measures and extends from Jim Thorpe to Lykens, a distance of 56 miles. The larger part of the coal fields, about 77 mi<sup>2</sup>, drain toward the Delaware River. Drainage from the remaining 64 mi<sup>2</sup> flows toward the Susquehanna River. About 129 mi<sup>2</sup> are upslope from the coal fields, and the total drainage area is about 270 mi<sup>2</sup>. Samples were collected from 151 sites in the Southern Field, water discharge totaled 210 ft<sup>3</sup>/s, sulfate discharge was 200 tons/d, and iron discharge was 7.2 tons/d.

Samples of the discharge from mines in the Southern Field were collected in 1941, water discharge was 141 ft<sup>3</sup>/s (86 percent was pumped), and acid discharge was 150 tons/d (94 percent was pumped). Samples were also collected during 1946, water and acid discharges were 42 ft<sup>3</sup>/s and 46 tons/d, respectively, significantly less than the 1941 data. During the sample collection in 1975, water discharge was 206 ft<sup>3</sup>/s (30 percent greater than 1941) and acid discharge was 55 tons/d (60 percent less than 1941).

Mine drainage was measured and sampled at 251 sites in the Northern, Eastern Middle, Western Middle, and Southern Coal Fields. Total water discharge was 918  $ft^3/s$ , the total sulfate load was 1,470 tons/d, and the total iron discharge was 79 tons/d.

#### SELECTED REFERENCES

- Ash, S. H., Eaton, W. L., Hughes, Karl, Romischer, W. M., and Westfield, James, 1949, Water pools in Pennsylvania anthracite mines: U.S. Bureau of Mines Technical Paper 727, 78 p.
- Ash, S. H., Felegy, E. W., Kennedy, D. O., and Miller, P. S., 1951, Acid-mine drainage problems, anthracite region of Pennsylvania: U.S. Bureau of Mines Bulletin 508, 72 p.
- Becher, A. E., 1971, Ground-water in Pennsylvania: Pennsylvania Geological Survey Educational Series, No. 3, 42 p.
- Berger Associates and A. B. Riedel Associates, 1975, Evaluation of mining constraints to the revitalization of Pennsylvania anthracite: Report to the U.S. Bureau of Mines, contract no. 50241039.
- Bergin, M. J., and Robertson, J. F., 1963, Preliminary report on the geology of the Wyoming Valley, Northern Anthracite Field, Luzerne and Lackawanna Counties, Pennsylvania: U.S. Geological Survey Administrative Report, 35 p.
- Biesecker, J. E., Lescinsky, J. B., and Wood, C. R., 1968, Water resources of the Schuylkill River basin: Pennsylvania Department of Forest and Waters Bulletin, No. 3, 198 p.
- Deasy, G. F., and Griess, Phyllis R., 1963, Atlas of Pennsylvania coal and coal mining, part II, anthracite: Pennsylvania State University, Mineral Industries Experimental Station Bulletin 80, 123 p.
- Edmunds, W. E., 1972, Coal reserves of Pennsylvania: Total, recoverable, and strippable (January 1, 1970): Pennsylvania Geological Survey, 4th series, Information Circular 72, 40 p.
- Felegy, E. W., Johnson, L. H., and Westfield, James, 1948, Acid mine water in the anthracite region of Pennsylvania: U.S. Bureau of Mines Technical Paper 710, 49 p.
- Growitz, D. J., 1976, Ground-water conditions in the Kingston area, Luzerne County, Pennsylvania and their effect on basement flooding: U.S. Geological Survey Open-File Report 76-793, 112 p.
- Hem, J. D., 1960, Some chemical relationships among sulfur species and dissolved ferrous iron: U.S. Geological Survey Water Supply Paper 1459-C, p. 57-73.
- ----1970, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water Supply Paper 1473, 363 p.
- Hollowell, J. R., and Koester, H. E., 1975, Ground-water resources of Lackawanna County, Pennsylvania: Pennsylvania Department of Environmental Resources, Water Resources Report 41, 106 p.

#### SELECTED REFERENCES--Continued

- Itter, H. S., 1938, The geomorphology of the Wyoming-Lackawanna Region: Pennsylvania Geological Survey, 4th Series, Bulletin G-9, 92 p.
- Pennsylvania Topographic and Geologic Survey, 1980, Geologic Map of Pennsylvania: scale 1:250,000.
- Rainwater, F. H., and Thatcher, L. L., 1960, Methods for collection and analysis of water samples: U.S. Geological Survey Water Supply Paper 1454, 301 p.
- Rhodes, R. L., and David, R. S., 1968, Mine drainage in the Susquehanna River basin: Federal Water Pollution Control Administration, 127 p.
- Stuart, W. T., and Simpson, T. A., 1961, Variations of pH with depth in anthracite mine-water pools in Pennsylvania: U.S. Geological Survey Professional Paper 424-B, p. B-82-84.
- Taylor, W. L., 1981, Hedrick's Haunts: Elizabethtown College Bulletin, Spring 1981, p. 4-7.
- Wood, G. H., Jr., Arndt, H. H., and Hoskins, D. M., 1963, Geology of the southern part of Pennsylvania anthracite region: Geological Society of America and Associated Societies Guidebook (Field Trip No. 4), 84 p.
- Wood, G. H., Jr., Trexler, J. P., and Kehn, T. M., 1969, Geology of the west-central part of the southern anthracite field and adjoining areas, Pennsylvania: U.S. Geological Survey Professional Paper 602, 150 p.