CHAPTER IV

THE UNIONTOWN SYNCLINE

TYPES OF DISCHARGES

Acid mine drainage discharges have been located and monitored throughout the syncline. The discharges have been classified as either artesian discharges or gravity discharges. Artesian discharges are those discharges which flow under artesian pressure, as indicated by the difference in elevation between the coal seam and the discharge point. These discharges are from a mine pool. The artesian discharges do not show great variations in flow when compared to total precipitation. The largest artesian discharges, such as P-1 and M-19, emerge from updip portions of the syncline near the outcrop. The gravity discharges are located mainly along the north bank of the Youghiogheny River, and along Rankin Run, Hickman and Bute Run. Normally, it would be expected that a gravity drain discharge would show more response to precipitation than an artesian mine pool discharge.

BARRIER PILLARS

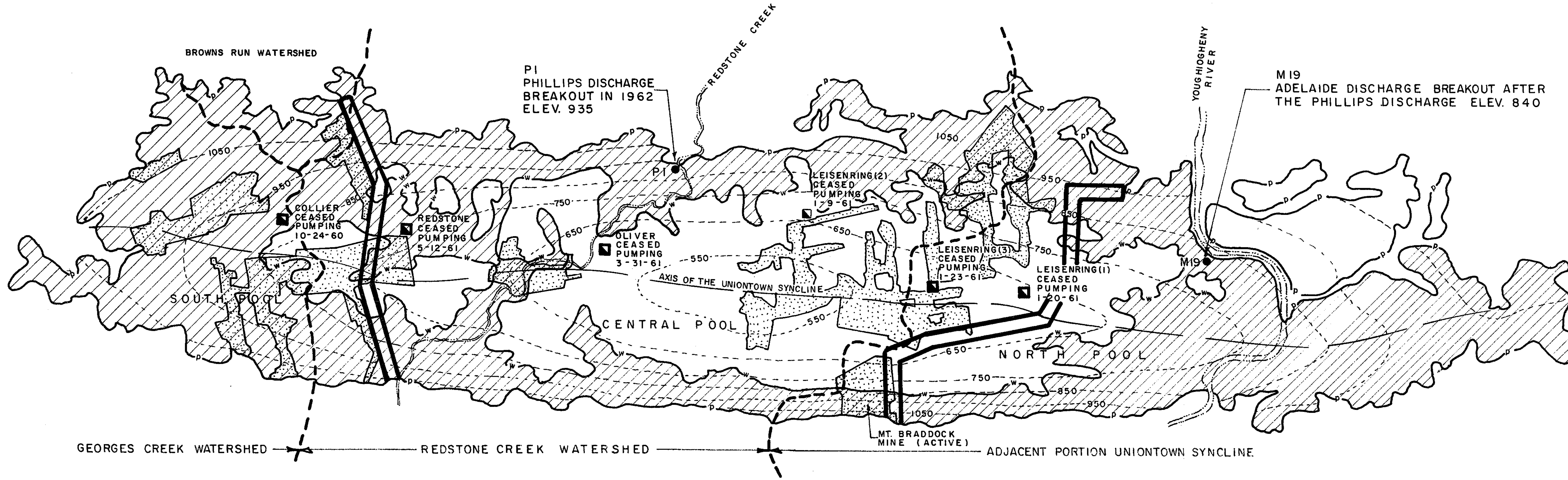
A review of the available mine maps for the Pittsburgh Coal indicates at least one barrier pillar between the Revere Mine and the South Union Mine and the adjacent mines, owned by H. C. Frick Coke Company mines. The location of these barrier pillars are shown on the Uniontown Syncline Map in the rear map pocket. Data obtained to date has not indicated that other barrier pillars exist between the other mines. The absence of additional barrier pillars is attributed to the ownership of the major mines in the area by the H. C. Frick Coke Company (13).

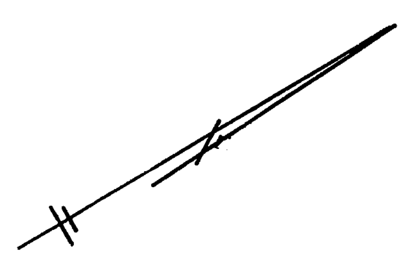
A recent Pennsylvania Geological Survey publication indicates several areas of Pittsburgh Coal seam reserves within the syncline (12). These areas are generally in the vicinity of the Leisenring Mines north of Uniontown and the Continental Mines south of Uniontown. The areas of coal in place reported by the Pennsylvania Geological Survey are shown on Figure 9 and are generally reflected on the Uniontown Syncline Map in the rear map pocket.

CHRONOLOGY OF EVENTS

Except for the Mt. Braddock Mine, deep mining operations of the Pittsburgh seam within the Uniontown Syncline ceased during October, 1960, with the closing of the Collier Mine located approximately three miles south of Uniontown. The Leisenring No. 3 Mine, located six miles north of Uniontown ceased operation during June of 1960.

The Leisenring No. 3 Mine preceded the closing of the Collier Mine by four months. However, pumping of mine water at several locations continued until May of 1961, while closedown procedures continued (13). The history of mining, closedown and pumping operation is presented on Table 5. As shown on Figure 9, acid mine drainage discharge P-1 began in 1962, about one year after all pumping in nearby mines had ceased.





L E G E N D

= Zone Of Maximum Infiltration Approx. 20,500 Acres. (Defined As Surface Area Between Pittsburgh Coal Outcrop And Waynesburg Coal Outcrop)

= Possible Barrier, Caused By Coal In Place And Roof Falls.

---750 = Contours Base Of Pittsburgh Coal. (REF. Outcrop Lines And Structure Contours From WPA Mine Maps

—p— = Pittsburgh Coal Outcrop

—w— = Waynesburg Coal Outcrop

= Coal In Place (REF. Bituminous Coal Resources In Western Pa. Mineral Resources Report 68, By Mark A. Sholes & V.W. Skema 1974, Commonwealth Of PA. D.E.R. 1974)

= Mine Shaft Location

PITTSBURGH COAL REMAINING WITHIN THE UNIONTOWN SYNCLINE
LOCATIONS OF EVENTS PERTAINING TO MINE POOL ANALYSIS

FIGURE - 9

TABLE 5

DATES OF MINING AND PUMPING FOR MAJOR MINES IN THE UNIONTOWN SYNCLINE

Mine Name	Date Opened	Date Operation Ceased	Date Pumping Discontinued
Adelaide	1901	1938	Unknown
Trotter	1901	1938	Unknown
Leisenring No. 1	1880	August, 1954	January, 1961
Leisenring No. 3	1886	June, 1960	January, 1961
Leisenring No. 2	1882	November, 1955	January, 1961
Oliver No. 3	Unknown	Unknown	March, 1961
Leith	1881	1944	Unknown
Redstone	1881	May, 1927	May, 1961
Continental No. 2	1900	May, 1926	Unknown
Collier	1907	October, 1960	October, 1961
York Run	1904	January, 1954	Unknown
Kyle	1904	January, 1954	Unknown

Source: Flow Chart of Mine Drainage in the Fairchance and Leisenring Fields supplied by United States Steel Corporation.

The chronology of acid mine drainage breakouts within the Uniontown Syncline is quoted from Fayette Engineering Pollution Abatement Study, SL 141:

> "... less than two years after the mines were abandoned and pumping was stopped, the mine water discharge north of Uniontown near Phillips appeared, indicating that the pool had filled and was overflowing. Other major discharge points from the south basin have since appeared at Adelaide and Henry clay mines on the Youghiogheny River." (2)

Following the Phillips discharge (P-1) breakout, the mine pool elevation continued to rise until about 1965. At this time, inflow probably balanced outflow and storage, and pool elevations thereafter fluctuated only with precipitation. This is supported by annual water level measurements within the abandoned Redstone airshaft (located approximately one-half mile south of Uniontown) from June 18, 1961, until September 2, 1970. On May 7, 1975, the water level elevation within the Redstone Mine airshaft was 1,033 ft. (19) A summary of these elevations is shown on Figure 10.

The elevation of monitored acid mine drainage discharges have been estimated for the purpose of analyzing the acid mine drainage from the Uniontown Syncline. The estimated elevations are listed on Table D-1 by subwatershed in Appendix D.

The data obtained can be summarized as follows:

A. After mining and pumping operations ceased in 1961, the mine pool level measured at the Redstone airshaft increased dramatically from 1961 to 1965.

B. From 1965 to 1970 the pool level fluctuated in relation to total annual precipitation.

C. The Phillips discharge began less than two years after mining stopped. Subsequently, the Adelaide discharge began.

D. The monitored average flow from the Uniontown Syncline during this study totaled 13,700 gpm, or 13% of yearly precipitation during the study over the surface area of the Uniontown Syncline. The average infiltration rate, based on the average discharge and approximate area of infiltration, was 0.5 gpm per acre.

E. The approximate location of Pittsburgh Coal in place has been determined by others.

COMPARISON OF MINE POOL ELEVATIONS AT REDSTONE MINE AND YEARLY PRECIPITATION

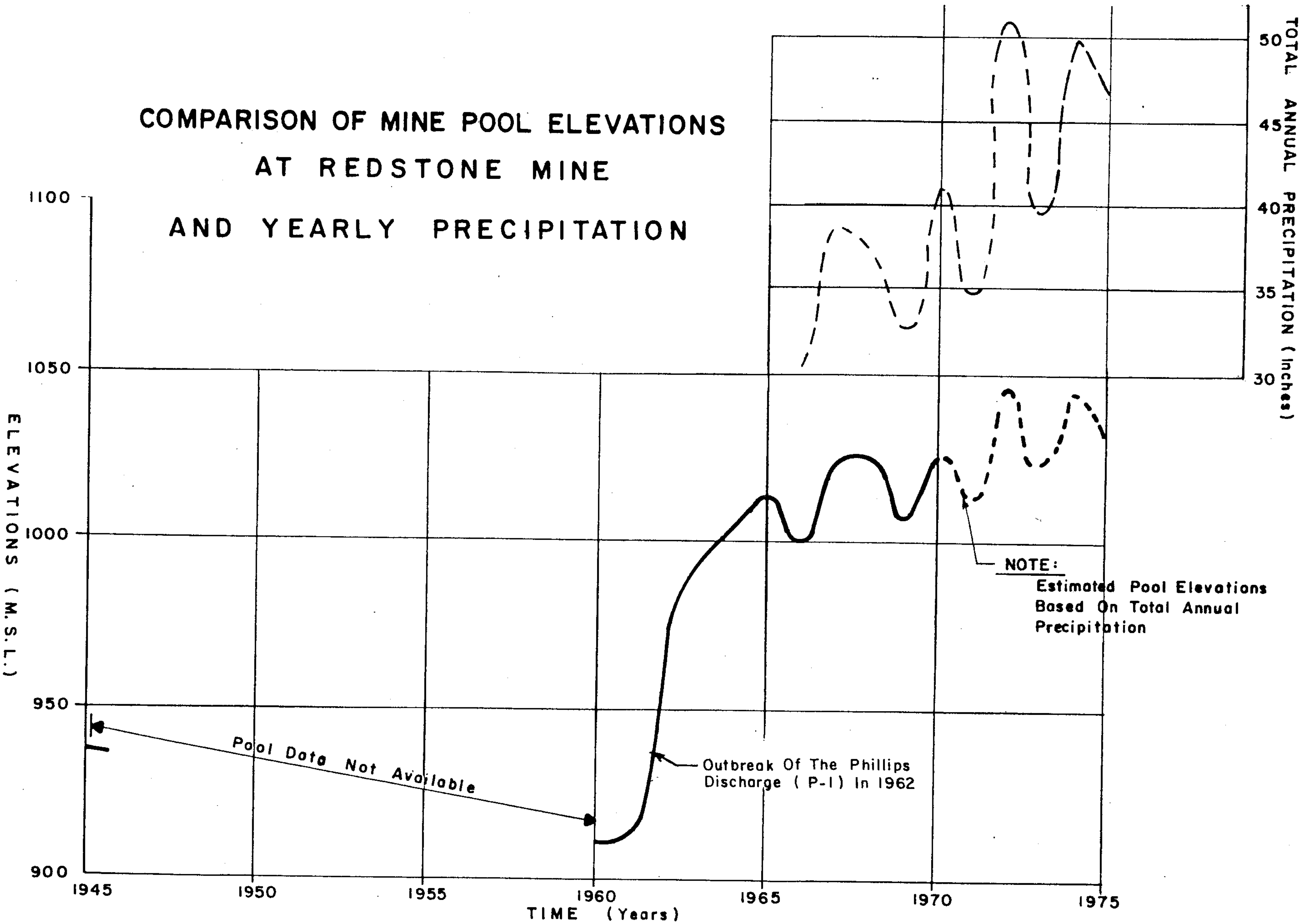


FIGURE 10

MINE POOL THEORIES

HYDROLOGIC CONCEPTS

The total mine drainage from the Uniontown Syncline, as monitored in this study and as combined with Georges Creek data (SL 186), was about 13,700 gpm measured over a hydrologic year from August, 1974 through July, 1975. To assess the relationship between mine pool inflow and outflow with precipitation and runoff, a mass curve was constructed for precipitation at Uniontown, Redstone Creek at Waltersburg and for the total acid mine drainage outflow from the Uniontown Syncline (see Figure 11). The mass curve used acre inches of drainage area for the units to compare the quantities. The drainage area for Redstone Creek at Waltersburg was well defined, but the drainage area or infiltration area for the Uniontown Syncline was subject to interpretation.

The estimated drainage area contributing to AMD outflow from the syncline was chosen as the area between the Pittsburgh Coal outcrop and the Waynesburg Coal outcrop. This assumed infiltration area is shown on the Uniontown Syncline Map in the map pocket. The basis for this assumed infiltration area is that coal strata have generally good water-bearing characteristics but are usually underlain by a relatively impermeable underclay or shale. Therefore, downward infiltration of precipitation may be restricted by underclays associated with coal strata, except where overlying strata are fractured by coal mine roof falls. Thus, the Waynesburg Coal, which lies generally 380 ft. above the coal was selected as the confining bed which retards infiltration to the mined-out Pittsburgh Coal and thus defines the limits of the infiltration area for preparing the mass curve of Figure 11.

As shown on Figure 11, stream flow for Redstone Creek at Waltersburg accounted for about 56% of precipitation over the drainage area and the total AMD outflow from the syncline represents approximately 13% of precipitation. However, the AMD discharges into Redstone Creek were also included in the stream discharge at Waltersburg. The sources not included in the Redstone Creek discharge at Waltersburg drained to the Youghiogheny River, Brown's Run and Georges Creek. The remaining precipitation is accounted for by ground water storage, evapotranspiration, and ground water recharge to other drainage basins.

ANALYSIS OF FINDINGS

There is no direct evidence obtained during this study to indicate how many mine pools exist. However, data collected during this study permits a degree of speculation on several mine pool theories. The mine pool theories are based on mine water pumping data, areas of coal in place, dates of occurrence of the largest artesian discharges, elevations of the discharges, and mine water effluent discharge parameters.

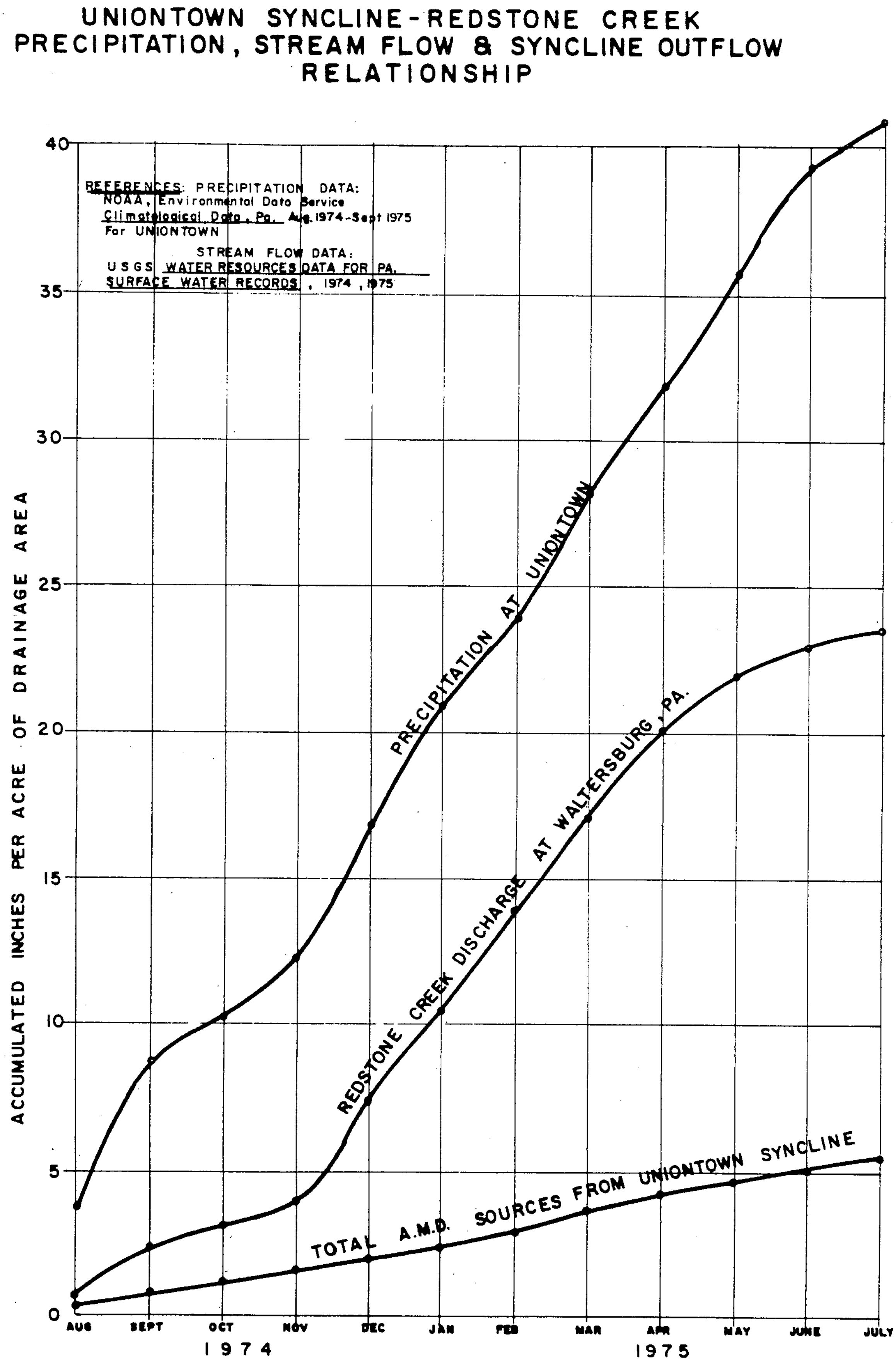

UNIONTOWN SYNCLINE-REDSTONE CREEK
PRECIPITATION, STREAM FLOW & SYNCLINE OUTFLOW
RELATIONSHIP
REFERENCES: PRECIPITATION DATA:
NOAA, Environmental Data Service
Climatological Data, Pa. Aug.1974-Sept 1975
For UNIONTOWN
STREAM FLOW DATA:
USGS WATER RESOURCES DATA FOR PA.
SURFACE WATER RECORDS, 1974, 1975
ACCUMULATED INCHES PER ACRE OF DRAINAGE AREA
40
35
30
25
20
15
10
5
0
PRECIPITATION AT UNIONTOWN
REDSTONE CREEK DISCHARGE AT WALTERSBURG, PA.
TOTAL A.M.D. SOURCES FROM UNIONTOWN SYNCLINE
AUG
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
1974
1975

FIGURE 11

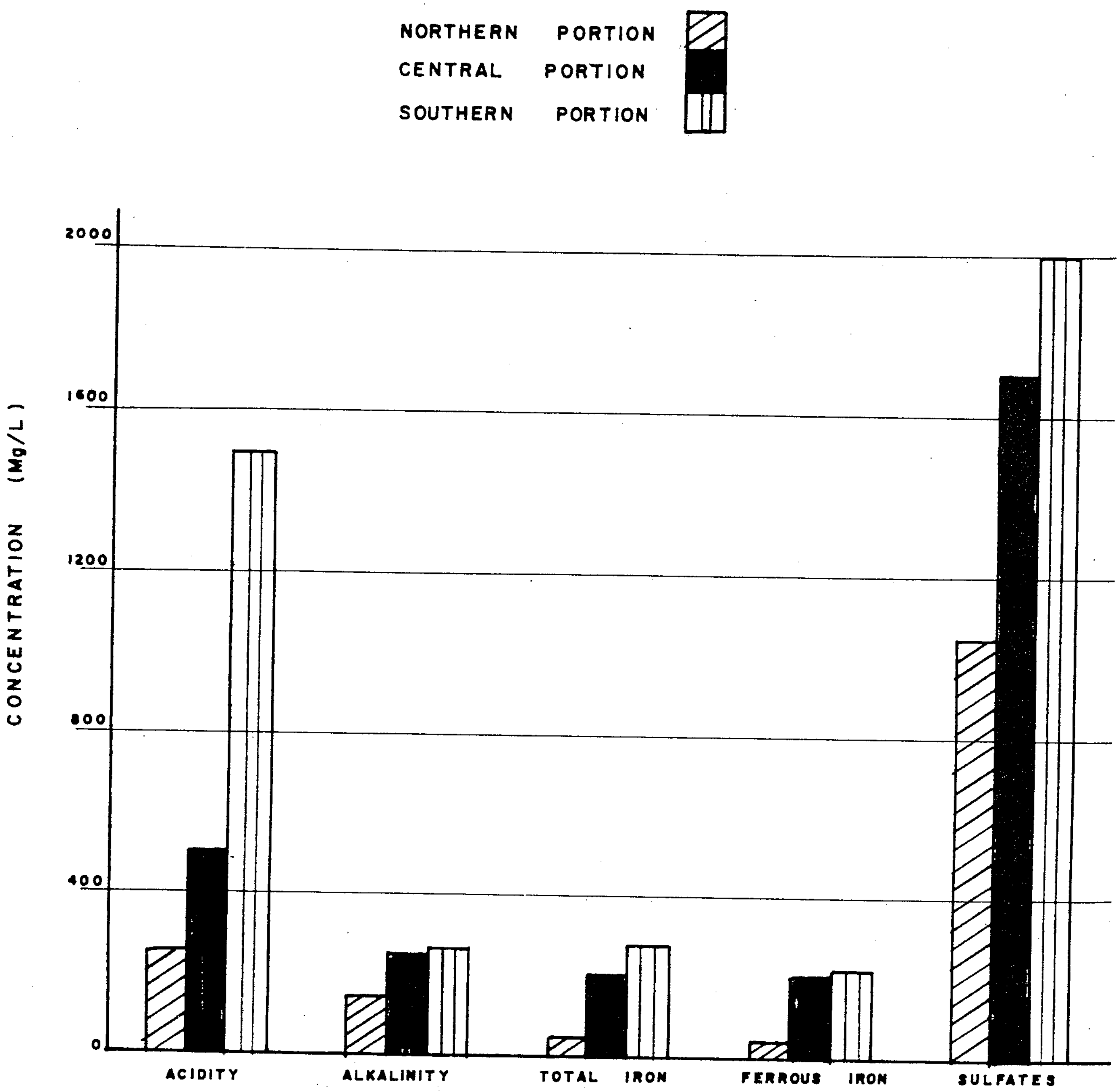
The most logical alternatives can be condensed into three general categories:

One Mine Pool: The majority of mineable coal in the Pittsburgh seam has been removed, leaving a vast mine complex within the syncline. Due to common ownership, barriers were dispensed with allowing interconnectedness throughout the syncline. After pumping ceased, the mines began to fill with water. Weaker points at or near the outcrop gave way, resulting in the Phillips discharge and later the Adelaide discharge.

Two Mine Pools: A combination of barriers, coal in place, and subsidence may separate the Redstone Creek Watershed from the mining complex northeast of the Redstone Creek Watershed. According to this theory, mine water infiltrating to the pool flows generally northeast to the plunge of the syncline yet has sufficient hydrostatic head to force the artesian discharge at Phillips (P-1). Also, the same process could explain the apparent ground water contamination in Rankin Run at about Elev. 940, about 5 ft. higher than Source P-1. The northern pool then would be about 100 ft. lower in elevation than Source P-1 and would be discharging by artesian pressure in the lowest convenient topographic location to the northeast of the Redstone Creek-Youghiogheny River Watershed boundary. The Youghiogheny River flood plain provides this elevation at about 840 ft. This is the approximate elevation of the large artesian discharges in the Youghiogheny River portion of the study area, namely sources M-19 and M-56 which provide a combined average flow of 5,140 gallons per minute.

Three Mine Pools: Although the mines into the Pittsburgh seam are probably interconnected, the combination of subsidence and coal in place may have created two impervious barriers within the synclines. The reasoning for this assumption is based on the fact that the Adelaide (M19) discharge began after the Phillips, even though it is almost 100 ft. lower in elevation. A comparison of discharge water quality within the assumed mine pool areas (Figure 12) shows differences that may be interpreted as stemming from separate mine pools. The extent of the three possible mine pools is shown on the Uniontown Syncline Map in the map pocket. This conclusion also concurs with the findings of the Federal Water Pollution Control Agency's 1969 study which said:

> "This flow comes from the mined-out Pittsburgh Coal vein which forms an oval basin with its long axis passing northeast under Uniontown toward Connellsville, which is out of the basin. The center of the basin is below the watershed boundary. The workings apparently do not connect with the mines coming from the Connellsville area since the water could then drain to that lower outcrop. Neither of the workings seem to connect with those to the southwest of Uniontown over the watershed boundary since mines beyond that point drain or are pumped to that higher outcrop. The mined-out region is apparently centered just north of Uniontown and extends north to the watershed boundary and south under Uniontown." (1)



COMPARISON OF MEAN WATER QUALITY OF DISCHARGES FROM THE NORTH, CENTRAL, AND SOUTHERN PORTIONS OF THE UNIONTOWN SYNCLINE

FIGURE 12

To attempt an explanation of the existence and number of mine pools, the source outflow totals within each assumed mine pool area were converted to inches per acre of infiltration area, and a cumulative outflow graph constructed. As shown in Figure 13, the cumulative annual outflows from the north, central and southern areas were 13.9, 9.6 and 1.8 in. per acre of assumed infiltration area respectively.

The infiltration areas were assumed to be only the surface area between the Pittsburgh and Waynesburg Coal outcrops. The infiltration area averages are summarized in Table 6 for the three assumed mine pools. From Figure 11 and Table 6, the proportion of total precipitation that was sampled as source outflows varies among the areas. Moreover, the total outflow from each area is not proportional to the assumed infiltration areas. This may be associated with differential infiltration rates within the areas, or differences in subsurface drainage characteristics.

As shown on Table 6, there is a substantial difference between outflow of the assumed southern pool (1.8 inches/acre) when compared to outflow from the assumed northern and central pools (13.9 inches/acre and 9.6 inches/acre respectively). This difference indicates that the precipitation that infiltrates to mine level in the Georges Creek Watershed is not entirely contained within the Georges Creek Watershed but contributes to mine outflow in another area, probably the Phillips-Rankin Run area.

In conclusion, the two mine pool theory is the most logical of the theories explored for the purposes of this study. However, this conclusion must be considered tentative since it is based upon gross assumptions of water infiltration rates, overburden permeability and roof conditions of the abandoned mine complexes. If more mine pool data is desired, an observation well program should be considered.

RELATION BETWEEN TOTAL OUTFLOW OF ASSUMED MINE POOLS

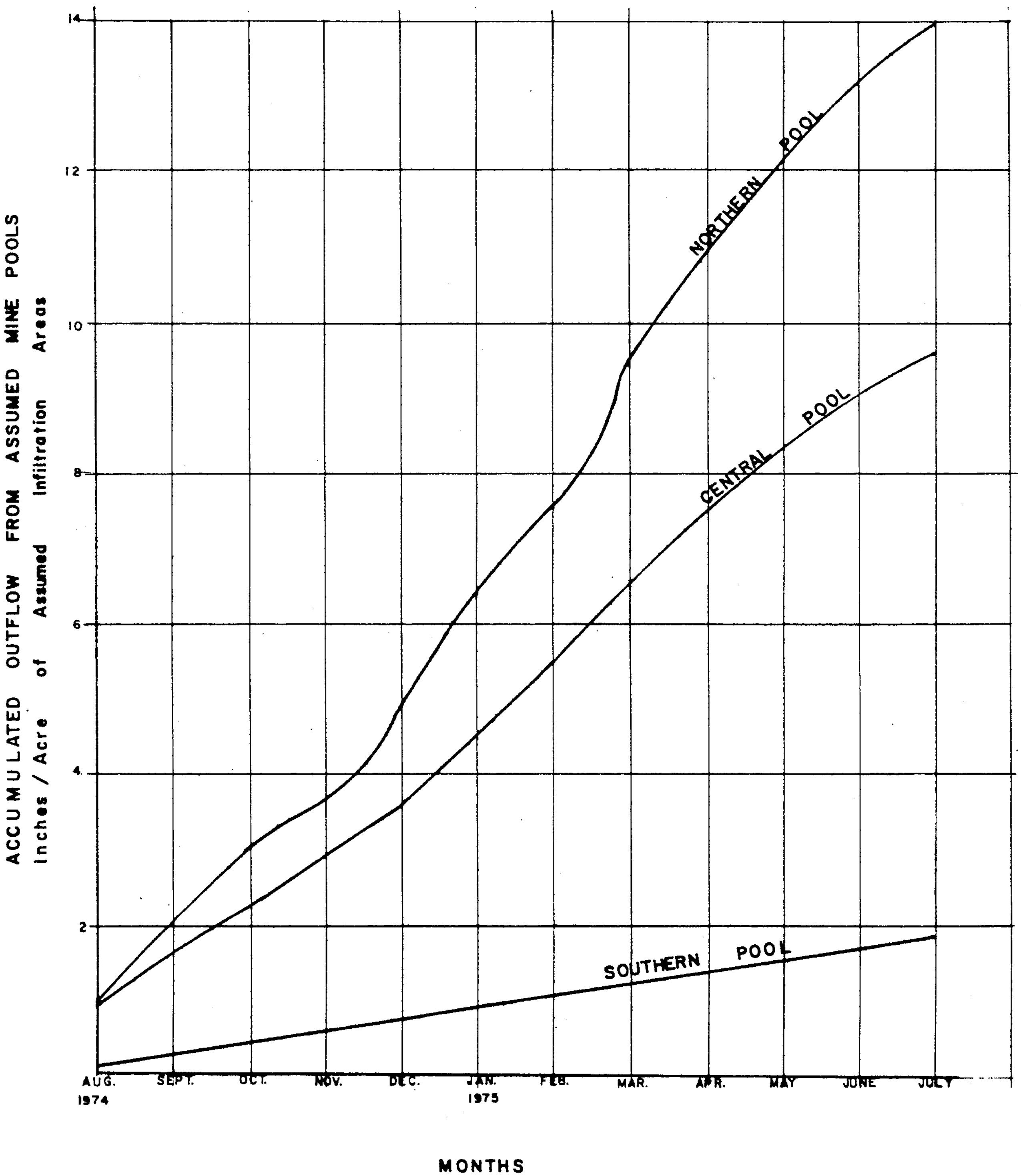


FIGURE 13

TABLE 6

MINE POOL INFILTRATION AREAS AND REQUIRED INFILTRATION RATES

	Total Surface Area	Infiltration Area	Percent of Total Surface Area	AMD Outflow	Infiltration Rate Required to Produce AMD
Northern Pool	15,700 acres	10,000 acres	64%	13.9 in/acre	34%
Central Pool	25,150 acres	11,100 acres	44%	9.6 in/acre	23%
Southern Pool*	8,260 acres	8,000 acres	97%	1.8 in/acre	4%

*Data from assumed southern pool is from Georges Creek Watershed, Preliminary Report, SL-186, July, 1974