

## INTRODUCTION

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### Purpose and Scope

Much of the Slippery Rock Creek Watershed is underlain by coal deposits which constitute an important economic mineral resource. Extensive commercial mining of coal began in the late 1800's. Initially, the coal was mined with little or no concern for the protection of the land surface and water supplies. These natural resources are necessary for a livable and pleasant environment. Mine drainage from numerous mines has contaminated and polluted many miles of streams in the watershed, principally in the headwaters. Acidity, iron, manganese, aluminum and sulfates contained in this mine drainage have destroyed aquatic life and rendered the streams unfit for domestic, industrial or recreational use.

Geologic conditions in 292 square mile Study Area of the Slippery Rock Creek Watershed were evaluated to understand their effect on the production of the mine drainage. Detailed information on the nature, distribution and structure of coal beds and associated strata; surface and subsurface water supplies, was obtained and analyzed. The work was done as a part of the engineering project in the watershed to determine the origin and sources of the mine drainage and the sufficiency of the remedial measures to be employed for its prevention and abatement - sealing of deep mines, refuse burial, water diversion, backfilling and revegetation.

Since January 1969, flow characteristics and water quality data have been obtained from 321 sampling and gauging stations in the study area of the watershed. Sources of mine drainage - deep mines, strip mines and refuse piles - have been identified, mapped and studied to determine their effect on stream quality. As a result of the engineering study, specific plans for abating mine drainage pollution from certain of these source areas have been developed and recommended.

When the proposed remedial work is accomplished, the water quality in the Slippery Rock Creek Watershed will be substantially improved. A monitoring program to measure the effectiveness of the reclamation projects has also been recommended.

## Location and Description

The Slippery Rock Creek Watershed drains an area of about 410 square miles, or 262,168 acres in west-central Pennsylvania. It is an irregular pie-shaped drainage basin, which generally trends in a northeast-southwest direction for approximately 30 miles. The Watershed has a maximum width of about 20 miles in the northeast portion, and narrows to approximately 3 miles at the southwest boundary and confluence with Connoquenessing Creek.

Included in the Watershed is the northwestern part of Butler County, the extreme southwestern part of Venango County, the southeastern part of Mercer County, the eastern part of Lawrence County and a small area along the county line in northeastern Beaver County. It is situated approximately 9 miles northwest of Butler and 35 miles north of Pittsburgh. (See Fig. 1.)

The principal features of the topography are shown on the fourteen U.S.G.S. 7½ Minute Topographic Quadrangles which cover the project area. Figure 2 is an outline map of the Slippery Rock Creek Watershed showing these 7½ Minute Quadrangle areas.

Two areas of the Watershed are not included in this mine drainage study: (See Fig. 2.) Area 1, comprising 102 square miles, or 65,357 acres, is the southernmost portion of the Watershed. It includes the 58.5 square mile Muddy Creek drainage basin – the site of 15,990 acre Moraine State Park. The most advanced mined land rehabilitation work is nearing completion in the park area. This work has consisted of deep mine sealing, strip mine restoration, mine refuse burial and surface sealing at an estimated cost of about 2.5 million dollars to prevent pollution of 3225 acre Lake Arthur. Area 2, consisting of 15.8 square miles, or 10,137 acres, is the drainage basin of the North Branch of the Slippery Rock Creek. Mine drainage pollution in this watershed will be abated by the treatment plant which has been completed at a cost of about \$728,000.00. These projects are funded under the \$500 million conservation bond issue, and are a part of the Pennsylvania Department of Mines and Mineral Industries Operation Scarlift Program.

Situated in the Pittsburgh Plateaus Section in the western part of the Appalachian Plateaus physiographic province, the Slippery Rock Creek Watershed is a broad moderately dissected upland. (See Fig. 3.) Surface features of the Watershed are in the early stage of maturity. The topography consists of gently rolling hills, which are often flat topped, and broad moderate to steep sided valleys with incised streams.

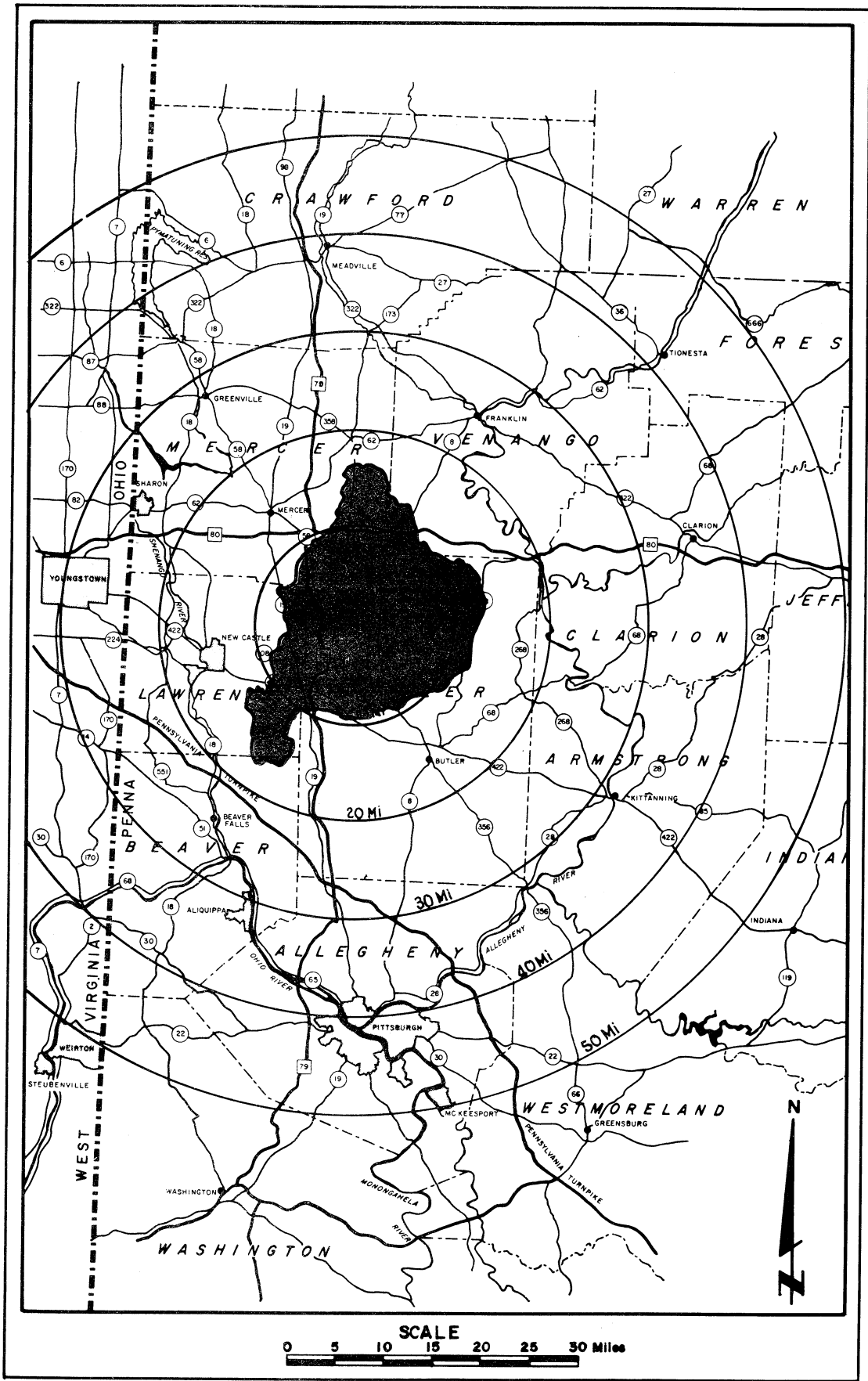
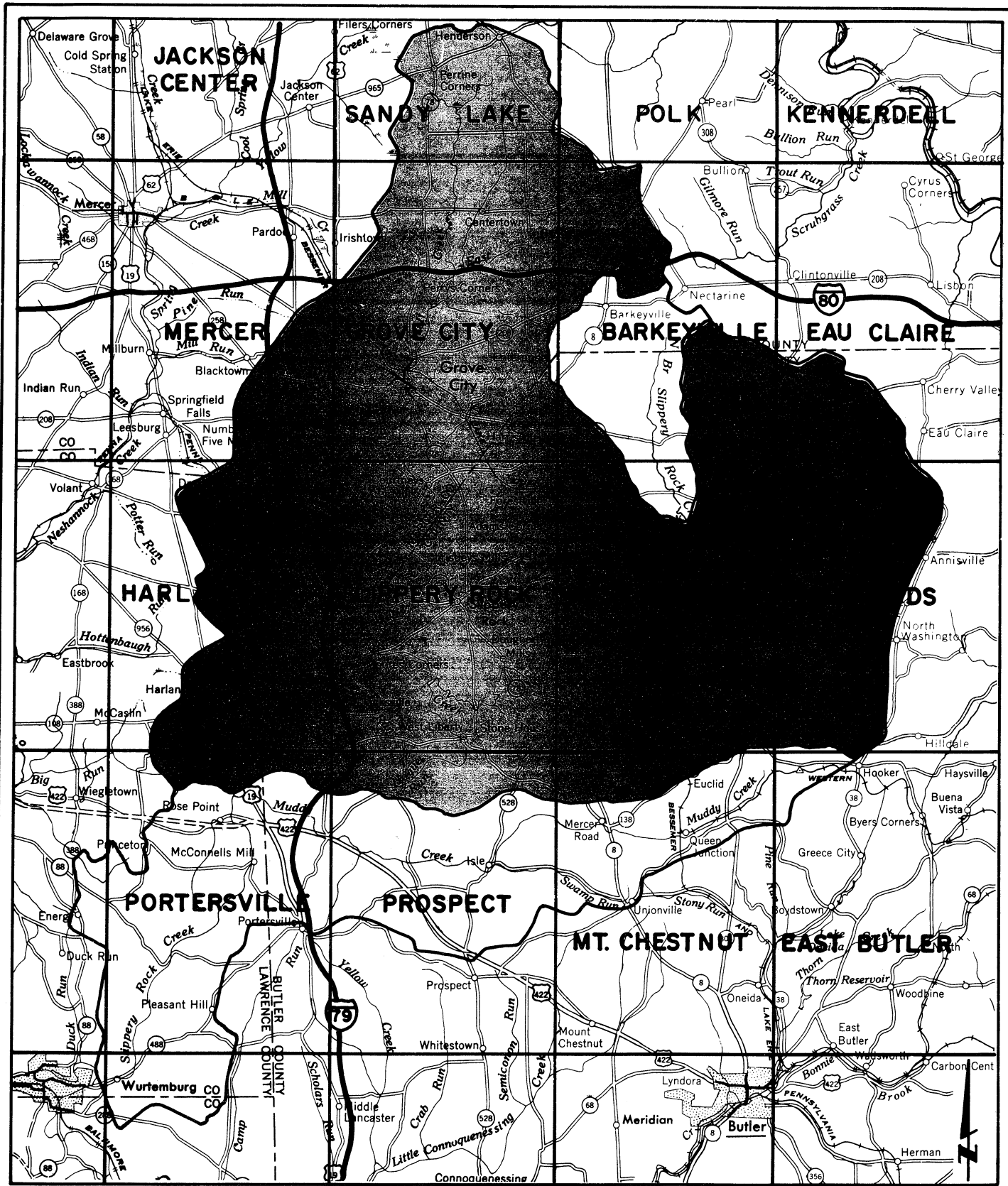


FIGURE 1. - Map of Western Pennsylvania showing the location of the Slippery Rock Creek Watershed.



WATERSHED BOUNDARY
  AREA OF PRESENT STUDY
  AREA EXCLUDED FROM PRESENT STUDY
  POLK

Scale 0 4 8 SM
 PUBLISHED 7 1/2' TOPOGRAPHIC QUADRANGLES

FIGURE 2. - Index Map of U.S.G.S. 7 1/2' Topographic Quadrangles in study area, showing principal centers of population and transportation routes.

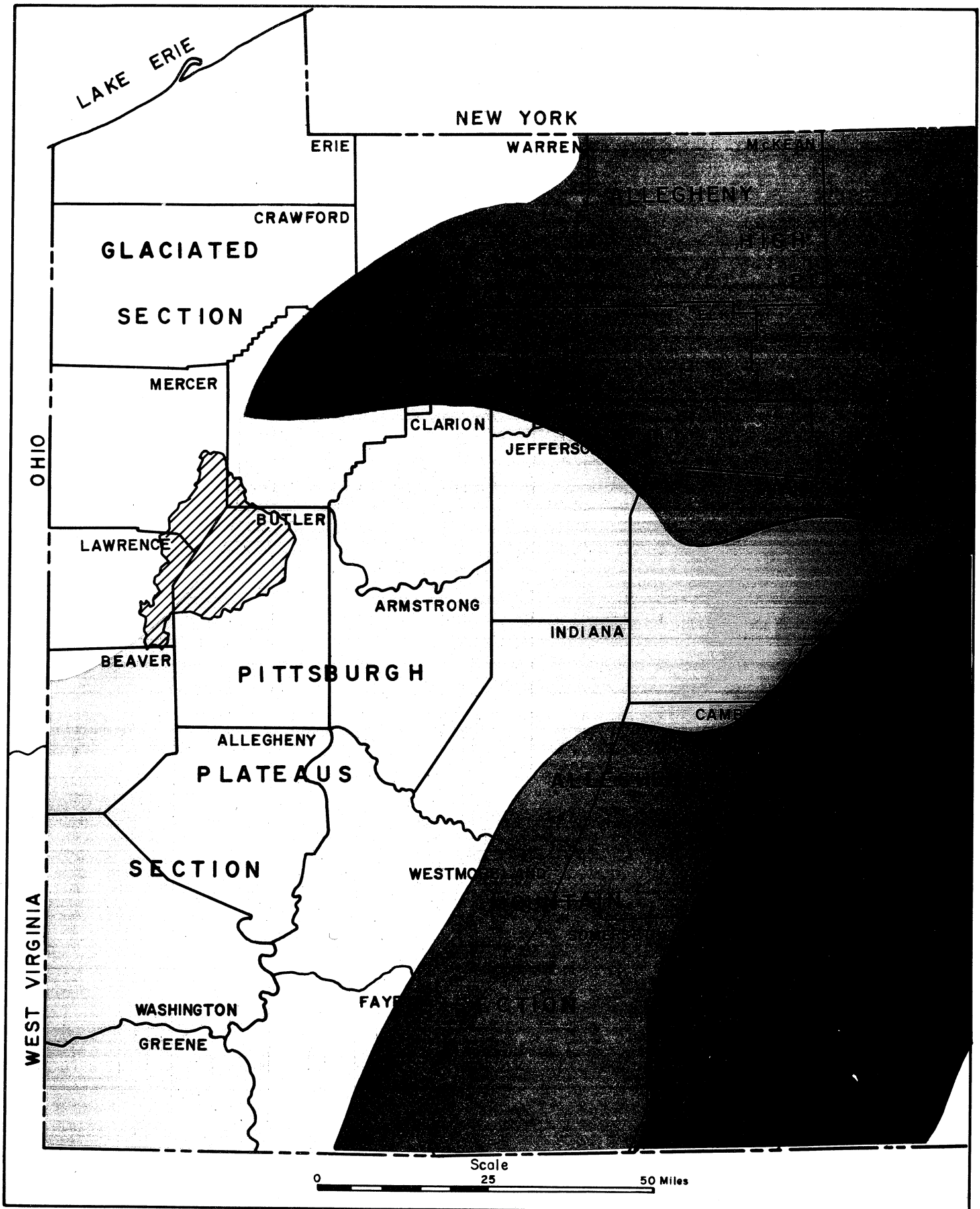


FIGURE 3. - Physiographic provinces of Western Pennsylvania showing location Slippery Rock Creek Watershed - From Pennsylvania Topographic and Geologic Survey Map.

Swamps are common in the lowland areas. They predominate in the Wolf Creek Watershed, where the drainage system was deranged by Illinoian and Wisconsin glaciation and the land surface is relatively flat. Slopes of 0 to 16 percent are prevalent throughout the watershed. Those exceeding 16 percent are located principally in the eastern and southern parts of the area.

The highest point in the Watershed is at the northern boundary, reaching an elevation of 1605 feet above sea level, in Worth Township, Mercer County, about one mile west of Hendersonville. Surface elevations diminish to 817 feet above sea level at the southern boundary, in Wayne Township, Lawrence County, at Wurtenburg, making the maximum relief of Watershed 788 feet. Local relief of 300 to 500 feet may occur near streams.

Slippery Rock Creek flows southwestward a distance of about 49.5 miles from its source in Venango Township, Butler County, to its point of confluence with Connoquenessing Creek at Wurtenburg, Wayne Township, Lawrence County. Above Kennedy Mill the stream meanders across flat flood plains. Below this point it flows through gorges carved by glacial waters. The Watershed has a dendritic drainage pattern form, except where deranged by glaciation. (See Fig. 4.) It has an average gradient of about 11.7 feet per mile, flowing from an elevation of 1430 feet at its source to 817 feet at the point of confluence with Connoquenessing Creek. The seventeen principal tributaries of the Watershed fed by flowing and intermittent streams have an average gradient of 35.4 feet per mile.

An intensive survey completed by the Butler County Planning Commission in 1967, showed that 223,426 acres, 85 percent of the total acreage in the watershed, is undeveloped or vacant land - mined-out, forest, water, swamp, agriculture and unused land. The remaining 38,742 acres, 15 percent of the watershed area, are developed for urban uses - residential, manufacturing, transportation, communication, utilities, trade, educational and governmental services, outdoor recreation and active mining.

Slippery Rock Borough (1966 population 2678) and Grove City (1966 population 9000) are the major centers of population located in the central and northwestern portions of the Watershed respectively. Numerous smaller communities are scattered throughout the Watershed. These include West Liberty, Kiesters, Hallston, West Sunbury, North Washington, Whiskerville, Hilliards, Moniteau, Argentine, Annisville, Boyers, Bovard, Murrinsville, Harrisville, Branchton, Forestville, Barkeyville, Harlansburg, Portersville, Prospect and Wurtenburg. In 1966 the Watershed had an estimated total population of 36,957.

Primary and secondary roads provide access to all parts of the Watershed. It was determined by the Butler County Planning Commission in 1967 that approximately 877 miles of open highway right-of-way exist within the Watershed.

Interstate 79 – Erie Expressway – crosses the western part of the area in a north-south direction, and Interstate 80 – Keystone Shortway – traverses the extreme northern end of the Watershed in an east-west direction.

The Watershed has a rail network of about 40 miles, and is serviced by the Bessemer and Lake Erie, and the West Allegheny railroads.

Climatologic data show that annual precipitation in the Watershed averages 40 inches, ranging from an average of 38 inches in the western part to 40 inches in the eastern part. Precipitation is well distributed throughout the year. A moderate amount of snowfall – about 49 inches – occurs in the winter months. Temperature during the winter months averages about 30°F and the summer temperature averages about 70°F. Considerable variations in the temperature occur which are characteristic of a Mid-Latitude Humid Continental climate.

#### Previous Investigations

In 1963 the Pennsylvania Department of Health conducted a comprehensive study of the Watershed to determine the effects of coal mining on stream quality. Results of this investigation were presented in a report which was approved and adopted by the Sanitary Water Board in 1965.

The study showed that the mine drainage problem in the Watershed is long-standing. In the early 1900's streams in the Watershed began to deteriorate when they received discharges of acid water from the first underground coal mines. Acid mine drainage from strip mine operations which started in the 1940's further contributed to the damages to water resources, property, aquatic life, recreational and esthetic values.

It was determined that the main stream was polluted from tributaries comprising less than 25 percent of the total drainage area of the Watershed, and that 70 percent of the total acid load originated in the headwaters above the confluence with Seaton Creek. Over 83 percent of the acid mine water was emanating from abandoned underground workings.



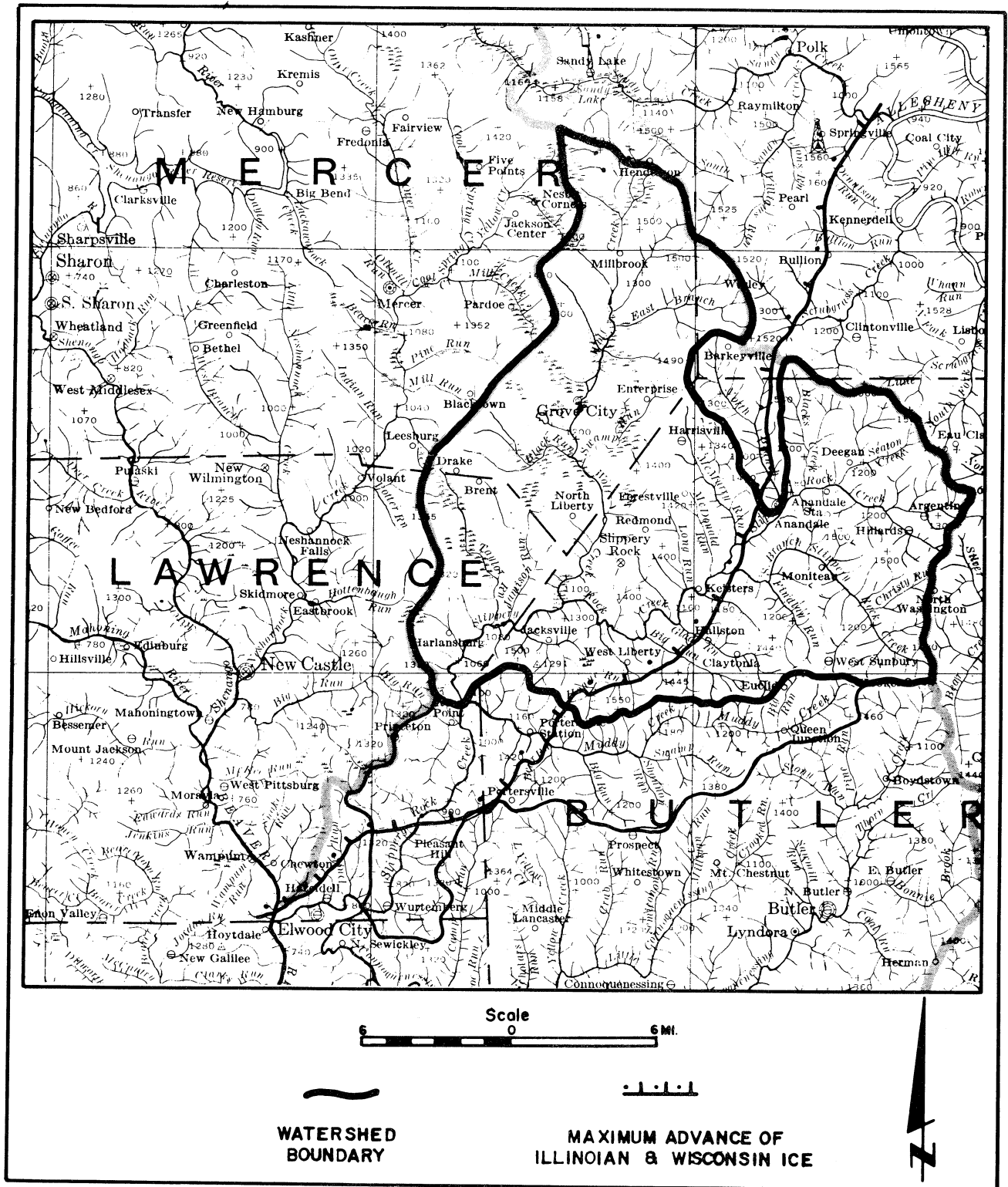


FIGURE 4. - Stream map in study area showing drainage pattern and maximum advance of Illinoian and Wisconsin ice - From Stream map of Pennsylvania, Higbee 1965.

This study further pointed out that acid mine drainage from the upper reaches of the Watershed was neutralized for 17 years by an alkaline discharge from the Annandale Plant of the Michigan Limestone Company near Boyers. When plant operations ceased in 1957, acid mine waters again polluted Slippery Rock Creek some distance downstream from the plant site to a point below Bovard. Slippery Rock Creek has also received large quantities of flushed out acid water during periods of heavy rainfall, with adverse effects on aquatic life.

A subsequent report on the pollution of Slippery Rock Creek, submitted to the Pennsylvania Department of Health in 1967 by Chester Engineers, Pittsburgh, confirmed the findings of the earlier study. This investigation indicated that the dimensions of the acid mine drainage problem in the Watershed are essentially the same as those described in these earlier reports.