

COMMONWEALTH OF PENNSYLVANIA

GOVERNOR MILTON J. SHAPP

DEPARTMENT OF ENVIRONMENTAL RESOURCES

SECRETARY MAURICE K. GODDARD

OFFICE OF

RESOURCES MANAGEMENT

C.H. McCONNELL, DEPUTY SECRETARY

DEPARTMENT OF ENVIRONMENTAL RESOURCES

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PROJECT SL 193
DEER CREEK WATERSHED
CLARION COUNTY, PENNSYLVANIA

INTRODUCTION

GENERAL

The Deer Creek Watershed has been the subject of intensive mineral resource recovery operations for the past one hundred and fifty years. Primarily, these activities have included the surface and underground extraction of bituminous coal and the drilling for petroleum and natural gas.

These operations, however, have had an adverse impact on the land and water environment of the Deer Creek Watershed. Most streams within the watershed are virtually devoid of aquatic life. Significant amounts of dissolved minerals in these waters has effectively disrupted the delicate biological environment. In addition, the water quality is such to preclude its use for human consumption or recreation. The pollution ultimately has its origin from abandoned mining operations. The resultant contamination is known as acid mine drainage.

The land affected by past mining activities in the watershed has been greatly disrupted. Un-vegetated spoil piles with little or no backfilling stand as mute testimony to this fact. The affected area is unsuitable for agricultural, commercial or conservational purposes. In addition, land of this nature is subject to severe erosion and greatly increases the sediment load to receiving streams. This further reduces the capacity of the streams to sustain aquatic life.

In order to effectively deal with acid mine drainage and its related problems, preliminary investigations are necessary. Studies of this nature identify and quantify problem areas and in turn provide the basis for effective means of dealing with the problems. The following report of the Deer Creek Watershed is one such endeavor.

The study initially involved a cursory sampling program of all streams tributary to the Deer Creek Watershed. As a result, the degree and extent of pollution due to acid mine drainage could be determined. In conjunction with this, monitoring stations were established to reveal a profile of water quality along Deer Creek and its main tributaries.

An investigation was then made of all surface and subsurface mining operations along with oil or gas wells located within the watershed. Sources discharging acid mine drainage were identified along with a survey of those areas capable of producing the same. Considerable public and private information was utilized to facilitate this procedure.

Once the sources of pollution were identified, a large scale flow measurement and sampling program was initiated. The data provided an accurate and quantitative measurement of the amount of acid mine drainage discharged to the watershed from each individual source.

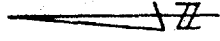
An analysis of the data from all the sources revealed certain areas responsible for discharging large amounts of acid mine drainage. These areas were studied in more detail as to the conditions responsible for the pollution. This study involved disciplines of geology, hydrology, and mining engineering that were applicable to the acid mine drainage problem. However, the origins of pollution from particular sources were not readily discernible. Therefore, an exploratory drilling program was initiated to confirm suspected correlations between certain mining operations and the discharge points.

After a complete evaluation of the conditions responsible for the mine drainage pollution, recommendations were developed for each area. Each site was analyzed as to the engineering feasibility of various abatement alternatives. A determination was also made of the most cost effective methods of abatement. The combination of these judgements resulted in an abatement plan for each project area in the Deer Creek Watershed. An estimate of the costs necessary to perform the proposed work were compiled for each project. The projects were assigned priorities relative to the amount of acid mine drainage each area was discharging.

It is felt that the implementation of the measures as outlined will improve the overall water quality within the Deer Creek Watershed. In addition, the proposed abatement plan will return considerable portions of land to useful and productive purposes. The resultant benefits will no doubt improve the overall quality of life for people in the immediate area.

LOCATION AND DESCRIPTION

The Deer Creek Watershed is located in the west-central portion of the Clarion River Basin and directly northwest of the Borough of Clarion. The watershed is surrounded on the east by Toby Creek, to the south by the Clarion River and a number of its minor tributaries, on the west by Canoe Creek, and



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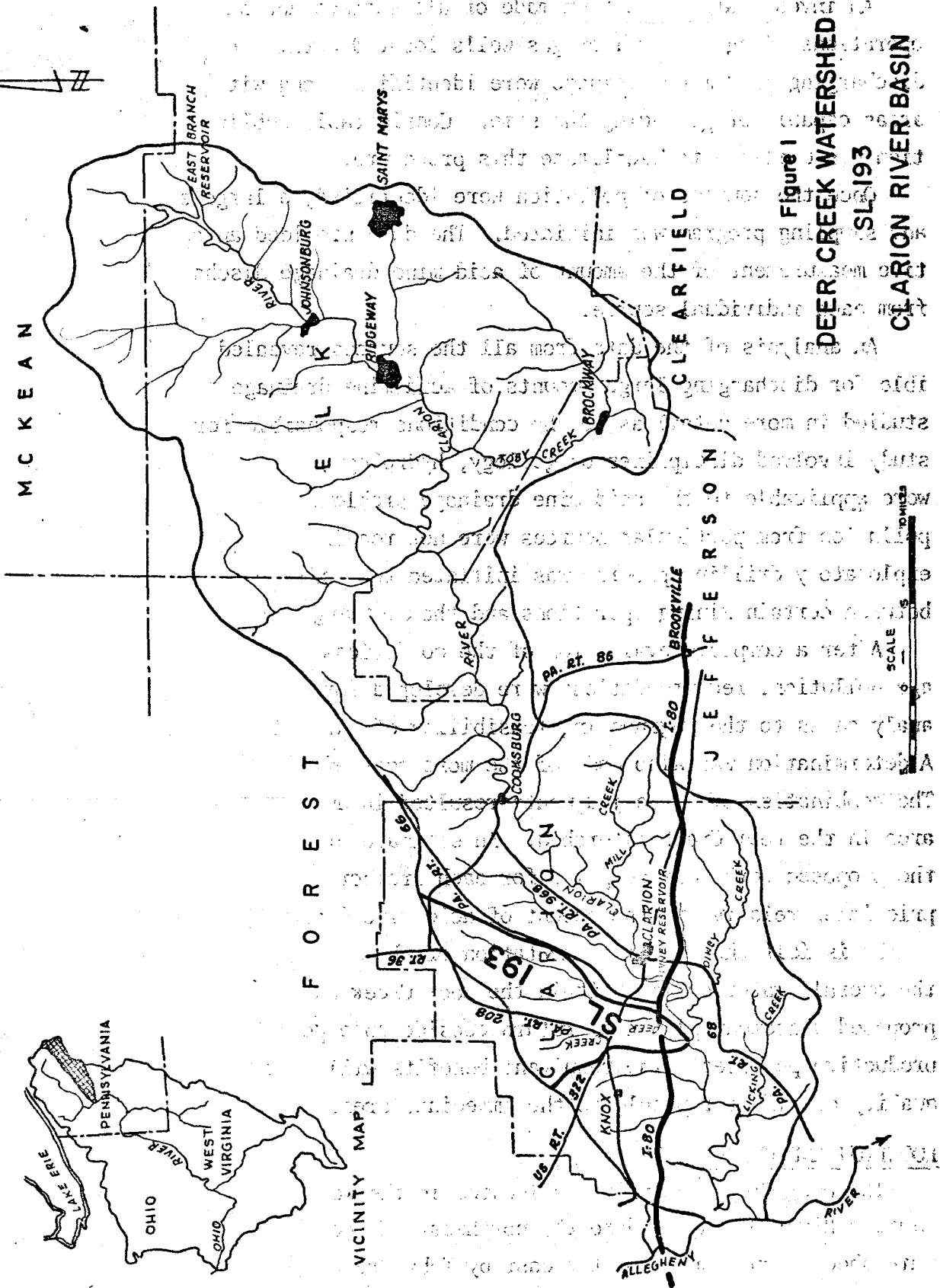


Figure 1

DEER CREEK WATERSHED
SL-193
CLARION RIVER BASIN

SCALE 1 MILE

VICINITY MAP

on the north by drainage to East Sandy Creek and Tionesta Creek. Deer Creek is fed primarily by Paint Creek, Licking Creek, Little Paint Creek, Little Deer Creek, and several smaller, feeder streams.

Deer Creek rises in north central Clarion County and flows southwest for some 18 miles to its confluence with the Clarion River. The creek drains an area of 37 square miles and is located entirely within Clarion County. The watershed attains a maximum width of 8 miles and an approximate length of 13 miles. The maximum relief attained is 810 feet ranging from an elevation of 1805 near Fryeburg to elevation of 1000 at the mouth of Deer Creek. near Fryburg to Local relief up to 400 feet is found in some of the larger stream valleys. The average gradient Creek is estimated to be 27 feet per mile.

Physiographically, the watershed is located in the Pittsburgh Plateau Section of the Appalachian Plateau Province. Topography varies considerably from the headwaters to the mouth with wide alleys and gently rolling hills predominating the northern reaches and narrow 'U' shaped valleys spaced between steep hillsides more prevalent to the south.

Several small communities are located in the watershed. To the north lies the villages of Frills Corners, Tylersburg, Strobleton and Lickingville. The central portion contains Lucinda, Huefner, Millerstown, Haynie, Billings, Arthurs and the Borough of Chippendale. The watershed also falls within the limits of five municipal townships of Clarion County. They include Elk, Beaver, Knox, Farmington and Paint Townships.

The topographic features of the Deer Creek Watershed are contained on the following 7 1/2 minute quadrangle series of the United States Geological Survey: Clarion, Knox, Kossuth, Fryburg, Lucinda, and Tylersburg

The coal industry was the main economic activity in the watershed prior to the 1970's. Most of the economically recoverable coal has been exhausted. Upon the decline of the coal mining, oil and gas industries, agriculture and lumbering watershed area.

The entire watershed area is readily accessible by a network of secondary roads and the following major highway arteries: Interstate 80, U.S. Route 322, and PA Routes 36, 66, 208, and 854. The Baltimore and Ohio Railroad and the Consolidated Railroad Corporation (Conrail) also service the area. The climate is typified by invasions of sub-tropical air masses in the summer and polar air masses in the winter. The average precipitation is 44 inches per year.

PREVIOUS INVESTIGATIONS

The Clarion River Basin of Clarion County has been partially studied on numerous occasions beginning in the late 1800's. In 1879, H.M. Chance published "The Geology of Clarion County," for the Second Geological Survey of Pennsylvania. This report was a detailed investigation on the geology and structure of post pre-Cambrian sedimentary rocks exposed in Clarion County, and discussed the present day drainage systems of the Clarion River and its tributaries. The "Foxburg-Clarion Folio #178," published by the United States Geological Survey in 1911, covered the geology, geologic history and mineral resources of the Foxburg-Clarion Quadrangles. In 1943 the U. S Public Health Service reported the 1940 acid stream conditions of certain tributaries of the Clarion River Basin.

During 1966, the Office of Water Programs of the Environmental Protection Agency in Wheeling, West Virginia conducted a stream quality survey of the Allegheny River Basin as part of the overall Appalachia Water Resources Survey. In the Clarion River area, a network of 12 stream sampling stations was established for repetitive sampling and flow measurements during 1966. Station #514 located at the mouth of Deer Creek was one such station. A cooperative study by the Environmental Protection Agency and the Pennsylvania Department of Health was conducted from May to October of 1967. The study examined the principle mine drainage problem areas in the Clarion River Basin. Approximately 90 mining sites and 1600 acres of strip-mined land were investigated in the Deer Creek Watershed. Fifty-seven sites were monitored during this time period. Of these sites, 6 locations were identified as principal pollution sources and accounted for 75% of the total acid load measured. The Mineral Industries Division of Gwin Engineers, Inc. (now Gwin, Dobson and Foreman, Inc., Consulting Engineers) published a report entitled "Preliminary Report of Mine Drainage Abatement and Land Reclamation" for the United States Army Corps of Engineers in May 1970. The study investigated the extent of acid mine drainage of six tributary watershed to the Clarion River including Deer Creek.

The total acid loads at the mouth of Deer Creek for each preceding

 are summarized in Table 1.

SAMPLING AGENCY	DATE OF SAMPLE	NO. SAMPLES	FLOW (gpm)	ACID LOAD (ppd)
EPA	1966	6	8685	13,845
EPA & DER	6/67	1	7110	21,756
Gwin Engineers, Inc US Army Corps of Engineers	5/70	1	13,465	7,475
Current Study	12/73 - 9/74	4	28,965	14,110

The United States Geological Survey is presently conducting a study of the Water quality of the Redbank Creek and Clarion River Basins. Acid mine drainage will again be monitored for Deer Creek and surrounding tributaries.

SUMMARY

The Deer Creek Watershed was the subject of an extensive investigation relative to stream pollution due to acid mine drainage. Over 280 source sampling stations were monitored over a 12-month period to determine the degree and extent of mine drainage generated within the basin. Eighteen stream (18) sampling stations were established to monitor the affect the pollution was having on various reaches of Deer Creek and its major tributaries. The geology of abandoned mine sites and related operations were analyzed in detail to determine the conditions responsible for the formation of acid mine drainage. After an examination of all applicable data, areas were designated for pollution abatement. General recommendations were formulated for these areas utilizing proven engineering abatement methods in acid mine drainage control. Pollution reduction and cost estimates with priorities were then developed for each project area.

The following summary is intended to reveal the major findings and pertinent observations determined as a result of the acid mine drainage study of the Deer Creek Watershed.

1. Deer Creek is severely degraded by acid mine drainage along its entire length. All of the major tributaries within the watershed are in an acidic condition. The Paint Creek sub-watershed accounts for 70% of the pollution, while Deer Creek above Shippenville accounts for the remaining 25-30%.
2. Deer Creek is a substantial and consistent acid tributary to the Clarion River. Results of the stream sampling program show the following mineral constituents added to the Clarion River: acid - over 10 tons/day; iron - over .75 tons/day; sulphates - over 40 tons/day.
3. Abandoned surface mines that operated in the Clarion coal and associated overburden are the major sources of acid mine drainage in the watershed. Other sources of acid mine drainage, in order of magnitude, are: flowing oil or gas wells, deep mines, springs and coal tippel runoff.
4. Pollution to local groundwater systems exiting at the surface as springs often has its origins (as determined by the drilling program) on surface mines topographically situated on ridge tops. Direct abatement of this source of pollution is not felt to be possible. An evaluation of adjacent watersheds indicates similar conditions of groundwater contamination. It would appear that the poor groundwater quality observed may be a

regionalized problem and not solely due to local conditions. However, flows from these areas may be reduced or improved following implementation of various abatement measures in the northern Clarion County region.

5. Little neutralization to the acidity in Deer Creek due to the absence of carbonates (e.g., limestone) in the watershed. In consideration of this and other factors, it is not known whether Deer Creek can ever be returned to a non-acidic condition. However, significant reduction to Deer Creek and the Clarion River could be accomplished by various abatement measures designated for the watershed.

6. Strip mine reclamation is felt to be the most effective method of controlling acid mine drainage in the Deer Creek Watershed. The plugging of flowing gas wells is felt to be the next most effective means. The total cost (1978) of acid mine drainage abatement in the Deer Creek Watershed approaches 14 million dollars.

7. A loss of flow on Deer Creek occurs between the mouth and the juncture of Deer Creek and Paint Creek. This may be due, in part, to the infiltration of flow into alluvium in this reach. It is recommended that future monitoring of Deer Creek relative to the overall contribution of mine drainage to the Clarion River be made at some point before the affect of stream flow loss becomes evident at the mouth (e.g., first bend above mouth).