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Bureau of Mining and Reclamation

Technical Study Document

for

A Petition to Designate Areas Unsuitable for Mining

Petition 26949901

Indian Creek

Fayette and Westmoreland Counties

Environmental Analysis & Support
Room 213, Executive House
P.O. Box 8461
Harrisburg, PA 17105-8461

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I. INTRODUCTION

Executive Summary

A petition to designate an area in Fayette and Westmoreland Counties as unsuitable for mining was received by the Department on April 20, 1994. The petition was submitted by Beverly Braverman, representing the Mountain Watershed Association. The petition area included an approximately 10,000 acre portion of the Indian Creek watershed located in Saltlick Township, Fayette County, and Donegal Township and Donegal Borough, Westmoreland County (Figure 1). The Department determined the petition was complete and notified the petitioners on May 19, 1994, that the petition was accepted for technical study.

The petitioners alleged that reclamation of surface and underground mining is not technologically and economically feasible because previous mining has resulted in acid mine drainage that has degraded the surface and groundwater. The petitioners also alleged that further mining would adversely affect aquatic resources, recreational and natural areas, and historic buildings, and would degrade or diminish public and private water supplies, springs and aquifers.

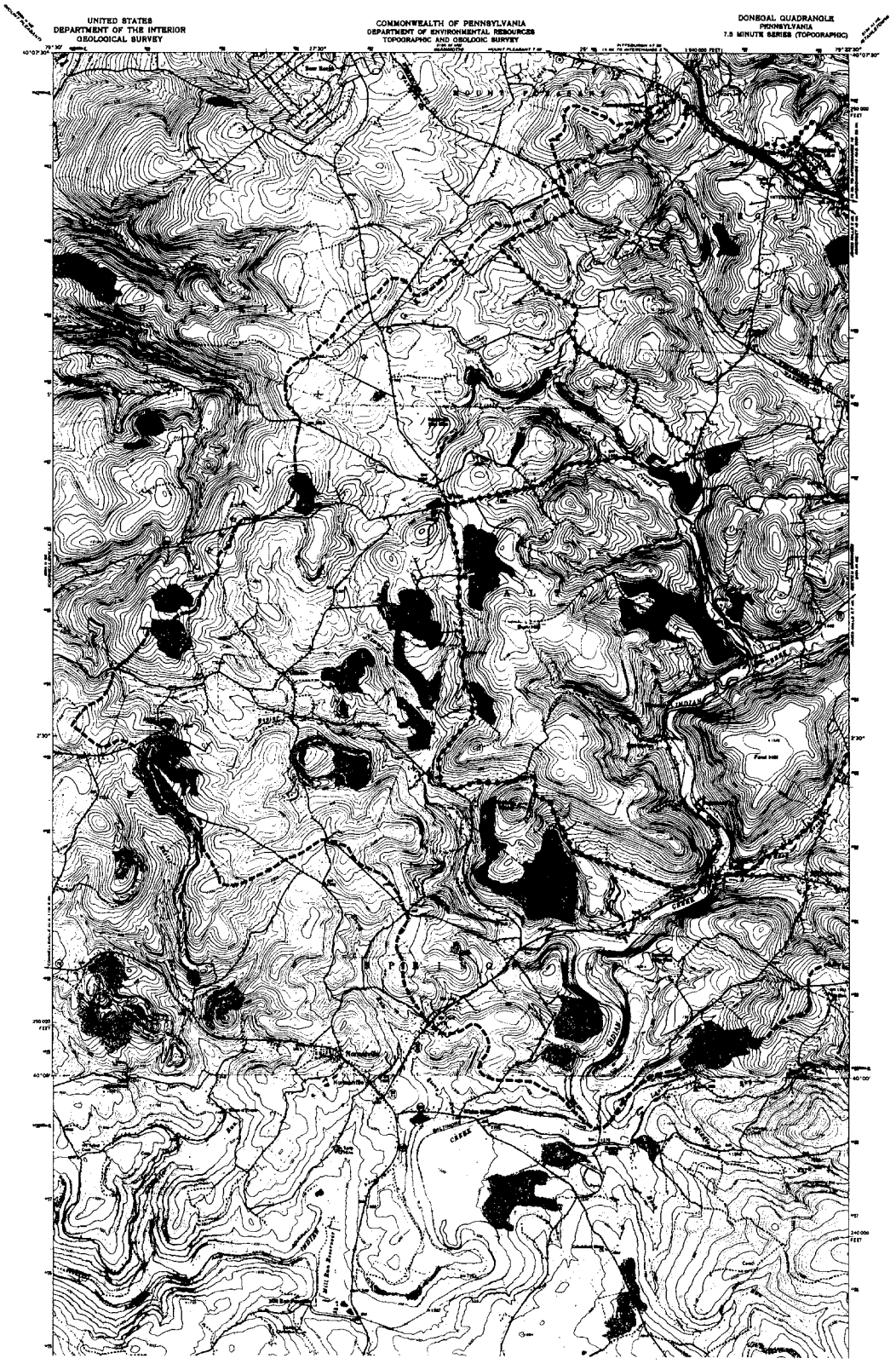
In order to evaluate the effects of surface and underground mining on the resources that the petitioners are seeking to protect, the Department enlarged the technical study area to include the entire surface water drainage area of Indian Creek upstream from the village of Rogers Mill, a total of approximately 49,871 acres. The study area includes portions of Saltlick and Springfield Townships, Fayette County, Donegal Township and Donegal Borough, Westmoreland County and Middlecreek Township and Seven Springs Borough, Somerset County.

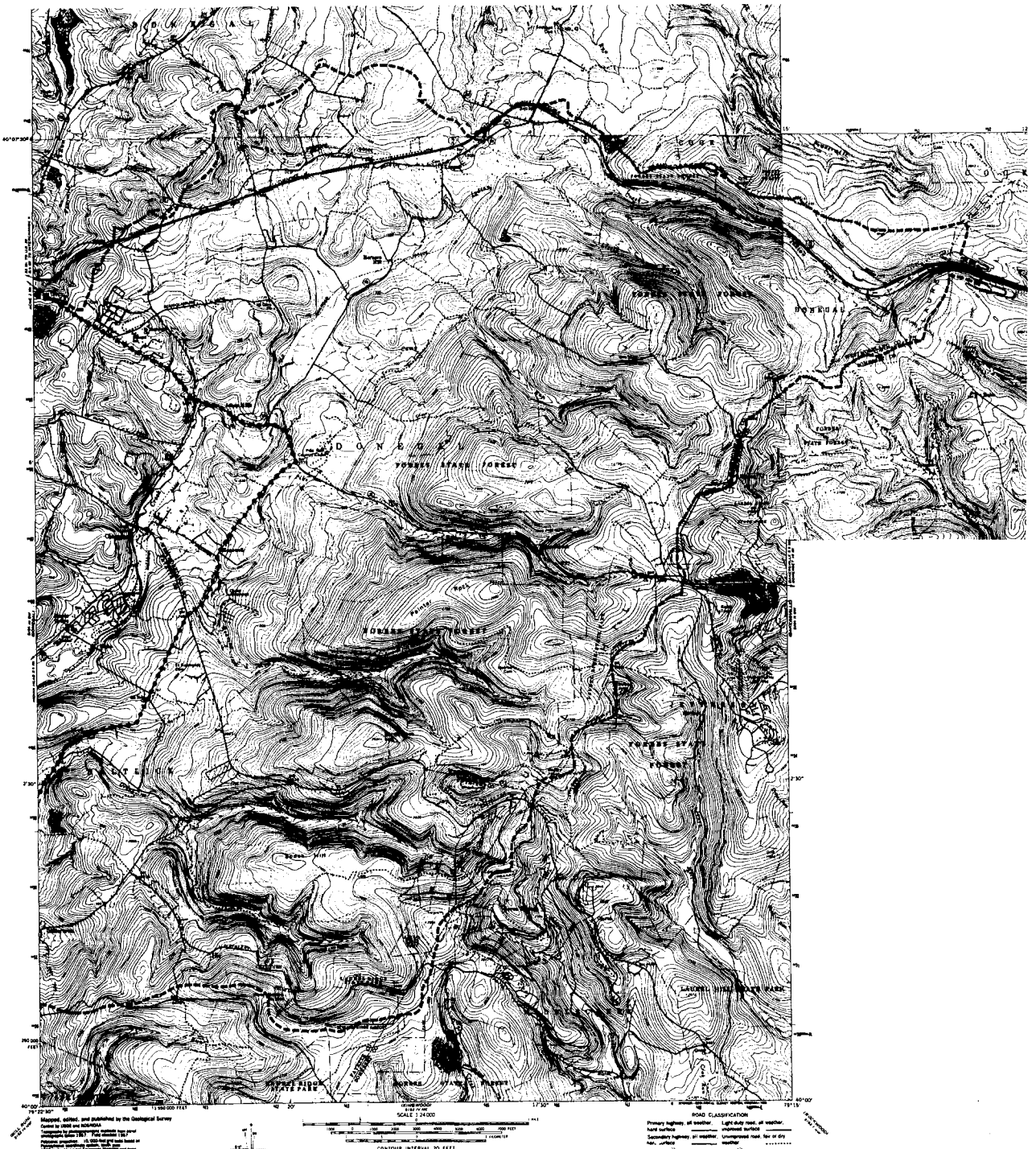
The geology of the study area is influenced by broad, nearly symmetrical, folds which trend approximately N. 30° E. The axial trace of the Ohiopyle (Ligonier) syncline roughly parallels Indian Creek. The western limb of this structure rises at a rate of approximately four percent northwest to the Chestnut Ridge anticline. The eastern limb rises more abruptly at six to eight percent to the southeast to become the topographically higher, Laurel Hill anticline. As a result of the relatively steep dip of the rock strata along the flanks of these structures, the older Pennsylvanian and Mississippian rocks are found at the top of these ridges and the stratigraphically higher, younger Pennsylvanian rocks are found in the lower elevations along Indian Creek and its tributaries.

The study area was found to contain mineable reserves of the Mahoning coal of the Conemaugh Group and of the Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning and Brookville-Clarion coals of the Allegheny Group. The Brush Creek and Lower Kittanning coals are either absent or are not of mineable thickness within the study area. Information concerning the coal resources within the Pottsville Group was not available. The majority of the study area south and east of Indian Creek is underlain by strata of the Pottsville Group and the noncoal bearing strata of the Mississippian System.

Underground coal mining began in this area in the mid 19th century and continued until the 1960's when surface coal mining became the prevalent coal extraction method. A significant portion of the study area between the mouth of Poplar Run and the village of Melcroft contains underground mines on the Middle Kittanning coal.

Figure 1. Map of the petition area and the Indian Creek study area.


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
DONEGAL QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



••••••• PETITION AREA ----- STUDY AREA

These large underground mines were connected by a system of pipes and tunnels known as the "flume", which was constructed in the 1920's to collect acid mine drainage from the mines and direct it downstream to a discharge point below the Mill Run Reservoir on Indian Creek. As the underground mines expanded in size, the volume of water exceeded the capacity of the flume and discharges developed along the coal crop. Despite attempts to upgrade and repair the flume, acidic water from these mines now flows into Indian Creek from abandoned mine portals and coal crop discharges. Smaller, country bank underground mines were also developed on the Lower Freeport and Middle Kittanning coals within the Little Champion Creek watershed, on the Lower Freeport coal within the Back Creek watershed, and on the Middle Kittanning coal within Poplar Run and the headwaters area of Indian Creek.

No active underground mining is currently being conducted within the study area. In August 1993, Rand Am, Inc. submitted Mine Permit Application #26931301 requesting to conduct underground coal mining on a 2,977 acre portion of the study area.

Surface coal mining has occurred on all of the coals found within the study area except the Brush Creek coal. The majority of this surface mining occurred on the Upper Freeport and Middle Kittanning coals within the Little Champion Creek and Poplar Run watersheds. Only two surface mines were in operation during the study; one mine operated by Purco Coal Company, Inc. near the village of Clinton and another mine operated by Pine Flats Coal Company, Inc. on an area approximately two miles northwest of the village of Melcroft. Both were mining the Upper and Middle Kittanning coals. The proposed Rand Am, Inc. underground mine planned to use the Pine Flats Coal Company surface mine area as the entry point for underground mining on the Middle Kittanning coal.

The determination of the potential water quality expected to result from mining activities within a given area must consider the initial chemical quality of the natural water systems, the effects of previous mining methods on the water quality and the chemical characteristics, relative abundance, and distribution of alkaline and potentially toxic material to be encountered by mining.

Chemical analyses of rock strata were performed on samples from 30 drill holes located within the study area. Analyses results indicated that the rock strata from the land surface down to a depth of 25 to 40 feet contained little or no alkaline material and generally low sulfur values, regardless of stratigraphic interval or lithology. The low alkalinity and sulfur content is believed to have resulted from weathering of the minerals in the near surface rock and subsequent leaching of calcium carbonate and sulfide minerals.

Below the weathered zone, strata associated with the Upper Freeport coal generally exhibit moderate neutralization potential (NP) with potentially toxic strata restricted to the 3 to 10 feet of strata immediately above the coal where sulfur values ranged from 0.6 to 5.0 percent.

The Lower Freeport coal was found to be thin and discontinuous throughout much of the study area with reported coal thickness ranging from a trace to 2.7 feet. Chemical analyses results from the strata associated with this coal indicate

significant variations in chemical quality, with several drill holes reporting 26 to 52 feet of strata with NP ranging from 35 to 237 and other drill holes in close proximity reporting no significant NP.

The Upper Kittanning coal was identified as a split coal separated by 1.5 to 2.0 feet of shale or siltstone. A thin, discontinuous rider coal was reported in several drill holes as occurring approximately 18 to 21 feet above the Upper Kittanning coal. Analyses of the strata associated with the Upper Kittanning coal indicates variable chemical quality with generally low NP. Approximately 8 to 12 feet of strata contain NP ranging from 33.85 to 135.84 and another 6 to 8 feet of strata have sulfur values of 0.51 to 2.65 percent. Where the rider coal is absent, the interval may contain 2 to 8 feet of strata with sulfur values ranging from 0.59 to 1.94 percent.

Analyses of strata associated with the Middle Kittanning coal found 26 to 44 feet of strata with NP over 30, including 8 to 12 feet of strata identified in drilling records as limestone, which exhibited NP ranging from 234 to 532. The stratigraphic position of this alkaline zone corresponds to the stratigraphic position of the Johnstown limestone in this area. The analyses also identified several strata with sulfur values ranging from 0.56 to 1.94 percent including a 4 foot section of the alkaline zone. Sulfur values for the recorded strata immediately above and below the Middle Kittanning coal ranged from 0.76 to 3.10 percent sulfur.

No overburden analysis data was available for the strata below the Middle Kittanning coal.

Groundwater movement within and adjacent to the study area is primarily controlled by lithology, stratigraphy, and regional geologic structure, and to a lesser extent by topography. Water infiltrates and accumulates in discrete permeable lithologic units and moves within these lithologic units down the anticlinal limbs of Chestnut Ridge and Laurel Hill towards the trough of the Ohiopyle (Ligonier) syncline which is positioned near and beneath Indian Creek. Regional topography influences the occurrence and movement of local groundwater in two ways. First, the exposure of stratigraphically confined local aquifer formations as outcrops along the sides of many hills in the study area allows discharges from the aquifers in the form of numerous springs. Secondly, the larger, gentler slope of the topographic exposure of the Allegheny Group west of Indian Creek allows for greater recharge of groundwater within this area than occurs on the steeper slopes and much less exposed areas of the Allegheny Group east of Indian Creek.

Results of chemical analyses of surface water samples indicate significant variations in water quality within the study area. The water quality of the unmined portion of the Indian Creek watershed upstream of the village of Melcroft varies from lightly buffered, naturally low pH streams originating from Mississippian strata on Laurel Hill to the near neutral pH, alkaline tributaries of the northwestern side of the watershed. This area contains diverse macroinvertebrate populations and has reproduction of native brook trout within the tributaries. Indian Creek from Melcroft to Jones Mills is stocked with trout by the Pennsylvania Fish and Boat Commission. Indian Creek tributaries,

which originate or receive drainage from areas adjacent to the Pennsylvania Turnpike, were found to contain elevated concentrations of sodium, chloride, and calcium resulting from road salt anti-skid.

Water sample analysis results indicate that Champion Creek and Little Champion Creek are generally alkaline, however, post mining discharges from surface and underground mines have caused elevated concentrations of iron and manganese in some stream sections. Macroinvertebrate diversity and fish species present are consistent with the shallow, warm water habitat found in these tributaries.

Analyses results indicate that acid discharges, containing elevated concentrations of iron, manganese, and aluminum, enter Indian Creek from abandoned Middle Kittanning underground mines between Melcroft and the confluence of Poplar Run. These discharges vary seasonally, with the greatest concentration of acidity and metals occurring under low flow conditions. Indian Creek generally contains sufficient flow to dilute these discharges and maintain pH's above 6.0 with some alkalinity; however, iron precipitate covers the stream substrate downstream to the village of Indian Head. Macroinvertebrate communities were depressed in this stream section as a result of iron precipitate, particularly during low flow conditions.

Analyses results from water samples of Back Creek, which enters Indian Creek from the east at Indian Head, show that the water quality is similar to the eastern headwaters tributaries of Indian Creek. The headwaters sections of Back Creek originate and flow through areas underlain by Pottsville Group and Mississippian strata and exhibit pH of 6.0 or less with low alkalinity and metals. Lower stream reaches generally have near neutral pH, moderate alkalinity and low metals concentrations. Back Creek contains diverse macroinvertebrate communities and naturally reproducing populations of brook trout and brown trout and is stocked with trout by the Pennsylvania Fish and Boat Commission. Two mine discharges were documented on a reclaimed Upper Freeport coal surface mine area (Better Mining Company, SMP 3375SM30). The discharges do not appear to adversely impact the water quality of Back Creek downstream of the mine.

The most downstream named tributary to Indian Creek within the study area is Poplar Run. Underground mining of the Middle Kittanning coal and surface mining of the Upper and Lower Freeport coals, Upper and Middle Kittanning coals, and the Brookville-Clarion coal has occurred within this watershed. Results of water sample analyses indicate that acidic discharges containing elevated concentrations of iron, manganese, and aluminum from several surface mined areas and from underground mine discharges have severely degraded the water quality over much of this stream length. Most of the discharges appear to be associated with mining of the Upper Kittanning, Middle Kittanning and Brookville-Clarion coals. Although the chemical quality of the water improves in some areas, the stream is virtually devoid of macroinvertebrates downstream from the surface mined areas. A population of brook trout, which included several year classes, was documented at one location on Poplar Run upstream from the confluence with Newmyer Run.

A significant portion of the study area, including the headwaters of Indian Creek, Little Run, Camp Run, Pike Run and Roaring Run, are located within the Forbes State Forest and Laurel Ridge State Park. Included within the Forbes

State Forest is the Roaring Run Natural Area. Recreational facilities are also provided by several privately owned campgrounds. No plant or animal species of special concern have been listed on the Pennsylvania Natural Diversity Index (PNDI), however, the Pennsylvania Game Commission has reported that the West Virginia Water Shrew (Sorex palustris), which is a Pennsylvania Threatened Species, has been found within the Pike Run watershed. The majority of these areas are underlain by noncoal bearing strata of the Mississippian System.

The Pennsylvania Historical and Museum Commission (PHMC) recorded 14 archeological sites, including several prehistoric Indian camps, within the study area. The PHMC also reported that 15 properties within the study area may be eligible for listing on the National Register of Historic Places, however, they have done no evaluation of these properties.

The Indian Creek Valley Water Authority currently supplies water from two springs to approximately 1,200 connections. Pritts Spring, near the headwaters of Neals Run, has been used as a water supply for the village of Melcroft since 1947. Grimm Spring, in the upper reaches of Laurel Run just outside the southeast boundary of the study area, has been in use since 1973. In 1993, the Authority drilled a well near the confluence of Neals Run and Trout Run and filed applications to the Department for expansion of water supply service to an additional 370 residences and 60 commercial businesses. All of the public water supply sources are located within Mississippian Age strata, which do not contain coal reserves.

Alternatives

The findings of the technical study can be addressed by the following alternatives:

1. Designate all the coals within the petition area as usuitable for all types of surface mining activities.

2. Designate none of the coals within the petition area as unsuitable for surface mining activities.

3. Designate the Brookville-Clarion coal within the petition area as unsuitable for surface mining activities.

4. Designate all coals within the petition area as unsuitable for underground mining activities.

The Pennsylvania Surface Mining Conservation and Reclamation Act, as amended, and Department Regulations in 25 Pa. Code, Section 86.121(a), exempts areas from designation on which surface mining activities are being conducted under a permit issued pursuant to the Act. Portions of 10 such permit areas lie within the study area. Four of these permit areas lie within the area covered by this petition: Amerikohl Mining, Inc., SMP 26880110 and SMP 26900106 (Upper Freeport coal); Pine Flats Coal Company, Inc., SMP 26823086(T) (Upper Kittanning coal); and Holliday Constructors, Inc., SMP 3375SM54 (Middle Kittanning coal).

The Petition Process

In this report, the term "petition" refers to a formal action by an interested party requesting that the Department designate a specified area as unsuitable for surface coal mining.

The petition process obligates the Department, in a timely manner, to consider petitions, review available information, conduct studies, provide for public participation by proper notifications and public hearings, and make recommendations to the Environmental Quality Board for rulemaking.

The Department is required by statute to designate areas as unsuitable for surface mining where the Department determines that reclamation pursuant to the requirements of the Act is not technologically or economically feasible. In addition, the Department may designate an area as unsuitable for all or certain types of coal mining activities if such operations will: 1) be incompatible with existing state or local land use plans or programs; 2) affect fragile or historic lands where such operations would result in significant damage to important historical, cultural, scientific, and aesthetic values and natural systems; 3) cause a substantial loss or reduction in long-range productivity of food or fiber products or water supply, including aquifers and aquifer recharge areas; or 4) substantially endanger life and property in natural hazard areas, including areas subject to frequent flooding and areas of unstable geology.

Legislative Authority

Legal Background

Although a formal procedure for designating areas unsuitable for mining was not made part of Pennsylvania statutes until 1980, the notion that certain areas may be unsuitable for mining is not new to Pennsylvania law. Common law principles of nuisance, trespass and riparian rights sometimes prevented or limited surface mining activities in certain areas because of their proximity to homes or businesses. Local zoning ordinances have also prevented mining in certain areas to protect public health, safety, and welfare. Indeed, the current statutory language has antecedents that can be traced back several decades.

These earlier statutory provisions had two basic themes, which are still important. First, the General Assembly concluded that mining was not permissible within certain distances of roads, parks, buildings, and similar facilities. The first statutory recognition of concern about the proximity of mining to such facilities was manifest in the Reclamation Act. Even before backfilling of mine excavations to approximate original contour was required, the General Assembly had more stringent requirements concerning backfilling and other mining activities where the operation was within specified distances of any group of five dwelling units, any public building, school, church, community or institutional building, cemetery, public recreation area, or public highway (Section 10 of the Bituminous Coal Open Pit Mining Conservation Act, as amended by Act 531 of 1961, P.L. 1210; and Section 4.2(b) and Section 5 of the Act, as amended by Act No. 133 of 1963, P.L. 238). In 1971, when the General Assembly amended the Act to require backfilling to approximate original contour, it also added a prohibition against opening pits for surface mining activities within

"one hundred feet of the outside line of the right-of-way for any public highway or within three hundred feet of any occupied dwelling, unless released by the owner thereof, or any public building, school, park, or community or institutional building or within one hundred feet of any cemetery, or the bank of any stream" (Section 4.2(c) of Act No. 147 of 1971, P.L. 554). Variances to these buffer zones were granted only if the interests of the public and landowners would be protected. The Commonwealth Court sustained the constitutionality of Section 4.2(c) in Harger v. Commonwealth, Department of Environmental Resources, 9 Pa. Commonwealth Ct. 482, 308, A.2d 171 (1973).

The second theme of these earlier statutory provisions is implicit in the ability of the Commonwealth to deny surface mining permits where the operator has failed to demonstrate that mining can be accomplished without causing pollution to the waters of the Commonwealth. To the extent that certain areas are extremely difficult if not impossible to mine without causing pollution, the laws protect such areas from being mined. The Clean Streams Law, originally enacted in 1937, was amended in 1945 (P.L. 435) to require operators to submit plans for the disposal of acid mine drainage. The 1945 amendments defined acid mine drainage as pollution for the first time, and to some extent prohibited such discharges. The constitutionality of that prohibition was sustained in Sanitary Water Board v. Sunbeam Coal Corp., 77 Dauph. 264 (1961). Although the Court said that the law might cause some operators to permanently treat discharges, it recognized that "the need for clean, wholesome water supply continues indefinitely." The Court concluded: "We realize that the burden thus placed upon the operator is great, but the public need out of which it is born, is correspondingly great" (77 Dauph. at 273-74). The Clean Streams Law was further amended in 1965 to impose a mandatory duty on the Commonwealth to deny permits where pollution was likely to occur. Section 315(a) of these amendments, P.L. 372, Act 194 of 1965, provided in part: "A permit shall not be issued if the board shall be of the opinion that the discharge from the mine would be or become detrimental to the public health, animal, or aquatic life or the use of the water for domestic or industrial consumption or recreation." The Courts have held that the operator has the burden of demonstrating in a permit application that the proposed operation will not cause pollution of the waters of the Commonwealth in Harmon Coal Co. v. Commonwealth, Dept. of Environmental Resources, 34 Pa. Commonwealth Ct. 610, 384 A.2d 289 (1978). The operator's ability to mine without causing pollution may largely depend on the characteristics of the site. These characteristics include the quality and composition of coal and groundwater movement. In denying some surface mining permit applications, the Department recognizes that certain areas cannot be mined by anyone, using existing technology, without causing pollution. Similarly, in 1980, the General Assembly, in effect, prohibited the Department from issuing permits where the proposed operation would cause the contamination or diminution of the quality or quantity of water supplies unless the operator could demonstrate the availability of an alternate supply of comparable quality and quantity. To the extent that applicants cannot meet the requirements of Section 4.2(f), the Act prohibits such areas from being mined.

Statutory Authority for the Petition Process

These two legally established regulatory concepts, buffer zones and permit denials to protect water quality and quantity, continue to form the core of the statutory provisions protecting certain areas from being mined. The October 10,

1980 amendments to three Pennsylvania statutes retained these provisions and added a new program known as the Areas Unsuitable for Mining Program. The key provisions, in this regard, can be found in Section 4.5(h) of the Surface Mining Conservation and Reclamation Act (as amended by Act 155 of 1980, P.L. 835), Section 6.1 of the Coal Refuse Disposal Control Act (as amended by Act 154 of 1980, P.L. 807), and Sections 315(h)-(o) of The Clean Streams Law (as amended by Act 157 of 1980, P.L. 894), which are based on Section 522 of the federal Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. Section 1272. The 1980 amendments establish a formal process for designating areas as unsuitable for mining and for terminating such designations.

II. DESCRIPTION OF THE PETITION AREA

The Petitioners

The petition was submitted by Beverly Braverman, representing the Mountain Watershed Association.

Petition Allegations

In submitting the petition, the petitioners filed allegations under the criteria listed in §86.122(a) and (b)(2) and (3), Title 25 Pa. Code. They alleged that surface mining in the Indian Creek watershed is not technologically or economically feasible because mining would result in production of acid mine drainage. The petitioners further allege that mining not only would result in significant damage to important historic, cultural, scientific and aesthetic values and natural systems, but would also cause a substantial loss or reduction in long-range productivity of food and fiber products or water supply, including aquifers and aquifer recharge areas.

Specifically, the petitioners alleged that reclamation of areas affected by mining activities is not feasible because of the geologic and hydrologic characteristics of the petition area. The petitioners also alleged that the petition area is hydrologically fragile and that surface and underground mining has already stressed the area's resources. The three abandoned Melcroft Coal Co. underground mines and two surface mines near the village of Rogers Mill were cited as examples of mining activities that have adversely affected water resources and degraded the water quality of Indian Creek between the villages of Melcroft and Normalville. They stated that large volumes of acidic water drain from the abandoned underground mines resulting in pollution of Indian Creek and that additional mining would cause further degradation of the area's natural resources.

The petitioners alleged that the petition area is the gateway to the Laurel Highlands, an important regional recreational area. The petition area includes several campgrounds, horse stables and scenic areas. The petitioners alleged that the petition area contains several historical buildings and prehistoric archeological sites.

The petitioners also alleged that the petition area contains ponds, lakes and springs of high quality, many of which are the sole source of water for businesses, farms, horse stables, residences, recreation areas and wildlife.

The petitioners alleged that previous mining has diminished or polluted water supply sources within the petition area and that further mining will destroy the remaining potable water sources and create additional pollution from the acid mine runoff and flume discharge from the Melcroft mines, resulting in further degradation of Indian Creek.

Supporting Evidence

Supporting evidence for the petitioners' allegations included water quality information on abandoned mine discharges in the Indian Creek watershed from the Youghiogheny River Operation Scarlift Report; information and correspondence from the Department's files on acid discharges from the Melcroft Coal Co. underground mine and the Lawrence Coal Co. and Marsolino Coal Co. surface mines; photographs of mine drainage damage to properties near underground mine discharges; geologic and hydrogeologic information from the permit application for the proposed Rand Am, Inc. underground coal mine (#26931301); and information from the local Chamber of Commerce and the Laurel Highland Tourist Bureau.

Milestone Dates

On April 20, 1994, the Department received a petition from Beverly Braverman, on behalf of the Mountain Watershed Association, to designate an approximately 10,000 acre portion of Indian Creek watershed in Westmoreland and Fayette Counties as unsuitable for mining. The Department determined the petition to be complete and notified the petitioners on May 19, 1994.

Notification of receipt and acceptance of the petition was made to persons with known mineral ownership, surface ownership over 10 acres and other interested parties on June 10, 1994. Notification to the general public was made on June 15 and 22, 1994 in The Daily Courier, Connellsville, Pennsylvania, and on June 19 and 26, 1994, in The Tribune Review, Greensburg, Pennsylvania, and in the Pennsylvania Bulletin on June 25, 1994 (24 Pa.B. 3162). Notices were also placed in several post offices and convenience stores in the vicinity of the petition area.

Intervenors

The legislative authority for the petition process includes provisions for intervenors, either in support of or in opposition to a petition requesting to have an area designated as unsuitable for surface mining. Intervenor status may be granted by the Department up to three days before the public hearing to persons who file, in writing, allegations of fact and identification of their interests in the petition area.

Intervenor status was requested by Melcroft Coal Co., Inc., who owns the coal reserves in Indian Creek watershed; Rand Am, Inc., who had submitted to the Department an application for an underground coal mine permit in Indian Creek watershed; and PennAmerican Coal, Inc., which plans to lease the coal and apply for a transfer of any mining activities permit issued to Rand Am, Inc. Intervenor status was granted on November 14, 1994.

The Petition Area

Physical Characteristics

The petition area, as originally submitted, included a portion of the Indian Creek watershed beginning at the Pa Route 31/381 bridge at Jones Mills and continuing downstream to the village of Indian Head, excepting most of the eastern tributaries of Indian Creek and Little Champion Creek. In order to evaluate the potential effects of surface and underground mining on the resources the petitioners seek to protect, the Department enlarged the technical study area to include the entire surface water drainage area of Indian Creek upstream of Rogers Mill (Figure 1). The study area is depicted on the Donegal, Seven Springs, Mill Run, Stahlstown and Bakersville 7.5 minute USGS topographic maps.

Indian Creek originates in Forbes State Forest, east of the village of Kregar, near the crest of the west flank of Laurel Hill and flows in a westerly direction along the Pennsylvania Turnpike for about four miles, then in a southwesterly direction to the village of Romney, then south to Indian Head. Indian Creek then meanders in a westerly direction for four miles to the Mill Run water supply reservoir located between the villages of Mill Run and Normalville. Indian Creek flows into the Youghiogheny River in a remote forested area about four miles east of South Connellsville. Indian Creek flows through a broad valley consisting of farms, villages and wood lots, located between the prominent ridges of Laurel Hill to the east and Chestnut Ridge to the west. Laurel Hill is mostly forested; Chestnut Ridge has farms and wood lots. Pa. Route 711/381 parallels Indian Creek from Jones Mills to about one mile downstream of Indian Head. Several villages, campgrounds, and numerous businesses are located along Pa Route 711/381. The Pennsylvania Turnpike cuts through the northern tip of the watershed. Turnpike Exit 9 is located at the northern edge of the petition area, in the Borough of Donegal.

Twelve named tributaries flow within the study area. The eastern tributaries, Little Run, Camp Run, Roaring Run and its tributary Pike Run, Back Creek and its tributaries Trout Run and Neals Run, originate on Laurel Hill and flow in narrow, steep-sided channels through forested, mountainous terrain. Ski lifts for the Seven Springs Ski Resort and the White Mountain Ski Area, which border the study area to the east, are located on Laurel Hill near the headwaters of Trout Run and Neals Run. The western tributaries are Champion Creek and its tributaries, Little Champion Creek, Minnow Run, Wash Run, and Poplar Run and its tributary Newmyer Run, which originate near Chestnut Ridge. The western tributaries generally flow through more dissected, gently rolling hills comprised of farm land, surface mines, scattered villages, rural houses, and wood lots.

Natural and Recreational Resources

The Indian Creek watershed, from the headwaters to the confluence with Champion Creek, and the Trout Run and Neals Run watersheds are classified as High Quality Cold Water Fishes (HQ-CWF) in Chapter 93 of the Department's Regulations. The remainder of the Indian Creek watershed is classified as Cold Water Fishes (CWF).

Forbes State Forest encompasses a large portion of the headwaters of Indian Little Run, Camp Run, Pike Run, and Roaring Run. An additional 2,442 acres of upper Indian Creek watershed were purchased in 1994 by the Western Pennsylvania Conservancy and transferred to Forbes State Forest. The Roaring Run Natural Area, within Forbes State Forest, includes the Roaring Run watershed upstream of the Roaring Run Camping Resort. Portions of Laurel Ridge State Park are located at the crest of Laurel Hill.

Indian Creek is stocked preseason by the Pennsylvania Fish and Boat Commission with brook and brown trout and in season with brown and rainbow trout from the confluence with Champion Creek upstream to Pa Route 31 at Jones Mills, a distance of 5.4 miles. Roaring Run is stocked with brook trout for a total of 1.9 miles from the mouth upstream to the state forest boundary. Back Creek is stocked with brook and brown trout for a total of 3.5 miles from the mouth upstream to the confluence of Trout Run and Neals Run. Indian Creek has a naturally reproducing population of brook and brown trout upstream of Skyview Road. The eastern tributaries of Indian Creek, Camp Run, Roaring Run, Pike Run, Trout Run, and Neals Run have naturally reproducing populations of brook trout. Back Creek has a native brook trout population in its upper reaches, near the confluence of Trout Run and Neals Run, and brown trout reproduction in the downstream reaches. A small population of warm water fish, including smallmouth bass and rock bass, are present in Indian Creek downstream of Indian Head.

Historical Resources

The Pennsylvania Historical and Museum Commission (PHMC) determined that 15 dwellings, churches or schools in the study area are potentially eligible for listing on the National Register of Historic Properties. The Commission also reported that the study area contains 14 archaeological sites including several prehistoric Indian camp areas located mainly on flood plains or upland flats.

Water Supplies

The Indian Creek Valley Water Authority currently supplies water from two springs to approximately 1,200 domestic, industrial and commercial connections, serving a population of 3,060, in Fayette and Westmoreland Counties. Pritts Spring, located on Laurel Ridge near the headwaters of Neals Run, has been used as a water supply for the village of Melcroft since 1947. Grimm Spring, located in the upper reaches of Laurel Run, which is outside the southeast border of the study area, has been used as a water supply since 1973. The Authority estimated the safe yield from each spring to be 300,000 gallons per day. The average daily water use for the period from 1980 to 1992 was 235,000 gallons per day.

In 1993, the Authority drilled a water supply well near the confluence of Neals Run and Trout Run and filed an application for a water allocation permit with the Department to extend water supply services to an additional 370 residences and 60 commercial businesses. The Neals Run well is capable of producing 150 gallons per minute, which is approximately 216,000 gallons per day. The Authority's distribution system includes five water storage tanks with a total capacity of 1.23 million gallons. The extension will add 17 miles of transmission mains to the 69 miles of transmission mains presently in the distribution system. Chlorination is the only treatment required prior to use

of the water from the spring sources and is expected to be the only treatment necessary for the well. This expansion is expected to be completed by August of 1995.

All three water supply sources are located within Mississippian Age strata which do not contain coal reserves.

The Water Authority presently has an agreement to purchase up to one million gallons of raw water per day from the Municipal Authority of Westmoreland County's Mill Run Reservoir, which is located on Indian Creek downstream of the petition study area. The Water Authority's allocation permit application has requested an allocation of 740,000 gallons per day from Mill Run Reservoir. The Water Authority has a small water treatment facility downstream from Mill Run Reservoir which enables them to use the raw water from the reservoir. This supply is used on an emergency basis if regular water sources are inadequate to supply their customers. The Water Authority has used the Mill Run Reservoir supply only once in the past 20 years, which occurred during the drought of 1991. At all other times, the springs were capable of providing enough water to supply all customers.

The Department's Bureau of Water Supply and Community Health indicated that the Water Authority's planned public water extension is needed for the residences and businesses within the Donegal area because the water quality of existing individual wells and springs has been degraded by mining or no longer provide sufficient quantities of water.

A well on the Gearhart property in the upper Little Champion Creek watershed is used as a commercial water supply for the filling of swimming pools. Because there are no chlorination facilities, this well is not approved as a drinking water supply.

Mining History

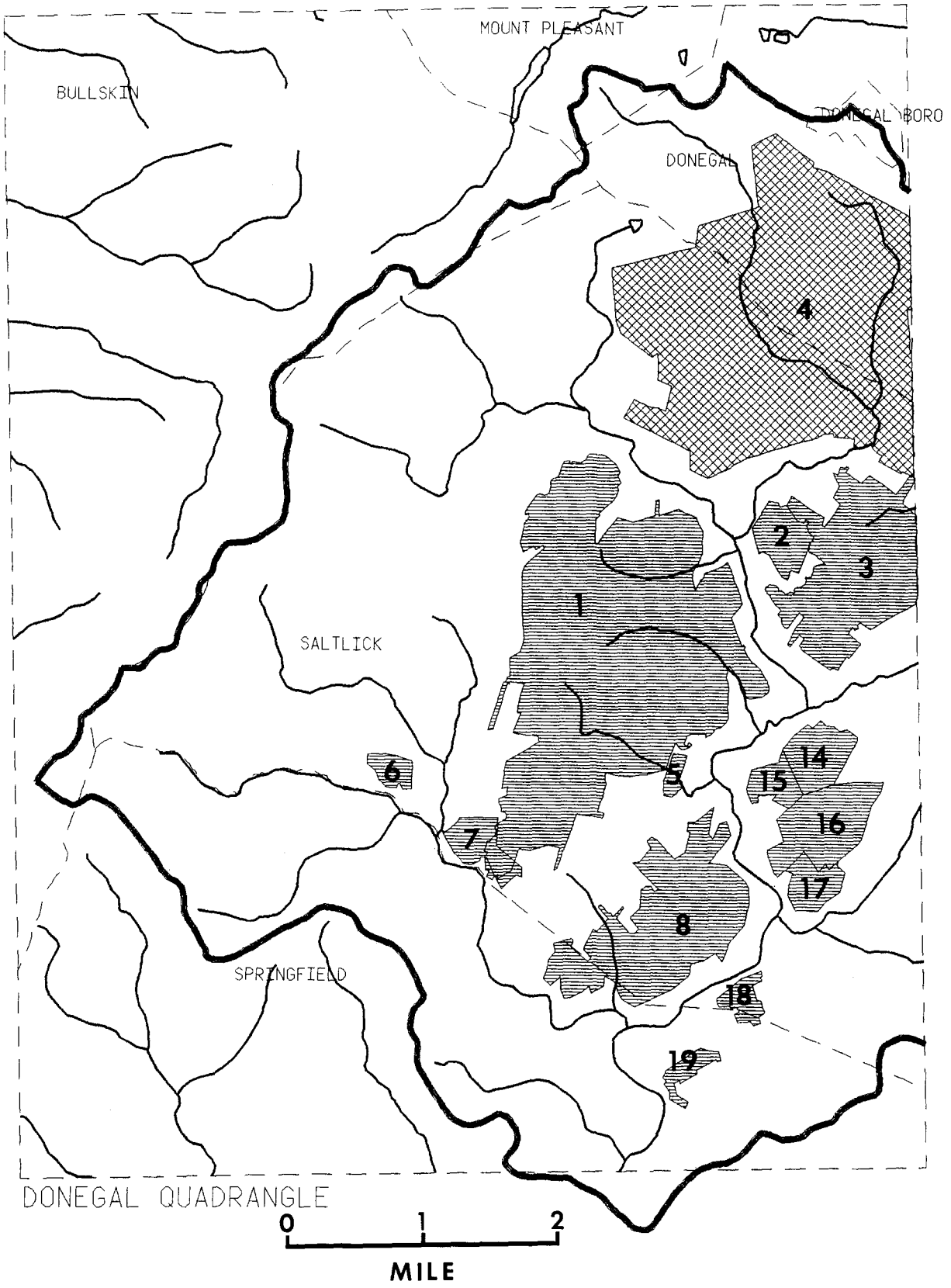
The study area lies within the western Pennsylvania bituminous coal field. Underground coal mining began in this area in the mid-19th century and continued until the 1960's when surface coal mining became the prevalent coal extraction method. The finding of the technical study indicates that many of the coals listed in surface mine permit files and on underground mining maps have been misidentified. Evaluation of drill logs and overburden analyses from surface mine permits and recent field studies and unpublished reports by Shaulis (1985) and Skema (1988) were used to determine the coals actually mined at each surface or underground mine within the study area.

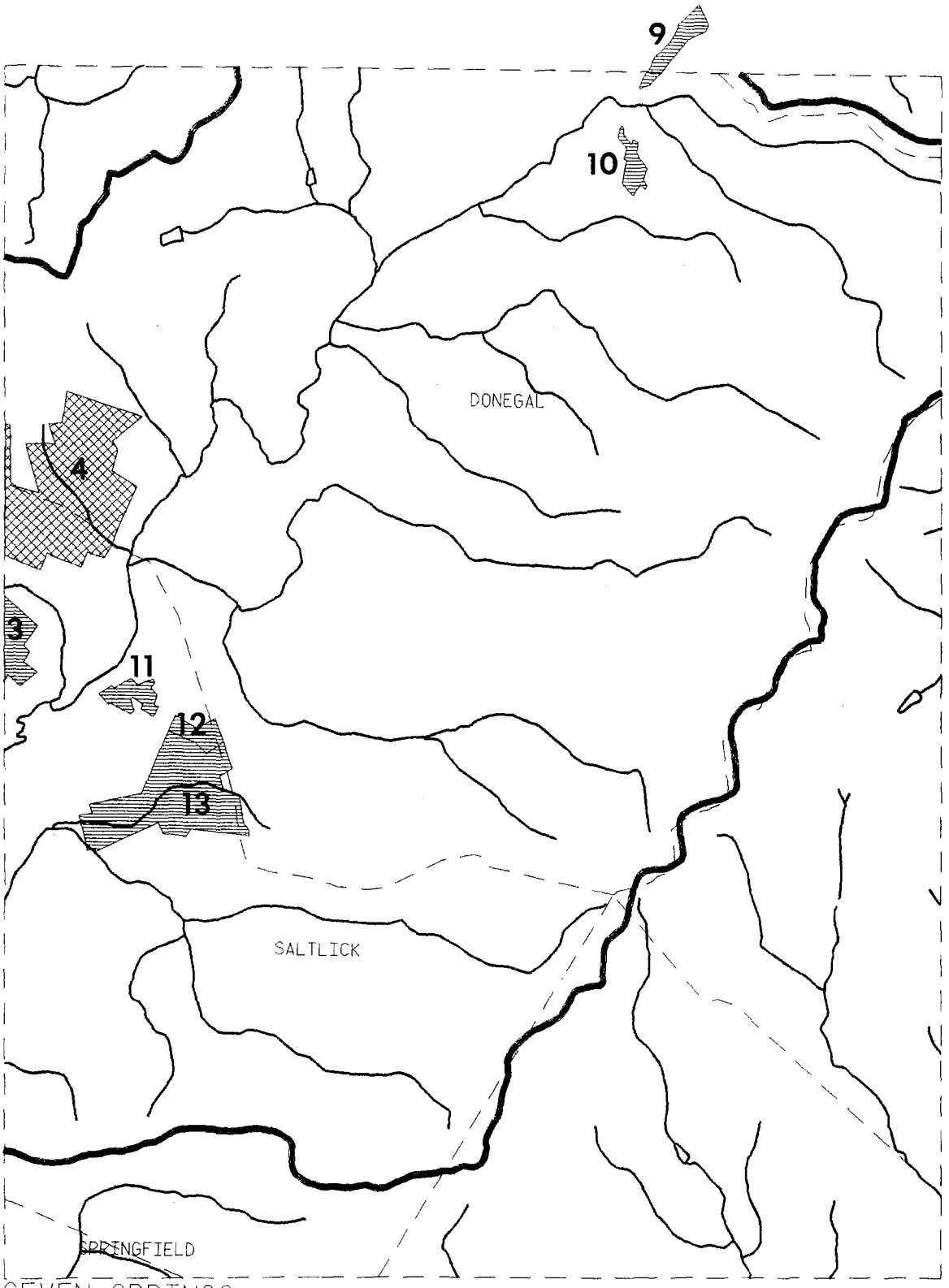
Large underground mines were developed on what is currently known to be the Middle Kittanning coal, along the main channel of Indian Creek, and smaller country bank underground mines were developed within the Poplar Run, Champion Creek and Little Champion Creek watersheds (Figure 2). Country bank mines were also developed on the Lower Freeport coal in the Little Champion Creek watershed near the village of White and in the Back Creek watershed. These now abandoned underground mines were developed up-dip to facilitate drainage from the mines. In 1924, as a result of a lawsuit brought by the Pennsylvania Railroad and other water companies using Indian Creek as a water supply, a diversion system known

Figure 2. Map of underground Middle Kittanning coal mine areas within the Indian Creek study area.

Index to Underground Coal Mine Map

(1) Melcroft No. 1 Mine
(2) Melcroft No. 2 Mine
(3) Melcroft No. 3 Mine
(4) Rand Am No. 4 Permit Application Area
(5) North Star Coal Co. - W. Chrestner Mine
(6) Layman Property Mine
(7) Unnamed Mine
(8) Indian Creek Coal & Coke Co.
(9) Blair Coal Co. - Kregar Mine
(10) M. K. Piper Coal Co. - Mine No. 1
(11) Nebo Coal Co. - Mohawk Mine
(12) Romney Coal Co. (no record of mining)
(13) Nebo Coal Co. (no record of mining)
(14) Romney Coal Co. - Little Squaw Mine
(15) Howard Coal Co. - Kimmel Mine
(16) Sagamore Coal Co. - Big Chief Mine
(17) Red Top Coal Co. - Puro Mine
(18) Indian Creek Coal & Coke Co. - Sparks Mine
(19) Salt Lick Mine


MOUNT PLEASANT
BULLSKIN
DONEGAL BORO
DONEGAL
4
2
3
1
SALTLICK
6
5
14
15
16
7
17
8
SPRINGFIELD
18
19
DONEGAL QUADRANGLE
0
1
2
MILE



SEVEN SPRINGS
QUADRANGLE

0 1 2

MILE

as "the flume" was constructed to carry mine drainage away from the mines and discharge the collected mine water below the Indian Creek Reservoir near the village of Normalville. As mining progressed, the volume of water produced by the mines exceeded the capacity of the flume and discharges from the mines developed along the coal crop. Several attempts were made to upgrade and repair the flume without success. Acidic water from these large underground mines now flow into the main channel of Indian Creek from the abandoned mine entries and coal crop discharges. Most of the discharges occur within the structural trough of the Ohiopyle (Ligonier) syncline between the confluence of Poplar Run with Indian Creek upstream to the village of Melcroft.

In August 1993, Rand Am, Inc. submitted permit application #26931301 requesting authorization to conduct underground coal mining activities on a 2,977 acre area within the study area. This mine permit application is currently under technical review by the McMurray District Mining Office.

Prior to 1967, surface coal mining within the study area had been limited to relatively shallow contour mines located along coal outcrops. Since 1967, 61 surface coal mining permits have been issued within the study area. Ten of these sites were not activated and the permits have expired.

A listing of the surface mining permit areas, where mining was conducted, is recorded in Table 1 and their locations are shown on Figure 3.

Surface coal mining has occurred on the Mahoning, Upper and Lower Freeport, Upper and Middle Kittanning and the Brookville-Clarion coals. The majority of the surface mining activities occurred on the Upper Freeport and Middle Kittanning coals. The Brush Creek coal was identified in drilling records, however, there is no record of this coal being mined within the study area. There is no evidence to indicate that the Lower Kittanning coal, which normally occupies the stratigraphic interval between the Middle Kittanning coal and the Brookville-Clarion coal, occurs within the study area.

Surface coal mining activities are occurring at two permit sites within the study area. Purco Coal Company, Inc. (SMP 26703078) is currently mining the Upper and Middle Kittanning coals on an area east of the village of Clinton. Pine Flats Coal Company, Inc. (SMP 26880113) is currently mining the Upper and Middle Kittanning coals on an area located approximately two miles northwest of the village of Melcroft. Rand Am, Inc. is planning to incorporate the Pine Flats Coal Company permit area into their proposed underground mining operations.

III. TECHNICAL STUDY

Geology

Structure

The Indian Creek watershed is situated in the Allegheny Mountain section of the Appalachian Plateau Physiographic Province. Three major geologic structures influence the occurrence and attitudes of rock formations within the Indian Creek study area. These are the Chestnut Ridge anticline, the Laurel Hill anticline, and the intermediate Ohiopyle (Ligonier) syncline.

Table 1. Surface mining history within the Indian Creek study area.

	Mining Operator "Mine"	Permit #	Coal Mined	Relevant Mining History
1.	Firestone Coal Corp. "Keller"	34A77SM14	Mahoning	loss of wells no surface water bonds released
2.	Milrock Mining, Inc. "Champion #1"	3375SM64	Mahoning & Upper Freeport	Mn discharge degraded springs by Fe & Mn bonds released
3.	Amerikohl Mining, Inc. "Prinkey"	26880101	Upper Freeport	acid discharges Fe & Mn discharges stage II bond release
4.	Amerikohl Mining, Inc. "Ritenour II"	26900106	Upper Freeport	Fe & Mn discharges degraded springs stage II bond release
5.	Better Mining Co. "Pritts"	3375SM30	Upper Freeport	acid discharges Fe & Mn discharges bonds denied release
6.	Bridgeport Coke "Sapone"	3376SM13	Upper Freeport	no water at mine site (small hilltops mined)
7.	Clarksburg Coal Co., Inc. "Barger"	3378BC20	Upper Freeport	acid discharges Fe & Mn discharges degraded well abandoned, bonds forfeited
8.	Firestone Coal Co., Inc. "Hensel"	26820101	Upper Freeport	acid and Fe discharge loss of updip springs bonds released
9.	Indy-Penn Coal Co., Inc. "Clark"	3377SM17	Upper Freeport	acid discharge abandoned, bonds forfeited
10.	Pine Flats Coal Co., Inc. "Hopewell"	26813036(T)	Upper Freeport	acid discharges Fe & Mn discharges degraded springs by Fe & Mn loss of updip spring bonds released
11.	William K. Tedesco "Tedesco"	3370BSM16	Upper Freeport	acid discharges Fe & Mn discharges (violation notices given) abandoned, bonds forfeited

Table 1. (continued)

12.	Amerikohl Mining, Inc. "Ritenour"	26880110	Upper Freeport & Lower Freeport	Fe & Mn discharges stage II bond release
13.	Bologna Mining Co. "Nicholson"	3374SM72	Upper Freeport & Lower Freeport	acid discharges Fe & Mn discharges bonds denied release
14.	Adam Eidemiller, Inc. "Miller-Pritts"	3376SM11	Upper Freeport & Lower Freeport	acid discharges Fe & Mn discharges bonds denied release
15.	Clarksburg Coal Co., Inc. "Flack"	3377SM25(T)	Upper Freeport & Lower Freeport	acid discharges Fe & Mn discharges pit floor drilled water drained to deep mine abandoned, bonds forfeited
16.	Laurel Ridge Coal, Inc. "Warrick"	3375SM38	Upper Freeport & Lower Freeport	acid discharges Fe & Mn discharges (compliance orders issued) permit suspended abandoned, bonds forfeited
17.	Ann Mineral Co. "Showman"	3375SM53	Lower Freeport	acid discharges Mn discharges (compliance orders issued) bonds released
18.	Fryske & Nole Coal Co. "Pletcher"	2968BSM25	Lower Freeport	acid discharges (compliance orders issued) bonds released
19.	Laurel Ridge Coal, Inc. "Geary #1"	3374SM77	Lower Freeport	acid discharges Mn discharges cease & desist order abandoned, bonds forfeited
20.	Laurel Ridge Coal, Inc. "Kineer/Warabak"	3374SM78	Lower Freeport	acid discharges Mn discharges abandoned, bonds forfeited
21.	Laurel Ridge Coal, Inc. "Speyer"	3378BC16	Lower Freeport	acid discharges Mn discharges abandoned, bonds forfeited
22.	Northbrook Mining, Inc. "Speyer"	26820112	Lower Freeport	acid discharges Mn discharges abandoned, bonds forfeited
23.	William K. Tedesco "Tedesco"	3370BSM8	Lower Freeport	acid discharges abandoned, bonds forfeited

Table 1. (continued)

24.	Brant Coal Co., Inc. "Mastowski"	3375SM33	Upper Kittanning	acid discharge Fe discharges bonds released
25.	Marsolino Coal & Coke, Inc. "Leighty"	3376SM14	Upper Kittanning	acid discharges Fe & Mn discharges (compliance orders issued) abandoned, bonds forfeited civil penalty assessments
26.	Morcoal Co. "Kalp"	34A76SM2	Upper Kittanning	acid discharges Fe & Mn discharges abandoned, bonds forfeited
27.	Pine Flats Coal Co., Inc. "La Rosa"	26823086(T)	Upper Kittanning	acid discharges Fe & Mn discharges degraded well bonds denied release
28.	Emerald Energy Enterprises "Knopsnider"	3375SM69	Upper Kittanning & Middle Kittanning	acid discharges Fe & Mn discharges abandoned, bonds forfeited
29.	Emerald Energy Enterprises "Marston"	3377SM13	Upper Kittanning & Middle Kittanning	acid discharges Fe & Mn discharges cease & desist order abandoned, bonds forfeited
30.	Pine Flats Coal Co., Inc. "Becker"	26880113	Upper Kittanning & Middle Kittanning	Mn discharge (Fe highwall seep) (mining is ongoing)
31.	Purco Coal Co., Inc. "Layman"	26703078 & 3370BSM23	Upper Kittanning & Middle Kittanning	(mining is ongoing)
32.	C & A Coal Co. "Secrist"	3375SM12	Middle Kittanning	acid discharges Fe discharges abandoned, bonds forfeited
33.	Adam Eidemiller, Inc. "Mastowski"	2969BSM10	Middle Kittanning	acid discharges bonds released
34.	Fryske & Nole Coal Co. "Eutsey"	461M115	Middle Kittanning	acid discharges cease & desist order bonds forfeited
35.	Fryske & Nole Coal Co. "Eutsey"	2966BSM14	Middle Kittanning	no water samples collected degraded well by acid & Fe (law suit settlement) bonds released

Table 1. (continued)

36.	Fryske & Nole Coal Co. "Knopsnider"	2966BSM36	Middle Kittanning	acid discharges (compliance orders issued) bonds forfeited
37.	Fryske & Nole Coal Co. "Benton"	2966BSM95	Middle Kittanning	acid discharges (violation notices given) bonds released
38.	Fryske & Nole Coal Co. "Knopsnyder"	2968BSM32	Middle Kittanning	acid discharges Fe discharges (compliance orders issued) bonds forfeited
39.	Genovese Coal Co. "Chearney"	3372SM20	Middle Kittanning	acid discharges Fe & Mn discharges abandoned, bonds forfeited
40.	Genovese Coal Co. "Becker"	3375SM23	Middle Kittanning	acid discharges Mn discharges abandoned, bonds forfeited
41.	Holliday Constructors, Inc. "Shaffer"	3375SM54	Middle Kittanning	Fe & Mn discharges bonds denied release
42.	Myers Coal Co. "Poplar Run"	3377SM6	Middle Kittanning	acid discharges Fe & Mn discharges (compliance orders issued) cease & desist order abandoned, bonds forfeited
43.	Purco Coal Co., Inc. "Brown"	2967BSM12	Middle Kittanning	acid discharges Fe discharges (compliance orders issued) degraded well by acid, Fe, & sulfate, loss of spring bonds released
44.	Purco Coal Co., Inc. "Coffman"	3371BSM6	Middle Kittanning	Fe discharge (compliance order issued) bonds released
45.	Purco Coal Co., Inc. "Clark"	3376SM7	Middle Kittanning	no water at mine site (small hilltop mined) bonds released
46.	The Rondell Co. "Knopsnider"	3372BSM4	Middle Kittanning	acid discharges Fe & Mn discharges (compliance orders issued) abandoned, bonds forfeited
47.	Curtis Snyder Coal Co. "Berdych"	3378SM14	Middle Kittanning	acid discharges Fe & Mn discharges (compliance orders issued) abandoned, bonds forfeited

TABLE 1. (continued)

48.	Nicholson & Shepler "Nicholson"	3375SM14	Middle Kittanning & Brookville-Clarion	acid discharges Fe & Mn discharges (violation notices given) bonds released
49.	The Rondell Co. "Correal"	3373SM7	Middle Kittanning & Brookville-Clarion	acid discharges Fe & Mn discharges downdip springs degraded (by Fe, Mn, and sulfates) (compliance orders issued) abandoned, bonds forfeited civil penalty assessment
50.	C & A Coal Co. "Hawk"	3375SM16	Brookville-Clarion	acid discharges abandoned, bonds forfeited
51.	Charles Kravetsky "Nicholson"	3377SM27	Brookville-Clarion	acid discharges Fe & Mn discharges abandoned, bonds forfeited

Figure 3. Map of surface coal mine permit areas within the Indian Creek study area. Area numbers refer to permits listed in Table 1.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

DONEGAL QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1967. Field checked 1967

Polyconic projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
1927 North American Datum (NAD 27)

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are given in USGS Bulletin 1875

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Revisions compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1988 and other sources
Contours not revised. This information not field checked
Map edited 1993

UTM GRID AND 1993 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route
County Route

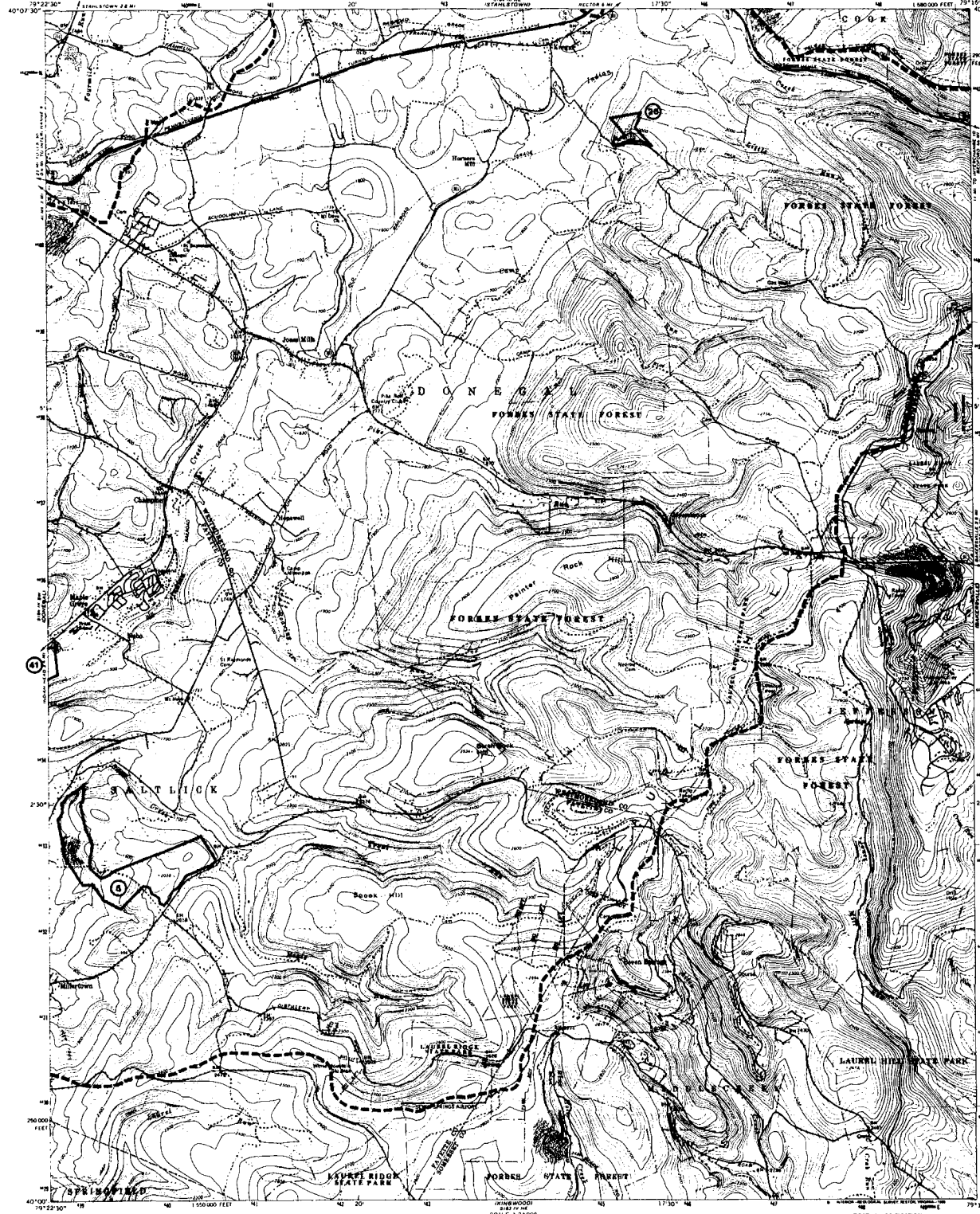
DONEGAL, PA.
40079-A4-TF-024

1967
REVISED 1993
DMA 5164 III SW–SERIES V831

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

SEVEN SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey
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Topography by photogrammetric methods from aerial photographs taken 1967. Field checked 1967

Polyconic projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south zone
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There may be private inholdings within the boundaries of the National or State reservations shown on this map

Revisions compiled in cooperation with Commonwealth of Pennsylvania agency as from aerial photographs taken 1985 and other sources. Contours not revised. This information not field checked
Map revised 1993

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1993 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Primary highway, all weather, hard surface	Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface	Unimproved road, fair or dry weather
Interstate Route	State Route

PENNSYLVANIA
QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

SEVEN SPRINGS, PA.
40079-A3-TF-024

1967
REVISED 1993
DMA 5104 III SE-SERIES V831

The northeast-southwest trends of the Chestnut Ridge and Laurel Hill anticlines coincide with the high topography forming the western and eastern borders of the watershed. The parallel trend of the Ohiopyle (Ligonier) syncline corresponds with the low topography along the main stem of Indian Creek (Figure 4). These broad, nearly symmetrical folds trend approximately N. 30° E. (Shaffner, 1963). The west limb of the syncline rises gradually and becomes increasingly steeper toward the Chestnut Ridge anticline, and the east limb of the syncline rises more abruptly to become the west limb of the topographically higher Laurel Hill anticline. The dip of the rock strata along the limbs of the syncline ranges from relatively flat lying along the axis to approximately four percent along the western limb and approximately six to eight percent along the eastern limb. The trace of the axis of the Ohiopyle (Ligonier) syncline crosses Indian Creek north of Indian Head and again south of Champion. The syncline is doubly plunging from a local structural high at Fowl Hill. The plunge to the southwest is approximately 0.5 percent and the plunge to the northeast is approximately 1.0 percent. North of Jones Mills, the axis of the syncline becomes less defined, until a few miles north of Donegal where it resumes plunging to the northeast.

The geologic structure and the resulting topography within the Indian Creek watershed combine to give the appearance of an inversion of the stratigraphic sequence. Because of the relatively steep dip of the strata along the flanks of the Laurel Hill and Chestnut Ridge anticlines, the older Pennsylvanian and Mississippian rocks are found on top of these ridges, whereas the stratigraphically higher, younger Pennsylvanian rocks primarily are found along the valley of Indian Creek.

No surface or subsurface faulting has been reported within the study area and drilling records do not indicate displacement of any strata.

Stratigraphy

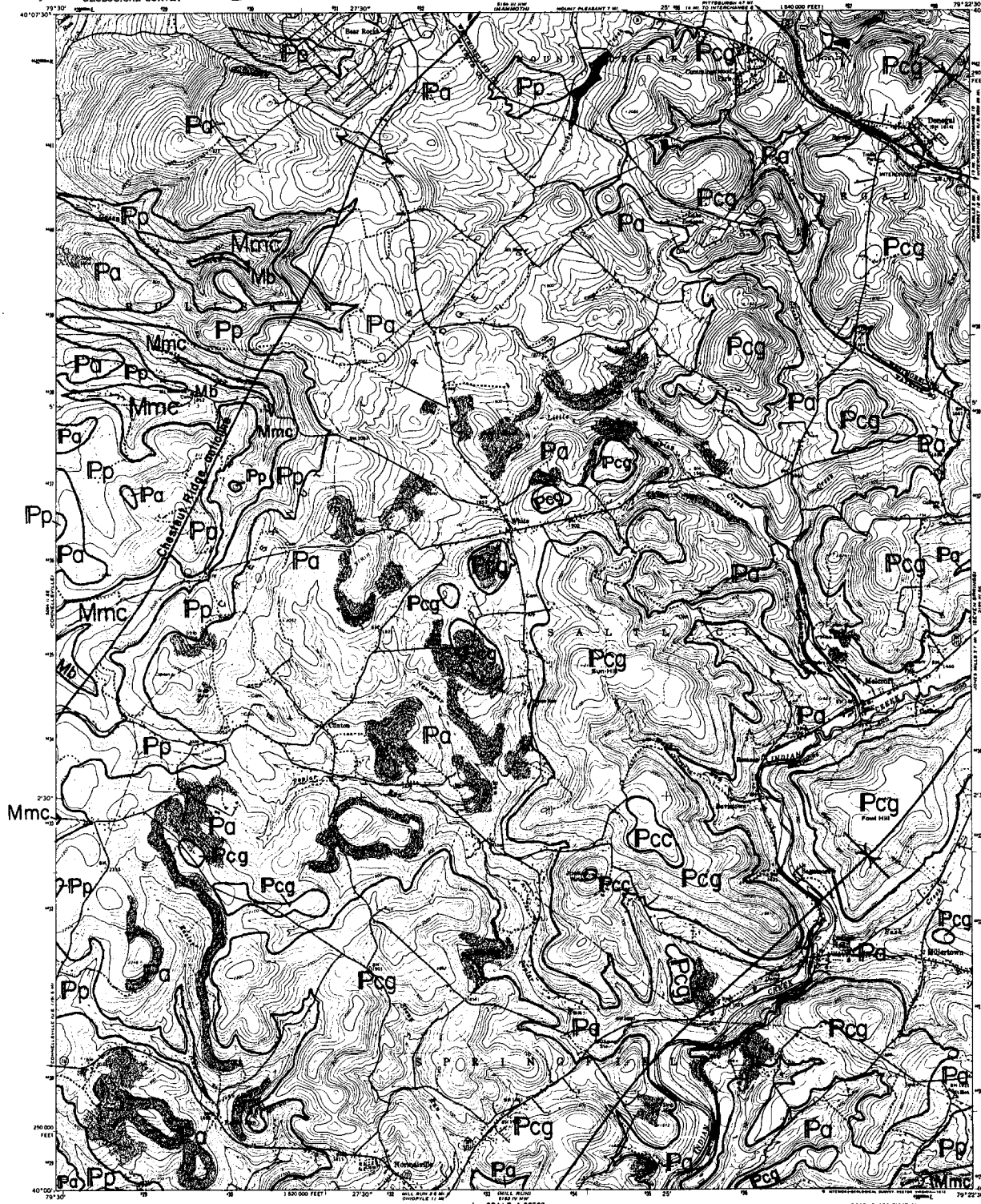
Review of available geologic literature, analysis of drill logs from coal exploration, and field investigations, indicate that all known surface exposures of consolidated rock within the study area are of sedimentary origin of Pennsylvanian and Mississippian age. In descending stratigraphic order, the area contains exposures of Pennsylvanian formations of the Conemaugh, Allegheny, and Pottsville Groups, and exposures of the Mississippian Mauch Chunk Formation and Pocono Group. Two Conemaugh Group coals and all coals known to exist within the Allegheny Group, except the Lower Kittanning coal, are present within the study area. Figure 4 shows the surface distribution of these formations.

The identification and correlation of the coals found within the study area were first described in Pennsylvania Geologic Survey publications by Hickok and Moyer (1940) and Shaffner (1963). Subsequent investigations by Shaulis (1985) and Skema (1988) found that the earlier studies had incorrectly identified the coals of the lower Allegheny Group. Consequently, the majority of the mining records within the study area also incorrectly identified the coal that was mined. A geologic map compiled from Shaulis (Fayette County, 1985) and Skema (Westmoreland County, 1988) is shown in Figure 5.

Figure 4. Map of geologic structure and formations within the Indian Creek study area, compiled by Glover and Edmunds (1976).

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DONEGAL QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



SOURCE
Maps 42 and 43
A48

Mississippian units based on aerial photo interpretation by Edmunds

EXPLANATION

Pcc
Casselman Fm.

Pcg
Glenshaw Fm.

Pa
Allegheny Gp.

Pp
Pottsville Gp.

Mmc
Mauch Chunk Fm.

Mb
Burgoon Ss.

REFERENCES

Shaffner, M. N. (1963), *Geology and mineral resources of the Donegal quadrangle, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Atlas 48, 116 p.

Wagner, W. R., Craft, J. L., Heyman, L., and Harper, J. A. (1975), *Greater Pittsburgh Region geologic map and cross sections*, Pennsylvania Geological Survey, 4th ser., Map 42.

Wagner, W. R., Heyman, L., Craft, J. L., and others (1976), *Greater Pittsburgh Region structure contour map*, Pennsylvania Geological Survey, 4th ser., Map 43.

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION

Primary highway, all weather, hard surface — Light-duty road, all weather, unpaved surface

Secondary highway, all weather, hard surface — Unimproved road, fair or dry weather

Interstate Route — State Route

Compiled by A. D. GLOVER and W. E. EDMUNDS, 1976

DONEGAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEVEN SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SOURCE

(1) In Westmoreland County, Maps 42 and 43.

(2) A 48.

(3) Mississippian and Devonian units based on aerial photo interpretation by Edmunds.

(4) Match with C 56A along southern edge.

EXPLANATION

Pcc
Casselman Fm.

Pcg
Glenshaw Fm.

Pa
Allegheny Gp.

Pp
Pottsville Gp.

Mmc
Mauch Chunk Fm.

Mb
Burgoon Ss.

MDso
Shenango Fm. through Oswayo Fm., undiv.

REFERENCES

Flint, N. K. (1965), *Geology and mineral resources of southern Somerset County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., County Report 58A, 267 p.

Shaffner, M. N. (1963), *Geology and mineral resources of the Donegal quadrangle, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Atlas 48, 116 p.

Wagner, W. R., Craft, J. L., Heyman, L., and Harper, J. A. (1976), *Greater Pittsburgh Region geologic map and cross sections*, Pennsylvania Geological Survey, 4th ser., Map 42.

Wagner, W. R., Heyman, L., Craft, J. L., and others (1975), *Greater Pittsburgh Region structure contour map*, Pennsylvania Geological Survey, 4th ser., Map 43.

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Primary highway, all weather, hard surface — Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface — Unimproved road, fair or dry weather
Interstate Route — State Route

Compiled by A. D. GLOVER and W. E. EDMUNDS, 1976

SEVEN SPRINGS

Figure 5. Map of coal outcrops within the Indian Creek study area, compiled by Shaulis (1985) and Skema (1988).

DONEGAL

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEVEN SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

CROP LINES

- bc — Brush Creek coal
- mh — Mahoning coal
- uf — Upper Freeport coal
- uk — Upper Kittanning coal
- mk — Middle Kittanning coal
- lk — Lower Kittanning coal
- cl — Clarion coal
- bk — Brookville coal
- mr — Mercer coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

3000

Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 100 feet.

MAP RELIABILITY
Coal crop lines—fair to good
Structure contours—fair to good

SEVEN SPRINGS

COAL CROP LINES AND STRUCTURE CONTOURS

To determine the coals which were actually mined, an evaluation of the drilling records from the 51 surface mine permit files was conducted and strike and dip calculations for individual coals were compiled. The results of this evaluation are presented in Table 2 (Note: Coal names have been corrected). In addition, a total of 78 drilling records from coal exploration activities were studied, of which, 40 records were selected for use in this report. These records were chosen because they include detailed lithologic descriptions of the strata encountered in drilling and because each hole reported the elevation and thickness of two or more coals which could be used for stratigraphic correlation. An index listing of these records is presented in Table 3 and the locations of the drill holes is shown on Figure 6.

Evaluation of the available drilling records and underground mine maps, in conjunction with field investigations of active surface mine areas and rock exposures within the study area, found that the recent work by Shaulis (1985) and Skema (1988) accurately defines the coal stratigraphy within the study area.

A generalized geologic column showing the vertical relationship of the coals found within the study area is shown in Figure 7 and the stratigraphic intervals and coal thickness reported in drill records are presented in Table 4.

Pennsylvanian System

The Conemaugh, Allegheny, and Pottsville Groups of the Pennsylvanian System are found within the study area. The stratigraphic intervals of the Conemaugh and Allegheny Groups are defined by the various coals which they contain. The base of the Pottsville Group is defined by an unconformity situated at the top of the underlying Mississippian System.

Conemaugh Group

The Conemaugh Group consists of sandstones, shales, sandy shales, coals, and thin limestones, and forms the majority of the surface area west of Indian Creek and on the flank of the Chesnut Ridge anticline (Figure 4). Stratigraphically, these are the youngest formations found in the study area, except for the colluvium and alluvium of Quaternary age found at the base of steep hills and along stream valley bottoms. The Conemaugh Group is divided into the Casselman and Glenshaw Formations. The Casselman Formation contains thin-bedded calcareous claystones, siltstones, locally massive sandstones, and freshwater limestones. This formation occurs on two hilltops west of Indian Head and on several hilltops located between Donegal and Horners Mill (Figure 4). The maximum thickness of this formation in the study area is unknown, but it appears that only the lower units of this Group are present. The Glenshaw Formation is over 300 feet thick, and contains thinly-bedded fossiliferous shales and claystones, freshwater and marine limestones, locally massive sandstones, and the Brush Creek coal and the Mahoning coal.

Table 2. Strike and dip of coals as reported in surface mining permit reports.

	Operator/"Mine"	Permit #	Coal	Strike	Dip
1.	Firestone Coal Corp. "Keller"	34A77SM14	Mahoning Upper Freeport	N 38° W N 28° W	1.8 % NE 1.2 % NE
2.	Milrock Mining, Inc. "Champion #1"	3375SM64	Mahoning & Upper Freeport	N 32° W	3.13 % NE
3.	Amerikohl Mining, Inc. "Prinkey"	26880101	Upper Freeport Lower Freeport	N 26° E N 12° E	5.35 % SE 5.62 % SE
4.	Amerikohl Mining, Inc. "Ritenour II"	26900106	Upper Freeport Lower Freeport	N 21° E N 06° E	7.4 % SE 6.0 % E
5.	Better Mining Co. "Pritts"	3375SM30	Upper Freeport	N 35° E	6.0 % W
6.	Bridgeport Coke "Sapone"	3376SM13	Upper Freeport	N 15° W	6.5 % E
7.	Clarksburg Coal Co., Inc. "Barger"	3378BC20	Upper Freeport	N 17° E	3.5 % E
8.	Firestone Coal Co., Inc. "Hensel"	26820101	Mahoning Upper Freeport	N 44° E N 07° E	3.0 % SE 2.0 % E
9.	Indy-Penn Coal Co., Inc. "Clark"	3377SM17	Upper Freeport	N 35° 30' W	4.5 % NE
10.	Pine Flats Coal Co., Inc. "Hopewell"	26813036(T)	Upper Freeport	N 15° E	3.3 % E
11.	William K. Tedesco "Tedesco"	3370BSM16	Upper Freeport	N 40° E	8.7 % SE
13.	Bologna Mining Co. "Nicholson"	3374SM72	Upper Freeport Lower Freeport	N 88° E N 73° E	6.0 % S 5.5 % S
14.	Adam Eidemiller, Inc. "Miller-Pritts"	3376SM11	Upper Freeport & Lower Freeport	N 46° 30' E	3.1 % SE
15.	Clarksburg Coal Co., Inc. "Flack"	3377SM25(T)	Upper Freeport & Lower Freeport	N 27° 30' E	5.5 % SE
16.	Laurel Ridge Coal, Inc. "Warrick"	3375SM38	Upper Freeport & Lower Freeport	N 10° W	3.1 % SW
17.	Ann Mineral Co. "Showman"	3375SM53	Lower Freeport	N 83° 30' E	2.5 % S

Table 2. (continued)

	Operator/"Mine"	Permit #	Coal	Strike	Dip
18.	Fryske & Nole Co. "Pletcher"	2968BSM25	Lower Freeport	N 03° E	2.0 % E
20.	Laurel Ridge Coal, Inc. "Kineer/Warabak"	3374SM78	Lower Freeport	N 73° E	1.2 % S
21.	Laurel Ridge Coal, Inc. "Speyer"	3378BC16	Upper Freeport Lower Freeport	N 85° E N 61° E	1.3 % S 3.7 % S
22.	Northbrook Mining, Inc. "Speyer"	26820112	Upper Freeport Lower Freeport	N 85° E N 88° E	1.3 % S 1.0 % S
23.	William K. Tedesco "Tedesco"	3370BSM8	Lower Freeport	N 60° E	5.3 % SE
25.	Marsolino Coal & Coke, Inc. "Leighty"	3376SM14	Lower Freeport Upper Kittanning	N 45° E N 45° E	2.2 % SE 2.2 % SE
26.	Morcoal Co. "Kalp"	34A76SM2	Upper Kittanning	not reported	8.0 % W
27.	Pine Flats Coal Co., Inc. "La Rosa"	26823086(T)	Upper Kittanning Middle Kittanning	N 42° E N 24° E	3.0 % SE 4.0 % SE
28.	Emerald Energy Enterprises "Knopsnider"	3375SM69	Upper Kittanning Middle Kittanning	N 20° E N 23° E	1.7 % SE 4.0 % SE
29.	Emerald Energy Enterprises "Marston"	3377SM13	Upper Kittanning Middle Kittanning	N 78° E N 66° E	6.5 % SE 6.3 % SE
30.	Pine Flats Coal Co., Inc. "Becker"	26880113	Middle Kittanning	N 11° W	3.4 % NE
31.	Purco Coal Co., Inc. "Layman"	26703078 & 3370BSM23	Middle Kittanning	N 30° E	5.5 % SE
32.	C & A Coal Co. "Secrist"	3375SM12	Middle Kittanning	N 20° E	3.33 % SE
33.	Adam Eidemiller, Inc. "Mastowski"	2969BSM10	Middle Kittanning	N 11° E	4.1 % E
35.	Fryske & Nole Coal Co. "Eutsey"	2966BSM14	Middle Kittanning	not reported	1.5 % SE
37.	Fryske & Nole Coal Co. "Benton"	2966BSM95	Middle Kittanning	N 02° E	1.5 % E
38.	Fryske & Nole Coal Co. "Knopsnyder"	2968BSM32	Middle Kittanning	N 18° E	6.5 % SE

Table 2. (continued)

	Operator/"Mine"	Permit #	Coal	Strike	Dip
41.	Holliday Constructors, Inc. "Shaffer"	3375SM54	Middle Kittanning	N 78° 30' W	0.6 % N
43.	Purco Coal Co., Inc. "Brown"	2967BSM12	Middle Kittanning	N 47° E	1.0 % SE
44.	Purco Coal Co., Inc. "Coffman"	3371BSM6	Middle Kittanning	N 20° E	4.0% SE
46.	The Rondell Co. "Knopsnider"	3372BSM4	Middle Kittanning	N 24° E	4.0 % SE
48.	Nicholson & Shepler "Nicholson"	3375SM14	Middle Kittanning & Brookville-Clarion	not reported	2.7 % SE
49.	The Rondell Co. "Correal"	3373SM7	Middle Kittanning	N 15° E	3.0 % SE
51.	Charles Kravetsky "Nicholson"	3377SM27	Brookville-Clarion	N 30° E	1.5 % SE

Table 3. Index to drill sites shown in Figure 6.

Map No.	Company Name	Hole No.	Coals
1	John T. Boyd	B-17	UF, LF, MK
2	John T. Boyd	B-24	UF, LF, UK, MK, BK-CL
3	John T. Boyd	B-16	Mh, UF, LF, UK rider, UK, MK, BK-CL
4	I.C.C. & C.	140	Mh, UF, UK rider, UK, MK
5	John T. Boyd	B-25	Mh, UF, UK, MK
6	Gaddy Engineering	DH80-1	BC, Mh, UF, UK, MK
7	Eastern Gas & Fuel Assoc.	K-7-61	UF, UK, MK
8	John T. Boyd	B-15	Mh, UF, UK, MK
9	John T. Boyd	B-33	UF, UK, MK
10	Eastern Gas & Fuel Assoc.	K-3-61	Mh, UF, UK, MK
11	Eastern Gas & Fuel Assoc.	K-4-61	UF, UK, MK
12	Harvey Drilling Co. (PP&L)	10-17	UK, MK
13	John T. Boyd	B31A	UK rider, UK, MK
14	John T. Boyd	B31B	UK, MK
15	John T. Boyd	B-29	UF, UK, MK
16	Eastern Gas & Fuel Assoc.	K-4-60	UK rider, UK, MK
17	Hetager Drilling	548	UF, UK rider, UK, MK
18	Eastern Gas & Fuel Assoc.	K-5-60	UF, UK, MK
19	John T. Boyd	B-32	UK, MK
20	Eastern Gas & Fuel Assoc.	K-1-60	UF, UK, MK
21	Eastern Gas & Fuel Assoc.	K-2-60	UF, UK, MK
22	Eastern Gas & Fuel Assoc.	K-6-61	UF, UK rider, UK, MK
23	I.C.C. & C.	No. 2	UK rider, MK
24	Harvey Drilling Co. (PP&L)	10-5	UK, MK
25	Harvey Drilling Co. (PP&L)	10-6	UK, MK
26	Amerikohl "Prinkey"	DH-40	UF, LF
27	Harvey Drilling Co. (PP&L)	10-15	UF, LF
28	Harvey Drilling Co. (PP&L)	10-9	Mh, UF
29	Harvey Drilling Co. (PP&L)	10-10	Mh, UF
30	John T. Boyd	B-34	BC, UF
31	John Foust Farm	No. 2	Mh, UF, UK, MK
32	Sagamore Coal Co.	Bc23	Mh, UF, UK, MK
33	Gaddy Engineering	GEC-2	UF, MK
34	John T. Boyd	B-6	UF, LF, MK
35	Harvey Drilling Co. (PP&L)	10-12	UF, LF
36	John T. Boyd	B-5	UF, LF, MK
37	John T. Boyd	B-37	UF, LF
38	John T. Boyd	B-4	UF, UK, MK
39	Johnson & Korsmo Diamond Drill	DH-33	UF, LF, UK, MK
40	John T. Boyd	B-10	UF, MK

Figure 6. Map of coal exploration drill hole locations within the Indian Creek study area. Drill holes are identified in Table 3 and stratigraphic information is given in Table 4.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

DONEGAL QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1967. Field checked 1967

Polyconic projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue

1927 North American Datum (NAD 27)

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are given in USGS Bulletin 1875

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Revisions compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1988 and other sources
Contours not revised. This information not field checked
Map edited 1993

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1993 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route
County Route

DONEGAL, PA.
40079-A4-TF-024
1967
REVISED 1993
DMA 6184 IV SW-SERIES V651

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

SEVEN SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1967. Field checked 1967

Polyconic projection. 10,000-foot grid ticks based on 1000-meter coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
1927 North American Datum (NAD 27)

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Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

There may be private inholdings within the boundaries of the National or State reservations shown on this map

Revisions compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1982 and other sources. Contours not revised. This information not field checked

Map edited 1983

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
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DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, all weather, hard surface	Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface	Unimproved road, fair or dry weather
Interstate Route	State Route

SEVEN SPRINGS, PA.
40079-A3-TF-024

1967
REVISED 1983
DMA 8184 III SE - SERIES V881

Table 4. Stratigraphic intervals and coal thickness from drill records.

Hole #	1	2	3	4	5	6	7	8	9	10	11
	-TOP-	-TOP-	-TOP-		-TOP-	-TOP-		-TOP-	-TOP-	-TOP-	-TOP-
Brush Creek Coal Thickness						0.6					
Brush Creek to Mahoning				-TOP-		37.6	-TOP-				
Mahoning Coal Thickness			0.5	3.5	0.3	3.5		0.5		0.7	
Mahoning to Upper Freeport			56.5	48.9	53.2	53.8		52.3		55.4	
Upper Freeport Coal Thickness	2.2	1.5	1.0	2.8	1.5	1.5	1.0	2.0	0.8	1.2	1.2
Upper Freeport to Lower Freeport	40.4	48.5	41.3								
Lower Freeport Coal Thickness	0.8	1.0	1.3								
Lower Freeport to Upper Kittanning		47.3	53.6								
Upper Kittanning Rider Thickness			1.0	0.6							
UK Rider to Upper Kittanning			18.9	20.1							
Upper Kittanning Coal Thickness		1.3	2.1	5.0	1.7	6.1	2.1	4.2	4.6	6.1	3.3
Upper Kittanning to Middle Kittanning		61.4	64.8	65.8	71.2	61.8	73.2	66.6	60.7	65.9	60.9
Middle Kittanning Coal Thickness	2.0	2.9	3.6	3.5	3.9	3.5	3.5	4.1	3.2	2.9	3.9
Upper Freeport to Upper Kittanning		95.8	94.9	93.8	86.2	95.0	84.5	90.2	93.1	91.7	89.2
Upper Freeport to Middle Kittanning	163.9	157.2	159.7	159.6	157.4	156.8	157.7	156.8	153.8	157.6	150.1

*All values given in feet.

Table 4. (continued)

Hole #	12	13	14	15	16	17	18	19	20	21	22	23
						-TOP-		-TOP-	-TOP-		-TOP-	
Brush Creek Coal Thickness												
Brush Creek to Mahoning												
Mahoning Coal Thickness										-TOP-		
Mahoning to Upper Freeport							-TOP-					
Upper Freeport Coal Thickness		-TOP-		-TOP- 2.7		1.9	1.0		0.4	1.2	1.7	
Upper Freeport to Lower Freeport	-TOP-											
Lower Freeport Coal Thickness					-TOP-							-TOP-
Lower Freeport to Upper Kittanning												
Upper Kittanning Rider Thickness		0.2			0.7	1.5					3.0	3.2
UK Rider to Upper Kittanning		19.0			21.0	19.3					18.9	
Upper Kittanning Coal	3.5	4.2	6.0	4.2	5.0	5.0	4.9	1.0	6.1	2.2	0.4	
Upper to Middle Kittanning	60.9	68.1	68.5	62.7	63.2	61.7	64.3	57.3	61.0	68.8	64.6	
Middle Kittanning Coal	3.2	3.3	3.5	3.3	3.2	3.1	3.5	3.3	3.3	3.3	3.3	3.4
Upper Freeport to Upper Kittanning				97.9		93.7	96.7		94.7	99.0	100.9	
Upper Freeport to Middle Kittanning				160.6		155.4	161.0		155.7	167.8	162.8	

*All values given in feet.

Table 4. (continued)

Hole #	24	25	26	27	28	29	30	31	32
						-TOP-	-TOP-	-TOP-	-TOP-
Brush Creek Coal Thickness							1.9		
Brush Creek to Mahoning					-TOP-				
Mahoning Coal Thickness					0.5	2.5		1.6	2.7
Mahoning to Upper Freeport					58.0	58.8		59.3	60.7
			-TOP-	-TOP-					
Upper Freeport Coal Thickness			2.5	3.0	3.0	1.8	2.0	2.7	2.4
						-BOT-			
Upper Freeport to Lower Freeport			37.5	37.2			-BOT-		
					-BOT-				
Lower Freeport Coal Thickness			2.7	2.3					
				-BOT-					
			-BOT-						
Lower Freeport to Upper Kittanning									
Upper Kittanning Rider Thickness	-TOP-	-TOP-							
UK Rider to Upper Kittanning									
Upper Kittanning Coal Thickness	1.0	1.2						5.0	4.7
Upper Kittanning to Middle Kittanning	67.3	63.9						73.6	72.0
Middle Kittanning Coal Thickness	3.3	2.9						3.9	3.7
Upper Freeport to Upper Kittanning								84.1	80.4
Upper Freeport to Middle Kittanning								157.7	152.4

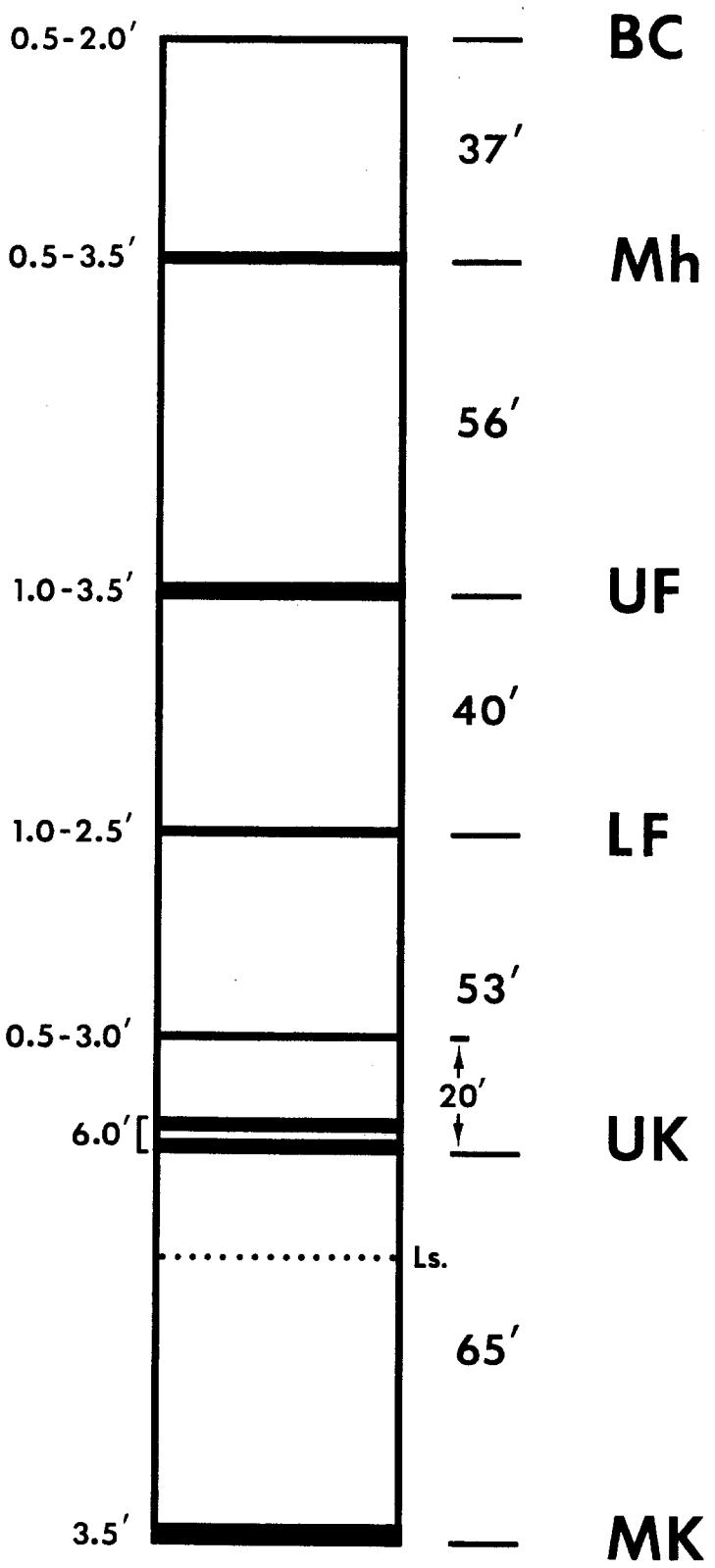
*All values given in feet.

Table 4. (continued)

Hole #	33	34	35	36	37	38	39	40
	-TOP-			-TOP-				
Brush Creek Coal Thickness			-TOP-					
Brush Creek to Mahoning								
								-TOP-
Mahoning Coal Thickness								
Mahoning to Upper Freeport						-TOP-		
		-TOP-					-TOP-	
					-TOP-			
Upper Freeport Coal Thickness	2.7	3.8	3.5	3.2	2.7	2.3	2.7	3.1
Upper Freeport to Lower Freeport		38.2	35.8	38.3	33.8		39.1	
Lower Freeport Coal Thickness		2.0	1.3	0.5	0.5		0.1	
			-BOT-					
					-BOT-			
Lower Freeport to Upper Kittanning							49.8	
Upper Kittanning Rider Thickness								
UK Rider to Upper Kittanning								
Upper Kittanning Coal Thickness						0.5	6.2	
Upper Kittanning to Middle Kittanning						69.9	73.3	
Middle Kittanning Coal Thickness	4.2	3.0		3.7		3.3	2.9	3.4
Upper Freeport to Upper Kittanning						103.7	88.9	
Upper Freeport to Middle Kittanning	155.6	152.0		153.8		163.6	162.2	162.9

*All values given in feet.

Figure 7. Geologic column showing the characteristic stratigraphic relationships of coals within the Indian Creek study area.


0.5-2.0′
BC
37′
0.5-3.5′
Mh
56′
1.0-3.5′
UF
40′
1.0-2.5′
LF
53′
0.5-3.0′
20′
6.0′
UK
Ls.
65′
3.5′
MK

The only occurrence of the Brush Creek coal within the study area was reported as a 0.6 foot thick coal in drill Hole 6 and as a 1.9 foot thick coal in drill Hole 30. There is no record of this coal being mined within the study area. The Mahoning coal, which occurs approximately 37 feet below the Brush Creek coal, was reported in 9 drill hole records and was surface mined at two locations near the confluence of Minnow Run and Champion Creek (Figure 3). This coal ranged in thickness from 0.5 to 3.5 feet.

The stratigraphic interval between the Mahoning, of the Conemaugh Group, and the Upper Freeport coal, of the Allegheny Group, ranges from 50.4 to 60.7 feet thick with an average interval of approximately 56 feet. This interval is predominantly shale and siltstone with a locally massive sandstone unit occurring in the middle of the section which may extend down to the Upper Freeport coal in some areas.

Allegheny Group

The Allegheny Group is the dominant coal bearing strata within the study area and is defined stratigraphically to be from the top of the Upper Freeport coal down to the base of the Brookville-Clarion coal. The Allegheny Group is exposed along most of Indian Creek and the smaller stream valleys located on the eastern side of Indian Creek and from Indian Creek westward to the crest of Chestnut Ridge. Coals of the Allegheny Group present within the study area include the Upper Freeport, Lower Freeport, Upper Kittanning rider, Upper Kittanning, Middle Kittanning, and the Brookville-Clarion coals. The Brookville and Clarion coals are poorly differentiated within this area and are referred to as the Brookville-Clarion coal in this study. In addition to the coals, the rocks of the Allegheny Group are predominantly shales, siltstones, and sandstones. Lateral variations, interbedding, and varied thicknesses of these clastic depositional units are common throughout the study area.

The Upper Freeport coal, which varies between 0.4 to 3.5 feet thick is laterally persistent throughout the study area wherever the top of the Allegheny Group occurs. The stratigraphic interval between the Upper Freeport and the Lower Freeport coals ranges from 37.2 to 48.5 feet with an average thickness of approximately 40 feet. This interval is predominantly shale with occasional one to two foot thick sandstone lenses. The Lower Freeport coal is thin and discontinuous, ranging from a coal trace to 2.7 feet thick. This coal was generally surface mined in conjunction with the Upper Freeport coal or the Upper Kittanning coal.

The stratigraphic interval between the Lower Freeport coal horizon and the Upper Kittanning coal ranges from 47.3 to 53.6 feet with an average thickness of approximately 53 feet. This interval is characterized by sandy shale with interbedded thin sandstone units which are generally less than one foot thick. A thin rider coal was reported in several drill hole records as occurring approximately 18 to 21 feet above the Upper Kittanning coal in the west-central portion of the study are (See Table 4 and Figure 6). The Upper Kittanning coal is persistent throughout most of the study area, however, drilling records from within the Poplar Run watershed indicate this coal was generally not present. The Upper Kittanning occurs as a split coal with total coal thickness ranging from approximately 5.0 to 6.0 feet, with approximately 1.5 to 2.0 feet of shale and siltstone separating the two coal units.

The stratigraphic interval between the Upper Kittanning and the Middle Kittanning coals ranges from 57.3 to 73.6 feet, with an average thickness of approximately 65 feet. This interval is predominantly calcareous shales and siltstones with a few thin interbedded sandstone units. The Johnstown limestone, which averages less than 1 foot thick within the study area, occurs at approximately 17 feet below the Upper Kittanning coal. The Middle Kittanning coal is laterally persistent throughout most of the study area where the Allegheny Group is present, with coal thickness ranging from approximately 2.9 to 3.9 feet. This coal has been surface mined within the upper reaches of Little Champion Creek and within the Poplar Run watershed. Underground mining has occurred on this coal along Indian Creek from the village of Melcroft downstream to Poplar Run.

Information concerning the stratigraphy below the Middle Kittanning coal is very limited with only drill Hole 2 and 3 reporting approximately 3.3 feet of coal at the Brookville-Clarion horizon. Four surface mines within the study area occurred on the Brookville-Clarion coal. Mine permit records for these areas contain 12 test hole records which reported the Brookville-Clarion coal ranged in thickness from 3.0 to 4.5 feet. The Rondell Company "Correal" mine (SMP 3373SM7), located on Chestnut Ridge west of Clinton, mined both the Middle Kittanning and Brookville-Clarion coals. The stratigraphic interval between the two coals at this mine was reported to consist of 70 to 75 feet of sandstone and shale, which corresponds to the stratigraphic interval and lithology for this interval reported from Holes 2 and 3.

Pottsville Group

The Pottsville Group, which lies uncomfortably on top of the Mauch Chunk Formation of the Mississippian System, is the lowest stratigraphic unit of Pennsylvanian age. The Pottsville Group is approximately 200 feet thick and consists of 3 members: the 30 foot thick Homewood sandstone, overlying the 20 foot thick Mercer shales, and the 150 foot thick Connoquenessing sandstone.

The Homewood sandstone at the top of the Pottsville Group is commonly composed almost completely of quartz grains cemented by silica. The Connoquenessing sandstone in the lower part of the Group tends to be impure and micaceous, with limonite concretions, and is more coarse grained than the Homewood sandstone (Shaffner, 1963). Both sandstones are generally massive and resistant to weathering, commonly forming cliffs within the study area. The Pottsville Group is exposed along the crest of the Chestnut Ridge anticline and along the western flank of the Laurel Hill anticline. No drill hole information was available from within the Pottsville Group.

Mississippian System

Mississippian age rocks are the oldest found within the study area. Their exposures are limited to the upper slopes and top of the Laurel Hill anticline. The Mauch Chunk Formation, which is found at the top of the Mississippian System, is approximately 250 feet thick. This formation is composed of a sequence of red shales and siltstones with intercalated beds of gray shales, gray sandstones, greenish flaggy siltstones, and the Greenbrier Limestone Member which occurs in the lower part of the formation (Shaffner, 1963). The Greenbrier Limestone occurs approximately 75 feet above the underlying Pocono

Group and is approximately 24 feet thick. The upper 14 feet of the Greenbrier Limestone is a massive, thick-bedded, dark-bluish-gray limestone, and the lower 10 feet are alternating beds of light bluish-gray limestone and calcareous shale (Shaffner, 1963). Fossils are abundant in the lower part of the Greenbrier Limestone and sparse in the upper part.

Stratigraphically below the Mauch Chunk Formation is the Pocono Group. The upper 55 to 60 foot unit of the Pocono Group is occupied by the Loyalhanna Limestone. In the study area, the Loyalhanna Limestone, with its well developed cross-bedded sedimentary structure, has such a high silica content (greater than 50 percent) that it is considered a calcareous sandstone (Shaffner, 1963) and has not been mapped as a separate unit (Shaulis, 1985 and Skema, 1988). The underlying Burgoon Sandstone Member is approximately 500 feet thick and consists of sandstones and sandy shales. The sandstones range from fine-grained, thin-bedded, greenish-gray sandstones with scattered mica flakes to massive, medium- to coarse-grained, gray to whitish sandstones which can be locally conglomeratic (Shaffner, 1963). The Burgoon Sandstone is exposed mainly in the upper reaches of stream valleys which dissect the western flank of Laurel Hill, such as Little Run, Camp Run, Pike Run, and Roaring Run. Glover and Edmunds (1976) mapped two surface exposures of the lower Pocono Group strata comprising the undifferentiated shales and sandstones of the Shenango-Oswayo Formations. Outcrops of these Mississippian deposits occur in the deeply incised valleys of Trout Run and Neals Run. No coals were recognized in the Mississippian formations within the study area.

Overburden Analysis

Overburden analyses have been performed on samples from 30 drill holes within the Indian Creek study area. The locations of these drill holes are shown in Figure 8. Table 5 identifies the mining operator, permit number, coal(s) encountered, the operator's hole number, and the drill hole number used in this study. Lithologic descriptions and specific values for overburden analyses for all depth intervals in these drill holes are shown in Figure 9. Summaries of the overburden analyses results are shown in Table 6 (Sulfur) and Table 7 (NP).

The quantity and quality of alkaline and acid forming material within strata overlying coals to be mined may be used in the prediction of potential acid mine drainage. Alkaline material generally occurs in the form of calcium carbonate, whereas acid producing material is generally represented by iron sulfide minerals, such as pyrite. Chemical analyses of overburden materials generally report results of alkalinity concentrations as NP. This is expressed as an equivalency of tons of calcium carbonate per 1,000 tons of overburden. Potential acidity is represented by total sulfur and is reported as weight percent. These values are commonly shown using a histogram format, with total sulfur percentages and NP values displayed on either side of the lithologic descriptions for each hole.

Figure 8. Map of overburden analysis drill hole locations within the Indian Creek study area. Drill holes are identified in Table 5.

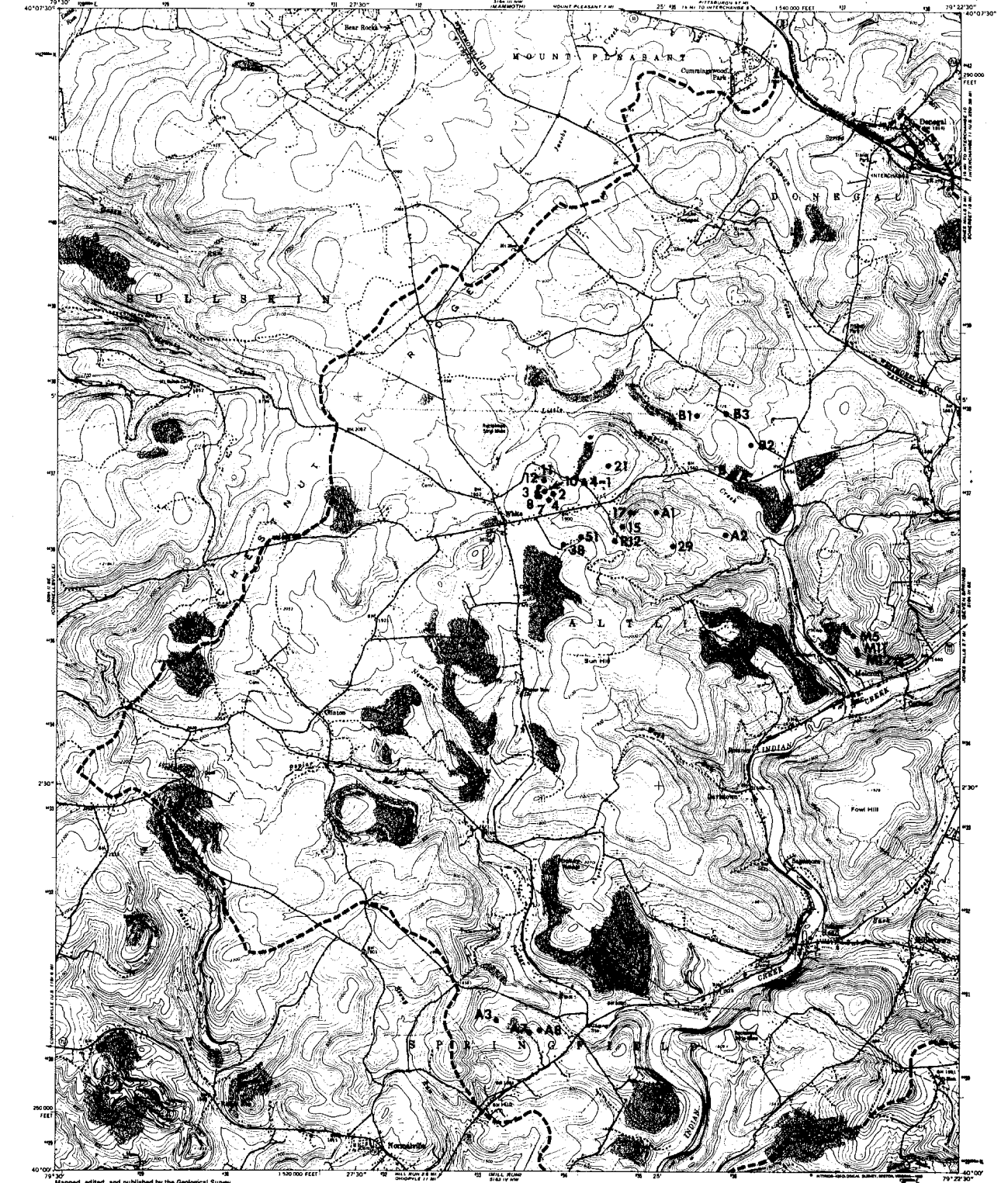
Table 5. Index to overburden drill sites shown in Figure 8.

Map No.	Company Name	Permit #	Company Hole No.	Coals
2	Amerikohl Mining, Inc.	26880101	OB-2	Upper Freeport
3	"	"	OB-3	Upper Freeport
4	"	"	OB-4	Upper Freeport
4-1	"	"	4-1	Upper & Lower Freeport
7	"	"	OB-7	Upper Freeport
8	"	"	OB-8	Upper & Lower Freeport
10	"	"	OB-10	Upper & Lower Freeport
11	"	"	OB-11	Upper Freeport
12	"	"	OB-12	Upper Freeport
21	"	"	OB-21	Upper & Lower Freeport
38	"	"	DH-38	Lower Freeport
51	"	"	DH-51	Lower Freeport
R12	"	26900106	DH-12	Upper & Lower Freeport
15	"	"	DH-15	Upper Freeport
17	"	"	DH-17	Upper Freeport
A1	"	26880110	OB-A1	Upper Freeport
A2	"	"	OB-A2	Lower Freeport
29	"	"	OB-29	Lower Freeport
B1	Pine Flats Coal Co., Inc.	26880113	OB-1	Upper & Middle Kittanning, UK rider
B2	"	"	OB-2	Upper & Middle Kittanning, UK rider
B3	"	"	OB-3	Upper & Middle Kittanning, UK rider
A	Rand Am, Inc.	SOAP 866	OB-A	Middle Kittanning
B	"	"	OB-B	Middle Kittanning
M5	Melcroft Coal Co.	26900113	DH-5	Mahoning, Upper Freeport
M11	"	"	DH-11	Lower Freeport
M12	"	"	DH-12	Lower Freeport
A3	Amerikohl Mining, Inc.	26910111	3	Upper Freeport
A7	"	"	7	Upper Freeport
A8	"	"	8	Upper Freeport

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

DONEGAL QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1967. Field checked 1967

Polyconic projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south zone
1,000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue

1927 North American Datum (NAD 27)

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are given in USGS Bulletin 1875

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Revisions compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1988 and other sources
Contours not revised. This information not field checked
Map edited 1993

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1993 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PENNSYLVANIA
QUADRANGLE LOCATION

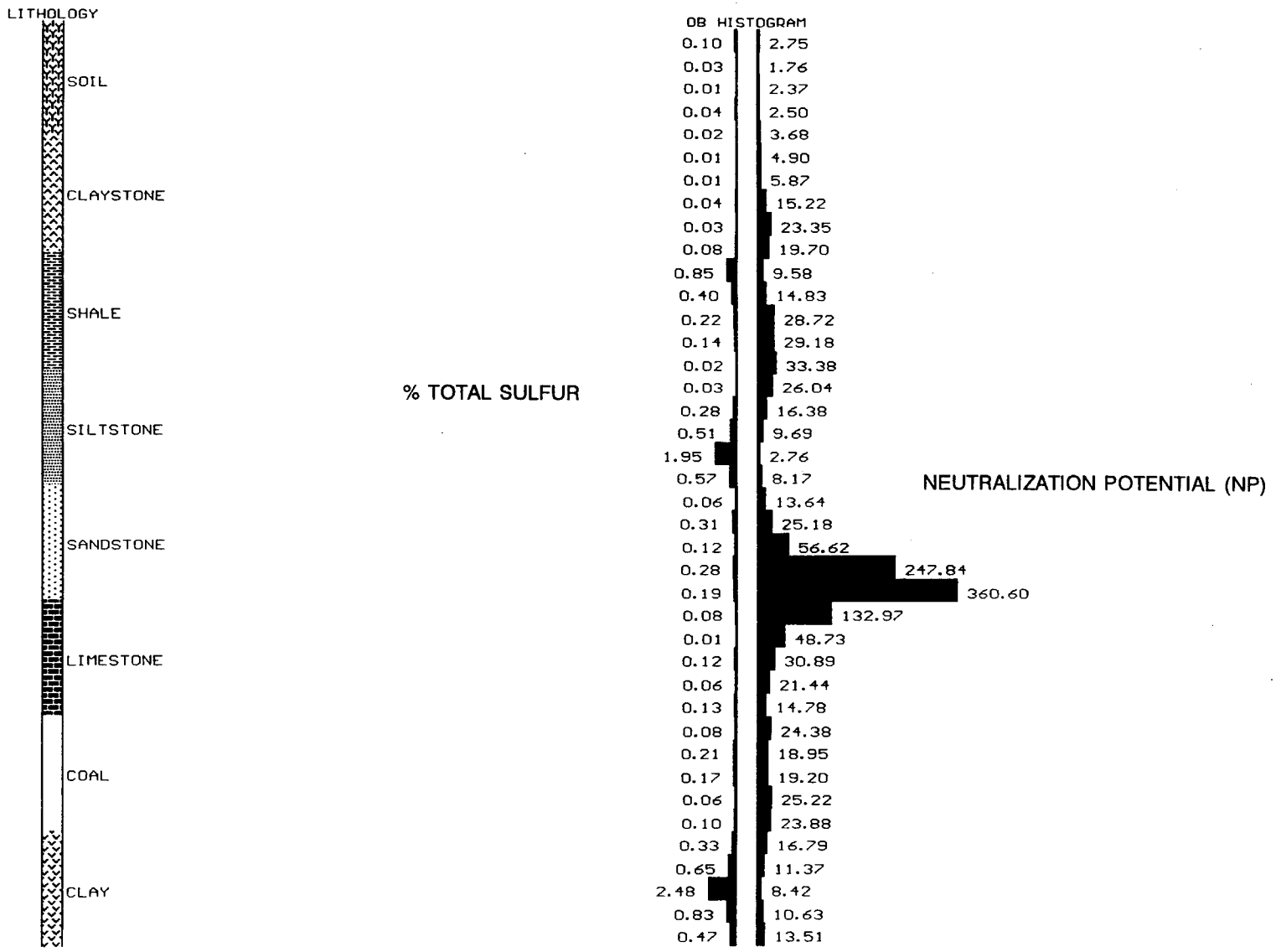
ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route
County Route

DONEGAL, PA.
40079-A6-TF-024
1967
REVISED 1993
DMA 5164 III SW - SERIES V831

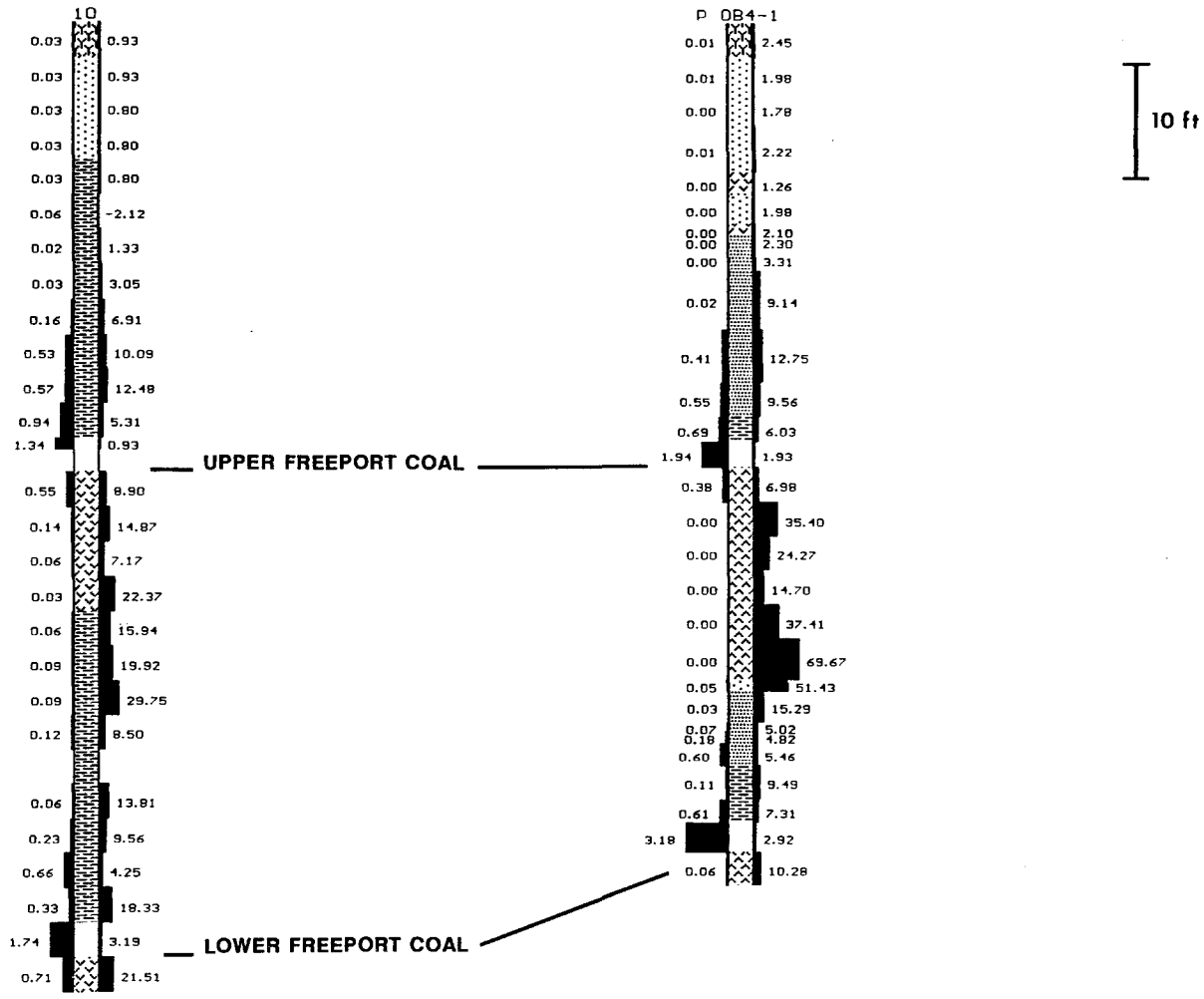
Figure 9. Graphic representation of neutralization potential and total sulfur content determined by overburden analysis of strata within the Indian Creek study area.

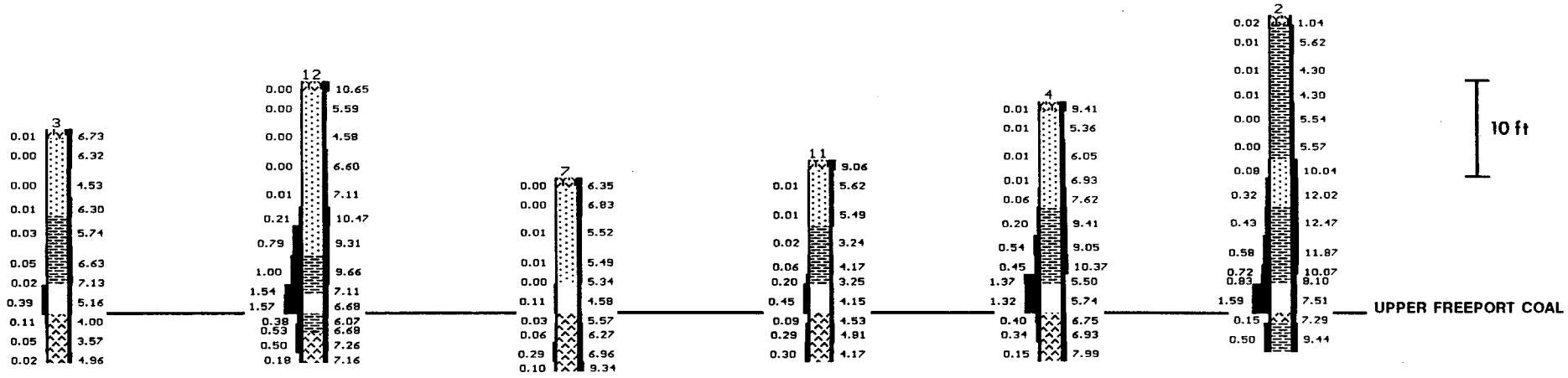
KEY TO WELL LITHOLOGY AND OVERBURDEN ANALYSIS RESULTS



DRILL CUTTINGS SAMPLES

CONTINUOUS CORE SAMPLES

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0.00 4.53
0.01 6.30
0.03 5.74
0.05 6.63
0.02 7.13
0.39 5.16
0.11 4.00
0.05 3.57
0.02 4.96
12
0.00 10.65
0.00 5.59
0.00 4.58
0.00 6.60
0.01 7.11
0.21 10.47
0.79 9.31
1.00 9.66
1.54 7.11
1.57 6.68
0.38 6.07
0.53 6.68
0.50 7.26
0.18 7.16
7
0.00 6.35
0.00 6.83
0.01 5.52
0.01 5.49
0.00 5.34
0.11 4.58
0.03 5.57
0.06 6.27
0.29 6.96
0.10 9.34
11
0.01 9.06
0.01 5.62
0.01 5.49
0.02 3.24
0.06 4.17
0.20 3.25
0.45 4.15
0.09 4.53
0.29 4.81
0.30 4.17
4
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0.01 5.36
0.01 6.05
0.01 6.93
0.06 7.62
0.20 9.41
0.54 9.05
0.45 10.37
1.37 5.50
1.32 5.74
0.40 6.75
0.34 6.93
0.15 7.99
2
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0.01 5.62
0.01 4.30
0.01 4.30
0.00 5.54
0.00 5.57
0.08 10.04
0.32 12.02
0.43 12.47
0.58 11.87
0.72 10.07
0.83 8.10
1.59 7.51
0.15 7.29
0.50 9.44
10 ft
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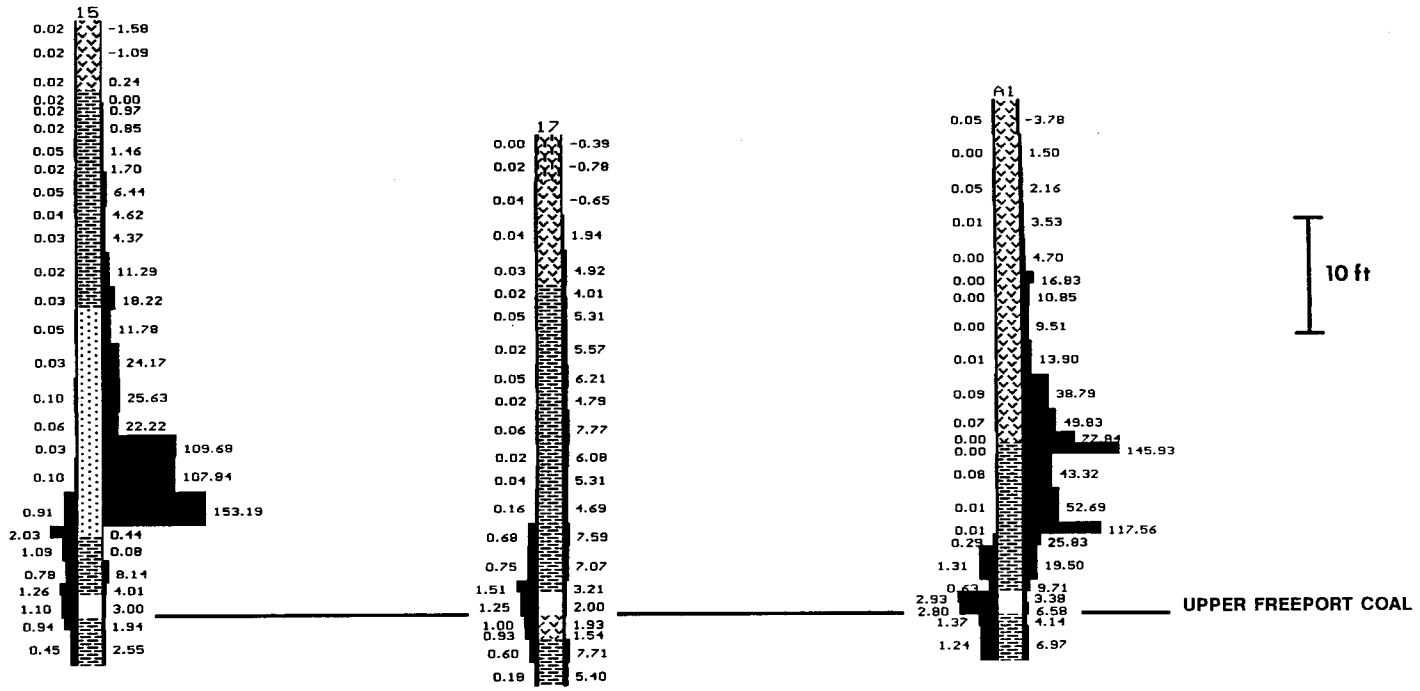
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0.05 6.44
0.04 4.62
0.03 4.37
0.02 11.29
0.03 18.22
0.05 11.78
0.03 24.17
0.10 25.63
0.06 22.22
0.03 109.68
0.10 107.84
0.91 153.19
2.03 0.44
1.09 0.08
0.78 8.14
1.26 4.01
1.10 3.00
0.94 1.94
0.45 2.55
17
0.00 -0.39
0.02 -0.78
0.04 -0.65
0.04 1.94
0.03 4.92
0.02 4.01
0.05 5.31
0.02 5.57
0.05 6.21
0.02 4.79
0.06 7.77
0.02 6.08
0.04 5.31
0.16 4.69
0.68 7.59
0.75 7.07
1.51 3.21
1.25 2.00
1.00 1.93
0.93 1.54
0.60 7.71
0.18 5.40
A1
0.05 -3.78
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0.05 2.16
0.01 3.53
0.00 4.70
0.00 16.83
0.00 10.85
0.00 9.51
0.01 13.90
0.09 38.79
0.07 49.83
0.00 22.84
0.00 145.93
0.08 43.32
0.01 52.69
0.01 117.56
0.29 25.83
1.31 19.50
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2.93 3.38
2.80 6.58
1.37 4.14
1.24 6.97
10 ft
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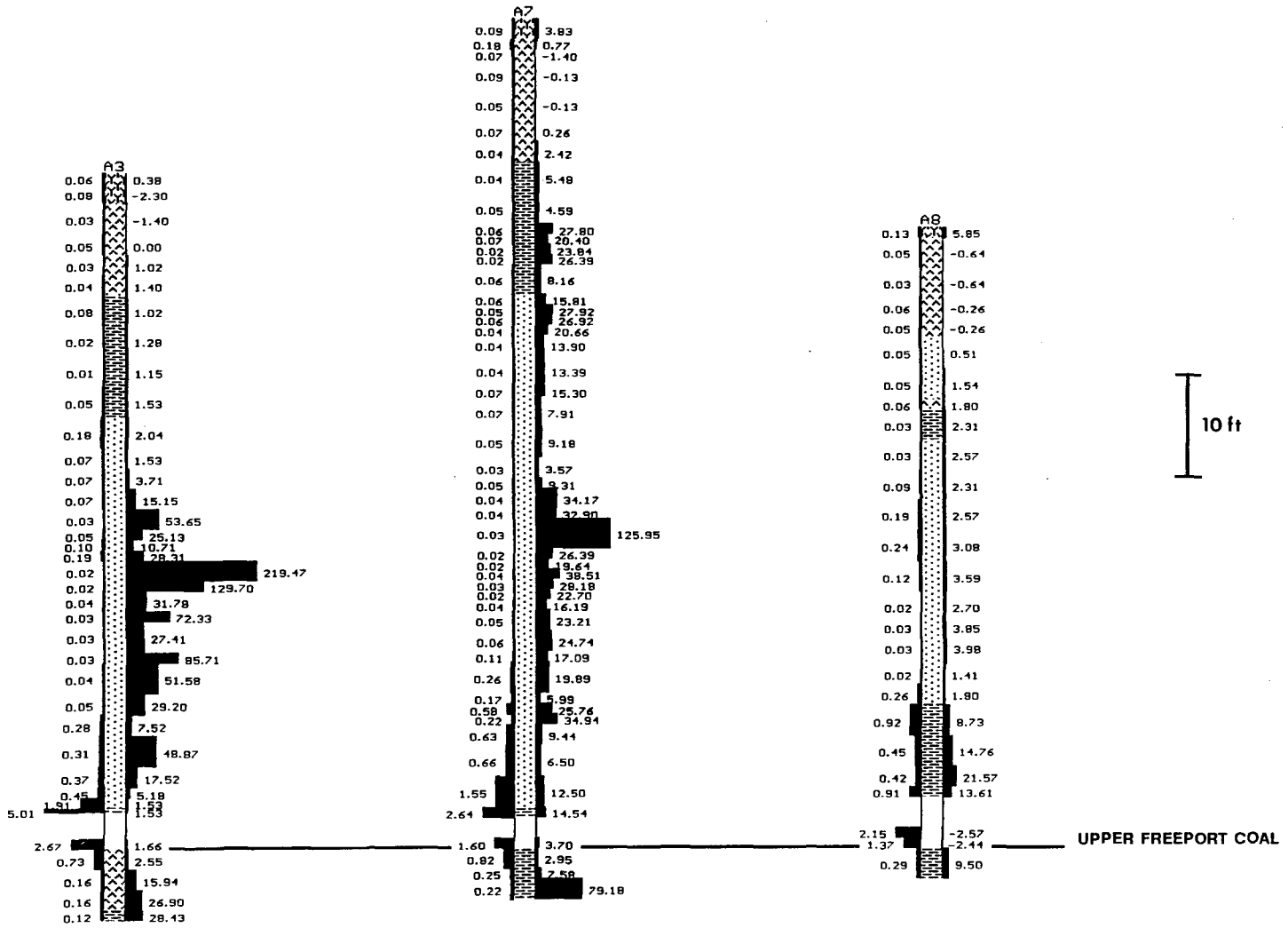
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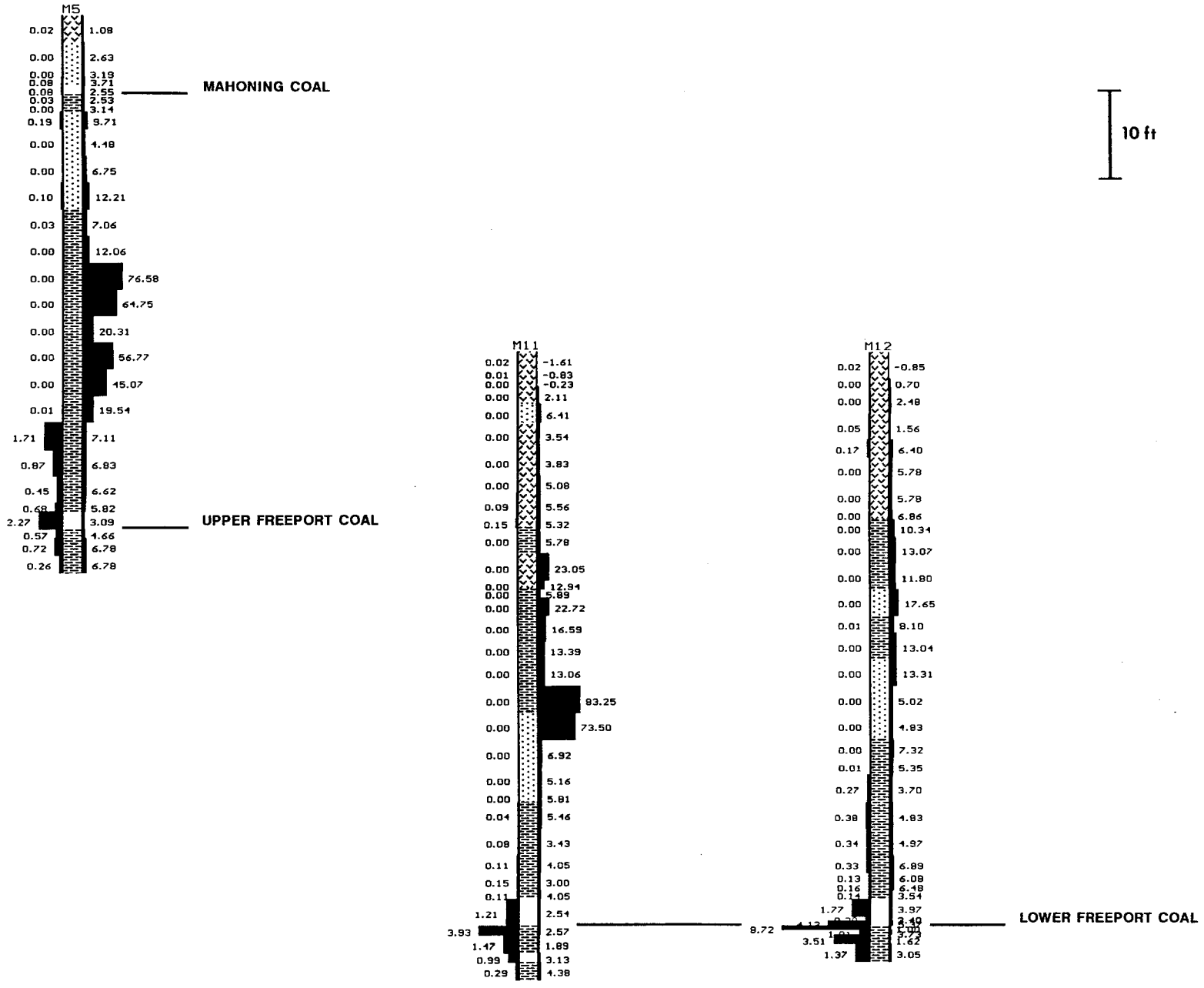
0.01 1.15
0.05 1.53
0.18 2.04
0.07 1.53
0.07 3.71
0.07 15.15
0.03 53.65
0.05 25.13
0.10 10.71
0.19 28.31
0.02 219.47
0.02 129.70
0.04 31.78
0.03 72.33
0.03 27.41
0.03 85.71
0.04 51.58
0.05 29.20
0.28 7.52
0.31 48.87
0.37 17.52
0.45 5.18
1.91 1.53
5.01 1.53
2.67 1.66
0.73 2.55
0.16 15.94
0.16 26.90
0.12 28.43
A7
0.09 3.83
0.18 0.77
0.07 -1.40
0.09 -0.13
0.05 -0.13
0.07 0.26
0.04 2.42
0.04 5.48
0.05 4.59
0.06 27.80
0.07 20.40
0.02 23.84
0.02 26.39
0.06 8.16
0.06 15.81
0.05 27.92
0.06 26.92
0.04 20.66
0.04 13.90
0.04 13.39
0.07 15.30
0.07 7.91
0.05 9.18
0.03 3.57
0.05 9.31
0.04 34.17
0.04 32.90
0.03 125.95
0.02 26.39
0.02 19.64
0.04 38.51
0.03 28.18
0.02 22.70
0.04 16.19
0.05 23.21
0.06 24.74
0.11 17.09
0.26 19.89
0.17 5.99
0.58 25.76
0.22 34.94
0.63 9.44
0.66 6.50
1.55 12.50
2.64 14.54
1.60 3.70
0.82 2.95
0.25 7.58
0.22 79.18
A8
0.13 5.85
0.05 -0.64
0.03 -0.64
0.06 -0.26
0.05 -0.26
0.05 0.51
0.05 1.54
0.06 1.80
0.03 2.31
0.03 2.57
0.09 2.31
0.19 2.57
0.24 3.08
0.12 3.59
0.02 2.70
0.03 3.85
0.03 3.98
0.02 1.41
0.26 1.80
0.92 8.73
0.45 14.76
0.42 21.57
0.91 13.61
2.15 -2.57
1.37 -2.44
0.29 9.50
10 ft
UPPER FREEPORT COAL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0.00 4.48
0.00 6.75
0.10 12.21
0.03 7.06
0.00 12.06
0.00 76.58
0.00 64.75
0.00 20.31
0.00 56.77
0.00 45.07
0.01 19.54
1.71 7.11
0.87 6.83
0.45 6.62
0.68 5.82
2.27 3.09
0.57 4.66
0.72 6.78
0.26 6.78
MAHONING COAL
UPPER FREEPORT COAL
M11
0.02 -1.61
0.01 -0.83
0.00 -0.23
0.00 2.11
0.00 6.41
0.00 3.54
0.00 3.83
0.00 5.08
0.09 5.56
0.15 5.32
0.00 5.78
0.00 23.05
0.00 12.94
0.00 5.89
0.00 22.72
0.00 16.59
0.00 13.39
0.00 13.06
0.00 83.25
0.00 73.50
0.00 6.92
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0.00 5.81
0.04 5.46
0.08 3.43
0.11 4.05
0.15 3.00
0.11 4.05
1.21 2.54
3.93 2.57
1.47 1.89
0.99 3.13
0.29 4.38
M12
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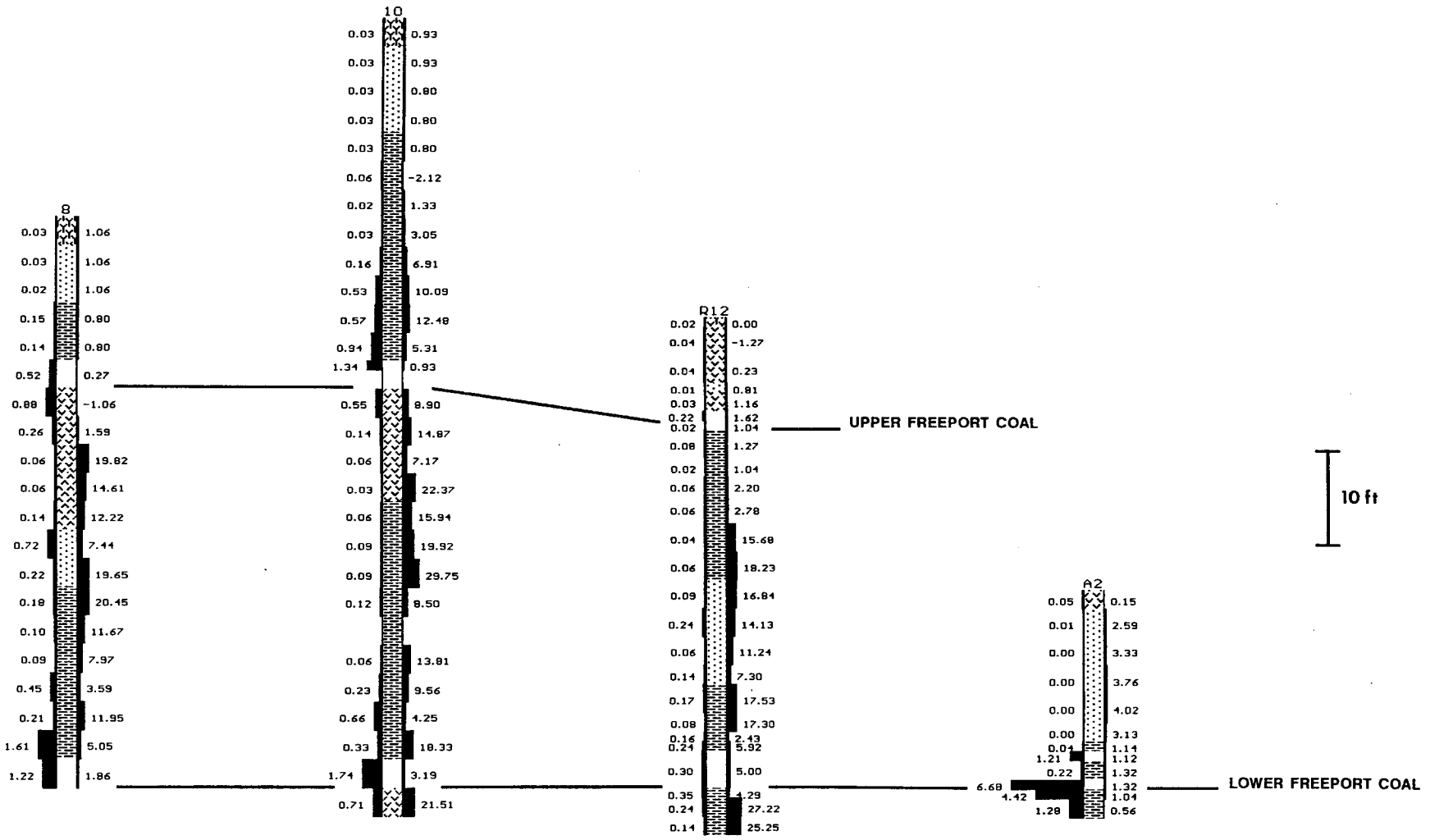
0.17 6.40
0.00 5.78
0.00 5.78
0.00 6.86
0.00 10.34
0.00 13.07
0.00 11.80
0.00 17.65
0.01 8.10
0.00 13.04
0.00 13.31
0.00 5.02
0.00 4.93
0.00 7.32
0.01 5.35
0.27 3.70
0.38 4.83
0.34 4.97
0.33 6.89
0.13 6.08
0.16 6.48
0.14 3.54
1.77 3.97
8.72
3.51
1.37 3.05
LOWER FREEPORT COAL
10 ft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0.03 1.06
0.02 1.06
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0.14 0.80
0.52 0.27
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0.06 19.82
0.06 14.61
0.14 12.22
0.72 7.44
0.22 19.65
0.18 20.45
0.10 11.67
0.09 7.97
0.45 3.59
0.21 11.95
1.61 5.05
1.22 1.86
10
0.03 0.93
0.03 0.93
0.03 0.80
0.03 0.80
0.03 0.80
0.06 -2.12
0.02 1.33
0.03 3.05
0.16 6.91
0.53 10.09
0.57 12.48
0.94 5.31
1.34 0.93
0.55 8.90
0.14 14.87
0.06 7.17
0.03 22.37
0.06 15.94
0.09 19.92
0.09 29.75
0.12 8.50
0.06 13.81
0.23 9.56
0.66 4.25
0.33 18.33
1.74 3.19
0.71 21.51
R12
0.02 0.00
0.04 -1.27
0.04 0.23
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0.03 1.16
0.22 1.62
0.02 1.04
0.08 1.27
0.02 1.04
0.06 2.20
0.06 2.78
0.04 15.68
0.06 18.23
0.09 16.84
0.24 14.13
0.06 11.24
0.14 7.30
0.17 17.53
0.08 17.30
0.16 2.43
0.24 5.92
0.30 5.00
0.35 1.29
0.24 27.22
0.14 25.25
UPPER FREEPORT COAL
10 ft
A2
0.05 0.15
0.01 2.59
0.00 3.33
0.00 3.76
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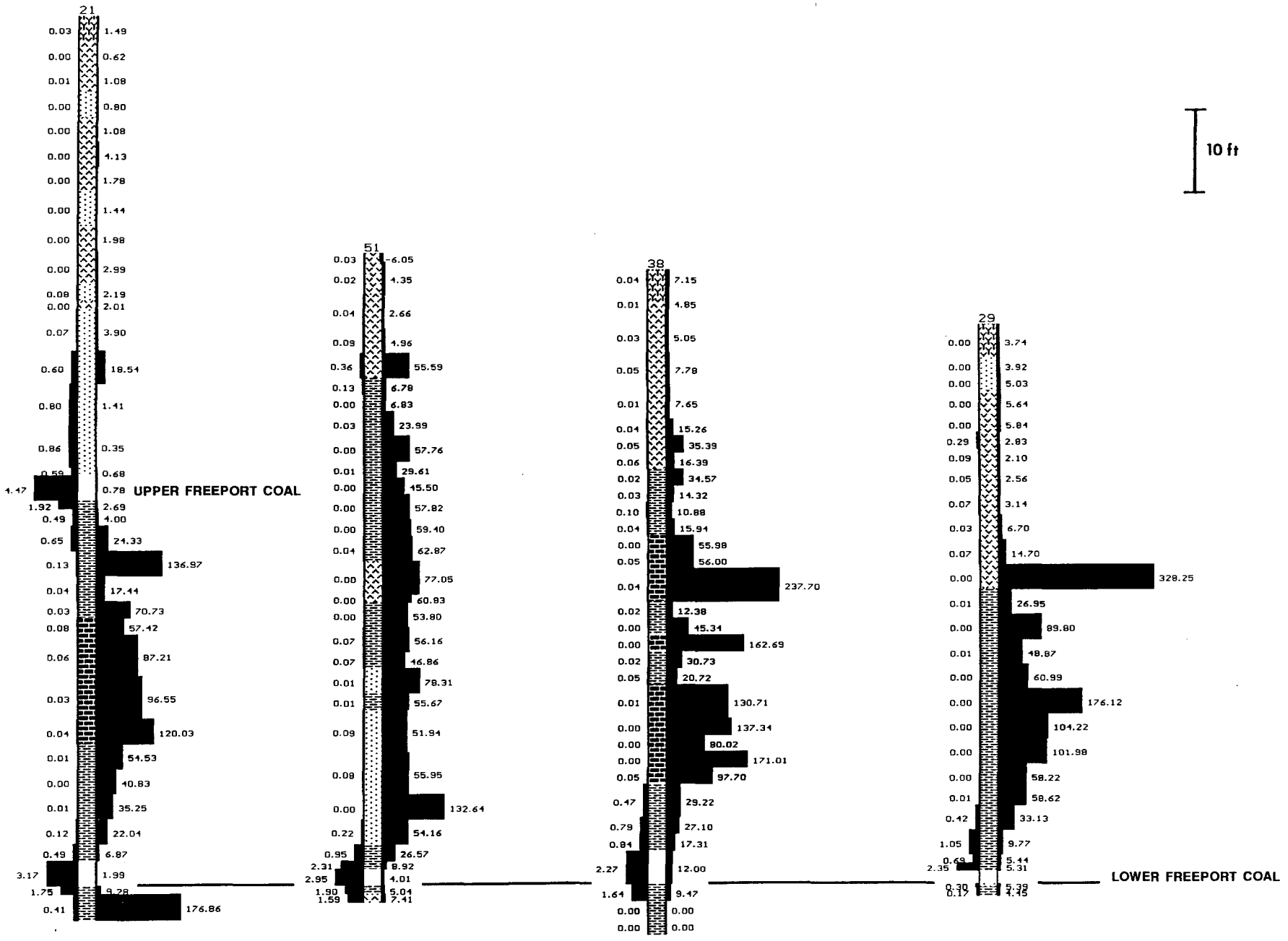
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0.00 1.98
0.00 2.99
0.08 2.19
0.00 2.01
0.07 3.90
0.60 18.54
0.80 1.41
0.86 0.35
0.59 0.68
4.47 0.78
1.92 2.69
0.49 4.00
0.65 24.33
0.13 136.97
0.04 17.44
0.03 70.73
0.08 57.42
0.06 87.21
0.03 96.55
0.04 120.03
0.01 54.53
0.00 40.83
0.01 35.25
0.12 22.04
0.49 6.87
3.17 1.99
1.75 9.28
0.41 176.86
UPPER FREEPORT COAL
51
0.03 6.05
0.02 4.35
0.04 2.66
0.09 4.96
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0.13 6.78
0.00 6.83
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1.90 5.04
1.59 7.41
38
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0.05 97.70
0.47 29.22
0.79 27.10
0.84 17.31
2.27 12.00
1.64 9.47
0.00 0.00
0.00 0.00
29
0.00 3.74
0.00 3.92
0.00 5.03
0.00 5.64
0.00 5.84
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0.01 58.62
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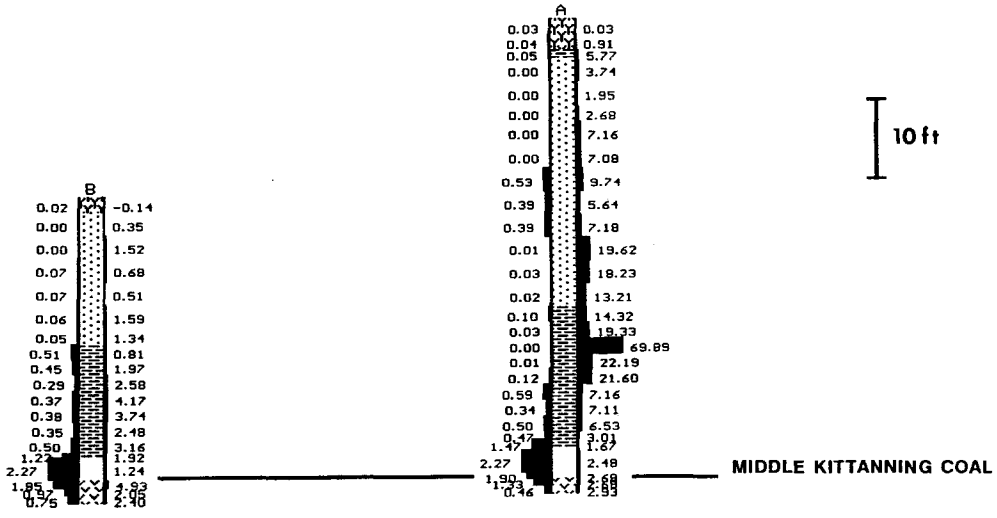
0.19 4.45
LOWER FREEPORT COAL
10 ft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0.07 0.68
0.07 0.51
0.06 1.59
0.05 1.34
0.51 0.81
0.45 1.97
0.29 2.58
0.37 4.17
0.38 3.74
0.35 2.48
0.50 3.16
1.22 1.92
2.27 1.24
1.85 4.93
0.57 2.05
0.75 2.40
A
0.03 0.03
0.04 0.91
0.05 5.77
0.00 3.74
0.00 1.95
0.00 2.68
0.00 7.16
0.00 7.08
0.53 9.74
0.39 5.64
0.39 7.18
0.01 19.62
0.03 18.23
0.02 13.21
0.10 14.32
0.03 19.33
0.00 69.89
0.01 22.19
0.12 21.60
0.59 7.16
0.34 7.11
0.50 6.53
0.47 3.01
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1.73 2.88
0.46 2.93
10 ft
MIDDLE KITTANNING COAL

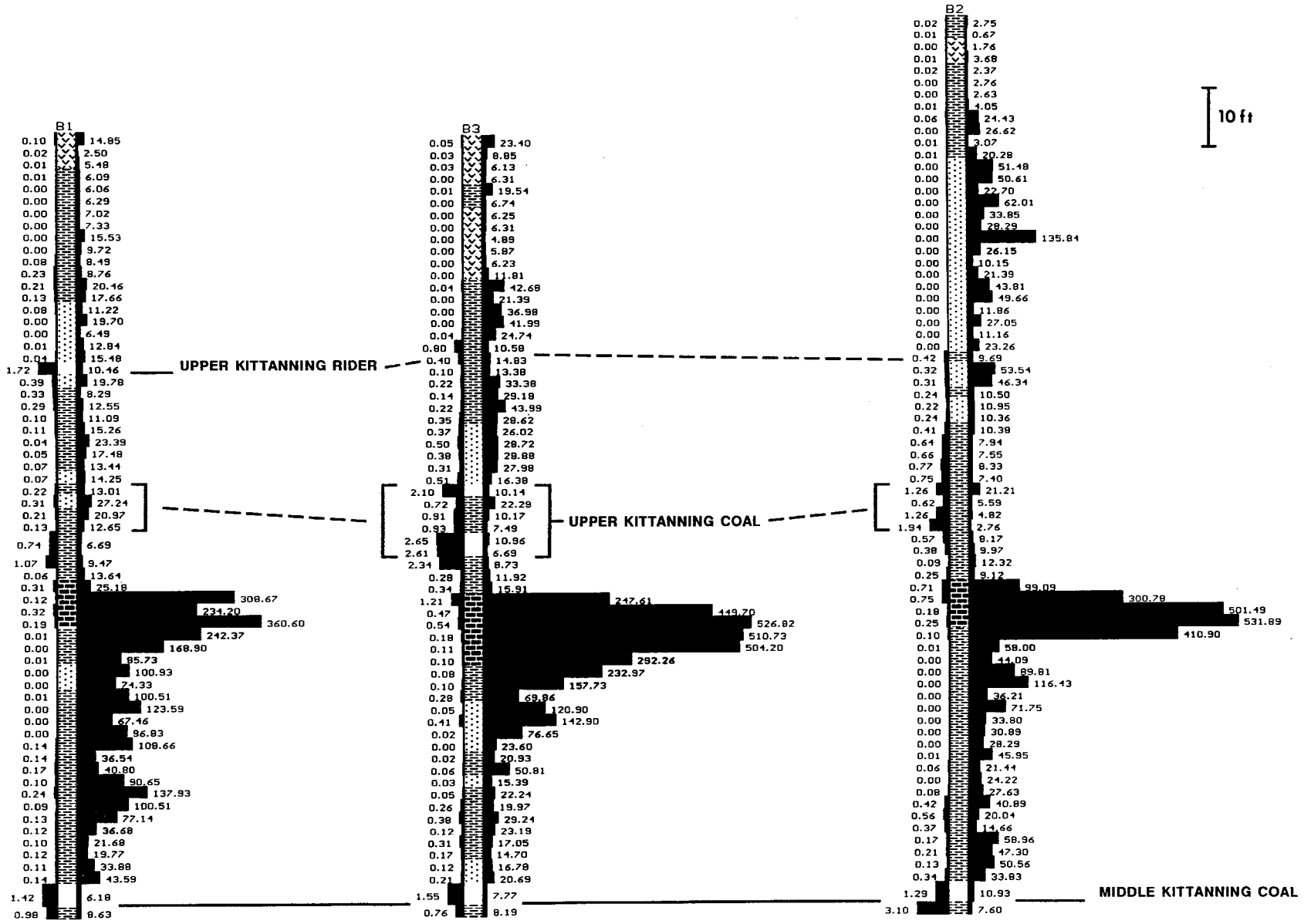

B1
B3
B2
10 ft
UPPER KITTANNING RIDER
UPPER KITTANNING COAL
MIDDLE KITTANNING COAL

Table 6. Summary of sulfur values reported for overburden analyses of strata within the Indian Creek study area.

Hole	Total Overburden Upper Freeport Coal	Overall Thickness of Units above Coal with Total Sulfur > 0.5%	Overall Thickness of Units below Coal with Total Sulfur > 0.5%	General Character of % Total Sulfur below Upper Freeport	General Character of % Total Sulfur above Upper Freeport
2	28 ft	5 ft	3 ft	High	High
3	16 ft	none	none	none	none
4	19 ft	3 ft	none	none	High
7	11 ft	none	none	none	none
8	15 ft	none	3 ft	High	none
10	36 ft	9 ft	3 ft	High	Very High
4-1	36.3 ft	5.1 ft	none	none	High
11	13 ft	none	none	none	none
12	22 ft	7 ft	3 ft	High	Very High
21	55 ft	15 ft	6 ft	Very High	Very High
A1	43 ft	4 ft	3.4 ft	High	High
R12	10 ft	none	none	none	none
15	50 ft	9 ft	1 ft	Moderate	Very High
17	40 ft	6 ft	4 ft	High	Very High
M5	56 ft	10 ft	3 ft	High	Very High
A3	62.4 ft	1.4 ft	2 ft	High	Moderate
A7	78 ft	10 ft	2 ft	High	Very High
A8	56 ft	4 ft	none	none	High

Table 6. (continued)

Hole	Total Overburden Lower Freeport Coal	Overall Thickness of Units above Coal with Total Sulfur > 0.5%	Overall Thickness of Units below Coal with Total Sulfur > 0.5%	General Character of % Total Sulfur below Lower Freeport	General Character of % Total Sulfur above Lower Freeport
8	57 ft	6 ft	none	none	Very High
10	78 ft	3 ft	3 ft	High	High
4-1	69.5 ft	4 ft	none	none	High
21	101 ft	2 ft	1 ft	Moderate	Low
38	70 ft	4 ft	2 ft	High	High
51	74 ft	3 ft	2 ft	High	High
A2	17 ft	none	3 ft	High	none
R12	46 ft	none	none	none	none
29	66 ft	5 ft	none	none	High
M11	62 ft	none	4 ft	High	none
M12	62 ft	none	4 ft	High	none

Table 6. (continued)

Hole	Total Overburden Upper Kittanning Coal	Overall Thickness of Units above Coal with Total Sulfur > 0.5%	Overall Thickness of Units below Coal with Total Sulfur > 0.5%	General Character of % Total Sulfur below Upper Kittanning	General Character of % Total Sulfur above Upper Kittanning
B1	58 ft	2 ft	6 ft	High	Low
B2	78 ft	8 ft	2 ft	High	Very High
B3	58 ft	6 ft	2 ft	High	High

Hole	Total Overburden Middle Kittanning Coal	Overall Thickness of Units above Coal with Total Sulfur > 0.5%	Overall Thickness of Units below Coal with Total Sulfur > 0.5%	General Character of % Total Sulfur below Middle Kittanning	General Character of % Total Sulfur above Middle Kittanning
B1	124 ft	none	2 ft	High	none
B2	144 ft	6 ft	2 ft	High	Moderate
B3	124 ft	6 ft	2 ft	High	Moderate
A	55.3 ft	8.3 ft	1.7 ft	High	Very High
B	33.5 ft	4.5 ft	3 ft	High	High

Table 7. Summary of neutralization potential values reported for overburden analysis of strata within the Indian Creek study area.

Hole	Total Overburden Upper Freeport Coal	Depth to First Unit below Surface having NP > 30 with fizz	Overall Thickness of Units above Coal having NP > 30 with fizz	Maximum NP Reported in Overburden	General Character of NP above Upper Freeport Coal
2	28 ft	no NP above coal	none	12.47	none
3	16 ft	no NP above coal	none	7.13	none
4	19 ft	no NP above coal	none	10.37	none
7	11 ft	no NP above coal	none	6.83	none
8	15 ft	no NP above coal	none	1.06	none
10	36 ft	no NP above coal	none	12.48	none
4-1	36.3 ft	no NP above coal	none	12.75	none
11	13 ft	no NP above coal	none	9.06	none
12	22 ft	no NP above coal	none	10.65	none
21	55 ft	no NP above coal	none	18.54	none
A1	43 ft	24 ft	14 ft	145.93	High
R12	10 ft	no NP above coal	none	1.16	none
15	50 ft	36 ft	8 ft	153.19	High
17	40 ft	no NP above coal	none	7.77	none
M5	56 ft	28 ft	12 ft	76.58	Moderate
A3	62.4 ft	33 ft	17 ft	219.47	High
A7	78 ft	48 ft	6 ft	125.95	Low
A8	56 ft	no NP above coal	none	21.57	none

Table 7. (continued)

Hole	Total Overburden Lower Freeport Coal	Depth to First Unit below Surface having NP > 30 with fizz	Overall Thickness of Units above Coal having NP > 30 with fizz	Maximum NP Reported in Overburden	General Character of NP above Lower Freeport Coal
8	57 ft	no NP above coal	none	20.45	none
10	78 ft	no NP above coal	none	29.75	none
4-1	69.5 ft	50.5 ft	7.5 ft	69.67	Low
21	101 ft	64 ft	29 ft	136.97	High
38	70 ft	20 ft	26 ft	237.70	High
51	74 ft	12 ft	52 ft	132.64	High
A2	17 ft	no NP above coal	none	4.02	none
R12	46 ft	no NP above coal	none	18.23	none
29	66 ft	29 ft	29 ft	328.25	High
M11	62 ft	38 ft	6 ft	83.25	Low
M12	62 ft	no NP above coal	none	17.65	none

Table 7. (continued)

Hole	Total Overburden Upper Kittanning Coal	Depth to First Unit below Surface having NP > 30 with fizz	Overall Thickness of Units above Coal having NP > 30 with fizz	Maximum NP Reported in Overburden	General Character of NP above Upper Kittanning Coal
B1	58 ft	no NP above coal	none	23.39	none
B2	78 ft	24 ft	16 ft	135.84	Moderate
B3	58 ft	24 ft	10 ft	43.99	Low

Hole	Total Overburden Middle Kittanning Coal	Depth to First Unit below Surface having NP > 30 with fizz	Overall Thickness of Units above Coal having NP > 30 with fizz	Maximum NP Reported in Overburden	General Character of NP above Middle Kittanning Coal
B1	124 ft	76 ft	44 ft	360.60	Very High
B2	144 ft	24 ft (94 ft 1st NP below UK)	38 ft	531.89	Very High
B3	124 ft	24 ft (76 ft 1st NP below UK)	26 ft	526.82	Very High
A	55.3 ft	41 ft	2 ft	69.89	Low
B	33.5 ft	no NP above coal	none	4.17	none

Methods currently in use in the interpretation of the chemical analyses of overburden material are based upon research conducted by diPretoro (1986), Erickson and Hedin (1988), Smith and Brady (1990), and Brady et. al. (1992 and 1994). These studies found that, in general, overburden, which contained sulfur concentrations greater than 0.5 percent and which exhibited NP of less than 30, had a significant potential for the production of acid mine drainage. Conversely, overburden which contained total sulfur concentrations of less than 0.5 percent and neutralization potentials greater than 30 generally resulted in alkaline postmining water quality.

The evaluation of overburden analyses which considers the relative abundance and distribution of alkaline and potentially toxic material for depth intervals that have total sulfur concentrations greater than 0.5 percent and depth intervals with NP values greater than 30 is commonly referred to as acid-base accounting. In comparing the relative abundance and distribution of alkaline and potentially toxic materials, a NP value greater than 30 is not considered valid unless the material reacted when acid was applied, indicating that the sample contained calcium carbonate, and not some less reactive (less neutralizing) alkaline mineral. When acid is applied to each sample, a qualitative rating is given to the intensity of the produced fizz reaction. The rating system includes categories of no reaction, a slight reaction, a moderate reaction, and a strong reaction. Determination of the potential water quality expected to result from mining activities within a given area must also consider the initial chemical quality of the natural water system and the various effects of past and present mining methods on water quality.

The following sections discuss results of overburden analyses associated with the Mahoning, Upper Freeport, Lower Freeport, Upper Kittanning, and Middle Kittanning coals found in the Indian Creek study area. No records were found of overburden analyses associated with the Brush Creek, Lower Kittanning, or Brookville-Clarion coals. Of the 29 overburden holes used in this study, 19 holes sampled overburden above the Upper Freeport coal, 11 holes sampled overburden above the Lower Freeport coal, 3 holes sampled overburden above the Upper Kittanning coal, and 5 holes sampled overburden above the Middle Kittanning coal. The Upper Kittanning rider coal was present in three holes. The Mahoning coal also was encountered as a partially weathered seam at a shallow depth of eight feet in a hole drilled to sample overburden above the Upper Freeport coal.

Upper Freeport Coal

Overburden analyses of the strata found above the Upper Freeport coal within the study area were reported from 18 drill hole records contained in the Amerikohl Mining, Inc. surface mine permit files (SMP 26880101, SMP 26880110, SMP 26900113, and App. 26910111) and from one drill hole record contained in the Melcroft Coal Company surface mine permit file (App. 26900113). The analysis results indicate that the chemical characteristics of the strata associated with the Upper Freeport coal varied with the depth at which the coal occurs beneath the land surface and the total thickness of strata above the coal. No significant alkaline strata were found to a depth of approximately 24 feet beneath the land surface and no potentially toxic strata were found to a depth of approximately 16 feet. The results of the analyses of drill holes A1, A3, A7, M5, and 15 indicate the presence of an alkaline zone above this coal which

ranges from 6 to 17 feet thick. This alkaline zone was reported only in areas where the total strata above the coal exceeded 43 feet. The reported NP of this strata ranged from 76.58 to 219.47 with slight to moderate fizz. Potentially toxic strata were identified in the 3 to 10 foot strata interval immediately above the Upper Freeport coal in 13 of the overburden holes. Total percent sulfur ranged from 0.6 to 5.0 percent.

Lower Freeport Coal

Overburden analyses of the strata associated with the Lower Freeport coal within the study area were reported from 11 drill hole records contained in the files of Amerikohl Mining, Inc. (SMP 26880101, SMP 26880110, and SMP 26900113) and from the Melcroft Coal Company's application (App. 26900113). The analyses results indicated significant variations in the chemical quality of these strata.

Results of sample analyses from drill holes 21, 29, 38, and 51 found that 26 to 52 feet of strata above the Lower Freeport coal contained NP values ranging from 35.25 to 237 with sulfur values reported at less than 0.36 percent. An interval of 2 to 5 feet of strata immediately above the Lower Freeport coal and up to 6 feet of strata immediately below the Upper Freeport coal reported sulfur values ranging from less than 0.5 to 2.35 percent.

Results of sample analyses from drill holes 4-1, 10, and M11 indicated that the strata encountered in these holes contain significantly less NP than was found in holes 21, 24, 38, and 51. Drill hole 4-1 and 10 were reported to have been drilled at the same location using two different drilling methods in order to determine if the method of drilling and type of sample collected had an effect on the results of the chemical analyses of the strata. Hole 10 was drilled using an air rotary drilling method with subsequent chemical analyses of rock chip samples collected from each strata. Hole 4-1 was drilled using a core sampling drilling method which provided a continuous sample of the rock column from which samples were collected for analyses. The lithologic description of rock units, strata intervals, strata thickness, and the results of the chemical analyses of samples collected from these two holes show some variations (see Figure 9); however, only the variation in chemical quality was believed to be significant. Sample analyses results from strata collected in hole 10 did not report any NP above 30. Analyses results of strata samples from hole 4-1 were similar to the analyses results of strata associated with the Lower Freeport coal reported from hole M11. Analyses of strata samples from these holes (4-1 and M11) indicate the presence of a 6 to 8 foot thick alkaline zone located approximately 20 feet above the Lower Freeport coal. Neutralization potential reported for this strata ranged from 37.41 to 83.25. With the exception of the 0.6 percent sulfur found within the 1 to 4 foot stratigraphic interval immediately above the Lower Freeport coal, total sulfur reported did not exceed 0.23 percent in any of the other strata.

Results of sample analyses from drill holes 8, A2, R12, and M12 indicated that the strata associated with the Lower Freeport coal in these holes does not contain any significant NP and with the exception of hole 8, all sulfur values reported were less than 0.38 percent. Analyses of strata from hole 8 found that approximately 3 feet of strata immediately below the Upper Freeport coal

contained total percent sulfur of 0.88 percent and another 3 foot stratigraphic interval located approximately 20 feet above the Lower Freeport coal contained total sulfur of 0.72 percent.

Upper Kittanning Coal and Upper Kittanning Rider Coal

Overburden analyses of the strata found above the Upper Kittanning coal, which includes the Upper Kittanning rider coal, were reported from three drill hole records contained in the file of the Pine Flats Coal Company, Inc. (SMP 26880113). The analysis results indicate that the strata associated with the Upper Kittanning coal and the Upper Kittanning rider coal contain both alkaline and potentially toxic zones. The results of the analyses of overburden samples from drill holes B1, B2, and B3 found no significant NP or sulfur to a depth of approximately 24 feet below the land surface. The chemical analyses of samples from hole B1 did not indicate significant NP in any strata above the Upper Kittanning coal. Analyses of the overburden samples from Holes B2 and B3 found 8 to 12 feet of strata above the Upper Kittanning rider coal with NP ranging from 33.85 to 135.84 with no significant sulfur zone. The analyses of the strata from Holes B2 and B3 also found a 2 to 4 foot thick stratigraphic interval above the Upper Kittanning coal with NP ranging from 43.99 to 49.66 and 6 to 8 feet of material with reported sulfur values of 0.51 to 2.65 percent. The Upper Kittanning coal was identified as a split coal separated by 2 to 4 feet of shale or siltstone.

Drilling records indicate that the Upper Kittanning rider coal is frequently absent, with shale or siltstone reported at this interval. Where this coal is not present, this interval may contain 2 to 8 feet of potentially toxic material with total sulfur ranging from 0.59 to 1.94 percent.

Middle Kittanning Coal

Overburden analyses of the strata associated with the Middle Kittanning coal within the study area were reported from three drill holes contained in the files of the Pine Flats Coal Company Inc. (SMP 26880113) and from two drill holes contained in a Small Operator Assistance Program (SOAP) project report prepared for Rand Am, Inc. (SOAP #866).

The analysis results indicated that the strata associated with the Middle Kittanning coal reported in drill hole B1, B2, and B3 were predominantly alkaline. The 60 to 65 foot stratigraphic interval overlying the Middle Kittanning coal reported in these drill holes contained 26 to 44 feet of alkaline strata with NP over 30, including an 8 to 12 foot thick unit identified as limestone with NP ranging from 234 to 531. The stratigraphic position of this alkaline zone corresponds to the expected position of the Johnstown limestone which is found approximately 45 feet above the Middle Kittanning coal. Analyses of overburden samples from drill holes B2 and B3 also found several strata with total sulfur ranging from 0.56 to 1.94 percent, including a 4 foot thick section of the reported alkaline zone, which had total sulfur ranging from 0.71 to 0.75 percent in drill hole B2. Sulfur content of the recorded strata immediately beneath the Middle Kittanning coal reported values ranging from 0.76 to 3.10 percent.

Results of the analyses of strata from drill holes A and B, which encountered only 30 to 50 feet of strata above the Middle Kittanning coal, show significantly less alkalinity than holes B1, B2, and B3. Much of the shale and limestone strata with reported alkalinity in holes B1, B2, and B3 appear to have been replaced by sandstones in holes A and B. Only one 2 foot thick interval reported neutralization potential over 30, and the analyses indicated 6 to 9 feet of strata above the coal with sulfur values ranging from 0.5 to 1.47 percent.

Groundwater Hydrology

Groundwater movement within and adjacent to the study area is primarily controlled by lithology, stratigraphy, and regional geologic structure, and to a lesser extent by topography. Water infiltrates and accumulates in discrete permeable lithologic units and moves within these lithologic units down the anticlinal limbs of Chestnut Ridge and Laurel Hill towards the trough of the Ohiopyle (Ligonier) syncline, which is positioned near and beneath Indian Creek. Regional topography influences the occurrence and movement of local groundwater in two ways. First, the exposure of stratigraphically confined aquifer formations as outcrops along the sides of many hills in the study area allows discharges from the aquifers in the form of numerous springs. Secondly, the larger, gentler slope of the topographic exposure of the Allegheny Group west of Indian Creek allows for greater recharge of groundwater than occurs on the steeper slopes and much less exposed areas of the Allegheny Group east of Indian Creek.

The stratigraphic occurrence and water quality of groundwater within the study area were characterized from information gathered at 11 water supply springs and 32 private water supply wells. Information on the local and regional movement of groundwater within the study area were obtained from water elevation measurements made for several aquifers in a series of piezometer wells located at four additional sites. The locations of springs and water wells used in this study are shown in Figure 10. The stratigraphic position and a summary of inorganic chemical analyses of eleven water supply springs sampled within the study area are given in Table 8. More detailed results of spring water chemical analyses are given in Appendix Table 1.

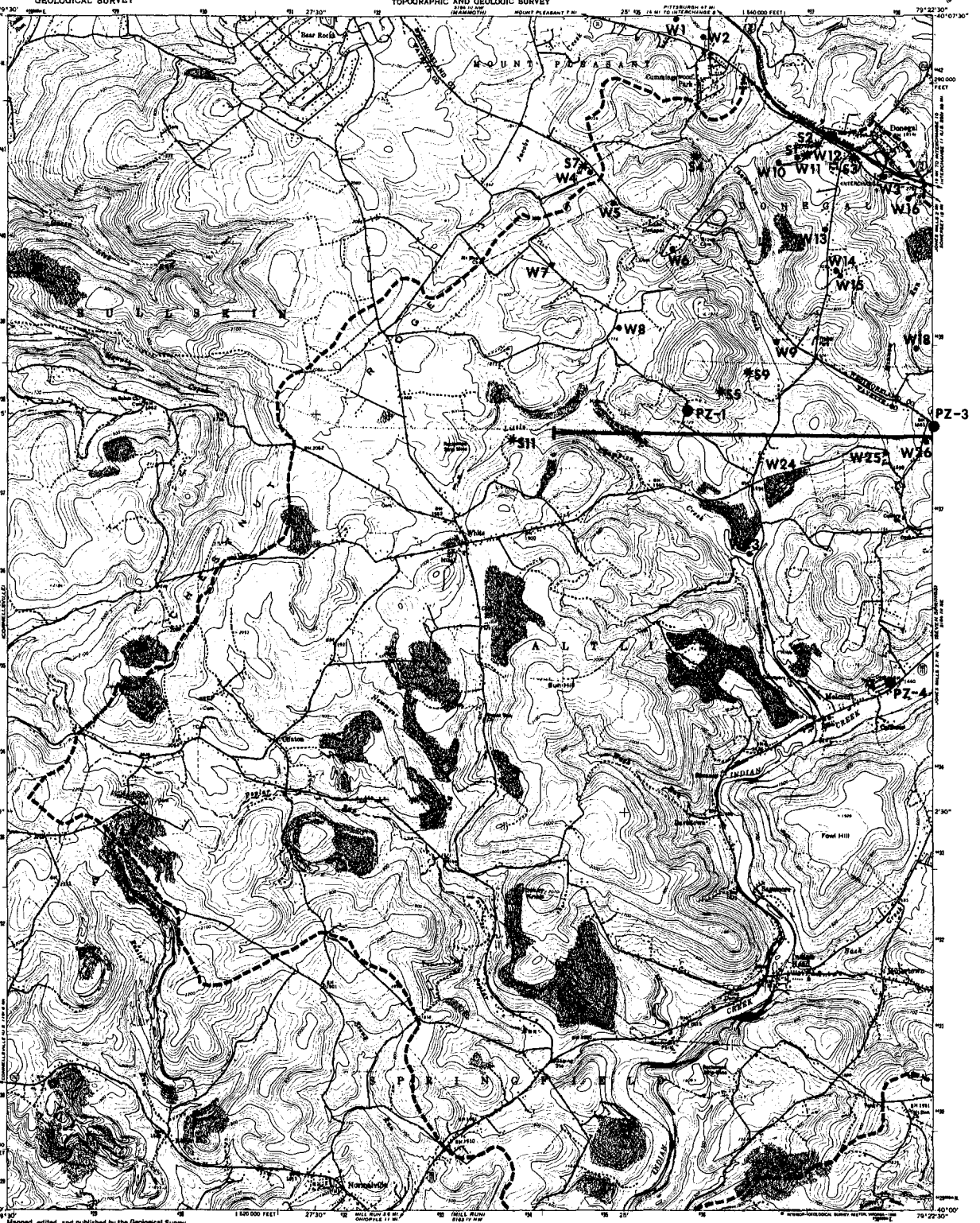
Eleven springs were sampled from seven stratigraphic intervals; six from within the Conemaugh Group and one spring aquifer from within the Allegheny Group. Springs S1, S2, and S3 originate from a stratigraphic unit situated approximately 180 feet above the Brush Creek coal. The water chemistry of this spring aquifer was characterized by pH values of 5.3 to 6.2, alkalinity ranging from 10 to 16 mg/l, calcium of 3.1 to 11.4 mg/l, magnesium of 0.8 to 2.2 mg/l, iron of less than 0.01 to 0.08 mg/l, and manganese of less than 0.01 to 0.02 mg/l. Spring S3, located near the intersection of Pa. Route 31 and State Route 2029, contained high concentrations of sodium (19.3 to 29.3 mg/l) and chloride (34 to 50 mg/l), which are most likely due to winter applications of road salt on the adjacent and overlying roadway of State Route 2029. This "salt effect" also accounts for the relatively higher pH (5.9 to 6.2) of this spring than is typical for this stratigraphic interval (pH 4.3 to 5.6).

Figure 10. Map of private water supply well and spring locations within the Indian Creek study area. Locations of piezometer wells and related cross section shown in Figure 11 are indicated.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

DONEGAL QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



SCALE 1:24000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route ○ U. S. Route ○ State Route
County Route

Mapped, edited, and published by the Geological Survey

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Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1967. Field checked 1967

Polyconic projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
1927 North American Datum (NAD 27)
North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are given in USGS Bulletin 1675

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Revisions compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1968 and other sources
Contours not revised. This information not field checked
Map edited 1993

UTM GRID AND 1993 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

PENNSYLVANIA
QUADRANGLE LOCATION

DONEGAL, PA.
40079-A4-TF-024

1967
REVISED 1993
DMA 8184 III SW - SERIES V851

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

SEVEN SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey
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Topography by photogrammetric methods from aerial photographs taken 1967. Field checked 1967
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Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
There may be private inholdings within the boundaries of the National or State reservations shown on this map
Revisions compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1990 and other sources. Contours not revised. This information not field checked
Map edited 1993

UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, all weather, hard surface	Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface	Unimproved road, fair or dry weather
Interstate Route	State Route

SEVEN SPRINGS, PA.
40079-A3-TF-024

1967
REVISED 1993
DMA 5164 III SE-SERIES V831

Table 8. Elevation, stratigraphic interval, and summary water quality of springs within the Indian Creek study area.

Spring	Elevation	Approximate Stratigraphic Interval of Spring Discharge	pH	Alk.	Fe	Mn	Ca	Mg	Na	Cl
S1	1850 ft	180 ft above Brush Creek coal	5.4-5.6	12-13	<.01-.04	<.01-.02	3.1-4.7	1.5-1.9	0.5-1.1	1-2
S2	1840 ft	180 ft above Brusk Creek coal	5.3-5.4	10-11	<.01-.05	.02	4.4-6.5	0.8-1.1	0.5-0.9	2
S3	1820 ft	180 ft above Brush Creek coal	5.9-6.2	14-16	.03-.08	<.01-.02	8.1-11.4	1.7-2.2	19.3-29.3	34-50
S4	1900 ft	95 ft above Brush Creek coal	5.9-6.1	15-18	.03-.20	.01-.06	4.5-5.6	2.0-2.5	0.3-0.9	<1-2
S5	1900 ft	95 ft above Brush Creek coal	6.3-6.6	26-86	<.01-.11	<.01	7.7-23.2	3.5-7.3	0.7-1.2	<1-2
S6	1735 ft	95 ft above Brush Creek coal	6.2	17	.03-.04	<.01-.01	5.7-7.2	2.1-2.6	1.3-1.8	2-3
S7	1905 ft	20 ft below Brush Creek coal	5.0-5.2	9-11	<.01-.06	.05-.06	5.3-6.9	3.7-4.5	9.7-11.1	21-27
S8	1570 ft	5 to 10 ft below Mahoning coal	6.5-6.6	48-70	.34-.35	.01-.02	13.4-16.9	5.2-5.8	1.6-1.8	1
S9	1720 ft	45 ft above Upper Freeport coal	6.0	17-20	<.01-.05	<.01	5.3-6.7	2.7-3.4	0.5-1.3	2-3
S10	1520 ft	10 ft above Upper Freeport coal	6.2-6.7	19-24	<.01-.03	<.01	4.4-6.7	1.8-2.9	0.7-1.3	<1-2
S11	1795 ft	30 ft above Middle Kittanning coal	6.2-6.4	19-24	.05-.15	<.01	8.0-9.4	1.2-1.4	0.6-0.7	2

*All concentrations are mg/l.

Springs S4, S5, and S6 originate from a stratigraphic interval located 95 feet above the Brush Creek coal. Springs originating from this aquifer occur on hills throughout the study area, from Chestnut Ridge to near Indian Creek. The springs had a pH range of 5.9 to 6.6, alkalinity 15 to 86 mg/l, calcium 4.5 to 23.2 mg/l, magnesium 2.0 to 7.3 mg/l, iron of less than 0.01 to 0.20 mg/l, and manganese of less than 0.01 to 0.06 mg/l. Spring S7, located on Chestnut Ridge, emanates from a stratigraphic unit situated 20 feet below the Brush Creek coal. This spring aquifer had the lowest pH (5.0 to 5.2) of any spring sampled within the study area and also had low alkalinity (9 to 11 mg/l), calcium (5.3 to 6.9 mg/l), magnesium (3.7 to 4.5 mg/l), iron (less than 0.01 to 0.06 mg/l), and manganese (0.05 to 0.06 mg/l). Spring S7 is located near State Route 1058 (County Line Road) and contained elevated concentrations of sodium (9.7 to 11.1 mg/l), and chloride (212 to 270 mg/l), which was similar to Spring S3 located along Pa. Route 31. The stratigraphic position of Spring S8, located just north of Jones Mills, corresponds to the shale unit situated 5 to 10 feet below the Mahoning coal. This spring aquifer had a pH of 6.5 to 6.6 and alkalinity ranging from 48 to 70 mg/l. All other chemical constituents analyzed for Spring S8 were at minimal concentrations.

Spring S9 orginates from an aquifer located approximately 45 feet above the Upper Freeport coal. This spring had a pH of 6.0 and relatively low alkalinity (17 to 20 mg/l), calcium (5.3 to 6.7 mg/l), magnesium (2.7 to 3.4 mg/l), iron (less than 0.01 to 0.05 mg/l), manganese (less than 0.01 mg/l), sodium (0.5 to 1.3 mg/l), and chloride (2 to 3 mg/l). Spring S10 flows from a stratigraphic unit situated 10 feet above the Upper Freeport coal. This spring had a slightly higher pH range (6.2-6.7) than Spring S9, but almost identical concentrations of alkalinity, metals, sodium, and chloride.

Spring S11 is from a shale unit located approximately 30 feet above the Middle Kittanning coal and stratigraphically lower than the Johnstown limestone and its associated interval of high alkalinity shales. Spring S11 had a pH range of 6.2 to 6.4, relatively low alkalinity (19 to 24 mg/l), calcium (8.0 to 9.4 mg/l), magnesium (1.2 to 1.4 mg/l), iron (0.05 to 0.15 mg/l), manganese (less than 0.01 mg/l), sodium (0.6 to 0.7 mg/l), and chloride (2 mg/l).

The chemical analyses of water samples from these seven spring aquifer zones, all of which were unaffected by mining activities, show that specific stratigraphic units consistently contain the same narrow range of water quality chemistry throughout the Indian Creek study area. Spring water pH levels have three approximate ranges: 5.0 to 5.6, 5.9 to 6.4, and 6.3 to 6.7. Spring recharge areas which are associated with major roadways have elevated concentrations of sodium and chloride. Springs emanating from stratigraphic units associated with coals have higher alkalinities and greater concentrations of iron.

Surface mining excavations, which may disturb several stratigraphic intervals, can alter the local flow of groundwater within the aquifer system, such that water once "perched" within a permeable rock unit at a higher elevation is released to more easily infiltrate to a stratigraphically lower spring aquifer or flow into the more deeply buried regional aquifer system. Surface mining permit records indicate that mining in three permit areas disrupted local spring aquifers and resulted in the loss of springs located updip from the surface mined areas.

Downdip draining of spring aquifers occurred on the Firestone Coal Co., Inc., SMP 26820101 and the adjacent Pine Flats Coal Co., Inc., SMP 26813036(T) surface mines, both of which mined the Upper Freeport coal, and on the Purco Coal Co., Inc. permit #2967BSM12 on the Middle Kittanning coal.

Mining activities may also impact groundwater aquifers as a result of postmining chemical reactions on the mining site. These reactions may produce high concentrations of iron, manganese, and sulfates, which can be transported by groundwater both vertically and laterally within and between aquifer systems. The downdip migration of these chemical constituents and the resulting degradation of spring groundwater was reported for Milrock Mining, Inc., MDP 3375SM64, on the Mahoning and Upper Freeport coals, and Amerikohl Mining, Inc., SMP 26900106, and Pine Flats Coal Co., Inc., SMP 26813036(T), on the Upper Freeport coal. Increased concentrations of iron, manganese, and sulfate also resulted from surface mining of the Brookville-Clarion coal by The Rondell Co. on MDP 3373SM7.

The locations of 32 private supply water wells that were studied are shown in Figure 10. Information on well depths and flow rates for these wells are given in Table 9. The approximate stratigraphic interval of well aquifers and general results of inorganic chemical analyses from 18 of these wells are shown in Table 10. More detailed results of well water chemical analyses are given in Appendix Table 2. Half of wells studied contain more than one flowing aquifer zone. Six of the 18 wells from which groundwater samples were collected penetrated two water bearing zones, so that in these instances water quality analysis results represent the composite water quality of both aquifer systems.

Water wells used in this study encountered aquifers at 20 different statigraphic intervals. Four of the water bearing zones in wells were also recognized as spring discharges. The combined studies of springs and wells identified 23 separate aquifers within the statigraphic interval extending from 180 feet above the Brush Creek coal to the Brookville-Clarion coal.

Six aquifer zones were identified above the Brush Creek coal horizon: at approximately 145 feet, 115 feet, 55 to 60 feet, 25 to 27 feet, and 5 to 7 feet above the coal. The most frequently encountered well aquifers above the Brush Creek coal were situated at 55 to 60 feet and at 5 feet above the Brush Creek coal.

The water chemistries of the aquifers situated 145 feet and 55 feet above the Brush Creek coal had relatively low pH (6.3 to 6.6), alkalinity (alk. 50 to 68 mg/l), calcium (17.8 to 21.8 mg/l), and magnesium (4.8 to 5.8 mg/l). The aquifer 145 feet above the Brush Creek coal had relatively high iron concentrations of 0.49 to 0.95 mg/l with manganese of less than 0.01 to 0.02 mg/l. The aquifer 55 feet above the Brush Creek coal had iron concentrations of 1.68 to 3.64 mg/l and manganese concentrations of 0.49 to 0.64 mg/l.

One aquifer zone was identified between the Brush Creek coal and the Mahoning coal, although this is the most commonly encountered aquifer within wells in the study area. This laterally persistent aquifer is situated 20 to 25 feet above the Brush Creek coal in seven wells.

Table 9. Depths, water producing zones, and flow rates of water wells.

Well	Well Depth	Casing Depth	Flow Rates	Water Depths	Lithology
W1	105 ft	20 ft	20 gpm	23 ft 66 ft	shale shale
W2	175 ft	25 ft	10 gpm	55 ft	shale
W3	400 ft	-	-	-	-
W4	100 ft	-	-	-	-
W5	145 ft	20 ft	12 gpm	55 ft 105 ft	shale shale
W6	205 ft	20 ft	4 gpm	95 ft 115 ft	shale shale
W7	150 ft	-	-	-	-
W8	5 ft	5 ft	-	2 ft	shale
W9	100 ft	20 ft	1 gpm 6 gpm	49 ft 72 ft	shale shale/sandstone contact
W10	250 ft	-	-	205 ft (pumped from)	-
W11	225 ft	-	-		-
W12	225 ft	-	-	210 ft (pumped from)	-
W13	170 ft	170 ft	-	150 ft (pumped from)	-
W14	100 ft	100 ft	6 gpm	100 ft	-
W15-new	320 ft	320 ft	6 gpm	-	-
W15-old	150 ft	-	8 gpm	90 ft	-
W16	305 ft	21 ft	9 gpm	65 ft 265 ft	shale shale

Table 9. (continued)

Well	Well Depth	Casing Depth	Flow Rates	Water Depths	Lithology
W17	425 ft	45 ft	7 gpm	290 ft	sandstone
				363 ft	shale
W18	445 ft	20 ft	3 gpm	85 ft	shale
				365 ft	limestone
W19	405 ft	20 ft	5 gpm	85 ft	shale
W20	345 ft	21 ft	4 gpm	105 ft	sandstone
W21	200 ft	22 ft	4 gpm	65 ft	sandy shale
				92 ft	shale
				150 ft	shale
W22	345 ft	20 ft	2 gpm	105 ft	shale
				230 ft	shale
W23	92 ft	37 ft	20 gpm	76 ft	shale
				88 ft	shale
W24	168 ft	20 ft	5 gpm	35 ft	shale
				105 ft	shale
W25	115 ft	115 ft	-	>50 ft (pumped from)	-
W26	175 ft	20 ft	10 gpm	35 ft	sandstone
				65 ft	sandstone/shale contact
W27	150 ft	-	-	100 ft (pumped from)	-
W28	145 ft	24 ft	6 gpm	45 ft	shale
				85 ft	shale
W29	45 ft	45 ft	-	45 ft	-
W30	85 ft	32 ft	20 gpm	38 ft	shale
W31	35 ft	21 ft	10 gpm	25 ft	clay/sandstone contact
W32	105 ft	26 ft	5 gpm	34 ft	shale
				64 ft	shale/sandstone contact

Table 10. Stratigraphic interval and summary water quality of wells within the Indian Creek study area.

Well	Approximate Stratigraphic Interval of Water Supply	pH	Alk.	SO4	Fe	Mn	Ca	Mg	Na	Cl
W1	6 ft below Mahoning coal 7 ft above Upper Freeport coal	-	-	-	-	-	-	-	-	-
W2	8 ft above Upper Freeport coal	6.4-6.5	70-78	<20	17.20-19.0	3.91-4.17	340-391	73.3-90.2	108-121	1210-1310
W3	unknown - well drilled 400 ft to 42 ft below Middle Kittanning coal	6.3-6.6	74-78	20-28	6.57-8.55	2.43-2.63	347-444	85.1-86.5	80.4-88.1	1040-1240
W4	10 ft above Upper Freeport coal	6.9-7.3	114-120	<20-31	<.01-.11	.04-.07	29.4-35.5	7.0-7.5	0.1-2.0	5-8
W5	27 ft above Brush Creek coal 23 ft below Brush Creek coal	-	-	-	-	-	-	-	-	-
W6	25 ft above Brush Creek coal 5 ft above Brush Creek coal	-	-	-	-	-	-	-	-	-
W7	28 ft above Middle Kittanning coal	6.8-7.1	124-154	<20	<.01-.05	.02-.04	38.0-49.6	8.5-9.6	0.6-9.9	10
W8	5 ft below Lower Freeport coal	6.5-6.9	98-104	<20-88	2.35-3.11	.17-.22	21.9-28.8	4.8-6.3	1.3-6.7	3-12
W9	14 ft above Upper Kittanning coal 4 ft below Upper Kittanning coal	-	-	-	-	-	-	-	-	-
W10	from 10 ft above Brush Creek coal to 35 ft below Brush Creek coal	6.9-7.4	128-132	<20-60	.08-.57	<.01-.03	31.8-33.8	8.2-9.1	5.5-8.4	4-13
W11	20 ft below Brush Creek coal	7.0	106	36	0.14	0.78	22.7	6.4	4.1	1
W12	10 to 25 ft below Brush Creek coal	7.4	112-114	<20	.07-.13	<.01	11.5-14.2	2.6-3.2	30.7-33.7	2
W13	55 ft above Brush Creek coal	6.3-6.5	52	<20-28	1.68-3.64	.49-.64	17.8-20.1	4.8-4.9	2.1-2.3	8
W14	145 ft above Brush Creek coal	6.5-6.6	50-68	27-44	.49-.95	<.01-.02	18.9-21.8	5.0-5.8	3.2-3.6	4-5
W15-old	145 ft above Brush Creek coal	-	-	-	-	-	-	-	-	-
W15-new	8 ft above Upper Freeport coal	7.1	104-112	22-86	.08-.17	.05-.07	32.0-33.0	7.3-7.9	2.9-3.0	6-8
W16	55 ft above Brush Creek coal 12 ft below Lower Freeport coal	7.0-7.4	88-90	18-85	.18-.39	.11-.12	23.2-25.0	6.1	2.5-3.0	13-17

*All concentrations are mg/l.

Table 10. (continued)

Well	Approximate Stratigraphic Interval of Water Supply	pH	Alk.	SO4	Fe	Mn	Ca	Mg	Na	Cl
W17	40 ft below Upper Freeport coal 20 ft below Upper Kittanning coal	7.0	114	<20	.37	.16	43.2	9.6	5.3	40
W18	60 ft above Brush Creek coal 31 ft above Middle Kittanning coal	-	-	-	-	-	-	-	-	-
W19	115 ft above Brush Creek coal	-	-	-	-	-	-	-	-	-
W20	60 ft above Brush Creek coal	-	-	-	-	-	-	-	-	-
W21	5 ft above Brush Creek coal 25 ft below Brush Creek coal 10 ft above Upper Freeport coal	-	-	-	-	-	-	-	-	-
W22	5 ft above Brush Creek coal 27 ft below Upper Freeport coal	-	-	-	-	-	-	-	-	-
W23	16 ft above Brookville-Clarion coal 4 ft above Brookville-Clarion coal	7.7	202	64	.20	.05	31.4	8.4	55.9	3
W24	18 ft below Upper Freeport coal the Upper Kittanning coal	-	-	-	-	-	-	-	-	-
W25	10 ft above Upper Freeport coal	6.9-7.0	156-166	<20-26	.26-.41	.13	40.6-42.3	9.4-9.8	4.6-4.9	1
W26	7 ft above Brush Creek coal 23 ft below Brush Creek coal	-	-	-	-	-	-	-	-	-
W27	0 to 50 ft above Brush Creek coal	7.2-7.3	104-110	<20	.04-.05	.11-.12	27.7-29.2	6.5-7.0	3.6-4.1	1-2
W28	15 ft above Brush Creek coal 25 ft below Brush Creek coal	7.1	132-144	<20-34	.07-.09	<.01-.03	19.4-24.0	5.8-6.3	22.3-29.6	1
W29	40 ft below Upper Freeport coal	6.8-7.1	148-150	70-106	.21-.51	.10	36.4-42.3	8.4-8.7	9.5-10.1	3
W30	40 ft below Upper Freeport coal	-	-	-	-	-	-	-	-	-
W31	4 ft below Lower Freeport coal	-	-	-	-	-	-	-	-	-
W32	12 ft below Lower Freeport coal 42 ft below Lower Freeport coal	-	-	-	-	-	-	-	-	-

*All concentrations are mg/l.

The water chemistry of this aquifer in wells W11 and W12 had a pH of 7.0 to 7.4, low to moderate alkalinity (alk. 106 to 114 mg/l), calcium (11.5 to 22.7 mg/l), magnesium (2.6 to 6.4 mg/l), and iron concentrations (0.07 to 0.14 mg/l) and variable manganese concentrations (less than 0.01 to 0.78 mg/l).

Well records identify two aquifers between the Mahoning coal and the Upper Freeport coal, one situated 6 to 8 feet below the Mahoning coal and one located 7 to 10 feet above the Upper Freeport coal. The aquifer located approximately 10 feet above the Upper Freeport coal was one of the most common aquifers throughout the area, occurring in six of the water wells used in this study. The water chemistry of well samples from this interval had a pH of 6.9 to 7.3, moderate to high alkalinity (alk. 104 to 166 mg/l), calcium (29.4 to 42.3 mg/l), and magnesium (7.0 to 9.8 mg/l), and variable concentrations of metals, from minimal iron of less than 0.01 to 0.17 mg/l to iron levels of 0.26 to 0.41 mg/l and minimal manganese of 0.04 to 0.07 mg/l to manganese concentrations as high as 0.13 mg/l.

Two well aquifers were identified between the Upper Freeport coal and the Lower Freeport coal, at approximately 18 feet and 27 feet below the Upper Freeport coal. No water chemistry analyses were available for these two aquifer zones. Three wells penetrated a water bearing zone in close stratigraphic proximity to the Lower Freeport coal, and two wells contained aquifer zones 4 to 5 feet below the Lower Freeport coal. The aquifer situated 40 feet below the Upper Freeport coal had a pH of 6.8 to 7.1, high alkalinity (alk. 148 to 150 mg/l), calcium (36.4 to 42.3 mg/l), magnesium (8.4 to 8.7 mg/l) and low to moderate metal concentrations (iron 0.21 to 0.51 mg/l and manganese 0.10 mg/l). The aquifer zone located 4 to 5 feet below the Lower Freeport coal had a slightly lower pH (6.5 to 6.9), slightly lower alkalinity (alk. 98 to 104 mg/l), calcium (21.9 to 28.8 mg/l), and magnesium (4.8 to 6.3 mg/l), but much higher metals concentrations, with iron at 2.35 to 3.11 mg/l and manganese at 0.17 to 0.22 mg/l.

An aquifer zone was found 12 feet below the Lower Freeport coal in well W16. Water samples collected for chemical analysis contained a mixture of water from this zone and from a higher zone, but moderately high concentrations of iron and manganese, typical of aquifers 4 to 5 feet below the Lower Freeport coal, were present.

Aquifer zones were recorded in water well descriptions for the stratigraphic interval 11 to 14 feet above the Upper Kittanning coal, for the Upper Kittanning coal interval itself, and for an interval 4 feet below the Upper Kittanning coal. A water bearing zone was located 20 feet below the Upper Kittanning coal. With the exception of Well W17, which penetrated multiple aquifers, no chemical analyses for these wells was available.

The most common aquifer zone identified between the Upper Kittanning coal and the Middle Kittanning coal was situated from 28 to 31 feet above the Middle Kittanning coal. Wells W7 and W18 encountered this aquifer, which was also the source of the spring S11 discharge. Well samples from this aquifer had a pH of 7.0, moderate alkalinity (alk. 124 to 154 mg/l), calcium (38 to 49.6 mg/l), and magnesium (8.5 to 9.6 mg/l). Concentrations of metals were relatively low (iron less than 0.01 to 0.05 mg/l, and manganese 0.02 to 0.04 mg/l).

Well W3, located near the Pennsylvania Turnpike, was drilled to a depth of approximately 400 feet, penetrating to about 42 feet below the Middle Kittanning coal. Water is pumped from the lower 100 feet of this well. Chemical analyses of water samples from this well indicated sodium concentrations of 80.4 to 88.1 mg/l and chloride concentrations of 1040 to 1240 mg/l. Iron concentrations were found to range from 6.57 to 8.55 mg/l, manganese 2.43 to 2.63 mg/l, calcium 347 to 444 mg/l, and magnesium 85.1 to 86.5 mg/l. Similar chemistry was found in well W2, which is also located near the Pennsylvania Turnpike. Well W2 groundwater associated with an aquifer 8 feet above the Upper Freeport coal contained had sodium concentrations of 108 to 121 mg/l and chloride of 1210 to 1310 mg/l. Iron concentrations were 17.2 to 19.0 mg/l, manganese 3.91 to 4.17 mg/l, calcium 340 to 391 mg/l, and magnesium 73.3 to 90.2 mg/l.

Two specific water zones were identified between the Middle Kittanning coal and the Brookville-Clarion coal. In well W23 these aquifers are situated 16 feet and 4 feet above the Brookville-Clarion coal. The sampled mixture of groundwater from these two aquifers had a pH of 7.7, high alkalinity (alk. 202 mg/l, calcium 31.4 mg/l, magnesium 8.4 mg/l), minimal concentrations of iron (0.20 mg/l) and manganese (0.05 mg/l), and a sodium concentration of 55.9 mg/l.

Private water supply wells located along State Route SR2029 were reportedly affected by water loss attributed to surface mining activities on the Mahoning coal (Firestone Coal Corp., SMP 34A77SM14). The aquifer source for most of these wells was reported to occur between 55 and 145 feet above the Brush Creek coal and approximately 90 to 180 feet above the Mahoning coal.

Several private supply water wells within the study area were degraded in quality by the introduction of increased metal concentrations and sulfates as a result of surface mining at four sites. Degradation of water supplies was reported for the Clarksburg Coal Co., Inc. permit #3378BC20 on the Upper Freeport coal, the Pine Flats Coal co., Inc. permit #26823086(T) on the Upper Kittanning coal (a deeper replacement well was provided), the Fryske & Nole Coal Co. permit #2966BSM14 on the Middle Kittanning coal (degraded by acid and iron, with law suit settlement), and the Purco Coal Co., Inc. permit #2967BSM12 on the Middle Kittanning coal (degraded by acid, iron, and sulfates; civil action recommended).

In conjunction with the Rand Am, Inc. underground mine permit application (#26931301), a number of specialized wells called piezometers were constructed at four sites within the petition area to further define and evaluate the local and regional groundwater systems. The location of these piezometer wells are shown on Figure 10 and the results of water level measurements and chemical analysis of water samples from the piezometers are shown in Table 11 and Appendix Table 3.

A piezometer is a particular type of well, constructed to identify, isolate, and measure the hydrologic characteristics of groundwater aquifer systems. Several piezometers may be installed at different elevations to measure the aquifers in the same well bore, or individual piezometers may be constructed adjacent to each other in separate bores. Construction is accomplished by the installation of a water measuring device, or stand-pipe, at the water bearing zone in a well,

Table 11. Static water level readings from piezometer wells within the Indian Creek study area.

Piezometer Well No.	Stratigraphic Interval of Water Zone Tested	Surface Elevation	Static Water Level Elevations						
			1/10/95	2/14/95	2/22/95	2/27/95	3/6/95	4/2/95	4/7/95
PZ-1A	Mahoning Water Table	1782.3 ft	-	1774.6 ft	1774.5 ft	1774.5 ft	1774.9 ft	-	-
PZ-1B	Upper Freeport Coal	1783.1 ft	-	1764.8 ft	1764.3 ft	1764.7 ft	1765.6 ft	-	-
PZ-1C	Upper Kittanning Coal	1782.9 ft	-	1685.8 ft	1685.1 ft	1685.6 ft	1685.7 ft	-	-
PZ-1D	Middle Kittanning Coal	1783.4 ft	-	1685.7 ft	1684.9 ft	1685.1 ft	1685.3 ft	-	-
PZ-2A	Buffalo Sandstone	1653.7 ft	-	1608.3 ft	1607.0 ft	1608.0 ft	1608.4 ft	-	-
PZ-2B	Corinth Sandstone	1653.9 ft	-	1570.3 ft	1569.6 ft	1569.9 ft	1569.7 ft	-	-
PZ-2C	Mahoning Sandstone	1653.2 ft	-	1530.1 ft	1529.6 ft	1529.9 ft	1529.9 ft	-	-
PZ-2D	Middle Kittanning Coal	1653.6 ft	-	1534.9 ft	1533.4 ft	1534.4 ft	1533.0 ft	-	-
PZ-3A	Champion Creek Level	1692.8 ft	-	1620.0 ft	1618.6 ft	1619.8 ft	1614.9 ft	-	-
PZ-3B	Mahoning Sandstone	1692.3 ft	-	1574.5 ft	1574.2 ft	1574.3 ft	1543.1 ft	-	-
PZ-3C	Upper Freeport Coal	1692.1 ft	-	1561.7 ft	1561.1 ft	1561.6 ft	1561.6 ft	-	-
PZ-3D	Upper Kittanning Coal	1692.2 ft	-	1560.3 ft	1559.9 ft	1560.2 ft	1560.1 ft	-	-
PZ-3E	Middle Kittanning Coal	1692.0 ft	-	1536.9 ft	1536.6 ft	1536.6 ft	1537.6 ft	-	-
PZ-4A	Upper Worthington Sandstone	1476.1 ft	-	1420.4 ft	1419.9 ft	1420.3 ft	1420.2 ft	1476.1 ft (flowing)	1476.1 ft (flowing)
PZ-4B	Middle Kittanning Coal	1475.9 ft	-	1420.4 ft	1420.1 ft	1419.9 ft	1420.2 ft	1475.9 ft (flowing)	1475.9 ft (flowing)
PZ-4C	Lower Worthington Sandstone	1485.4 ft	1475.0 ft	1418.2 ft	1417.7 ft	1418.0 ft	1418.1 ft	1485.4 ft	1482.0 ft

and the well bore is sealed above and below the water bearing zone. This allows measurement of the hydrostatic head or pressure of a particular aquifer system, and provides a means for collection of water samples from a given aquifer. The hydrostatic head in a single aquifer, measured at multiple locations, determines the piezometric surface of that aquifer.

Water level measurements from these piezometer wells (Table 11) indicate that the piezometric surface of the aquifer associated with the Middle Kittanning coal ranges from an elevation of 1685 feet at well PZ-1D to an elevation of 1534 feet at well PZ-2D. The Middle Kittanning coal piezometric surface approaches the ground surface elevation along Champion Creek near PZ-3D and is projected to occur 40 to 75 feet above the elevation of Indian Creek between the villages of Champion and Melcroft (Figure 11). The 151 foot decrease in the piezometric surface from well PZ-1D to PZ-2D confirms the expected eastward movement of groundwater, downward along the geologic structure.

Reported water level elevations from piezometer PZ-1, PZ-2 and PZ-3 indicate both downward recharge and lateral flow components of groundwater. In addition, water level elevations reported from piezometer PZ-3, which is located midway between the Chestnut Ridge anticline and the Ohiopyle (Ligonier) syncline, and piezometer PZ-2, which is located near the lower portion of the syncline, indicate an upward flow component of groundwater from the Middle Kittanning coal aquifer.

The piezometers at PZ-4 are located down-dip from a portion of the abandoned Melcroft No. 3 underground mine which was developed on the Middle Kittanning coal. Water level elevations reported from four measurements of the PZ-4 piezometers from February 14 through March 6, 1995, show water elevations ranging from 1418 feet to 1420 feet; however, inspection of the piezometers by Department personnel on January 31, April 2, and April 7, 1995, found water discharging to the surface from wells PZ-4A and PZ-4B at an elevation of approximately 1476 feet (Table 11).

Results of chemical analysis of water samples from PZ-4A and PZ-4B indicate elevated concentrations of iron and manganese, and elevated concentrations of sulfates were found in all of the PZ-4 well sample analyses. These water analysis results are consistent with the results of chemical analyses of water samples collected at sample point D5, located on the flood plain of Indian Creek along Fowl Hill Road (T-904), which is believed to be a groundwater discharge originating from the abandoned Melcroft No. 3 underground mine. The observed surface discharge of water from piezometer wells PZ-4A and PZ-4B, which are located approximately 500 feet horizontally and approximately 100 feet vertically from the known extent of the underground mine workings; and the groundwater discharge at water quality sample point D5, located approximately 1200 feet from the Melcroft No. 3 underground mine workings, confirms the expected lateral and vertical movement of groundwater in this area.

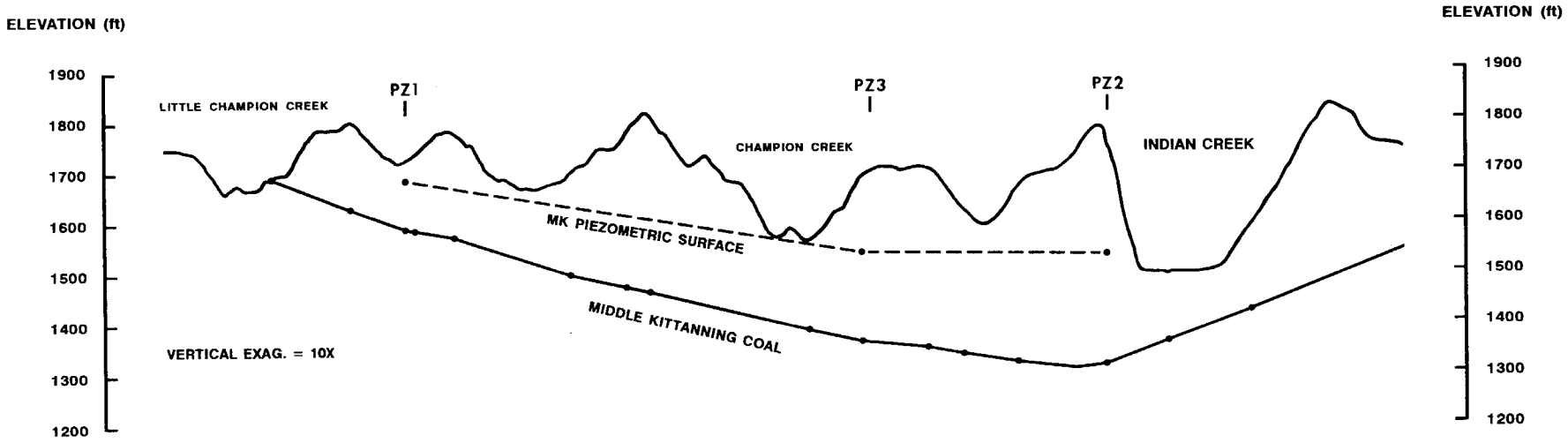

Figure 11. East-west topographic cross section showing depths to the Middle Kittanning coal and the piezometric surface of the aquifer associated with this coal.

Surface and Mine Drainage Water Quality

Water samples were collected monthly from streams, underground mine discharges, and surface mine discharges from May 1994 through April 1995 to determine the surface water and groundwater quality of the Indian Creek watershed. Samples for chemical analysis were collected in 500 ml high density polyethylene bottles. A separate 125 ml high density polyethylene bottle from each sample location was fixed with 2 ml of nitric acid for total metals analysis. In addition to the sampling program established for 1994 and 1995, historic water quality sample results were obtained through review of the Department's surface mining permit files. These data include results of premining, active mining, and postmining water samples. Sampling locations for both the 1994-1995 samples and the historic samples are depicted on Figure 12 and results of chemical analyses are given in Appendix Table 4. Surface water sampling points are numbered consecutively beginning at the headwater of Indian Creek following a hierarchical arrangement from upstream to downstream including named and unnamed tributaries to Indian Creek as well as main stem Indian Creek sampling locations. Mine discharge sampling point locations are listed in the same manner and appear in Appendix Table 4 in relation to their location within the study area. In some cases, the exact locations of historic discharge points could not be determined due to backfilling and reclamation of abandoned sites, and some discharges which were present during active mining phases or on formerly abandoned disturbed areas are not now present.

For purposes of this water quality discussion, the Indian Creek study area was divided into three sections based on land use and general chemical characteristics of the water. They are: the upper Indian Creek watershed, which has few roads, little development and few surface mines; the middle Indian Creek watershed, which has businesses, campgrounds, rural development and little mining; and the lower Indian Creek watershed including the Champion Creek, and Poplar Run watersheds, which contain villages, rural development and the majority of the surface and underground mining.

Upper Indian Creek Watershed

Upper Indian Creek, which includes the headwaters downstream to Pa Route 31/381 near Jones Mills, consists mainly of forested land, with a few scattered farms and houses east of Pa Route 381, and farms, fields, scattered houses and a few woodlots west of PA Route 381. Much of the forested land is in Forbes State Forest. Four eastern tributaries enter upper Indian Creek: Little Run, about 0.5 mile south of the turnpike; an unnamed tributary at Horners Mill, Camp Run, approximately 0.75 mile upstream of Jones Mills and an unnamed tributary (Camp Run Road Tributary), approximately 1000 feet south of Camp Run. Two unnamed tributaries drain the western portion of upper Indian Creek.

Water quality of upper Indian Creek (Sample Points 1, 3, 5, and 12) was characterized by pH values ranging from 6.3 to 6.8, alkalinity from 20 to 50 mg/l, iron 0.04 to 0.25 mg/l, manganese 0.02 to 0.10 mg/l, aluminum less than 0.13 to 0.33 mg/l, zinc less than 0.01 to 0.08 mg/l, and no acidity. Sodium concentrations ranging from 15.7 to 108 mg/l and chloride from 27 to 210 mg/l were measured in upper Indian Creek, with the highest concentrations occurring during the summer low flow period.

Figure 12. Map of surface water sample points, including historic and recent stream and coal mine discharge sample points within the Indian Creek study area. Stream sample locations are designated by ● , surface mine discharges by ✳ , and underground mine discharges by ✱ .

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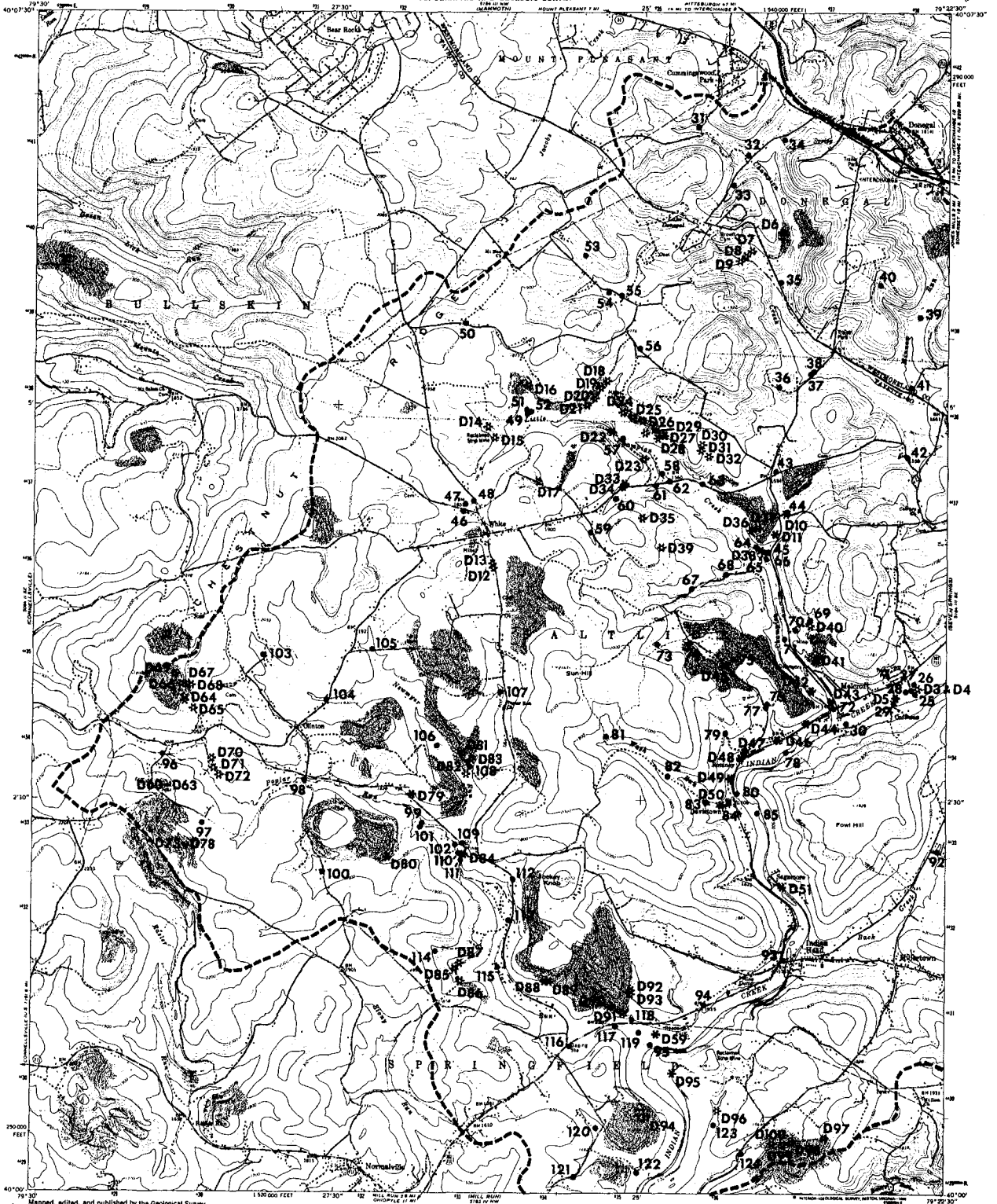
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

DONEGAL QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



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Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1967. Field checked 1967

Polyconic projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
1927 North American Datum (NAD 27)

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are given in USGS Bulletin 1875

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

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UTM GRID AND 1993 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road
Interstate Route	U.S. Route / State Route
	County Route

DONEGAL, PA.
40079-A4-TF-024

1967
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DEPARTMENT OF THE INTERIOR
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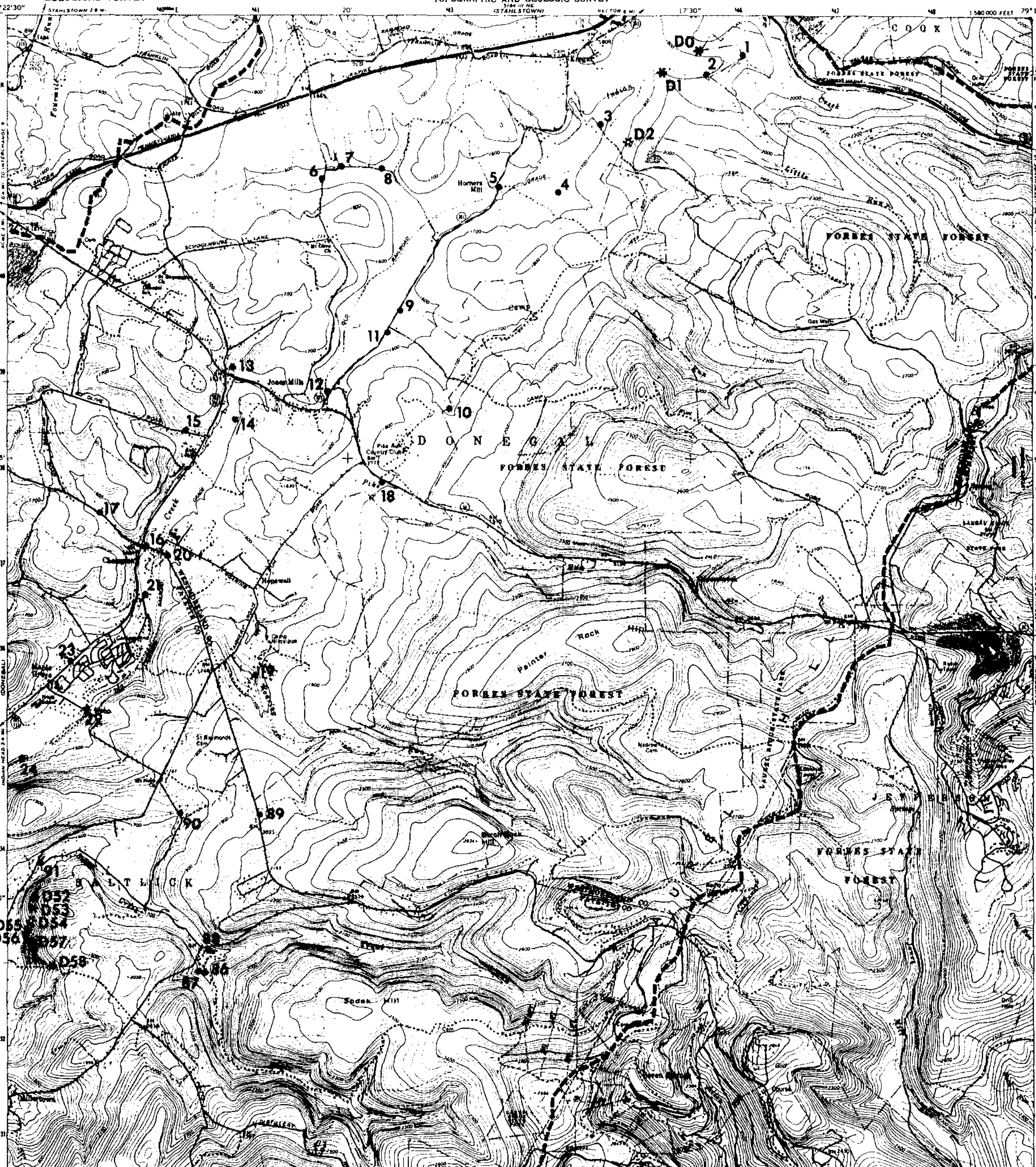
SEVEN SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



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There may be private inholdings within the boundaries of the National or State reservations shown on this map

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PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, all weather, hard surface	Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface	Unimproved road, fair or dry weather
Interstate Route	State Route

SEVEN SPRINGS, PA.
40079-A3-TF-024

1967
REVISED 1993
DMA 5164 III SE–SERIES V831

Concentrations of sodium and chloride were highest upstream of Little Run; however, elevated concentrations were measured down to the village of Jones Mills. The elevated sodium and chloride concentrations were attributed to runoff of anti-skid road salt from the Pennsylvania Turnpike, which is adjacent to the upper four miles of Indian Creek.

The upper Indian Creek watershed contains two abandoned Middle Kittanning coal underground mines and one small Upper Kittanning surface mine. The Blair Coal Co. "Kregar" underground mine is located near the watershed divide northeast of the village of Kregar and the M. K. Piper No. 1 underground mine is located near the mouth of Little Run. The "Kregar" mine (Sample Point D0) discharges into an unnamed tributary that enters Indian Creek approximately 0.5 mile downstream of Little Run. In April 1995, the Kregar discharge had a pH value of 3.2, no alkalinity, an acidity concentration of 114 mg/l, iron of 4.91 mg/l, manganese of 1.10 mg/l, and aluminum of 4.63 mg/l. Sodium concentrations were 111 mg/l and chlorides were 285 mg/l. A 1986 water sample from the unnamed tributary which receives this discharge had a pH value of 3.0, acidity of 92 mg/l, iron of 0.96 mg/l, manganese of 1.45 mg/l and aluminum of 7.78 mg/l. The Piper mine has a discharge (Sample Point D1) which had pH values ranging from 3.1 to 3.2, acidity of 128 to 190 mg/l, iron of 12.7 to 24.8 mg/l, manganese of 2.0 to 3.21 mg/l, and aluminum of 6.5 to 11.4 mg/l.

The Morcoal "Kalp" surface mine (MDP 34A76SM2) on the Upper Kittanning coal is located approximately 0.5 mile east of Indian Creek, north of Skyview Road. The Morcoal surface mine has a discharge (Sample Point D2) with pH values ranging from 3.2 to 4.4, iron ranging from 0.11 to 4.91 mg/l, manganese from 5.07 to 27.4 mg/l and aluminum from 14.45 to 73.0 mg/l. The volume of this discharge was estimated to be less than five gallons per minute.

Little Run (Sample Point 2) and Camp Run (Sample Point 4) originate near the crest of Laurel Hill and flow through forested watersheds. Little Run and Camp Run had pH values ranging from 6.3 to 6.8 and alkalinity from 22 to 32 mg/l, with no acidity reported. Metals concentrations were generally less than 0.33 mg/l. Little Run and Camp Run flow through the Mauch Chunk and Burgoon Formations of the Mississippian System.

Camp Run Road Tributary (Sample Points 10 and 11) had pH values of less than 5.2 and acidity often exceeding alkalinity. The iron concentrations ranged from 0.02 to 0.15 mg/l, manganese from 0.03 to 0.14 mg/l and aluminum from less than 0.13 to 0.32 mg/l. The Camp Run Road Tributary originates about 1.25 miles downslope of the crest of Laurel Hill and flows through Pottsville and lower Allegheny Group strata. Sharpe et al (1987), in their study of Laurel Hill streams, showed that streams originating in Pottsville Group strata that flow through rocky, forested terrain do not contain significant buffering capacity and often become acidic following spring runoff and snow melt. Less frequently, streams may be acidic all year. In general, streams originating or flowing through lower Allegheny Group strata also have little buffering capacity. Sharpe et al also indicated that streams flowing mainly through Mississippian strata, like Little Run and Camp Run, had near-neutral pH water and were little affected by acid precipitation.

The western unnamed tributaries of Indian Creek originate in the alkaline Conemaugh Group strata and have different water quality than the eastern tributaries. One tributary (Sample Point 6) drains part of the western portion of the upper Indian Creek watershed and has two branches, represented by Sample Point 7 and Sample Point 8, which originate north of the Pennsylvania Turnpike and drain mostly farmland. Another small unnamed tributary (Sample Point 13) drains farmland south of Schoolhouse Lane. These tributaries had pH values ranging from 6.7 to 8.5, alkalinity ranging from 62 to 104 mg/l and metals concentrations less than 0.58 mg/l. Sample Points 6, 7, and 8 had sodium concentrations ranging from 23 to 78 mg/l and chloride concentrations from 55 to 134 mg/l. The lowest salt concentrations were in the Schoolhouse Lane tributary, which is farthest away from the turnpike.

Middle Indian Creek Watershed

Middle Indian Creek watershed, from Pa Route 381 at Jones Mills south to the village of Melcroft, consists of scattered farms and woodlots west of Tannery Road, commercially developed land with campgrounds, restaurants and other businesses along Pa Route 711/381, and the Roaring Run Natural Area within Forbes State Forest east of Indian Creek. Several small unnamed tributaries to Indian Creek are on the west side and two named tributaries on the east. Roaring Run, which originates at the summit of Laurel Hill, enters Indian Creek at the village of Champion. Pike Run, which also originates on Laurel Hill and flows along Pa. Route 31, combines with Roaring Run near Camp Alliquippa (Roaring Run Camping Resort).

Indian Creek (Sample Points 14, 16, 21 and 29) had pH values ranging from 6.3 to 7.0, alkalinity ranging from 26 to 40 mg/l, sulfates from less than 20 to 26 mg/l, iron from 0.12 to 0.32 mg/l, manganese 0.02 to 0.23 mg/l, aluminum from less than 0.13 to 0.25 mg/l and zinc from less than 0.01 to 0.08 mg/l. Sodium concentrations ranged from 16.1 to 34.8 mg/l and chloride from 29 to 71 mg/l. Roaring Run and Pike Run (Sample Points 18, 19 and 20) flow through the same geologic formations as Little Run and Camp Run located in the upper section of Indian Creek watershed and their water chemistries were also similar. The pH values ranged from 6.3 to 6.7 and alkalinity was 17 to 38 mg/l; metals concentrations were less than 0.26 mg/l.

Three small unnamed tributaries, represented by Sample Point 15 (Mt. Olive Road tributary), Sample Point 17 (County Line tributary), and Sample Point 23 (Maple Grove tributary) enter Indian Creek from the west and drain an area of farmland and scattered houses. These tributaries flow mainly through Conemaugh Group strata. They had pH values ranging from 6.3 to 6.8 and alkalinity from 34 to 80 mg/l. No surface or underground mines are located on these tributaries. The one underground mine in this portion of Indian Creek watershed, a small abandoned Middle Kittanning coal underground mine located near the village of Nebo, does not appear to have any surface drainage.

A reclaimed Holliday Constructors, Inc. surface/auger mine (SMP 3375SM4) on the Middle Kittanning coal is located on the floodplain adjacent to Indian Creek approximately 1/4 mile upstream from the village of Coffman. A postmining discharge (Sample Point D3) developed at this site. Chemical analysis results indicate that in 1982 the discharge water was alkaline with an iron concentration of 20.30 mg/l, manganese of 12.90 mg/l, and sulfate of 720 mg/l.

Review of the historic data shows a steady decrease in manganese and sulfate concentrations; however, iron was variable, ranging from a high of 20.30 mg/l in 1982 to a low of 6.18 mg/l in 1991. In August of 1994, sample analysis results showed an iron concentration of 7.92 mg/l, manganese of 2.48 mg/l, and a sulfate concentration of 128 mg/l. The discharge flows through a pond and then into an unnamed tributary to Indian Creek, which flows along the southern boundary of the reclaimed site. This unnamed tributary originates upslope from the mine site and water quality results of samples taken in 1983 and 1995 at Sample Point 26 indicate no effects from mining activities, with alkalinities of 40 and 46 mg/l, iron of 0.17 and 0.22 mg/l, manganese of 0.06 and 0.09 mg/l, and sulfate concentrations of 26 and 47 mg/l. Downstream from the discharge (Sample Point 27), the unnamed tributary had a pH value of 6.5 to 6.7, alkalinity concentrations of 18 to 24 mg/l, iron of 2.30 mg/l, manganese of 1.00 to 1.65 mg/l, and sulfate of 74 to 78 mg/l. Indian Creek stream water was sampled at two points (Sample Points 24 and 25) upstream of the Holliday unnamed tributary discharge confluence, where results of chemical analysis indicate that pH values ranged from 6.2 to 6.6 with alkalinity concentrations of 18 to 24 mg/l, iron of less than 0.19 to 0.24 mg/l, and manganese of less than 0.05 to 0.09 mg/l. Downstream of the tributary confluence, Indian Creek had pH values of 6.2 to 6.9, alkalinity concentrations of 18 to 24 mg/l, iron of 0.27 to 0.37 mg/l, and manganese of 0.07 to 0.11 mg/l.

An iron precipitate stained pond is located in the Indian Creek floodplain adjacent to Fowl Hill Road (Coffman village). This ponded water, an oxbow of Indian Creek, (Sample Point D5) had pH values ranging from 6.3 to 6.6, alkalinity concentrations of 70 to 108 mg/l, iron of 1.67 to 32.50 mg/l, manganese of 0.98 to 5.58 mg/l, and sulfate of 80 to 134 mg/l.

Lower Indian Creek Watershed

Lower Indian Creek watershed, was defined as the main stem of Indian Creek downstream of the village of Melcroft, including Champion Creek, Little Champion Creek, Back Creek, and Poplar Run. This section contains most of the surface and underground mining in the watershed. Abandoned Middle Kittanning underground coal mines, including Melcroft Mines #1, #2 and #3, Indian Creek Coal and Coke Co. #1 and #2, and several smaller mines underlie most of lower Indian Creek watershed and the downstream portions of Champion Creek and Little Champion Creek watersheds. Champion Creek, Minnow Run, Little Champion Creek, Poplar Run, and Newmyer Run also contain numerous surface mined areas on the Upper Freeport through Brookville coals and several small Middle Kittanning underground coal mines.

Champion Creek upstream of Little Champion Creek confluence

Champion Creek originates in the foothills of Chestnut Ridge, near the village of Cummingswood Park, approximately 1.5 miles west of the Donegal exit of the Pennsylvania Turnpike. Two sampling locations on Champion Creek, Sample Point 31 and Sample Point 32, reflect background conditions unaffected by mining. Chemical results showed a pH value range of 6.2 to 6.7, alkalinity range of 17 to 40 mg/l, iron concentrations of less than 0.79 mg/l, manganese of less than 0.60 mg/l, aluminum of less than 0.50 mg/l, and sulfate ranging from less than 20 to 65 mg/l.

Two unnamed tributaries, Sample Point 33 and Sample Point 34 enter Champion Creek immediately downstream from Sample Point 32. These tributaries exhibit chemical conditions similar to the headwater of Champion Creek; however, the tributary at Sample Point 34, which originates near the Pennsylvania Turnpike, had sodium concentrations ranging from 33.1 to 58.5 mg/l and chloride concentrations ranging from 70 to 199 mg/l, which is attributed to runoff from salt applications to the turnpike.

One surface mine permit, Milrock Mining, Inc. (MDP 3374SM64) on the Mahoning and Upper Freeport coals is located in the Champion Creek watershed between Sample Point 32 and Sample Point 38. Permit file information indicates that seeps and discharges documented during the 1984 to 1988 time period consistently produced alkaline water. Chemical results from three different discharge areas, Sample Points D7, D8, and D9, had pH values ranging from 5.9 to 6.7, iron of 0.35 to 5.78 mg/l, and manganese concentrations consistently reported in the 1.5 to 6.5 mg/l range. Sulfate concentrations ranged from 72 to 182 mg/l and aluminum concentrations were less than the lower detection limit of 0.50 mg/l.

A discharge (Sample Point D6) from an abandoned country bank mine (Upper Freeport coal) flows to Champion Creek upstream from Sample Point 35. The discharge, located within the permit boundaries of V & B Excavating noncoal surface mine (SMP 65892305), was not affected by the Milrock mine and has been reported as flowing at several gallons per minute. Results of samples taken in 1989 and 1993 indicate that the pH value was 2.8 and acidities ranged from 558 to 1096 mg/l, with iron concentrations of 105 to 272 mg/l, manganese of 2.28 to 4.04 mg/l, and aluminum of 33.3 to 77.2 mg/l.

Downstream from Sample Point D6, Champion Creek 1994 sample results for Sample Point 35 showed pH values ranging from 6.4 to 6.8, alkalinity concentrations of 22 to 42 mg/l, iron of 0.14 to 0.41 mg/l, manganese of 0.02 to 0.08 mg/l, and aluminum of less than 0.13 to 0.29 mg/l.

Sample Points 36 and 37 are located on an unnamed tributary to Champion Creek approximately 0.7 mile downstream from sample Point 35. This tributary drains from farmlands and is indicative of water quality in unmined areas of this watershed with pH values ranging from 6.3 to 7.3, alkalinity consistently in the 18 to 36 mg/l range, and sulfate of less than 20 to 37 mg/l.

Water quality at Sample Point 38, located on Champion Creek immediately downstream from the tributary confluence, was similar to upstream Sample Point 35. The pH values ranged from 6.4 to 6.8, alkalinity ranged from 26 to 44 mg/l, iron concentrations were less than 0.65 mg/l, manganese of less than 0.11 mg/l, aluminum of less than 0.24 mg/l, and sulfate ranging from 25 to 35 mg/l.

Minnow Run, a tributary to Champion Creek, which originates in Conemaugh Group strata near the Donegal exit of the turnpike, includes a large campground at the headwater and extensive farmland in its watershed. One surface mine on the Mahoning coal was operated by the Firestone Coal Corp. (MDP 3477SM14) immediately west of Minnow Run. No postmining surface water discharges from this mine are documented. Sample Points 39 and 40 are located upstream of any effects from the surface mine area. The pH values ranged from 6.0 to 7.1. At low concentrations of suspended solids, iron, manganese, and aluminum

concentrations were at or near the lower detection limits for the laboratory test methods. Sulfate ranged from less than 20 to 58 mg/l. Sample Point 41, located on Minnow Run downstream from the surface mined area, had pH values ranging from 6.6 to 7.2 and alkalinity 40 to 104 mg/l. Sodium concentrations ranged from 64.8 to 103 mg/l and chloride concentrations ranged from 102 to 159 mg/l. Iron concentrations ranged from 0.29 to 0.63 mg/l, manganese from 0.29 to 0.40 mg/l, aluminum was less than 0.14 mg/l and zinc was less than 0.04 mg/l.

At Sample Point 42, located approximately 1200 feet downstream of the Minnow Run confluence, Champion Creek had pH values ranging from 6.6 to 7.1 and alkalinity of 34 to 96 mg/l. Iron was less than 0.45 mg/l.

A portion of a reclaimed surface mine on the Upper Kittanning coal (Pine Flats Coal Co., SMP 26823086T) is located to the north and east of Sample Point 44. The pH values at this sample point ranged from 6.5 to 7.0 and alkalinity ranged from 46 to 110 mg/l. Iron was less than 0.42 mg/l and manganese was less than 0.16 mg/l. Sulfate concentrations ranged from 39 to 105 mg/l.

A stream bank seep (Sample Point D10) was observed immediately downstream from Sample Point 44. The pH value of the seep was 6.6 with an alkalinity of 104. The seep had an iron concentration of 16.30 mg/l, manganese of 3.75 mg/l and sulfate of 412 mg/l.

Several country bank mine openings were present prior to mining by the Pine Flats Coal Co. Water quality chemical results at one of these openings (Sample Point D11) indicate that pre-mining discharges had pH values ranging from 4.0 to 4.3, acidity of 4 to 2.03 mg/l, iron of 0.32 to 2.03 mg/l, manganese of 0.04 to 0.046 mg/l, and sulfate of 63 to 75 mg/l. Postmining sample results showed pH values ranging from 3.3 to 3.5, acidity concentrations of 236 to 508 mg/l, iron of 54.70 to 209.00 mg/l, manganese of 53.60 to 89.3 mg/l, and sulfate of 1342 to 1694 mg/l. This discharge was reported as low volume (several gallons per minute) and the mine opening has been sealed by the operator. No discharge from this point has recently been observed by the district mine conservation inspector.

April 1995 sample analysis results for Sample Point 45, located upstream from the Little Champion Creek confluence, showed a pH value of 6.8, alkalinity of 40, iron of 0.30 mg/l, manganese of 0.26 mg/l, aluminum of 0.26 mg/l, and sulfate of 59 mg/l.

Little Champion Creek

Little Champion Creek originates on Chestnut Ridge about one mile northwest of the village of White. The upper portions of Little Champion Creek and its two tributaries (Sample Points 46, 47, 48) had similar water quality with pH values ranging from 6.1 to 6.7, alkalinity from 22 to 34 mg/l, iron from 0.14 to 1.47 mg/l, manganese from 0.01 to 0.67 mg/l, aluminum from less than 0.13 to 0.61 mg/l, and zinc less than 0.04 mg/l. Several surface mines on the Upper Freeport and Upper and Middle Kittanning coals are located on the upper portion of the Little Champion Creek watershed. Water sample results at Sample Point D12 indicate that in 1988 water draining from a surface mine (William K. Tedesco, MDP 3370BSM16) on the Upper Freeport coal along the west side of State Route 1009 south of White was acidic with a pH value of 3.9, acidity of 52 mg/l, iron

of 8.35 mg/l, manganese of 3.59 mg/l, and sulfate of 612 mg/l. Results of 1994 water samples from a discharge (Sample Point D13), which exits from pipe downstream of Sample Point D12 and south of White, draining from the now backfilled Tedesco surface mine, showed seasonal variability. From June through October, the pH values ranged from 6.2 to 6.3 and alkalinity 76 to 146 mg/l, iron 0.11 to 8.66 mg/l, manganese 0.01 to 0.80, and aluminum less than 0.13 mg/l. The May sample; however, had pH value of 4.1, alkalinity 3 mg/l, iron 15.6 mg/l, manganese 4.29 mg/l, and aluminum of 0.84 mg/l.

Surface mining was conducted on the Middle Kittanning coal on the north side of Little Champion Creek during the early to mid 1970's. Permit file information for one of these mines, Adam Eidemiller, Inc., MDP 2969BSM10, indicates that accumulated water and discharge water (Sample Points D14 and D15, 1971 and 1973) at this site had pH values ranging from 5.1 to 6.2, alkalinities of 0 to 16 mg/l, acidities of 0 to 14 mg/l, iron of 0.10 to 1.50 mg/l, and sulfate of 84 mg/l to 480 mg/l. This mine was backfilled by 1977 and no postmining discharges were reported in the permit file. Water samples taken in 1994 from Little Champion Creek (Sample Point 49), downstream from the Eidemiller site, had pH values ranging from 6.4 t0 7.1, alkalinities of 26 to 76 mg/l, iron ranging from 0.10 to 0.21 mg/l, manganese of 0.03 to 0.10 mg/l, and sulfate of 49 to 133 mg/l.

An unnamed tributary flows into Little Champion Creek from the northwest, immediately downstream of Sample Point 49. Water quality of this tributary is represented by Sample Point 50, located near the headwater and Sample Point 51, located at the tributary mouth. Water sample results at Sample Point 50 showed pH values of 6.1 to 6.8, alkalinities of 22 to 82 mg/l, iron of 0.41 to 1.47 mg/l, manganese of 0.31 mg/l to 2.65 mg/l. Sulfate concentrations ranged from less than 20 to 80 mg/l. Surface mining activities were conducted by the Genovese Coal Co. (MDP 3372SM20) on the Middle Kittaning coal upstream from Sample Point 51. Results of pit water samples (1980-1987) at this site showed alkaline conditions with pH values of 6.7 to 7.5, alkalinities of 148 to 158 mg/l, metals concentrations were consistently near the lower detection limits for the laboratory test, with sulfates of 114 to 200 mg/l. Downstream of this surface mined area, the tributary (Sample Point 51) water quality results were similar to upstream Sample Point 50 results. Little Champion Creek at Sample Point 52, approximately 50 feet downstream of the unnamed tributary confluence, exhibited chemistry similar to Sample Point 49. A premining discharge (Sample Point D17) associated with a reclaimed Amerikohl Mining Co. surface mine (SMP 26880101) on the Lower Freeport coal originates on a hillside approximately 2500 feet due south of Sample Point 52. Permit file water sample results over the 1987 to 1994 time period indicate consistent acidic conditions with pH values of 3.4 to 4.9 and acidities of 32 to 60 mg/l. Iron concentrations were variable ranging from less than 0.30 to 2.75 mg/l, manganese concentrations fell predominantly within the 1.00 to 2.50 mg/l range, and aluminum results, with one exception (<0.50 mg/l), ranged from 0.92 to 6.26 mg/l. Flow rates during 1987 and 1988 were reported at 17 to 108 gallons per minute (gpm), however, from 1989 to 1994 flows were reported in the 1 to 4 gpm range. There is no evidence that this discharge contributes surface flow to Little Champion Creek.

An unnamed tributary flowing from the north enters Little Champion Creek between old areas of the Brant Coal Co. reclaimed surface mine (MDP 3375SM3) on the Upper Kittanning coal and the northern portion of the Genovese Coal Co. (MDP 3375SM23) surface mine on the Middle Kittanning coal. The southern portion of the Genovese mine and some additional acreage, extending along the northern drainage slope of Little Champion Creek, was permitted and mined by the Pine Flats Coal Co. under permit number SMP 26880133 on the Upper and Middle Kittanning coals.

Water quality of the unnamed tributary, upstream of any mining influence, is represented by Sample Points 53, 54, 55, and 56. All sample results indicate little variability in chemistry with a pH value range of 6.2 to 6.9 and average alkalinity of 40 mg/l (22-66 mg/l range). Iron averaged 0.40 mg/l (0.10-0.93 mg/l range) and manganese averaged 0.09 mg/l (0.01-0.42 mg/l range). Aluminum ranged from less than 0.13 to 0.75 mg/l, with sulfate from less than 20 to 89 mg/l.

Review of the Brant Coal Co. permit file sample results indicate that from 1976 to 1980, sedimentation pond water, toe of spoil discharge, and other waters at this site (Sample Points D18 through D21) ranged in pH value from 6.6 to 7.1 with alkalinities of 10 to 85 mg/l. Iron ranged from 0.80 to 4.00 mg/l with sulfate of 30 to 140 mg/l. A single sample taken upslope from the Brant site was acidic with a pH value of 4.5 and acidity of 14; however, iron, manganese, and aluminum concentrations were less than 0.6 mg/l.

Representative water sample results from the Genovese site permit file ((Sample Points D24, D26, and D26 (1986)) indicate slightly acidic to moderately alkaline chemistry. The pH value range at these sample points was 4.5 to 6.6; however, only one sample showed acidity (18 mg/l) exceeding alkalinity (6 mg,l). Metals were of relatively low concentrations; with iron of less than 0.75 mg/l, manganese of less than 0.95 mg/l, and aluminum of less than 0.69 mg/l. Sulfate ranged from 105 to 344 mg/l.

Pit water sample results from the active Pine Flats Coal Co. mine were higher in pH and alkalinity than water in unaffected areas. The pH value of the Middle Kittanning coal pit (Sample Point D31) was 7.1 to 7.5 with alkalinities of 148 to 236 mg/l. The water contained iron concentrations of less than 0.38 mg/l, manganese of less than 0.98 mg/l, and aluminum of less than 0.50 mg/l. Sulfate concentrations were 214 to 521 mg/l. Other sample results from seeps, pit water (undefined), and sedimentation pond effluents showed pH values ranging from 6.2 to 7.6 with alkalinities of 13 to 176 mg/l. Metals concentrations ranged more widely with iron concentrations of 0.33 to 8.07 mg/l, manganese of 0.19 to 11.10 mg/l, and aluminum of less than <0.13 to 1.28 mg/l.

Two springs, which flow into the middle reaches of Little Champion Creek, are associated with Middle Kittanning coal surface mines on the southern drainage slope of the stream opposite from the Genvovese Coal Co. and Pine Flats Coal Co. mine sites. One spring is a discharge (Sample Point D22) located along the haul road of the Purco Coal Co. (MDP 3371BSM6) reclaimed surface mine on the Middle Kittanning coal. This discharge was characterized by pH values ranging from 6.5 to 6.9 and alkalinity of 142 to 174 mg/l, iron ranged from 1.65 to 6.50 mg/l, manganese from 2.29 to 3.83 mg/l, and zinc less than 0.03 mg/l. Aluminum was less than 0.13 mg/l in June, July and September, 0.52 mg/l in August and 0.42 in

October. The second spring, (Sample Point D23), which is located downslope on the north side of the Purco surface mine haul road, had pH values ranging from 6.4 to 6.6, alkalinity of 108 to 164 mg/l, iron 0.10 to 0.36 mg/l, manganese 0.01 to 0.04 mg/l, and aluminum less than 0.13 to 0.29 mg/l.

Sample Points 57 and 58 on Little Champion Creek represent stream water quality after receiving drainage and recharge from the Brant Coal Co., Genovese Coal Co., and Pine Flats Coal Co. surface mine sites. The water quality at these two sample points was virtually the same as upstream Sample Points 49 and 52.

An unnamed tributary to Little Champion Creek, (Sample Points 59, 60 and 61), which flows along the south side of State Route 1050, had pH values ranging from 6.1 to 7.0, alkalinity of 32 to 62 mg/l and metals concentrations less than 0.59 mg/l. This unnamed tributary receives discharges (Sample Points D33 and D34) from an abandoned Middle Kittanning coal underground mine. The combined discharge flow enters the tributary between Sample Points 60 and 61. Sample Point D33, a seep exiting from a rock wall, had pH values ranging from 6.0 to 6.8, alkalinity 15 to 68 mg/l, acidity 0 to 36 mg/l, iron 0.38 to 6.35 mg/l, manganese 0.08 to 0.34 mg/l and aluminum 0.25 to 2.56 mg/l. Aluminum precipitate was present on the rock wall and soil under the discharge. Flow in the roadside ditch (Sample Point D34), which appeared to be originating from the same mine, had a wider range of water quality: pH values ranged from pH 3.4 to 6.3, alkalinity 0 to 32 mg/l, iron 7.37 to 35.8 mg/l, manganese 0.81 to 1.27 mg/l, and aluminum less than 0.13 to 6.82 mg/l. This flow may be affected by a small coal refuse pile along the road. This unnamed tributary also receives surface runoff from the northern end of a reclaimed Amerikohl Coal Co. surface mine (SMP 26880110) on the Upper and Lower Freeport coals. A postmining discharge (Sample Point D35) once drained from this area; however, the discharge was alkaline, and diminished in flow to the point where it was no longer considered for monitoring as a discharge. Results from Sample Point 62, located at the SR1050 bridge, indicate that the relatively low volume discharges to the unnamed tributary cause no discernible changes in the water quality of Little Champion Creek.

Between Sample Points 62 and 64, Little Champion Creek receives acidic mine drainage from the Pine Flats Coal Co. (SMP 26823086T) surface mine on the Upper Kittanning coal. Results of samples at Sample Points D36 and D37 are representative of the water quality at this discharge area. The pH values ranged from 3.1 to 4.6, acidities of 72 to 622 mg/l, iron of 1.79 to 125 mg/l, manganese of 33.20 to 102.00 mg/l, and sulfate of 984 to 1974 mg/l. Flows from this area were reported in inspection reports as several gallons per minute.

Sample Point 65 on Little Champion Creek about one-fourth mile upstream from the confluence with Champion Creek had pH values ranging from 6.3 to 7.1, alkalinity 52 to 76 mg/l, iron 0.66 to 2.03 mg/l, manganese 0.24 to 1.00 mg/l, aluminum less than 0.13 to 0.26 mg/l, and zinc less than 0.03 mg/l. An iron seep (Sample Point D38) upwells from the stream bottom of Little Champion Creek just upstream of Sample Point 65. Results from two sample analyses of the D38 discharge from permit files (1991-1992) reported a pH value range of 6.3 to 6.7 and alkalinities of 94 to 110 mg/l, iron concentrations were 26.70 and 40.70 mg/l with manganese of 3.82 and 6.97 mg/l. Iron precipitate was present on the bottom of Little Champion Creek downstream of this seep, about one-third of the way out from the south bank. This seep is believed to originate from the upper

portion of the Melcroft #1 underground mine and flow through rock fractures into the stream bed. The effects of this discharge on downstream water quality compared to upstream Sample Point 62 showed an increase in concentrations of iron and manganese at Sample 65.

Champion Creek downstream of Little Champion Creek confluence

Sample Point 66, located on Champion Creek downstream of the Little Champion Creek confluence, is representative of the combined effects of surface and underground discharges to the upper watershed areas. Monthly sample results from May through October of 1994, recorded pH values ranging from 6.4 to 7.0, alkalinity concentrations of 32 to 52 mg/l, iron of 0.33 to 0.86 mg/l, manganese of 0.17 to 0.64 mg/l, and sulfate of 53 to 140 mg/l.

Immediately downstream of Sample Point 66, an unnamed tributary enters Champion Creek from the west. The headwaters flow to this unnamed tributary drain from surface mining areas on the Upper and Lower Freeport coals. Sample Point 67 had pH values ranging from 6.3 to 7.0 and alkalinity concentrations of 32 to 52 mg/l. Iron concentrations were less than 0.46 mg/l, manganese less than 0.02 mg/l, and aluminum less than 0.53 mg/l. A tributary flow, which originates on the reclaimed Amerikohl Coal Co. (SMP 26880110) reclaimed surface mine, receives flow from a postmining discharge (D39) which developed at this site. Permit file sample results of the discharge (1991-1992) documented a pH value range of 6.9 to 7.5 and an alkaliny range of 164 to 278 mg/l. Iron concentrations ranged from 2.01 to 36.30 mg/l, manganese 6.78 to 10.80 mg/l, and aluminum was consistently less than 0.50 mgl; however, a sample taken in March of 1994, showed a significant decline in alkalinity to 64 mg/l, iron to 0.79 mg/l, and manganese to 2.30 mg/l. Sample Point 68, located at the T729 bridge crossing downstream from Sample Point D39, is affected by acidic mine drainage which occurs as a discharge along the stream bank. During high stream flow, water sample analysis results showed pH values of 6.2 to 6.4, alkalinity concentrations ranging from 30 to 48 mg/l, iron 1.07 to 6.83 mg/l, and manganese of less than 0.53 mg/l. When the tributary flows diminish, the stream water is made up primarily of flow from this mine drainage, which in June and July of 1994, had a pH value range of 3.3 to 3.5, acidities of 66 to 128 mg/l, with elevated iron concentrations ranging from 21.90 to 47.9 mg/l, manganese 1.84 to 2.37 mg/l and aluminum 1.81 to 2.78 mg/l.

Champion Creek, from the confluence with Little Champion Creek downstream to the village of Melcroft, (Sample Points 66 and 71) had pH values ranging from 6.4 to 7.3, alkalinity 28 to 88 mg/l, iron 0.15 to 0.86 mg/l, manganese 0.15 to 0.64 mg/l, and aluminum less than 0.13 to 23 mg/l. This section of Champion Creek receives a tributary locally known as Puzzle Run (Sample Points 69, D40, and 70). The upper end of the east branch of Puzzle Run at Sample Point D40 had pH value of 3.2 to 3.3, acidity 164 to 186 mg/l, iron 6.69 to 7.92 mg/l, manganese 6.12 to 6.89 mg/l and, aluminum 15.90 to 20.10 mg/l. Seeps from the reclaimed surface spoil from the Melcroft #3 underground mine is the source of the acid mine drainage entering the east branch of Puzzle Run. The west branch of Puzzle Run (Sample Point 69), which had pH values ranging from 6.3 to 6.4, alkalinity 15 to 16 mg/l, and metals concentrations of less than 0.24 mg/l, appears to be

unaffected by mining. Except for the August 1994 sample, Puzzle Run at Sample Point 70 had pH values ranging from 3.7 to 4.6, acidity of 24 to 120, manganese 0.73 to 4.92 mg/l, and aluminum 2.16 to 16.60 mg/l. Aluminum precipitate covered the stream substrate. In August, the pH value was 6.2, alkalinity 11 mg/l, and all metals concentrations were less than 0.30 mg/l.

Three discharges from abandoned underground mines enter Champion Creek at Melcroft upstream of Sample Point 72: an abandoned mine entry from Melcroft #1 (Sample Point D42), a pond at an abandoned mine entry into Melcroft #3 (Sample Point D41), and a flume discharge along the bank of Champion Creek (Sample Point D43). The discharge at Sample Point D41 had pH values ranging from 3.1 to 3.3, zero alkalinity and acidity 82 to 140 mg/l. Iron concentrations ranged from 0.83 to 8.16 mg/l, manganese from 0.55 to 4.47 mg/l, and aluminum from 1.71 to 5.87 mg/l. The discharge at Sample Point D42 had pH values ranging from 3.4 to 5.1, acidity 18 to 82 mg/l, and iron 5.24 to 13.90 mg/l, manganese 0.55 to 2.95 mg/l, and aluminum less than 0.13 to 2.54 mg/l. The flume breakout (Sample Point D43) had similar pH value, but usually much higher iron concentrations (1.12 to 45.4 mg/l) than the two other discharges.

Champion Creek at Sample Point 72 in the village of Melcroft, had pH values ranging from 6.0 to 6.7, alkalinity 32 to 42 mg/l, iron 0.96 to 3.47 mg/l, manganese 0.55 to 0.82 mg/l, aluminum 0.65 to 9.95 mg/l, and zinc of 0.03 to 0.13 mg/l. The stream substrate was covered by iron precipitate.

Indian Creek downstream of Champion Creek confluence

Indian Creek at Sample Point 78, which is downstream of the confluence of Champion Creek, had pH values ranging from 6.4 to 6.8, alkalinity concentrations ranging from 30 to 36 mg/l, iron 0.40 to 0.99 mg/l, manganese 0.10 to 0.30 mg/l, and an aluminum concentration of less than 0.13 to 0.26 mg/l.

A spring seep at the Middle Kittanning coal outcrop (Sample Point 44) was observed along PA Route 711 approximately 1100 feet south of the village of Melcroft. Water sample analysis results showed a pH value range of 6.1 to 6.4, alkalinity concentrations of 40 to 54 mg/l, iron of 5.15 to 10.90 mg/l, manganese of 1.28 to 1.88 mg/l, and sulfate of 334 to 546 mg/l. Iron precipitate was evident at this point and the seep appears to be Middle Kittanning coal mine drainage diluted by groundwater originating from higher elevations.

An unnamed tributary to Indian Creek, along T850 (Romney Road), flows through the Pine Flats Coal Co. (SMP 26923036T) reclaimed surface mine on the Upper Freeport coal which overlies the Melcroft #1 mine. Water quality of this tributary is represented by Sample Points 73 through 77. Sample Point 73, located upslope of the mining disturbed area, was sampled in September and December of 1994. The reported pH value were 6.7 and 7.2 with alkalinity of 34 an 54 mg/l, iron of 0.25 and 0.08 mg/l, manganese of 0.10 and 0.02 mg/l, aluminum of less than 0.13 mg/l, and sulfate of 45 and 34 mg/l. At Sample Point 74, approximately 1200 feet downstream of Sample Point 73, little change in water quality was observed, pH and alkalinity were essentially within the same range. A slight overall increase in iron concentrations, which ranged from 0.22

mg/l to 0.68 mg/l, and aluminum which ranged from 0.16 to 0.45 mg/l, was observed. Manganese levels were 0.02 to 0.03 mg/l. A low volume discharge enters the tributary approximately 1800 feet downstream of Sample Point 74. This discharge exhibited elevated alkalinity concentrations of 168 to 222 mg/l with iron concentrations of 1.19 to 1.27 mg/l, manganese of 0.94 to 1.03 mg/l, and aluminum of 0.60 to 1.19 mg/l. An increase in sulfate (119 to 142 mg/l) was also noted. Sample Points 75 and 76, located downstream of the discharge, had pH values ranging from 6.6 to 7.7, alkalinity 66 to 118 mg/l, iron less than 0.61 mg/l, manganese less than 0.11 mg/l, and aluminum less than 0.48 mg/l. The highest metals concentrations were measured during the May high flow period.

Between the villages of Melcroft and Davistown, Indian Creek receives several discharges from the abandoned Melcroft underground mine complex on the Middle Kittanning coal. These discharges occur from underground mine openings, cropline seeps and flume breakouts adjacent to PA Route 711/381. The results of chemical analyses of the discharges from Sample Points D46, D47, and D48 show similar water quality characteristics with pH values ranging from 2.9 to 3.4, acidity 188 to 304 mg/l, iron 12.3 to 80.5 mg/l, manganese 1.85 to 2.58 mg/l, aluminum 4.88 to 14.7 mg/l, and sulfate 365 to 720 mg/l. In general, the lowest concentrations of iron, manganese, aluminum and sulfate were recorded from May samples collected at high flow conditions and the highest concentrations were found during October and November sampling during low flow conditions. The measured flow from sample Point D47 (Kalp mine entry) at low flow conditions in September 1994 was over 400 gallons per minute. Chemical analyses results of water samples collected at Sample Points D44, D49 and D50 are somewhat different than those of the primary underground mine discharges. The spring discharge at Sample Point D46 had pH values ranging from 6.1 to 6.4, alkalinity 40 to 54 mg/l, iron 5.15 to 10.7 mg/l, manganese 1.28 to 1.88 mg/l, aluminum from less than 0.13 to 0.83 mg/l, and sulfate ranging from 334 to 546 mg/l. Analysis of water samples from Sample Points D49 and D50 showed that pH values ranged from 3.1 to 4.6, an acidity concentration range of 13 to 196 mg/l, iron of 1.72 to 13.7 mg/l, manganese of 0.10 to 1.13 mg/l, aluminum of 0.39 to 16.8 mg/l, and sulfate of 66 to 546 mg/l. In general, these discharges had less acidity and lower metals and sulfate concentrations; however, they exhibit seasonal variation in water quality similar to that found at Sample Points D46, D47, and D48.

About 2000 feet downstream of the Kalp discharge, Indian Creek at Sample Point 80 had pH values ranging from 6.0 to 6.3, alkalinity 17 to 24 mg/l, iron 0.52 to 3.23 mg/l, manganese 0.15 to 0.37 mg/l, and aluminum 0.21 to 0.79 mg/l. No iron precipitate was visible during the high flow conditions in May 1994; however, in July and August, masses of iron precipitate and blue-green algae covered the rocky substrate and floated in pooled stream areas.

Wash Run

Wash Run is a small tributary that flows from the northwest into Indian Creek at the village of Davistown. This watershed is unaffected by mining in its upper drainage area; however, a discharge (Sample Point D50) of several gallons per minute flows into Wash Run at Davistown. The unaffected reach of Wash Run is represented by Sample Points 81, 81, and 83. Extensive logging was underway in the watershed in 1994. The pH values ranged from 6.3 to 6.9 and sulfate concentrations were consistently at or near the lower detection limit of 20

mg/l. The Sample Point D50 discharge had pH values ranging from 3.1 to 3.4, iron concentrations from 3.11 to 13.7 mg/l, manganese from 0.61 to 1.13 mg/l, and aluminum from 6.24 to 16.8 mg/l. Downstream of the discharge, Wash Run stream water showed an increase of dissolved solids concentrations, but no other marked change in water chemistry was caused by the discharge.

A discharge from a Middle Kittanning underground mine (Sample Point D51) flows toward Indian Creek at the village of Sagamore. The results of two samples showed pH values of 3.1 and 3.2, acidity of 638 and 886 mg/l, iron of 160 mg/l, manganese of 3.06 and 3.47 mg/l, and aluminum of 54.8 to 57.4 mg/l. Flow rate of this discharge was estimated at 1 to 5 gallons per minute. No direct flow channel to Indian Creek was observed.

Back Creek

Back Creek is the only eastern named tributary flowing into this section of Indian Creek. Trout Run and Neals Run, the headwater tributaries of Back Creek, originate on the higher elevations of Laurel Hill near the Seven Springs resort area. These two streams, which are unaffected by mining activities, are represented by Sample Point 86 and 87 on Neals Run and Sample Point 88 on Trout Run. Water analysis results showed pH values ranging from 6.4 to 6.9, alkalinity concentrations of 20 to 64 mg/l with no acidity, and total iron, manganese, and aluminum concentrations of less than 0.33 mg/l. Where suspended solids concentrations were less than 2 mg/l, iron concentrations ranged from 0.01 to 0.04 mg/l with manganese of less than 0.01 mg/l, and aluminum of less than 0.13 mg/l.

Two water sample results at the headwater (Sample Point 89) of an unnamed tributary to Back Creek, located at a lower elevation than Neals Run and Trout Run headwaters, showed pH values of 4.7 and 4.8, alkalinity concentrations of 8 mg/l, and acidity of 6 and 8 mg/l. Reported iron concentrations were 0.04 and 0.28 mg/l, manganese of 0.12 and 0.22 mg/l, and aluminum of 0.23 and 0.31 mg/l.

The Better Mining Co. surface mine permit area (SMP 3375SM30) on the Upper Freeport coal is located on Back Creek downstream from Back Creek Sample Point 91, which had reported pH values ranging from 6.5 to 6.9, alkalinity concentrations of 24 to 38 mg/l, iron of less than 0.15 mg/l, manganese of less than 0.02 mg/l, aluminum of less than 0.17 mg/l, and sulfate of less than 20 mg/l. The Better Mining permit has two primary discharges. One discharge (Sample Point D54) had pH value range of 5.1 to 6.0 over the 1992 to 1994 time period. Alkalinity was 8 to 22 mg/l with acidity ranging from 9 to 44 mg/l, iron of 1.85 to 14.20 mg/l, manganese of 0.92 to 4.08 mg/l, and aluminum of less than 0.50 to 0.73 mg/l. The other discharge (Sample Point D56) over the same time period had pH value of 5.9 to 6.3, alkalinity of 24 to 64 mg/l, iron of less than 0.30 to 12.1 mg/l, manganese of 0.20 to 7.47 mg/l, and aluminum of less than 0.50 mg/l. Other discharge areas, Sample Points D52, D53, D55, and D57, including premining discharges, toe-of-spoil discharges, and sedimentation ponds at this site, showed similar results with variable iron and manganese concentrations, and aluminum generally near the lower detection limit of 0.50 mg/l. Water analysis results at Sample Point 92, downstream of the Better Mining site, showed virtually no change compared to chemical results observed at Sample Point 91.

Indian Creek at Indian Head (Sample Point 59), had pH values ranging from 6.1 to 6.6, alkalinity concentrations from 20 to 24 mg/l, iron 0.53 to 1.37 mg/l, manganese 0.07 to 0.35 mg/l, and aluminum less than 0.13 to 0.27 mg/l. Algae and iron precipitate were present at this sample point in July and August of 1994. Approximately one mile downstream from Indian Head, Indian Creek receives discharge of acid mine drainage from the abandoned Middle Kittanning coal "Gallentine" underground mine opening, located just east of Pa Route 711/381 about 500 feet upstream of the confluence with Poplar Run. The Gallentine discharge (Sample Point D59) had a pH values ranging from 3.9 to 4.1, alkalinity 0 to 4 mg/l, acidity 130 to 144 mg/l, iron 53.5 to 59.2 mg/l, manganese 1.68 to 1.75 mg/l, and aluminum 3.07 to 4.10 mg/l. Flow from the Gallentine mine was measured at 27 gpm on September 9, 1994. Indian Creek (Sample Point 95), downstream of the Gallentine discharge, had pH values of 6.3 to 6.5, alkalinity concentrations of 22 to 24 mg/l, iron 0.74 to 0.87 mg/l, manganese 0.18 to 0.34 mg/l and aluminum 0.19 to 0.20 mg/l. Iron precipitate was visible on the stream substrate.

Poplar Run watershed

The Poplar Run watershed was included in the study area to supplement information on the geology and water quality of the Indian Creek watershed, and because the southwestern portion of the petition area was within the Poplar Run watershed. Poplar Run and its major tributary, Newmyer Run, originate on Chestnut Ridge about one mile west of the village of Clinton. The Poplar Run confluence with Indian Creek is located about one mile downstream of Indian Head. Surface mining within the Poplar Run watershed has been conducted on the Upper and Lower Freeport coals, the Upper and Middle Kittanning coals, and the Brookville-Clarion coal, which was mined in the Poplar Run and Newmyer Run headwater areas.

The headwaters section of Poplar Run is represented by Sample Point 96, located at Township Road T-719 on the upper fringe of surface mine disturbed areas. No documented mine discharges are located upstream of this point. 1994 water sample analysis show pH values ranging from 6.0 to 6.2, alkalinity 10 to 19 mg/l, acidity 2 to 4 mg/l, iron 0.19 to 0.23 mg/l, manganese 0.04 to 0.08 mg/l, aluminum less than 0.13 to 0.26 mg/l, and zinc less than 0.01 to 0.02 mg/l.

The southwestern slopes of the Poplar Run drainage due south of Sample Point 96 were surface mined for the Middle Kittanning and Brookville-Clarion coals. These mine sites were for the most part abandoned and had acidic discharges. Review of permit file information for two of these sites; Nicholson and Shepler (MDP 3375SM14) and C & A Coal Co. (MDP 3375SM12), Sample Points D60, D63, D73, D75, D77, and D78, indicates that in the early 1980's discharges and ponded water from this general area were frequently acidic with pH values ranging from 2.9 to 4.1, with acidity concentrations of 64 to 1000 mg/l, iron of 0.08 to 81.8 mg/l, and manganese of 12.60 to 20.42 mg/l. Descriptions of the discharge points found in the Department's permit file records indicate that at least a portion of these discharge waters flowed directly to Poplar Run from these disturbed sites. This area was in the contouring stages of reclamation by the Department's Bureau of Abandoned Mine Reclamation during the summer of 1994.

An unnamed tributary to Poplar Run originating at the southeast end of the contoured area enters Poplar Run one-half mile upstream of the village of Clinton. Sample Point 97, located one-fourth mile downstream of the reclaimed area, was considered representative of recent water quality leaving the reclaimed site. The pH value was 4.3 in September of 1994 and 6.2 in October of 1994, alkalinity was 7 mg/l, acidity ranged from 1 to 28 mg/l, iron 0.62 to 0.75 mg/l, manganese 6.80 to 10.63 mg/l and aluminum was less than 0.13 to 0.92 mg/l. Results of an April 1995 water sample indicated a pH value of 5.3, alkalinity of 10 mg/l, acidity of 17 mg/l, iron of 0.47 mg/l, and manganese of 3.40 mg/l. Iron precipitate was present in September of 1994; however, no staining was observed on the other sampling dates.

The Rondell Co. operated a surface mine (MDP 3373SM7) on the Middle Kittanning and Brookville-Clarion coals, which is located at the crest of Chestnut Ridge north of the Bureau of Abandoned Mine Land Reclamation site. Several discharges, which enter Poplar Run and the southern headwater branch of Newmyer Run, appeared at the Rondell mine. The discharge water to the Poplar Run and Newmyer Run drainages is attributed to the mining of the Brookville-Clarion coal. Drainage to Poplar Run is represented by Sample Points D64 and D65 which flow into a T828 roadside ditch and then into Poplar Run approximately 1500 feet downstream from headwater Sample Point 96. Water sample analysis results from 1988, 1993, and 1995 reported pH values ranging from 4.5 to 4.9, alkalinity concentrations of 7 to 10 mg/l, acidity of 16 to 116 mg/l, iron of less than 0.30 to 0.37 mg/l, manganese of 0.43 to 21.3 mg/l, aluminum of less than 0.50 to 9.11 mg/l, and sulfate of 54 to 423 mg/l.

A backfilled surface mine (MDP 3377SM27) on the Brookville-Clarion coal, which was operated by Charles Kravetsky, lies upstream of the Sample Point 97 tributary confluence and north of Poplar Run. This site was abandoned and acidic discharges were documented flowing to Poplar Run. A toe-of-spoil discharge and a diffuse seep area (Sample Points D70 and D71) had pH values ranging from 3.0 to 4.8, acidity concentrations of 8 to 197 mg/l, iron of 0.09 to 12.02 mg/l, and manganese of 1.01 to 10.90 mg/l. Chemical results (1983-1985) from Discharge Point 72, described as the treatment pond sump, showed pH values ranging from 2.9 to 3.3, acidity concentrations of 418 to 636 mg/l, iron of 62.58 to 245.67 mg/l, manganese of 8.61 to 24.84 mg/l, and aluminum of 1.12 to 4.31 mg/l.

Downstream of the described surface mining disturbed areas, 1994 water sample results from Poplar Run, at Township Road T-834 (Sample Point 98) had pH values ranging from 4.5 to 5.4, alkalinity 7 to 9 mg/l, acidity 7 to 132 mg/l, iron 0.20 to 0.37, manganese 1.28 to 3.55 mg/l, aluminum 0.37 to 1.50 mg/l, and zinc 0.07 to 0.22 mg/l. The 5.4 pH value was recorded during the October low flow conditions.

Approximately 0.75 mile downstream of Sample Point 98, an abandoned Middle Kittanning underground coal mine located north of State Route 1054 (Sample Point D79) discharges to Poplar Run. This discharge is monitored (MP11) in conjunction with a Purco Coal Co. (SMP 26703078) active surface mine on the Upper and Middle Kittanning coals. Results of samples taken from 1979 through 1994 showed variable pH values ranging from 4.0 to 6.8. At times alkalinity, which ranged from 1 to 56 mg/l exceeded acidity while, other results showed acidity, which ranged from 0 to 92 mg/l, exceeding alkalinity. Iron

concentrations ranged from 0.03 to 1.82 mg/l with manganese of 0.05 to 8.5 mg/l, and aluminum of less than 0.50 to 13.6 mg/l. Observations of trends in water chemistry indicate no significant overall increases in metals concentrations, with the higher concentrations occurring at periods of lower pH values.

Poplar Run at Sample Point 99, located three-fourth mile downstream of the village of Clinton, and downstream from the Sample Point D79 discharge, had pH values ranging from 5.8 to 5.9, alkalinity 12 mg/l, acidity 9 to 12 mg/l, iron 0.22 to 0.35 mg/l, manganese 0.19 to 0.60 mg/l, and aluminum less than 0.13 to 0.48 mg/l.

An unnamed tributary to Poplar Run originates west of Township Road T-834, about one mile south of Clinton and flows into Poplar Run immediately downstream from Sample Point 99. The headwater at (Sample Point 100) had pH values ranging from 6.2 to 6.3, alkalinity 12 to 18 mg/l and metals concentrations less than 0.16 mg/l. Surface mining was conducted to the north of the tributary by Emerald Energy Enterprises, Inc. (MDP 3377SM13) and Myers Coal Co. (MDP 3377SM6) on the Upper and Middle Kittanning Coals. An Operation Scarlift Report documented several toe-of-spoil surface mine seeps and discharges from two abandoned underground mine drift openings flowing to the tributary. Mine permit file water sample results of several discharges, presented as Sample Point D80, showed pH values ranging from 3.7 to 6.3, alkalinity concentrations of 0 to 18 mg/l, acidity of 7 to 105 mg/l, iron of less than 0.05 to 30.90 mg/l, manganese of 6.60 to 13.70 mg/l, and aluminum of 0.20 to 12.50 mg/l. Water samples taken in 1974 and 1979 from the unnamed tributary downstream of the abandoned surface mines indicate that the tributary had a pH value of 3.8, iron of 1.04 and 1.4 mg/l, manganese of 1.5, and aluminum of 2.8 and 3.0 mg/l (Bureau of Water Quality Management aquatic investigations). In 1988, the Department's Bureau of Abandoned Mine Reclamation reclaimed parts of the abandoned mines, and 1994 and 1995 water sample results from Sample Point 101 at the tributary mouth, downstream of the reclamation project, had pH values ranging from 6.5 to 6.6, alkalinity 38 to 40 mg/l, iron 0.28 to 0.55 mg/l, manganese 0.22 to 0.42 mg/l, and aluminum less than 0.13 to 0.25 mg/l.

Poplar Run at Sample Point 102, located upstream from Newmyer Run confluence, had pH values ranging from 6.3 to 6.5, alkalinity 19 to 25 mg/l, and metals concentrations less than 0.44 mg/l. Iron staining was visible at stream edges and under rocks.

Newmyer Run

Newmyer Run, the largest tributary to Poplar Run, originates on Chestnut Ridge one mile northwest of the village of Clinton. The headwater of Newmyer run is affected by acid mine drainage flowing from the Rondell Coal Co. (MDP 3373SM17) abandoned surface mine on the Brookville-Clarion coal. Water analysis results of samples taken from 1988 to 1995 (Sample Points D66 and D67) show pH values ranging from 2.7 to 3.2, acidity concentrations of 506 to 2100 mg/l, iron of 57.90 to 270.00 mg/l, manganese of 52.50 to 221.00 mg/l, and aluminum of 48.80 to 207.00 mg/l.

A headwater spring, which forms a tributary to Newmyer Run (Sample Point 103), emerges from an area unaffected by mining activities and had pH values ranging from 4.8 to 5.0, alkalinity concentrations of 8 to 10 mg/l, acidity 4 to 11

mg/l, iron 0.22 to 0.24 mg/l, manganese 0.25 to 0.30 mg/l, and aluminum 0.24 to 0.28 mg/l. Review of Departmental permit file water quality sample results of unaffected springs in this general area indicates that the Sample Point 103 spring is typical of the background water quality of Chestnut Ridge shallow aquifers.

Sample Point 104 is located on Newmyer Run approximately one mile downstream from the Rondell (MDP 3373SM17) surface mine discharge. Departmental surface mine permit file water sample results indicate that: in 1976 the pH value was 4.9 with alkalinity of 2 mg/l and acidity of 17 mg/l, iron of 0.40 mg/l, and sulfate of 40 mg/l; in 1982, the pH value was reported at 4.1, zero alkalinity concentration and acidity of 26 mg/l, iron of 0.15 mg/l, manganese of 6.9 mg/l, and sulfate of 74 mg/l; and in 1994 and 1995 the pH values ranged from 3.9 to 4.2, with alkalinity of 0 to 6 mg/l, acidity 60 to 120 mg/l, iron 0.65 to 0.91 mg/l, manganese 6.79 to 9.57 mg/l, aluminum 5.53 to 8.34 mg/l, and zinc 0.32 to 0.42 mg/l.

An unnamed tributary to Newmyer Run flowing from the north (Sample Point 105) had pH values ranging from 6.9 to 7.1, alkalinity concentrations of 74 to 102 mg/l, iron of 0.44 to 1.43 mg/l, manganese 0.18 to 0.30 mg/l, aluminum less than 0.13 to 1.13 mg/l, and zinc 0.01 mg/l. The Rondell Co. surface mine (MDP 3372BSM4) on the Middle Kittanning coal and the Emerald Energy Enterprises surface mine (MDP 3375SM69) on the Upper and Middle Kittanning coals were located near the headwaters of this tributary. A pre-mining (02/09/72) Department of Mines and Mineral Industries field engineer's report for the Rondell mine documented a pH value of 5.6, alkalinity of 6 mg/l, iron of 0.10 mg/l, and sulfate of 40 mg/l at Sample Point 105. The same report documented a previously disturbed area with a combined underground/surface mine discharge, which had a pH value of 3.2, acidity of 20 mg/l, and sulfate of 120 mg/l. Background monitoring sample results (1982) at Sample Point 105 for the Emerald Energy Enterprises site reported a pH value of 7.1, alkalinity of 29 mg/l, acidity of 2 mg/l, iron of less than 0.01 mg/l, and manganese of 1.00 mg/l.

An unnamed tributary flowing to Newmyer Run from the east was sampled at two locations, upstream and downstream of a forfeited Marsolino Coal & Coke, Inc. (MDP 3376SM14) surface mine on the Upper Kittanning coal. Upstream of the Marsolino mine (Sample Point 107), the tributary had pH values ranging from 6.6 to 6.8, alkalinity 34 to 80 mg/l, iron 0.05 to 0.29 mg/l, manganese 0.02 to 0.05 mg/l, aluminum less than 0.13 mg/l, and zinc less than 0.01 mg/l. A discharge enters this tributary at Sample Point D83 with pH values of 3.4 to 3.5, acidity concentrations of 168 to 272 mg/l, iron of 2.17 to 4.26 mg/l, and aluminum and manganese within the 20.00 to 32.00 mg/l range. Downstream of the Marsolino mine, this tributary (Sample Point 108), had pH values ranging from 3.5 to 3.9, zero alkalinity, acidity 96 to 206 mg/l, iron 2.41 to 3.87 mg/l, manganese 14.2 to 26.7 mg/l, aluminum 11.0 to 19.5 mg/l, and zinc 0.55 to 1.08 mg/l. Iron precipitate covered the substrate.

In addition to groundwater discharges to the tributary, acidic discharges flow directly into Newmyer Run. Historic and recent water samples were collected at two different points near the discharge origins. Water sample results from 1988 through 1994 at Sample Point D81, identified as the primary discharge, had a pH range of 3.0 to 3.7, acidity concentrations ranging from 220 to 862 mg/l, iron of 2.00 to 55.3 mg/l, manganese of 22.10 to 66.7 mg/l, and aluminum of 22.30 to

98.60 mg/l. Over the same time period, sample results at the treatment pond sump had similar acidic chemistry and metals concentrations. The flows from these discharges enter Newmyer Run about 100 feet upstream from the mouth of the eastern unnamed tributary, where a pipe drains a series of interconnected former treatment ponds. Flow from the last pond (Sample Point D82) was measured at 135 gpm on September 9, 1994 and had a pH value of 3.4, alkalinity 0 mg/l, acidity 334 mg/l, iron 5.86 mg/l, manganese 28.3 mg/l, aluminum 37.7 mg/l, and zinc 1.72.

Surface mining was also conducted within the watershed of this tributary by William K. Tedesco (MDP 3370BSM8) on the Lower Freeport coal, by Fryske & Nole Coal Co. (MDP 2968BSM32) on the Middle Kittanning coal, and by Indy-Penn Coal Co., Inc. (MDP 3377SM17) on the Upper Freeport coal. All three permit areas were abandoned. The Department's permit file information (not included in the water quality table) showed that a discharge sample from the Tedesco permit area in June, 1986 had pH value of 5.0, alkalinity of 10 mg/l, iron less than 0.3 mg/l, manganese 1.56 mg/l, and aluminum 0.73 mg/l. Water quality data from the Fryske & Nole permit collected in 1974 indicated that discharges had pH values ranging from 3.3 to 4.3, acidity 25 to 250 mg/l, and iron ranging from less than 0.1 to 6.5 mg/l. A January 1980 sample from the Indy-Penn (Upper Freeport coal) backfilled area had a pH value of 6.8, an alkalinity concentration of 62 mg/l, iron less than 0.05 mg/l, manganese 0.5 mg/l, and aluminum 0.6 mg/l. Newmyer Run near the confluence with Poplar Run (Sample Point 109) had pH values ranging from 4.7 to 4.8, alkalinity 9 to 10 mg/l, acidity 36 to 82 mg/l, iron 0.21 to 1.93 mg/l, manganese 8.2 to 12.3 mg/l, aluminum 6.29 to 9.99 mg/l, and zinc 0.38 to 0.63 mg/l. Aluminum precipitate covered the substrate and some iron precipitate was present at the stream edges.

Sample Point 110 on Poplar Run downstream of the Newmyer Run confluence represents the cumulative effects of surface and underground coal mining on the upper watersheds of these two streams. Poplar Run at this point had pH values ranging from 4.9 to 5.2, alkalinity of 9 to 12 mg/l and acidity 22 to 42 mg/l. Iron concentrations ranged from 0.82 to 1.39 mg/l, manganese 5.15 to 7.20 mg/l, aluminum 3.82 to 5.88 mg/l and zinc 0.25 to 0.37 mg/l. Aluminum precipitate covered the substrate. An underground mine discharge (Sample Point D84) enters Poplar Run just downstream of Sample Point 110. This discharge had pH values ranging from 3.7 to 4.1, acidity 92 to 130 mg/l, iron 37.0 to 61.0 mg/l, manganese 5.05 to 5.88 mg/l, and aluminum less than 0.13 mg/l. At Sample Point 113, approximately three-fourth mile downstream of the underground mine discharge, Poplar Run had pH values ranging from 4.7 to 5.9, alkalinity 8 to 13 mg/l and iron 1.40 to 2.17 mg/l, manganese 4.69 to 4.75 mg/l, and aluminum 1.63 to 4.08 mg/l.

A Bologna Mining Co. reclaimed surface mine (MDP 3374SM72) on the Upper and Lower Freeport coals drains to an unnamed tributary which flows to Poplar Run from the west. Monitoring data (1985-1993) from the permit file for this site at the headwater of the tributary (Sample Point 114) reported a pH value range of 5.6 to 7.6, alkalinity concentrations of 2 to 16 mg/l, acidity of 0 to 9 mg/l, iron of 0.05 to 1.45 mg/l, manganese of 0.06 to 1.85 mg/l, and sulfate of less than 10 to 38 mg/l. Several postmining discharges developed at this mine, which were monitored at three treatment facilities (Bologna Mining TP1, TP2, and TP3). These points are identified as Sample Points D85, D86, and D87. Chemical results at Sample Points D85 and D87, downslope of areas where the Lower

Freeport coal was extracted, had pH values ranging from 4.3 to 5.4, alkalinity concentrations of 5 to 22 mg/l, acidity of 7 to 40 mg/l, iron of less than 0.30 to 3.00 mg/l, and manganese of 1.34 to 6.62 mg/l. Sample Point D86 in 1993, downslope of an Upper Freeport coal removal area, had a pH value of 6.2, alkalinity ranging from 28 to 34 mg/l, iron of 2.20 to 3.70 mg/l, and manganese of 2.40 to 2.82 mg/l. As of October 1993, Sample Point D86 was removed from the monitoring program for this site. Downstream of the treatment ponds, the unnamed tributary flowing through the mine site (Sample Point 115), had pH values ranging from 5.5 to 5.9, alkalinity 8 to 11 mg/l, acidity 6 to 11 mg/l, and metals concentrations less than 0.16 mg/l.

Due east of the Bologna surface mine, an area was mined by Adam Eidemiller, Inc. (SMP 3376SM11) on the Upper and Lower Freeport coals. Postmining discharges are found at both the western and eastern ends of this permit area. At all discharge areas, amelioration of the discharges has been attempted by installation of limestone channels, aeration structures, and detention ponds.

Two discharges are at the western end, Sample Points D88 and D89. Sample Point D88 had pH values ranging from 2.8 to 3.2, acidity of 96 to 322 mg/l, iron of 0.34 to 12.8 mg/l, and manganese of 4.36 to 11.20 mg/l. Sample Point D89 had a pH value range of 5.2 to 5.8, alkalinity of 8 to 11 mg/l, acidity of 0 to 9 mg/l, iron of less than 0.30 to 0.28 mg/l, and manganese of less than 0.05 to 0.97 mg/l. At the east-central part of the area, a discharge (Sample Point D90) was documented in a 1981 hydrologic report by Roger Hornberger and D.R. Thompson, Bureau of Mining and Reclamation, DER. From 1980 to 1981, pH values were reported at 4.9 to 5.1, alkalinity ranging from 10 to 19 mg/l, acidity of 24 to 76, mg/l, iron of 0.50 to 1.08 mg/l, manganese of 11.60 to 12.1 mg/l, and sulfate of 852 to 988 mg/l. More recent sample analysis results from 1992 to 1995 had pH values ranging from 6.0 to 6.6, alkalinity concentrations of 15 to 44 mg/l, acidity of 0 to 10 mg/l, iron of less than 0.30 to 0.63 mg/l, manganese of 0.32 to 2.31 mg/l, and sulfate of 270 to 638 mg/l.

A toe-of-spoil discharge (Sample Point D91) flows into a pond along the southern edge of the permit area. Results of samples taken in 1992 and 1993 showed a pH value range of 4.3 to 4.8, with acidity concentrations (12 to 38 mg/l) exceeding alkalinity. 1994 sample results showed a pH value range of 4.7 to 6.7 with alkalinity consistently exceeding acidity. Metals concentrations were variable over the 1992 to 1994 time period with iron ranging from less than 0.30 mg/l to 2.29 mg/l, manganese of 0.30 to 7.88 mg/l, and aluminum of less than 0.13 to 4.57 mg/l.

Two discharges, Sample Points D92 and D93, are located at the eastern edge of this site and drain to an unnamed tributary which enters Poplar Run approximately 1200 feet upstream of the Poplar Run/Indian Creek confluence. Sample Point D92 results in 1994 and 1995 showed pH values ranging from 4.5 to 6.5, alkalinity of 7 to 42 mg/l, acidity of 0 to 54 mg/l, iron of 0.10 to 0.39 mg/l, and manganese of 3.40 to 6.17 mg/l. Over the same time period, water sample analysis at Sample Point D93 showed pH values ranging from 5.1 to 6.5, alkalinity of 11 to 42 mg/l, acidity of 0 to 18 mg/l, iron of 0.02 to 0.04, and manganese of 1.29 to 1.63 mg/l.

The "Eidemiller Tributary" (Sample Point 118), which flows along the eastern edge of the Eidemiller surface mine, had a pH values ranging from 6.1 to 6.5, alkalinity 24 to 32 mg/l and metals concentrations less than 0.21 mg/l. The Clarksburg Coal Co. surface mine (MDP 3378BC20) on the Upper Freeport coal was located upslope of the Eidemiller permit.

Poplar Run near the confluence with Indian Creek (Sample Point 119) had pH values ranging from 5.7 to 6.2, iron concentrations were less than 0.35 mg/l, and manganese ranged from 1.13 to 2.80 mg/l. Aluminum varied from less than 0.13 to 1.20 mg/l and aluminum precipitate covered the stream substrate.

Indian Creek downstream of Poplar Run

An abandoned surface mine area on the Lower Freeport coal is located approximately one mile south of the Adam Eidemiller site. Information from the Laurel Ridge Coal Co., Inc. (MDP 3378BC16), "Speyer" surface mine permit file for this area indicates that an acidic discharge to Indian Creek developed at the northern end of the site. Water quality chemical results for this discharge (Sample Point D94) indicate that from 1981 to 1983 the pH values ranged from 3.0 to 5.0, alkalinity concentrations were 0 to 15 mg/l, acidity 48 to 230 mg/l, iron 0.14 to 16.35 mg/l, manganese 12.54 to 30.78 mg/l, aluminum 5.20 to 18.19 mg/l, and sulfate 445 to 1920 mg/l. An increase of alkalinity and a decrease in iron and aluminum concentrations was observed from 1986 to 1989 when pH values were reported as ranging from 5.8 to 6.2, alkalinity of 38 to 80 mg/l, acidity of 0 to 52 mg/l, iron of less than 0.30 mg/l, aluminum of less than 0.66 mg/l, manganese of 7.48 mg/l, and sulfate of 804 to 1468 mg/l.

An unnamed tributary to Indian Creek flows from the west through the abandoned surface mine area. February and April 1995 water sample results for the two headwater branches at Sample Points 120 and 121, located upslope of the mine, showed pH values ranging from 6.3 to 6.6, alkalinity concentrations of 14 to 24 mg/l, acidity of 0 to 8 mg/l, iron of 0.16 to 0.95 mg/l, manganese of 0.01 to 0.04 mg/l, and sulfate of 13 to 20 mg/l. Downslope of the site at Sample Point 122 pH values were 6.5, alkalinity concentrations were 22 to 26 mg/l with no acidity, iron 0.60 to 0.85 mg/l, manganese 0.17 to 0.19 mg/l, and sulfate 40 to 42 mg/l.

On the east side of Indian Creek, across from the Laurel Ridge Coal Co. (MDP 3378BC16) site, surface mining was conducted by Ann Minerals (MDP 3375SM53) "Showman" on the Upper Freeport coal and by Laurel Ridge Coal Co., Inc. (MDP 3375SM38) "Warrick" on the Upper and Lower Freeport coals. Reported water quality results from 1984 to 1986 for a discharge (Sample Point D95) draining toward Indian Creek from the Ann Minerals site showed a pH range of 3.6 to 4.1, alkalinity of 0 to 6 mg/l, acidity of 62 to 276 mg/l, iron of 0.40 to 6.5 mg/l, and manganese of 6.80 to 23.2 mg/l. A second discharge (Sample Point D96) at this site, draining toward an unnamed tributary to Indian Creek, had reported pH values of 3.7 to 4.1, alkalinity of 0 to 4 mg/l, acidity of 94 to 720 mg/l, iron of 0.10 to 0.60 mg/l, manganese of 2.70 to 51.6 mg/l, and aluminum of 4.80 to 106 mg/l. The receiving tributary (Sample Point 123) at that time had pH values ranging from 5.7 to 6.6, alkalinity of 10 to 40 mg/l, acidity of 0 to 16 mg/l, iron of 0.18 to 0.30 mg/l, and manganese of 1.70 to 4.25 mg/l. Acidic discharges were also documented at the Laurel Ridge Coal Co. surface mine.

Mine inspectors reports described the discharges as low volume and water analysis results from 1989 and 1990 for four of these discharges indicate a pH value range of 3.6 to 4.5, alkalinity of 0 to 4 mg/l, acidity of 32 to 498 mg/l, iron of less than 0.30 to 12.50 mg/l, and manganese of 5.89 mg/l to 31.10 mg/l. These discharges drain toward the east branch of the Sample Point 123 unnamed tributary, and water quality chemical results at Sample Point 124 showed a pH value range of 5.9 to 6.3, alkalinity of 9 to 16 mg/l, and acidity of 0 to 14 mg/l. Iron concentrations were less than 0.30 mg/l, manganese ranged from 1.02 to 1.11 mg/l, and aluminum from less than 0.13 to 0.66 mg/l.

Indian Creek near Rogers Mill (Sample Point 125) was the most downstream location sampled within the Indian Creek drainage basin and marks the lower limit of the study area. Water quality and physical conditions were similar to those at Indian Head, Sample Point 59. The pH values ranged from 6.1 to 6.5, alkalinity 18 to 32 mg/l, iron 0.36 to 0.94 mg/l, manganese 0.28 to 0.40 mg/l and aluminum less than 0.13 to 0.29 mg/l.

Summary of Surface Water Quality

Indian Creek originates on the western slope of Laurel Hill in the vicinity of the Pennsylvania Turnpike. Results of chemical analyses of surface water samples indicate significant variations in water quality within the study area. The water quality of the unmined portion of the Indian Creek watershed upstream of the village of Melcroft varies from lightly buffered, naturally low pH tributaries originating from Pottsville and Lower Allegheny Group strata on Laurel Hill to the near-neutral pH, alkaline tributaries of the northwestern side of the watershed. The tributary streams draining the Mississippian and Conemaugh strata generally have pH values in the 6.50 to 6.8 range with alkalinity concentrations in the 20 to 80 mg/l range. Tributaries flowing from Pottsville Group strata have pH values in the 4.5 to 5.0 range with acidity concentrations exceeding alkalinity.

Two abandonded underground mines near the village of Kregar on the Middle Kittanning coal and one surface mine area on the Upper Kittanning coal contribute mine drainage to Indian Creek with pH values in the 3.1 to 3.6 range; however, the volume of the moderately alkaline Indian Creek stream water neutralizes and dilutes these relatively low volume discharge flows. Indian Creek also receives alkaline mine drainage with elevated iron concentrations from a reclaimed surface mine on the Middle Kittanning coal located upstream of the Champion Creek confluence at Melcroft. Several other discharges, presumably from the abandoned Melcroft underground mine, also enter Indian Creek in this area. Despite the entry of acidic mine drainage and alkaline-iron discharges, Indian Creek stream water in 1994 remained moderately alkaline with low metals concentrations from the headwater to the village of Melcroft.

Indian Creek tributaries, which originate or receive drainage from areas adjacent to the Pennsylvania Turnpike were found in 1994 to contain elevated concentrations of sodium, calcium, and chloride resulting from road salt applications.

The headwater tributaries of Champion Creek originate in Conemaugh Group geologic strata, and land use in this sub-basin is predominately agricultural. Champion Creek and its tributaries in this area had pH values in the 6.2 to 7.0 range and alkalinity concentrations consistently in the 30 to 80 mg/l range.

Two reclaimed surface mines on the Mahoning and Upper Freeport coals are located in the upper Champion Creek watershed. Water from one of these mines was alkaline with pH values in the 6.0 to 6.8 range and alkalinity concentrations of greater than 100 mg/l. Iron concentrations were in the 1.00 to 5.80 mg/l range and manganese concentrations were in the 1.00 to 6.50 mg/l range. Water encountered during mining at the second mine was consistently within regulatory effluent standards. There are no documented postmining discharges from these sites.

Champion Creek receives a low volume acidic discharge from a small abandoned underground mine on the Upper Freeport coal which had a pH value of 2.8 with acidity exceeding 500 mg/l. Iron concentrations were in the 100.00 to 275.00 mg/l range, manganese in the 2.00 to 4.00 mg/l range, and aluminum in the 30.00 to 80.00 range.

One reclaimed surface mine on the Upper Kittanning coal is located upstream from the Little Champion Creek confluence with Champion Creek. A country bank mine discharge in this area became highly acidic after the surface mine was reclaimed, however, the opening was sealed and the discharge, of several gallons per minute ceased flowing.

Because of alkaline conditions at the reclaimed surface mines on the Mahoning and Upper Freeport coal, and the relatively low volumes of acidic water entering the stream, water quality throughout this section of Champion Creek was similar to the moderately alkaline conditions described for the headwater stream flows. Iron concentrations were consistently within the 0.10 to 0.80 mg/l range, manganese in the 0.02 to 0.30 mg/l range, and aluminum of less than 0.60 mg/l.

Little Champion Creek and its tributaries originate in and flow through Allegheny Group strata. Surface mining has been conducted on the Upper Freeport, Upper Kittanning, and Middle Kittanning coals. Both acidic and alkaline mine drainage with elevated metals concentrations have been documented from this mining. The lower portion of Little Champion Creek also receives what is believed to be a Middle Kittanning coal underground mine discharge, which occurs as an upwelling in the stream, with resultant iron precipitate on the stream substrate.

The cumulative effects of the discharges are represented by water sample analysis results in the lower portion of the watershed where pH values were usually within the 6.0 to 7.0 range. With the exception of elevated stream water iron concentrations near the mouth of Little Champion Creek, iron concentrations were predominately less than 0.60 mg/l, manganese less than 0.20 mg/l, and aluminum less than 0.60 mg/l range.

Below the confluence with Little Champion Creek, Champion Creek receives drainage from two reclaimed surface mines, one on the Upper and Lower Freeport coals, and the other on the Upper Freeport coal. Discharges which appeared on these surface mines had pH values within the 6.4 to 7.0 range, with alkalinity

concentrations usually within the 150 to 300 mg/l range. A decrease in iron and manganese concentrations occurred from 1991 to 1994, with iron decreasing from a 10 to 40 mg/l range to several mg/l, and manganese from a 7.00 to 10.00 mg/l range to a 2.00 to 5.00 mg/l range.

This stream section also receives acidic drainage from abandoned underground workings on the Middle Kittanning coal. The middle section is affected by acid discharges to Puzzle Run and intermittent overflows from pooled water at the Melcroft #3 underground mine opening. The pH values of these discharge waters were within the 3.0 to 4.0 range, but dilution by higher-volume, relatively-alkaline Champion Creek stream water results in little upstream to downstream differences in pH values or alkalinity concentrations in Champion Creek between the Little Champion Creek confluence and the the village of Melcroft. The pH values were in the 6.4 to 7.2 range, with alkalinity concentrations in the 40 to 90 mg/l range. Iron concentrations were in the 0.15 to 0.65 mg/l range, manganese in the 0.05 to 0.65 mg/l range with aluminum at or near the lower detection limit of 0.13 mg/l. Two other point-source discharges enter Champion Creek at the village of Melcroft, which cause a decrease in pH values of Champion Creek stream water to a 6.0 to 6.7 range and alkalinity concentrations to a 30 to 45 mg/l range. Increases in iron, manganese, and aluminum concentrations were also observed with iron precipitates staining the stream substrate.

Below the village of Melcroft, Indian Creek receives acid mine drainage from extensive underground mine workings on the Middle Kittanning coal. Water sample analysis results indicate that the discharges have pH values of 2.9 to 4.1 with an approximate average acidity concentration of 264 mg/l, iron of 66 mg/l, manganese of 3 mg/l, aluminum 12 mg/l, and sulfate of 500 mg/l. Observed and measured flow rates indicate a discharge range of approximately 500 to 1100 gallons per minute from these discharges. The highest flow discharge from this complex is the "Kalp" discharge at the village of Romney.

Two reclaimed Upper Freeport coal surface mines, one at the village of Melcroft and the other located adjacent to Back Creek, which flows from Laurel Hill into Indian Creek at the village of Indian Head, have relatively low volume discharges, which in 1994 were alkaline to slightly acidic with iron concentrations consistently within the 1.00 to 10.00 mg/l range, and a manganese range of 1.00 to 3.00 mg/l.

Indian Creek, upstream from the underground mine discharges, had pH values within the 6.4 to 6.6 range with an average alkalinity of 32 mg/l, iron of 0.52 mg/l, manganese of 0.14 mg/l, and sulfate of 37 mg/l. After the entry of the "Kalp" discharge, Indian Creek had pH values ranging from 6.1 to 6.3, with an average alkalinity of 20 mg/l, acidity of 3 mg/l, iron of 2.32 mg/l, manganese of 0.24 mg/l, and sulfate of 70 mg/l. Further downstream, after the entry of several alkaline tributaries, Indian Creek stream water pH values increased to a 6.3 to 6.5 range and average iron concentrations decreased to 0.18 mg/l.

Chronic metals loading causes continued chemical reactions which precipitate oxidized metal compounds upon Indian Creek stream substrate. The most noticable precipitates are iron oxides. During the summer low flow periods, globular masses, identified by Herricks and Cairns (1974) as iron precipitate combined with algal growths, cover the substrate downstream of the "Kalp" discharge.

Surface mining on the Brookville-Clarion and Middle Kittanning coals at the headwaters of Poplar Run and Newmyer Run has resulted in the formation of acid discharges. Historically many of these discharges had pH values within a range of 2.8 to 5.0, with acidity concentrations from 100 to over 2100 mg/l. Iron concentrations were commonly reported in the 90 to 250 mg/l range with elevated manganese and aluminum concentrations. In 1995, discharges to Newmyer Run continued to exhibit these chemical characteristics. Permit file information indicates that both Poplar Run and Newmyer Run were adversely affected by mine drainage well before 1970. The majority of these mines have been backfilled or reclaimed. In 1994 and 1995, water analysis results for Poplar Run downstream of the former mine sites reported pH values within the 4.5 to 5.5 range, alkalinity concentrations in the 7 to 9 mg/l range, and acidity of 1 to 132 mg/l. Iron concentrations averaged 0.28 mg/l, manganese of 1.95 mg/l, and aluminum of 0.80 mg/l.

The middle reach of Poplar Run receives an abandoned underground mine discharge with reported 1988 to 1995 pH values within the 4.0 to 6.4 range. Iron concentrations were consistently less than 1.00 mg/l, manganese less than 1.60 mg/l, and aluminum within the 1.00 to 15.00 mg/l range. Downstream of this discharge, a formerly acidic tributary flows from a reclaimed surface mine area on the Upper and Middle Kittanning coals. Water analysis results from 1994 showed pH values within the 6.4 to 6.6 range with low metals concentrations. Upstream of the Newmyer Run confluence, Poplar Run had pH values within the 6.5 to 6.7 range with average alkalinity concentrations of 19 mg/l, iron of 0.31 mg/l, manganese of 0.34 mg/l, and aluminum of 0.11 mg/l.

The Newmyer Run headwater is affected by acid mine drainage from a Brookville-Clarion coal surface mine with pH values within the 2.7 to 3.2 range, with average acidity of 1280 mg/l, iron of 150 mg/l, manganese of 125 mg/l, aluminum of 117 mg/l, and sulfate of 2200 mg/l. The effects on Newmyer Run were evident in 1994 sample results taken downstream of the mine drainage, where pH values ranged from 3.9 to 4.9 with average alkalinity concentrations of 6 mg/l and acidity of 56 mg/l. Metals concentrations averaged 0.52 mg/l of iron, 5.99 mg/l of manganese, 5.18 mg/l of aluminum, and 133 mg/l of sulfate.

Postmining discharges, resulting from surface mining on the Upper and Middle Kittanning coals, enter Newmyer Run approximately 2000 ft upstream of the Poplar Run confluence. In 1994, the pH values at the final discharge point ranged from 3.4 to 3.5 with average acidity concentrations of 294 mg/l, iron of 4.21 mg/l, manganese of 15.5 mg/l, aluminum of 20.33 mg/l, and sulfate of 1312 mg/l. An unnamed tributary which enters downstream of the primary discharge is similarly affected.

The cumulative mining effects on Newmyer Run are reflected in chemical results of samples taken near the mouth of the stream where pH values ranged from 4.7 to 6.7 with average alkalinity concentration of 11 mg/l, acidity of 52 mg/l, iron of 1.08 mg/l, manganese of 8.83 mg/l, aluminum of 7.09 mg/l, and sulfate of 533 mg/l.

The entry of Newmyer Run results in pH depression in Poplar Run to the 4.9 to 6.3 range and precipitation of iron and aluminum. A Middle Kittanning underground coal mine discharge in this area also contributes acidity and

elevated metals concentrations to Poplar Run. The effects on Poplar Run were apparent approximately 2000 feet downstream of the Newmyer Run confluence where pH values ranged from 4.7 to 6.0, with average alkalinity concentrations of 10 mg/l, acidity of 16 mg/l, iron of 1.26 mg/l, manganese of 3.86 mg/l, aluminum of 2.06 mg/l, and sulfate of 300 mg/l. The lower Poplar Run watershed was surface mined on the Upper and Lower Freeport coals. Discharge water quality from these mines was variable, with several discharges in the pH 2.8 to 3.1 range. The majority of the discharges had pH values within the 4.2 to 6.7 range, with alkalinity concentrations in the 0 to 76 mg/l range and acidities of 0 to 76 mg/l. Metals concentrations were also variable, with iron concentrations ranging from less than 0.30 mg/l to 3.70 mg/l, aluminum less than 0.13 mg/l to 7.74 mg/l, and sulfate less than 20 to 988 mg/l. Manganese concentrations were less than 0.01 mg/l. In many of the discharge areas, limestone lined channels and detention ponds were installed as "passive treatment" and some discharges have increased in alkalinity over time. Poplar Run downstream of all mining related disturbances had pH values ranging from 5.7 to 6.2, with average alkalinity concentrations of 13 mg/l, acidity of 9 mg/l, iron of 0.23 mg/l, manganese of 2.09 mg/l, aluminum of 0.39 mg/l, and sulfate of 313 mg/l.

At Rogers Mill, located approximately 1.5 miles downstream of the Poplar Run confluence, Indian Creek had a pH range of 6.1 to 6.5 with alkalinity concentrations ranging from 18 to 22 mg/l. Average iron concentration was 0.57 mg/l, manganese 0.34 mg/l, aluminum 0.34 mg/l, and sulfate 84 mg/l.

The cumulative effects of mine discharges identified in the Department's study result in the the degradation of the lower portion of Champion Creek, Poplar Run, and the approximately 4.5 miles of Indian Creek extending from the village of Melcroft downstream to the village of Rogers Mill. The abandoned underground mines on the Middle Kittanning coal have also degraded a significant portion of the regional groundwater systems within the study area, which provides base flow to Indian Creek.

Aquatic Life

Benthic Macroinvertebrates

Benthic macroinvertebrates include insects and other invertebrate organisms that live attached to or associated with the stream substrate. Because of their relatively long life cycles and limited mobility, benthic macroinvertebrates reflect long-term cumulative effects of pollutants on an aquatic environment. Generally, a high diversity of macroinvertebrates, including a variety of the taxonomic orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) (EPT), is indicative of unpolluted water. Polluted waters are usually dominated by a low diversity of pollution tolerant taxa such as flies and midges (dipterans).

Acid mine drainage degrades both the physical habitat and water quality, severely limiting the diversity and abundance of macroinvertebrates, especially the EPT taxa. The severity of the effect is dependent upon the pH, concentrations concentrations have the most harmful effect of the mine drainage metals on aquatic macroinvertebrates; however, at near-neutral stream pH, the effect is usually minimal. Generally, a pH value of less than 4.5 and elevated concentrations of metals eliminate all but the most acid tolerant species, such

as dipterans and alderflies. Iron and aluminum precipitates coat the stream bottom, filling in small crevices used as hiding places and causing the insects to have difficulty holding their position in the current. Aluminum precipitate is more toxic to macroinvertebrates than iron precipitate. Some mayflies and caddisflies may be abundant in streams with alkaline or neutralized mine drainage and iron precipitate. Other sources of pollution and the type of land use also affect the macroinvertebrate community. Streams with organic enrichment or high alkalinity usually have an abundance of mayflies and filter-feeding caddisflies. Lightly buffered, forested streams usually have an abundance of stoneflies and caddisflies and few mayflies. Additional information on the effects of mine drainage on stream aquatic life is presented in Gale et al. (1976), Herricks and Cairns (1974), Kimmel (1983), Letterman and Mitsch (1978) and Morris et al. (1989).

Previous aquatic investigations in the Indian Creek watershed were conducted by Bureau of Water Quality Management (BWQM) biologists in 1974, 1979, and 1982. An aquatic investigation of the Indian Creek watershed was conducted by Bureau of Mining and Reclamation (BMR) biologists in 1986. Site-specific aquatic investigations were conducted by BMR biologists in 1980, 1982, and 1983 and by the Pennsylvania Fish and Boat Commission (PFBC) biologists in 1979, 1982, and 1990. BWQM has a water quality network station on Indian Creek at Jones Mills, which is sampled annually for water chemistry and macroinvertebrates.

Methods

Benthic macroinvertebrates were collected in Indian Creek and selected tributaries on May 11, June 28, July 26 to 29, and August 16, 1994. Qualitative samples were collected with a kick screen placed in riffles composed of rubble and gravel substrate. Individual rocks were also examined for presence of invertebrates not dislodged into the kick screen. Representative organisms were collected from each screen until no new recognizable taxa were observed. Samples were preserved in vials containing 70% ethanol. Relative abundances were noted in the field. Macroinvertebrates were identified in the laboratory under a compound dissection microscope. Station locations, which correspond to water sample point numbers at these locations are shown on Figure 12 and results are presented in Appendix Tables 5, 6, and 7.

Upper Indian Creek Watershed

The upper Indian Creek watershed includes the headwaters downstream to Pa Route 31 at Jones Mills. The eastern side of the upper Indian Creek watershed is mainly forested, with very little development. The western side is comprised of farms, a scattering of houses, and wood lots.

Two forested locations in upper Indian Creek were sampled for macroinvertebrates in 1994; upstream of Little Run (Station 1) and at Skyview Road (Station 3). Both locations had a similar number of macroinvertebrate taxa with 16 taxa found in July at Station 1, and 17 taxa found in July and 15 in August at Station 3. An abundance of stoneflies and caddisflies and a few mayflies were present, which is typical of cool, headwater stream reaches.

Three pollution sources in upper Indian Creek have a potential to adversely affect the macroinvertebrate population: runoff of road salt from the Pennsylvania Turnpike, which causes elevated concentrations of sodium, chloride and calcium, and acid discharges from an underground mine and a surface mine. Based on the water chemistry and presence of macroinvertebrates, the mine discharges appear to have had no adverse effect on upper Indian Creek. The effects of elevated salt concentrations on macroinvertebrates are more difficult to evaluate. Pollution tolerant taxa were collected from both headwater Stations 1 and 3 on upper Indian Creek. A comparison of the macroinvertebrates from upper Indian Creek with those of similarly forested tributaries showed that Stations 1 and 3 had fewer macroinvertebrate taxa than Pike Run (Station 18) and Roaring Run (Station 19), and the same number of taxa as Little Run (Station 2). Little Run, Roaring Run, and Pike Run did not exhibit elevated sodium and chloride concentrations.

The eastern tributaries of upper Indian Creek, Little Run, and Camp Run, are similar in water quality, habitat, and land use. These tributaries, which originate near the crest of Laurel Ridge, are mainly forested watersheds, with little or no development, and have low to moderate alkalinity and cool water. Little Run (Station 2) had 16 taxa of macroinvertebrates and Camp Run (Station 9) had 22 taxa of macroinvertebrates, including many pollution sensitive genera of stoneflies, mayflies, and caddisflies.

Indian Creek at Horners Mill (Station 5) had 5 macroinvertebrate taxa present on May 11, 1994. Since water quality at this Station was similar to upstream Stations 1 and 3, the low diversity at this station was most likely due to poor riffle habitat. The substrate presented few protruding rubble-sized rocks for attachment of macroinvertebrates. The 1986 sampling at Horners Mill yielded 11 macroinvertebrate taxa.

Indian Creek at Jones Mills (Station 12) contained 20 taxa of macroinvertebrates on May 11, 1994, 23 taxa on June 28, 1994, and 19 taxa on August 16, 1994. The May and June totals contained the highest number of taxa and the August sample the second highest number of taxa of the stations sampled on upper Indian Creek. The macroinvertebrate fauna consisted of an abundance of EPT taxa, including 7 mayfly taxa in May, 5 in June, and 2 in August, and several species of *Hydropsyche* and *Chimarra* caddisflies, which are typical of warm water streams. *Pteronarcys* and Peltoperlidae stoneflies and *Diplectrona* and *Dolophilodes* caddisflies, which are more typical of smaller, cooler water streams were also present. This area of Indian Creek receives some organic enrichment and increased alkalinity from the western unnamed tributaries, conditions which provide more favorable habitat for mayfly nymphs. This location could be considered a transition area between the forested cool water stream conditions of the headwaters and the warmer, more open downstream reaches. Similar numbers of macroinvertebrate taxa were present during the 1986 investigation.

Middle Indian Creek Watershed

Middle Indian Creek, which includes Indian Creek from the Pa Route 31 bridge downstream to the mouth of Champion Creek, is bordered mostly by fields, although scattered wood lots provide some vegetative cover and shade. Many

houses, businesses, and campgrounds are located along Pa Route 711/381 which parallels Indian Creek. Habitat consists mainly of slow moving, pooled conditions and little riffle habitat.

Pike Run (Station 18) had 22 taxa of macroinvertebrates. Roaring Run (Station 19) had 28 taxa of macroinvertebrates, the highest total number of taxa of all the tributaries sampled. Most of Roaring Run watershed is forested; however, the Roaring Run Camp Resort, which is located upstream of Station 63, may add some organic enrichment that contributes to the diversity of mayfly genera. Both Roaring Run and Pike Run had a high diversity of mayflies, stoneflies and caddisflies.

Macroinvertebrate sampling on June 29, 1994, in Indian Creek at the village of Nebo (Station 22) yielded a total of 12 taxa. The Nebo station could not be sampled in August 1994 because of construction of a new bridge over Indian Creek, therefore, Indian Creek was sampled upstream of Nebo at Durstine Road (Station 21) on August 16, 1994. A total of 26 taxa were collected at Durstine Road, the highest number of species collected at any station on middle Indian Creek. The macroinvertebrate sample contained 17 EPT taxa, including 5 genera of mayflies, and an abundance and variety of caddisflies. The Durstine Road station had excellent riffle habitat.

Lower Indian Creek Watershed

Lower Indian Creek includes the portion of the study area from Champion Creek downstream to Rogers Mill. This portion contains the majority of the underground coal mines within the study area, most of which discharge directly into main stem Indian Creek downstream of the village of Melcroft. Champion Creek adds neutralized mine drainage with elevated iron concentrations. The villages and campgrounds located along Pa Route 711/381 contribute organic enrichment in the form of sewage discharges. This section was more open, warmer, and slower moving than the middle section, and few riffles were present.

Four stations on Champion Creek and one on Minnow Run were sampled for macroinvertebrates in 1994. The uppermost station on Champion Creek, Station 35, had a total of 18 taxa, including several genera of mayflies, stoneflies and fly larvae. Two genera of Hydropsychid caddisflies, *Diplectrona* and *Cheumatopsyche*, the only caddisflies present, were abundant. Minnow Run (Station 41) had 14 taxa of macroinvertebrates, including an abundance of caddisflies, Elmid beetles and Chironomids, no mayflies and only one genus of stonefly. Champion Creek downstream of Minnow Run (Station 44) had 14 taxa of invertebrates, including one mayfly genus, no stoneflies and an abundance of caddisflies, fishflies, and Chironomids.

Little Champion Creek was sampled at three locations. Station 48, located north of the village of White, and Station 62 at State Route 1050 each contained 17 taxa of macroinvertebrates, including an abundance and variety of caddisflies, dipterans, and several genera of stoneflies and mayflies. The major difference between Stations 48 and 62 was a shift in dominance from *Diplectrona* and *Cheumatopsyche* caddisflies at Station 48 to a dominance of *Glossosoma* and *Hydropsyche* caddisflies at Station 62. This change could be attributed to the wider, warmer, more alkaline stream conditions at Station 62. The third station on Little Champion Creek (Station 65) was located 50 yards upstream of the

confluence with Champion Creek. Station 65 had 14 taxa of invertebrates on June 28, 1994 and 19 taxa on July 27, 1994. The July sample contained a diversity of mayflies, stoneflies and caddisflies.

Station 66, located on Champion Creek downstream of the confluence of Little Champion Creek, was sampled for macroinvertebrates in May, June, and July 1994. Total numbers of taxa ranged from 15 in May to 13 in June and July. The majority of the taxa present were EPT taxa (7 to 12 taxa). Hydropsychid and *Glossosoma* caddisflies were the most common taxa. Macroinvertebrates were also sampled in Champion Creek at Melcroft (Station 72) in July 1994. Only a few individuals of four pollution tolerant taxa were present.

Champion Creek, Minnow Run and Little Champion Creek could be characterized as small, warm water, organically enriched stream habitats. Organic enrichment usually results in an increase in mayflies and filter-feeding caddisflies. Surface mining does not appear to have adversely affected the macroinvertebrates in Champion Creek or Little Champion Creek. The water in these streams became more alkaline in the downstream reaches of the watershed. The lower reach of Champion Creek; however, receives acid mine drainage from Melcroft underground mines, resulting in an accumulation of iron precipitate on the stream substrate which adversely affects the macroinvertebrates.

Indian Creek was sampled one-half mile downstream of Champion Creek (Station 78) in July and August 1994. Thirteen taxa of macroinvertebrates (7 EPT) were present on July 8 and 15 taxa (11 EPT) were found on August 16, 1994. The abundance of *Hydropsyche* caddisflies, which filter fine organic particles from the water, was believed to be due to organic enrichment. The absence of stoneflies could be attributed to the warm water conditions (25^{o}C in July 1994).

Macroinvertebrates were sampled in May, July, and August 1994 on Indian Creek, one-half mile downstream of the Kalp discharge (behind the Davistown United Methodist Church, Station 85), and about one and one-fourth mile downstream of the Kalp discharge (Indian Head, Station 93). On May 11, 1994, the sample from Station 85 contained 12 taxa of macroinvertebrates, including two genera each of stoneflies and mayflies. In July, only two *Hydropsyche* caddisflies and one *Tipula* cranefly larvae were found at Station 85 and no macroinvertebrates were present in August of 1994. The May sample at Station 93 contained 14 taxa, including six genera of mayflies and three species of *Hydropsyche* caddisflies. Six taxa of macroinvertebrates were collected at Station 93 in July and three in August. No taxa were abundant or common. Both stations had taxa typically found in organically-enriched warm water streams. The larger, late-instar mayflies and Hydropsyche caddisflies were covered with iron precipitate. The depressed macroinvertebrate communities could be attributed to the chemical and physical changes in water quality during the summer low flow conditions. At Indian Head, the pH values decreased from 6.8 in May to 6.1 in July and 6.2 in August; iron concentrations increased from 0.53 mg/l in May, to 1.21 mg/l in July and 1.35 mg/l in August. During May, little iron precipitate was visible at Station 85; however, in July and August the iron precipitate combined with algae to form mat-like masses which covered most of the exposed rocks and floated through pooled areas. At Indian Head, iron precipitate was found mainly under rocks and covering the substrate in the pools. Only a few, small patches of algae were visible. A study conducted by Herricks and Cairns (1974) noted a similar reduction in macroinvertebrates in Indian Creek downstream of

underground mine discharges during the summer. They found that the lower summer stream flow combined with the increase in acidity and metals concentrations from the underground mine discharges during the summer months affected the diversity and abundance of macroinvertebrate communities. Gale et al. (1976) reported that higher water temperature increases the precipitation of iron, which accumulates more readily on stream substrate under low flow conditions.

Some mayflies and caddisflies have life cycle adaptations that may allow them to live in streams such as Indian Creek, that periodically have unfavorable habitat conditions. The mayfly and caddisfly taxa, which were present downstream of the underground coal mine discharges in Indian Creek in mid-May, are not affected by the adverse summer conditions because they emerge as adults and leave the stream during late May and June. In addition, the eggs of many mayfly species do not hatch immediately after the female deposits them in the stream. The eggs remain in a resting stage until hatching occurs in the fall of the year.

Wash Run at Station 84 contained 18 taxa of macroinvertebrates in July 1994. Wash Run enters the west side of Indian Creek at the village of Davistown. Its watershed is mainly wooded, with a scattering of houses along the lower 2,000 feet. Logging was being conducted in its watershed during 1994.

Back Creek at Station 91 contained 28 taxa of macroinvertebrates, including 22 EPT taxa and 7 genera of mayflies. Trout Run at Station 88, a tributary of Back Creek, contained 19 taxa of macroinvertebrates.

On July 26, 1994, macroinvertebrate sampling in Poplar Run at Station 98, south of the village of Clinton, and at Station 102, upstream of Newmyer Run, yielded one crayfish at each station and no aquatic insects. The water quality analyses results from Station 98, from June through October, 1994, found pH values ranging from 4.5 to 5.4, acidity exceeding alkalinity, and aluminum concentrations ranging from 1.32 to 1.50 mg/l. The water quality samples collected from June through October at Station 102; however, do not indicate degraded conditions and substrate habitat was suitable for macroinvertebrate colonization. The pH values at Station 102 ranged from 6.3 to 6.5, iron and manganese concentrations were less than 0.44 mg/l, and aluminum concentrations were less than 0.23 mg/l. Some iron precipitate was visible under rocks and at the stream edges. It is possible that periodic discharges of silt, acid, iron, and aluminum from upstream abandoned surface mines adversely affect the macroinvertebrates in this section of Poplar Run.

Macroinvertebrate sampling in Newmyer Run near the confluence with Poplar Run at Station 109, in July 1994, yielded only a few crayfish. The pH value was 4.7 to 4.8, aluminum ranged from 9.99 to 11.40 mg/l, and zinc from 0.51 to 0.63 mg/l. Accumulations of aluminum precipitate and some iron precipitate were present. The July 1986 sampling yielded a few individuals of the Hydropsychid caddisfly *Diplectrona*.

Chironomids and a few *Acroneuria* stoneflies were the only invertebrates collected in Poplar Run at Station 117 in July 1994. The pH value was 6.1 at this location and aluminum precipitate was present.

Fish

Fish are more mobile than benthic macroinvertebrates and many species of fish can be found in streams that contain accumulations of iron or aluminum precipitate, which would normally eliminate most macroinvertebrates. Fish numbers are usually much lower in streams with iron precipitate than in non-degraded streams (Gale et al., 1976). In streams where pH values are depressed dissolved metals can be toxic to fish. Studies conducted in the 1980's have documented adverse toxic effects on brook trout and white suckers attributable to dissolved aluminum (Baker and Schofield 1992).

Indian Creek is stocked by the Pennsylvania Fish and Boat Commission (PFBC) prior to the spring trout angling season with brown and brook trout and in-season with brown and rainbow trout from the confluence with Champion Creek upstream to Pa Route 31 at Jones Mills, a distance of 5.4 miles.

Fish sampling was conducted by the PFBC, Somerset Regional Office, on June 28 and 29, 1994 and by the Bureau of Water Quality Management (BWQM), Pittsburgh Regional Office, on June 28, 1994.

Upper Indian Creek Watershed

Electrofishing by the PFBC on June 28, 1994 in Indian Creek at Skyview Road (Station 3) found naturally reproducing populations of both brook and brown trout. Brown trout have apparently moved upstream out of the stocked area and have colonized the upstream reaches of Indian Creek. Reproduction of both species is often seen in the slightly warmer reaches of native brook trout streams that are stocked with brown trout. Mottled sculpins, creek chubs and one adult rainbow trout were also present.

The PFBC conducted electrofishing on June 28, 1994 at T916, about one-half mile downstream of Horners Mill. Three adult brook trout and two brown trout were collected. One 50 mm rainbow trout and one 125 mm brown trout were also captured, indicating limited reproduction of these two trout species. Mottled sculpins, blacknose dace, creek chubs, johnny darters, white suckers and northern hogsuckers were also present.

Aquatic investigations by BWQM and the PFBC documented the presence of naturally reproducing populations of brook trout in Camp Run and Roaring Run. Camp Run is the only stream in Westmoreland County designated as a Class A brook trout stream by the Pennsylvania Fish and Boat Commission. Class A trout waters are streams which support a population of naturally reproducing trout of sufficient size and abundance to support a long-term sport fishery. Back Creek also contained naturally reproducing brook and brown trout.

Middle Indian Creek Watershed

Electrofishing in this section was conducted by the PFBC on June 28 and 29, 1994 at Jones Mills, near Station 14, and at Station 22 at the village of Nebo. Both locations had adult brook and brown trout, pumpkinseeds, mottled sculpins, creek chubs, white suckers, northern hogsuckers, bluntnose minnows, blacknose and longnose dace, central stonerollers and darters.

Lower Indian Creek Watershed

Electrofishing on Little Champion Creek was conducted by the PFBC in July 1990 and by BWQM in June 1994. The 1990 sampling by the PFBC collected blacknose dace, mottled sculpins, white suckers, and one adult brook trout at Station 48, near the village of White. Sampling at Station 65, near the confluence with Champion Creek, yielded blacknose and longnose dace, sculpins, johnny darters, pumpkinseeds, bluegills, hogsuckers and white suckers. No trout were collected. The 1994 electrofishing by BWQM at Station 29 captured white suckers, hogsuckers, creek chubs, sculpins, blacknose dace and johnny darters.

Electrofishing was conducted at Indian Head (Station 93) by the PFBC on June 29, 1994. Fish present were adult brown and rainbow trout, mottled sculpins, blacknose and longnose dace, creek chubs, central stonerollers, johnny darters, golden redhorse and northern hogsuckers. The PFBC also electrofished at Whites Bridge, approximately three miles downstream of Indian Head below the study area. Smallmouth bass and rock bass were present in addition to most of the species collected at Indian Head. No trout were collected.

Electrofishing by BWQM in Poplar Run at Station 102 in June 1994 yielded several year classes of brook trout, indicating natural reproduction. None of the previous aquatic investigations conducted electrofishing in this area of Poplar Run.

Summary of Aquatic Life

The headwaters section of upper Indian Creek upstream of Skyview Road and the eastern tributaries of middle and lower Indian Creek, which originates on Laurel Hill, contain a diversity of macroinvertebrate taxa and have naturally reproducing brook trout populations. Back Creek also contains a naturally reproducing brown trout population.

The middle section of Indian Creek, from the village of Melcroft upstream to Jones Mills, is stocked with brown, rainbow and brook trout. This stream section represents a transition from the fast flowing cold water habitat of the wooded upland headwaters to the more open warm water habitat of lower Indian Creek. This section of Indian Creek contains an abundance of macroinvertebrates with the highest total number of taxa found in the study area.

The aquatic communities of the lower Indian Creek are adversely affected by discharges from surface and underground mines, particularly during low flow conditions. Champion Creek and Little Champion Creek contain macroinvertebrate communities and fish populations typical of small, alkaline, organically enriched warm water streams. The aquatic life of the lower section of Champion Creek and Indian Creek from the village of Melcroft downstream to the village of Indian Head, has been adversely affected by acid mine drainage and iron precipitate from surface and underground coal mine discharges. Aquatic life in Newmyer Run and in the headwaters of Poplar Run has essentially been eliminated as a result of acid mine drainage from surface mines. The middle section of Poplar Run upstream of Newmyer Run has a small population of native brook trout, but virtually no macroinvertebrates. Poplar Run downstream of Newmyer Run is affected by aluminum precipitate which has eliminated all aquatic life except for a few pollution tolerant macroinvertebrate taxa.

IV. TECHNICAL STUDY FINDINGS

- Mineable reserves of the Mahoning, Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning, and Brookville-Clarion coals occur within and adjacent to the study area. The Brush Creek and Lower Kittanning coals are either absent or are not of mineable thickness.

- Chemical analyses of overburden associated with the Mahoning, Upper Freeport, Lower Freeport, Upper Kittanning and Middle Kittanning coals indicate that the rock strata from the land surface down to a depth of 25 to 40 feet contain little or no alkaline material and variable sulfur content. Where overburden cover is greater than 40 feet, chemical analyses indicate little alkalinity and high sulfer content above the Upper Kittanning coal, high alkalinity above the Middle Kittanning coal, and significant variations in alkalinity and sulfer content associated with all other coals. No chemical analyses for Brookville-Clarion overburden were available.

- Groundwater movement within and adjacent to the petition area is primarily controlled by lithology, stratigraphy, and regional geologic structure, and to a lesser extent by topography. Groundwater tends to move from recharge areas on the structural and topographic highs along Chestnut Ridge and Laurel Hill toward the trough of the Ohiopyle (Ligonier) syncline, which generally parallels Indian Creek.

- Abandoned Middle Kittanning underground coal mines capture a significant portion of the regional groundwater flow and direct it to discharge points along Indian Creek. Volume of underground mine discharges are high in comparison to the discharge volume resulting from surface mining.

- With the exception of drainage from one surface mined area, which is known to have been connected to underground mines through drill holes in the pit floor, there is no evidence to indicate that underground mining has affected shallow, near surface groundwater aquifers in areas not using public water supply.

- Water from point-source discharges from underground Middle Kittanning coal mines is highly acidic with elevated concentrations of metals and sulfate. Underground Middle Kittanning mine water which is transported laterally and vertically within regional aquifer systems often discharges as alkaline artesian seeps with elevated iron concentrations.

- Many surface mined areas, particularly those mined prior to 1978, have resulted in production of acid mine drainage or have produced alkaline discharges containing elevated concentrations of metals and sulfate.

- Surface mining of the Mahoning coal generally produced alkaline discharges with only slight increases in concentrations of sulfate.

- Surface mining activities conducted on only the Lower Freeport coal and on only the Upper Kittanning coal have consistently produced acidic discharges with elevated concentrations of metals and sulfates. Surface mining activities conducted on the Brookville-Clarion coal have consistently produced acidic mine drainage with high levels of metals and sulfate.

- The chemical characteristics of discharges associated with surface mining activities on the Upper Freeport and Middle Kittanning coals are variable, producing both alkaline and acidic discharges with elevated concentrations of metals and sulfate.

- Acid mine drainage from Middle Kittanning underground mines have degraded water quality and aquatic habitat, which adversely affects invertebrate and fish communities, in approximately 4.5 miles of Indian Creek, from the village of Melcroft downstream to the village of Rogers Mill.

- Iron and aluminum precipitates have degraded aquatic invertebrate habitat in stream areas of Indian Creek, Champion Creek, and Poplar Run watersheds downstream of mine discharges containing elevated metals concentrations.

- Discharges from abandoned surface and underground mines have degraded Poplar Run, virtually eliminating all aquatic life.

- The Pennsylvania Historical and Museum Commission recorded 14 archeological sites and 15 properties which may be eligible for listing on the National Register of Historic Places; however, the Commission has made no evaluation of these properties.

- The Indian Creek Valley Water Authority currently supplies public water to a portion of the petition area from two springs located in non-coal bearing strata outside the petition area.

- Water supply sources for the remainder of the residences and businesses in this area are provided by private wells and springs derived from one or two aquifers of the 20 different stratigraphic aquifers that occur within and adjacent to the petition area.

- Documentation indicates that several wells and springs have been chemically degraded or lost as a result of surface mining, however, several deeper local and regional aquifers were used and have potential to be used as replacement water supply sources.

- The Pennsylvania National Diversity Index does not indicate the presence of any plant or animal species with special concern within the petition area nor are there any publicly owned natural areas.

- Four surface mine permit areas within the petition boundaries were found to be exempt from the designation process in accordance with 25 Pa. Code, Section 86.121(a).

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VI. APPENDIX

Key for use with Tables 1, 2, 3, and 4

pH = negative logarithm of hydrogen ion concentration

The following reported as total concentrations in milligrams per liter

Alk = alkalinity

Acid = acidity

Fe = iron

Mn = manganese

Al = aluminum

SO4 = sulfate

DS = dissolved solids

SS = suspended solids

Ca = calcium

Mg = magnesium

Na = sodium

K = potassium

Cl = chloride

Zn = zinc

Table 1. Water quality chemical analysis results and location descriptions of springs used for evaluation of hydrology and water quality of aquifers within the Indian Creek study area.

Spring - S1

Donegal Campground, at the end of lower road, 800 feet from Pa. Route 31

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/94	5.4	12	7	<0.01	<0.01	<0.13	<20	56	<2	3.1	1.5	0.5	0.8	2	0.01
07/21/94	5.6	13	0	0.04	0.02	<0.13	<20	30	6	3.3	1.8	0.6	0.6	1	0.03
08/12/94	5.5	12	0	<0.01	0.02	<0.13	<20	68	6	4.7	1.9	1.1	0.8	2	0.02
09/22/94	5.6	13	7	<0.01	<0.01	<0.13	<20	10	20	3.7	1.7	0.6	0.6	1	<0.01

Spring - S2

Donegal Campground, near road entrance, 200 feet from Pa. Route 31

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/94	5.3	11	5	0.05	0.02	<0.13	<20	50	<2	6.4	0.8	0.6	<0.5	2	0.01
07/21/94	5.3	10	1	0.02	0.02	<0.13	<20	28	16	4.4	0.9	0.5	<0.5	2	0.02
08/12/94	5.4	11	0	<0.01	0.02	<0.13	<20	52	4	6.5	1.1	0.9	<0.5	2	<0.01
09/22/94	5.3	11	11	<0.01	0.02	<0.13	<20	20	4	6.2	0.8	0.6	<0.5	2	<0.01

Spring - S3

Candlelight Restaurant springhouse, south side of Pa Route 31, 350 feet east of SR2029

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	5.9	14	0	0.03	0.01	<0.13	<20	130	18	8.1	1.7	19.3	9.6	34	0.01
08/12/94	6.0	16	0	0.08	0.02	<0.13	<20	184	<2	11.4	2.2	29.3	0.8	50	0.01
09/22/94	6.2	16	6	0.06	<0.01	<0.13	<20	130	<2	10.1	2.2	22.3	0.8	34	<0.01

Spring - S4

Hillside spring, Double T Farm, 1000 feet northwest of T878 (Thompson Road), 750 feet south of Champion Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/94	5.9	16	0	0.13	0.06	<0.13	<20	56	2	5.4	2.0	0.3	1.1	1	<0.01
07/21/94	6.0	17	2	0.20	0.02	<0.13	<20	34	22	4.5	2.4	0.5	0.6	2	<0.01
08/12/94	5.9	15	0	0.07	0.01	<0.13	<20	64	6	5.6	2.5	0.9	0.7	2	<0.01
09/22/94	6.0	16	5	0.04	0.02	<0.13	<20	18	12	4.6	2.1	0.5	0.7	2	<0.01
11/25/94	6.0	18	3	0.10	0.02	<0.13	<20	6	8	5.5	2.4	0.5	1.1	1	<0.01
02/03/95	6.1	16	7	0.05	0.01	<0.13	25	24	6	4.9	2.3	0.5	0.7	<1	<0.01
04/03/95	6.1	15	1	0.03	0.01	<0.13	11	38	<2	4.8	2.2	0.7	0.8	1	<0.01

Spring - S5

Hillside spring, Dorothea Gearhart farm, 3800 feet southwest SR1050 junction with SR1058 (County Line Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/94	6.6	86	0	0.11	<0.01	0.16	<20	124	<2	23.2	7.3	1.2	0.8	2	<0.01
07/21/94	6.5	84	0	0.02	<0.01	<0.13	35	102	14	18.9	7.2	1.0	0.7	2	<0.01
08/12/94	6.3	40	0	<0.01	<0.01	<0.13	20	74	10	11.7	4.6	1.0	0.8	1	<0.01
09/22/94	6.4	46	0	0.08	<0.01	[illegible]0.13	<20	56	16	12.5	4.7	0.9	0.8	1	<0.01
02/03/95	6.5	26	0	0.06	<0.01	<0.13	17	58	<2	7.7	3.5	0.7	0.9	<1	0.04
04/03/95	6.6	36	0	0.02	<0.01	<0.13	15	72	<2	10.4	4.1	0.7	0.9	1	<0.01

Spring - S6

Hillside spring, Chestnut Ridge Stables, above pond, 200 feet south of T307 (Mount Olive Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/12/94	6.2	17	0	0.03	0.01	<0.13	<20	56	6	7.2	2.6	1.8	1.0	3	<0.01
09/30/94	6.2	17	6	0.04	<0.01	<0.13	<20	42	<2	5.7	2.1	1.3	1.6	2	<0.01

Table 1 (continued)

Spring - S7

Double T Farm, house supply springhouse, 200 feet southwest of SR1058 (County line Road) and 300 feet north of SR1007

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/29/94	5.0	10	3	0.06	0.06	0.15	<20	120	2	6.3	4.4	11.1	0.8	27	0.03
07/21/94	5.0	9	6	<0.01	0.05	<0.13	<20	106	12	5.3	4.1	9.8	0.9	25	0.03
08/12/94	5.1	10	2	<0.01	0.05	<0.13	<20	108	10	6.9	4.5	10.9	1.0	25	0.03
09/22/94	5.2	11	14	<0.01	0.05	<0.13	<20	90	<2	5.4	3.7	9.7	1.3	21	0.03

Spring - S8

Water supply for James Miller house, on hillside, 520 east of Jones Mills Road, 620 feet north of PA Rt. 31

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/12/94	6.6	70	0	0.35	0.01	0.28	29	120	12	16.9	5.8	1.8	0.7	1	<0.01
09/09/94	6.5	48	0	0.34	0.02	0.46	22	70	16	13.4	5.2	1.6	0.7	1	<0.01

Spring - S9

Springhouse at Braverman house, hillside above pond, 1400 feet west of SR1050

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/29/94	6.0	20	0	0.02	<0.01	<0.13	<20	44	<2	5.3	2.7	0.5	0.6	2	0.02
08/12/94	6.0	19	0	<0.01	<0.01	<0.13	<20	64	8	6.7	3.3	1.3	<0.5	3	<0.01
09/22/94	6.0	17	4	0.05	<0.01	<0.13	<20	36	<2	6.1	3.2	1.1	<0.5	2	<0.01

Spring - S10

Hillside pipe along PA Rt. 711, 1250 feet south of PA Rt. 31 at Jones Mills

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.2	24	0	0.02	<0.01	<0.13	<20	46	8	6.7	2.9	1.2	0.7	<1	<0.01
11/26/94	6.3	22	0	<0.01	<0.01	<0.13	<20	34	<2	4.3	1.8	0.7	0.8	1	<0.01
12/04/94	6.7	19	0	<0.01	<0.01	<0.13	23	44	10	5.4	2.3	1.0	0.8	1	<0.01
02/03/95	6.5	20	0	0.03	<0.01	<0.13	14	66	<2	5.3	2.2	0.8	1.0	1	<0.01
04/03/95	6.5	24	0	<0.01	<0.01	<0.13	16	22	10	4.8	1.9	1.1	0.8	2	<0.01

Spring - S11

Hillside spring, pipe above pond at an abandoned cottage, at western power line crossing of Little Champion Creek, 3500 feet north of SR1050

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/25/94	6.2	24	0	0.15	<0.01	<0.13	22	50	<2	9.4	1.4	0.7	0.8	2	<0.01
04/03/95	6.4	19	5	0.05	<0.01	<0.13	110	28	6	8.0	1.2	0.6	0.8	2	<0.01

Springs affected by surface mining activities.

* = background

Milrock Mining, Inc. "Champion #1" MDP 3375SM64
on the Mahoning coal

In a hollow on the east side of the the permit area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
08/14/87	6.6	140	0	5.10	2.78	0.50	124
07/20/88	3.9	0	36	0.30	1.49	2.20	106

Table 1 (continued)

Springs affected by surface mining activities.

* = background

Milrock Mining, Inc. "Champion #1" MDP 3375SM64
on the Upper Freeport coal

Spring in a hollow on the west side of the permit area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
06/23/86	6.2	14	2	0.40	<0.05	0.50	<40
05/07/87	6.0	14	16	1.00	<0.05	0.72	<40
09/15/87	5.5	8	8	1.00	<0.05	1.29	63

Below toe-of-slope on the west side of the permit area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
11/06/86	6.7	126	0	0.56	0.50	0.68	184
05/07/87	6.5	124	0	0.33	0.14	<0.50	228
09/15/87	7.1	56	0	0.96	0.14	0.99	94

Clarksburg Coal Co. "Barger" MDP 3378BC20
on the Upper Freeport coal

Overton Spring

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
02/27/84	6.3	56	0	0.44	0.05	0.15	413
08/08/85	6.6	10	0	<0.30	<0.05	<0.5	456

Pine Flats Coal Co., Inc. "Hopewell" SMP 26813036T
on the Upper Freeport coal

Storage tank on the east side of Phase IV

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
03/29/88	6.6	198	0	<0.3	0.07	<0.5	190
04/15/88	6.8	206	0	<0.3	0.16	<0.5	132

In a hollow between Phase I and Phase IV

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
03/29/88	6.7	14	0	1.32	0.07	0.94	<40
04/15/88	5.5	7	38	<0.30	0.75	<0.50	143
08/24/88	7.0	58	0	2.02	0.55	1.60	<40

Storage tank along T850 adjacent to Phase I

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
06/17/87	7.1	162	0	0.39	0.24	<0.50	78
05/27/88	7.8	354	0	<0.30	0.67	<0.50	245
05/27/88	6.7	192	0	<0.30	0.15	<0.50	142
08/24/88	6.5	242	0	<0.30	0.20	<0.50	152

MP10 along T850 across the road from Phase I

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
7/29/87	6.6	224	0	<0.30	0.21	<0.50	190
6/29/92	6.8	246	0	<0.30	0.20	<0.50	138

Table 1 (continued)

Springs affected by surface mining activities.

* = background

Kalp family household spring

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
08/24/88	5.5	8	22	1.28	<0.05	1.50	<40
11/16/88	5.6	14	26	1.10	0.58	1.08	47
01/18/89	5.6	13	6	<0.30	0.55	<0.50	60
02/25/92	5.6	12	8	<0.30	0.44	<0.50	63

A small seep from a dried-up spring on the Ritenour property - water loss from surface mining activities

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
10/13/83	7.6	92	0	0.90	0.11	0.37	60

Amerikohl Coal Co. "Ritenour II" SMP 26900106 on the Upper Freeport coal

Spring MP S30

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
04/23/92	7.0	308	0	0.36	5.35	<0.50	251
01/27/93	7.4	288	0	<0.30	5.33	<0.50	474

Pine Flats Coal Co., "LaRosa" SMP 26823086(T) on the Upper Kittanning coal

LaRosa Spring MP52

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
05/18/82	6.4	7	0	0.1	0.1	-	24*
02/01/84	5.8	4	7	0.19	0.09	-	4*
06/28/84	7.6	85	0	<0.04	0.35	-	20
08/15/85	5.7	3	11	0.5	0.53	-	80
09/25/85	5.8	3	3	7.7	0.64	-	74
07/11/89	3.9	0	38	1.33	7.68	4.11	542

The Rondell Co. "Correal" MDP 3373SM7 on the Brookville-Clarion coal

Clark Spring

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
09/16/82	4.4	6	142	0.05	25.65	8.14	390
03/25/83	4.6	8	82	0.03	9.92	3.33	265
04/28/83	4.6	7	60	0.17	10.12	3.07	275

M. Correal Spring

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
04/30/73	5.3	6	0	0.10	-	-	44*
09/05/74	4.5	0	15	<0.05	-	-	315
09/16/82	4.3	7	196	0.46	29.45	11.60	630
03/25/83	4.4	8	162	0.02	18.43	14.90	500
04/28/83	4.3	7	192	0.06	23.18	16.60	530

Knopsnider Spring

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
04/30/73	4.7	4	0	0.10	-	-	30*
04/28/83	4.6	8	56	0.07	4.53	6.77	145

Table 2. Water quality chemical analysis results and location descriptions of wells used for evaluation of hydrology and water quality of aquifers within the Indian Creek study area.

Well - W1

Donegal Highlands Golf Course, fairway well 700 feet north of Pa. Route 31 and 1250 feet west of SR2025

Well - W2

Donegal Highlands Golf Course, maintenance building 450 feet north of Pa. Route 31 and 200 feet west of SR2025

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/05/94	6.5	70	0	19.00	3.91	0.31	<20	4564	26	391.0	90.2	121.0	4.8	1310	0.02
11/03/94	6.4	78	0	17.20	4.17	<0.13	<20	4272	18	340.0	73.3	108.0	4.7	1210	<0.01

Well - W3

Pa. Turnpike administrative building at Donegal exit, 200 feet north of Pa. Route 31 and 100 feet east of turnpike entrance road at toll booths

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	6.3	78	0	6.66	2.56	<0.13	28	4800	28	347.0	86.5	80.4	4.3	1040	0.02
08/12/94	6.4	74	0	6.57	2.43	<0.13	22	4608	16	444.0	85.1	82.6	3.9	1240	0.02
09/22/94	6.6	76	0	8.55	2.63	<0.13	20	5312	20	380.0	85.2	88.1	5.0	1150	0.02

Well - W4

Double T Farm, 200 feet west of intersection of SR1058 (County Line Road) and SR1007

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/29/94	7.1	120	0	0.11	0.07	0.16	31	152	4	33.7	7.2	1.4	1.2	5	0.01
07/21/94	6.9	118	0	0.11	0.06	<0.13	<20	130	16	32.3	7.5	0.1	3.1	7	0.01
08/12/94	7.2	118	0	<0.01	0.06	<0.13	<20	190	6	35.5	7.5	1.7	1.4	6	<0.01
09/22/94	7.3	114	0	0.02	0.04	<0.13	<20	152	<2	29.4	7.0	2.0	1.5	8	<0.01

Well - W5

Barry McElroy house, 200 feet south of SR1058 (County Line Road) and 100 feet southwest of Saltlick-Bullskin Township Line

Well - W6

Bob Adams house, 950 feet south of SR1058 (County Line Road) and 700 feet southeast of Lake Donegal

Well - W7

Fred and Jane Stauffer house, 75 feet northeast of SR1007 and 1100 feet southeast of intersection of SR1007 and T844

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/94	7.1	154	0	0.05	0.03	<0.13	<20	220	2	48.5	9.9	0.6	1.4	10	0.02
07/21/94	6.8	148	0	0.02	0.02	<0.13	<20	210	10	43.6	9.6	0.6	1.1	10	0.01
08/12/94	6.9	152	0	<0.01	0.02	<0.13	<20	244	6	49.6	9.9	1.0	1.2	10	<0.01
09/22/94	7.1	124	0	0.05	0.04	<0.13	<20	194	<2	38.0	8.5	0.9	1.3	10	0.02

Table 2. (continued)

Well - W8

Gearhart Water commercial well, 200 feet east of SR1007 and 575 feet south of T819

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/29/94	6.5	100	0	2.91	0.20	<0.13	<20	136	2	27.6	6.2	6.7	1.0	12	0.03
07/21/94	6.5	100	0	2.65	0.20	<0.13	<20	124	16	24.0	6.0	3.9	0.8	6	<0.01
08/12/94	6.6	98	0	2.68	0.20	<0.13	<20	138	6	28.0	6.3	2.3	1.1	4	<0.01
09/08/94	6.6	98	0	2.59	0.21	<0.13	28	126	8	27.2	5.6	1.9	1.3	4	<0.01
09/22/94	6.8	102	0	2.49	0.17	<0.13	<20	126	<2	27.0	5.8	2.1	1.0	4	<0.01
11/25/94	6.5	102	0	2.91	0.22	<0.13	<20	104	4	27.6	6.1	2.0	1.3	4	<0.01
02/03/95	6.6	102	0	2.77	0.20	<0.13	41	112	10	26.8	5.8	2.1	1.2	4	<0.01
02/16/95	6.9	104	0	3.11	0.22	<0.13	45	142	2	28.8	6.1	2.3	1.2	4	<0.01
04/03/95	6.6	100	0	2.35	0.17	<0.13	88	108	14	21.9	4.8	1.3	1.3	3	<0.01

Well - W9

Tom Firestone house, 600 feet west of SR1058 (County Line Road) and 1600 feet northwest of SR1050

Well - W10

Dick Chearney house, 100 feet north of the end of Donegal Campground Road, 1000 feet southeast of T878 (Thompson Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	6.9	128	0	0.57	0.03	<0.13	60	148	6	31.8	8.2	5.5	1.6	4	0.06
09/22/94	7.4	132	0	0.08	<0.01	<0.13	<20	196	<2	33.8	9.1	8.4	1.7	13	<0.01

Well - W11

Dan Yeckel house, 100 feet north of Donegal Campground Road and 1300 feet south of Pa. Route 31

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	7.0	106	0	0.14	0.08	<0.13	36	94	16	22.7	6.4	4.1	0.9	1	0.03

Well - W12

Donegal Campground service well, 50 feet north of Donegal Campground Road and 900 feet south of Pa. Route 31

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/12/94	7.4	112	0	0.13	<0.01	<0.13	<20	152	12	11.5	2.6	33.7	0.6	2	0.03
09/22/94	7.4	114	0	0.07	<0.01	<0.13	<20	120	16	14.2	3.2	30.7	0.8	2	<0.01

Well - W13

Terry Ulery house, 100 feet west of SR2029 and 3200 feet south of Pa. Route 31

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	6.3	52	0	1.68	0.49	<0.13	28	104	18	17.8	4.9	2.1	<0.5	8	0.02
08/12/94	6.5	52	0	3.64	0.64	<0.13	<20	154	<2	20.1	4.8	2.3	<0.5	8	0.04

Well - W14

Charles Contant house, Amanda Lane 300 feet east of SR2029 and 3750 feet north of SR1058 (County Line Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/30/94	6.5	50	0	0.95	0.02	<0.13	27	110	<2	18.9	5.0	3.6	1.3	5	<0.01
11/03/94	6.6	68	0	0.49	<0.01	<0.13	44	134	<2	21.8	5.8	3.2	1.1	4	<0.01

Table 2. (continued)

Well - W15

John and Karen Murphy house, on Amanda Lane 450 feet east of SR2029 and 3750 feet north of SR1058 (County Line Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/12/94	7.1	104	0	0.17	0.05	<0.13	22	190	4	33.0	7.9	3.0	0.6	8	<0.01
09/29/94	7.1	112	0	0.08	0.07	<0.13	86	162	<2	32.0	7.3	2.9	1.0	6	<0.01

Well - W16

Days Inn Motel, 500 feet south of Pa. Route 31 and 2800 feet east of SR2029

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/26/94	7.0	90	0	0.40	0.12	<0.13	85	154	<2	25.0	6.1	2.5	1.0	17	<0.01
02/03/95	7.4	88	0	0.18	0.11	<0.13	18	144	4	23.2	6.1	3.0	1.1	13	<0.01

Well - W17

Laurel Highlands Campground, hillside well 600 feet southwest of Pa. Route 31 and 1250 feet west-northwest of campground entrance road

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/30/94	7.0	114	0	0.37	0.16	<0.13	<20	234	<2	43.2	9.6	5.3	1.4	40	<0.01

Well - W18

Rocco Scigliano house, east of Minnow Run, 1000 feet north of T307 and 3800 feet east of SR2029

Well - W19

Former Weathervane Restaurant, 200 feet south of Pa. Route 31 and 5900 feet northwest of Pa. Route 31 and Pa. Route 711 intersection at Jones Mills

Well - 20

Donegal Community Center, 400 feet north of Pa. Route 31 and 3700 feet northwest of Pa. Route 31 and Pa. Route 711 intersection at Jones Mills

Well - W21

Opal Snyder house, 100 feet south of Route 31 and 1850 feet northwest of Pa. Route 31 and Pa. Route 711 intersection at Jones Mills

Well - W22

James Goeble house, 100 feet south of T337 (Schoolhouse Lane) and 3550 feet east of SR2031 (Jones Mill Road)

Well - W23

John LaRosa house, new well, 250 feet west of SR1007 and 2600 feet south of SR1050

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/19/92	7.1	198	0	0.75	<0.05	<0.50	25	-	3	-	-	59.5	-	-	-
10/19/92	7.7	202	0	0.65	0.34	<0.13	<10	-	7	-	-	63.0	-	-	-
01/27/93	8.2	188	0	0.44	<0.05	<0.50	60	-	<2	-	-	62.4	-	-	-
06/24/93	7.5	200	0	<0.30	<0.05	<0.50	104	-	<3	-	-	58.3	-	-	-
02/14/95	7.7	202	0	0.19	0.05	<0.13	64	304	2	31.4	8.4	55.9	2.7	3	0.02

Table 2. (continued)

Well - W24

Jerry Micklow house, 75 feet south of T722 and 1250 feet east of SR1050

Well - W25

William and Joyce Howard house, 50 feet south of T722 and 250 feet west of Champion Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	6.9	166	0	0.26	0.13	<0.13	26	194	6	40.6	9.8	4.9	1.8	1	<0.01
09/30/94	7.0	156	0	0.41	0.13	<0.13	<20	180	<2	42.3	9.4	4.6	2.8	1	<0.01

Well - W26

William Ritenour house, 150 feet east of T722 and 800 feet south of SR1058 (County Line Road)

Well - W27

Robert and Evelyn Pritts house, Chestnut Ridge Stables, 400 feet south of T307 (Mt. Olive Road) and 3100 feet west of T307 and Pa. Route 711 intersection

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/12/94	7.2	104	0	0.05	0.12	<0.13	<20	140	10	29.2	7.0	4.1	0.7	2	<0.01
09/30/94	7.3	110	0	0.04	0.11	<0.13	<20	148	<2	27.7	6.5	3.6	1.3	1	<0.01

Well - W28

Larry Grabiak house, 100 feet north of T307 (Mt. Olive Road) and 2100 feet west of T307 and Pa. Route 711 intersection

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/05/94	7.1	132	0	0.09	0.03	<0.13	34	194	<2	24.0	6.3	22.3	0.9	1	0.02
11/03/94	7.1	144	0	0.07	<0.01	<0.13	<20	180	<2	19.4	5.8	29.6	1.1	1	<0.01

Well - W29

Hillside Stables barn, 100 feet north of T307 (Mt. Olive Road) and 250 feet west of T307 and Pa. Route 711 intersection

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	6.8	148	0	0.51	0.10	<0.13	70	170	<2	36.4	8.4	9.5	1.7	3	0.01
08/12/94	7.1	150	0	0.21	0.10	<0.13	106	184	6	42.3	8.7	10.1	1.5	3	<0.01

Well - W30

Russell Keller house, 50 feet east of Pa. Route 711 and 150 feet south of T307 and Pa. Route 711 intersection

Well - W31

Gertrude Kalp house, 75 feet south of Pa. Route 31 and 400 feet east of Pa. Route 31 and Pa. Route 711 intersection at Jones Mills

Well - W32

Matt Evangeliste house, 75 feet south of Pa. Route 31 and 600 feet east of Pa. Route 31 and Pa. Route 711 intersection at Jones Mills

Table 2. (continued)

Wells affected by surface mining activities.

* = background

Clarksburg Coal Co. "Barger" MDP 3378BC20
on the Upper Freeport coal

Overton Well

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
12/14/82	6.6	74	0	17.6	1.24	0.16	210
02/27/84	6.5	94	0	1.325	1.62	0.28	216

Pine Flats Coal Co., "LaRosa" SMP 26823086(T)
on the Upper Kittanning coal

LaRosa Well (old) MP53

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	
08/15/85	6.8	75	0	4.00	0.37	-	22	*
09/25/85	6.7	79	0	4.10	0.30	-	9	*
06/15/92	6.6	100	0	21.70	2.77	<0.50	312	
06/29/92	6.5	98	0	19.90	2.75	<0.50	244	

LaRosa well (new) MP53A

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
10/19/92	7.1	198	0	0.75	0.05	<0.50	25
10/19/92	7.7	202	0	0.65	0.34	<0.13	<10
01/27/93	8.2	188	0	0.44	0.05	<0.50	60
06/24/93	7.5	200	0	0.30	0.05	<0.50	104

Purco Coal Co. "Brown" MDP 2967BSM12
on the Middle Kittanning coal

Wilford Ulery well

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4
01/19/68	2.9	0	240	100.00	-	-	390

Table 3. Water quality chemical analysis results from piezometer wells within the Indian Creek study area.

♦ = Department of Environmental Resources samples
* = Rand Am, Inc. samples
f = Filtered sample

PIEZOMETER WELL LOCATION - PZ-1 Lat 40° 05' 01.3" N Lon 79° 24' 28.5" W - Along SR1007

Well No. 1A - Mahoning water table

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll No.
02/14/95	6.3	50	0	10.80	0.24	9.22	16	134	116	14.1	4.0	5.7	4	0.05	4133381♦
02/14/95	7.1	41	0	0.51	0.15	0.90	10	-	20	-	-	-	-	-	RAPZ1A1*
03/06/95	6.9	50	0	0.43	0.15	0.80	6	-	8	-	-	-	-	-	RAPZ1A2*

Well No. 1B - Upper Freeport coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	6.4	64	0	1.06	0.57	<0.13	17	130	2	20.4	7.6	2.4	18	0.01	4133382♦
02/14/95	7.2	53	0	1.02	0.54	0.10	10	-	11	-	-	-	-	-	RAPZ1B1*
03/06/95	6.7	60	0	0.34	0.55	0.10	10	-	20	-	-	-	-	-	RAPZ1B2*

Well No. 1C - Upper Kittanning coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	6.8	160	0	0.98	0.38	2.16	82	264	10	27.9	7.3	58.1	8	2.33	4133383♦
02/14/95	7.8	151	0	0.58	0.32	1.00	48	-	123	-	-	-	-	-	RAPZ1C1*
03/06/95	7.6	162	0	0.21	0.22	0.20	52	-	15	-	-	-	-	-	RAPZ1C2*

Well No. 1D - Middle Kittanning coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	7.3	192	0	10.10	0.44	3.59	24	240	40	44.3	11.0	19.5	6	2.96	4133384♦
02/14/95	8.2	180	0	0.24	0.27	<0.10	12	-	<5	-	-	-	-	-	RAPZ1D1*
03/06/95	7.9	173	0	0.21	0.25	0.10	8	-	21	-	-	-	-	-	RAPZ1D2*

Table 3. (continued)

♦ = Department of Environmental Resources samples
* = Rand Am, Inc. samples
f = Filtered sample

PIEZOMETER WELL LOCATION - PZ-2 Lat 40° 05' 11.7" N Lon 79° 21' 26.4" W - Along T307

Well No. 2A - Buffalo sandstone

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	8.1	168	0	0.23	0.03	0.16	159	202	12	9.4	2.0	62.1	2	0.02	4133377♦
02/14/95	8.4	160	0	0.80	0.02	0.40	10	-	14	-	-	-	-	-	RAPZ2A1*
03/06/95	8.4	161	0	0.24	0.02	0.20	7	-	12	-	-	-	-	-	RAPZ2A2*

Well No. 2B - Corinth sandstone

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	7.3	138	0	8.69	0.27	9.19	93	202	142	28.2	6.8	24.6	3	0.58	4133378♦
02/14/95	7.9	134	0	19.30	0.38	7.50	21	-	637	-	-	-	-	-	RAPZ2B1*
03/06/95	7.9	145	0	0.65	0.14	0.06	19	-	18	-	-	-	-	-	RAPZ2B2*

Well No. 2C - Mahoning sandstone

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	9.0	318	0	3.24	0.03	8.81	131	434	16	1.8	0.9	145.0	1	0.24	4133379♦
02/14/95	9.0	309	0	20.90	0.29	8.30	25	-	500	-	-	-	-	-	RAPZ2C1*
03/06/95	9.2	302	0	3.24	0.03	2.20	15	-	56	-	-	-	-	-	RAPZ2C2*

Well No. 2D - Middle Kittanning coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	7.8	166	0	0.66	0.17	1.43	38	240	14	20.0	5.1	51.2	3	0.44	4133380♦
02/14/95	8.2	157	0	2.68	0.19	1.50	30	-	82	-	-	-	-	-	RAPZ2D1*
03/06/95	8.0	130	0	0.14	0.14	0.20	15	-	18	-	-	-	-	-	RAPZ2D2*

Table 3. (continued)

♦ = Department of Environmental Resources samples
* = Rand Am, Inc. samples
f = Filtered sample

PIEZOMETER WELL LOCATION - PZ-3 Lat 40° 04' 54.7" N Lon 79° 22' 29.3" W - SR1058

Well No. 3A - Champion Creek level

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	7.4	142	0	24.60	0.47	17.50	41	282	732	48.4	15.6	11.6	23	0.09	4133385♦
02/14/95	8.1	130	0	3.87	0.21	1.90	37	-	112	-	-	-	-	-	RAPZ3A1*
03/06/95	7.8	163	0	1.23	0.17	0.60	39	-	73	-	-	-	-	-	RAPZ3A2*

Well No. 3B - Mahoning sandstone

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	7.9	220	0	13.00	0.11	18.40	37	462	318	19.9	6.8	88.8	13	0.54	4133386♦
02/14/95	8.3	214	0	7.31	0.09	3.60	32	-	314	-	-	-	-	-	RAPZ3B1*
03/06/95	8.0	205	0	1.18	0.06	1.70	32	-	73	-	-	-	-	-	RAPZ3B2*

Well No. 3C - Upper freeport coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	8.0	238	0	7.14	0.09	12.10	30	362	130	10.9	3.5	103.0	13	0.23	4133387♦
02/14/95	8.4	226	0	5.48	0.07	2.90	25	-	152	-	-	-	-	-	RAPZ3C1*
03/06/95	8.4	213	0	1.09	<0.02	1.10	25	-	35	-	-	-	-	-	RAPZ3C2*

Well No. 3D - Upper Kittanning coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	8.3	214	0	7.33	0.08	14.00	37	400	198	12.2	4.3	95.7	12	0.39	4133388♦
02/14/95	8.5	200	0	6.57	0.07	3.90	34	-	263	-	-	-	-	-	RAPZ3D1*
03/06/95	8.4	195	0	1.06	0.05	1.70	29	-	57	-	-	-	-	-	RAPZ3D2*

Well No. 3E - Middle Kittanning coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	7.8	222	0	21.70	0.40	1.75	39	314	14	26.0	8.8	56.3	14	1.05	4133389♦
02/14/95	8.3	218	0	1.04	0.16	0.70	32	-	34	-	-	-	-	-	RAPZ3E1*
03/06/95	8.1	169	0	0.06	0.22	<0.10	26	-	9	-	-	-	-	-	RAPZ3E2*

Table 3. (continued)

♦ = Department of Environmental Resources samples
* = Rand Am, Inc. samples
f = Filtered sample

PIEZOMETER WELL LOCATION - PZ-4 Lat 40° 05' 18.7" N Lon 79° 22' 51.0" W - Along Pa. Route 711

Well No. 4A - Upper Worthington sandstone

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	6.2	86	52	94.40	4.10	<0.13	537	1072	12	153.0	34.9	16.8	2	0.50	4133390♦f
02/14/95	6.3	32	67	67.90	4.89	<0.10	660	-	<5	-	-	-	-	-	RAPZ4A1*f
02/28/95	6.1	88	128	92.40	4.80	<0.13	810	1079	29	-	36.3	18.7	2	-	4607080*f
03/06/95	6.5	73	0	28.20	3.93	<0.10	610	-	16	-	-	-	-	-	RAPZ4A2*

Well No. 4B - Middle Kittanning coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	6.6	138	0	31.40	1.41	<0.13	343	676	42	114.0	25.4	19.4	1	0.64	4133391♦f
02/14/95	7.1	107	0	22.90	1.64	<0.10	370	-	39	-	-	-	-	-	RAPZ4B1*f
02/28/95	6.5	126	0	23.10	1.79	<0.13	417	692	40	-	27.3	21.8	1	-	4607081♦f
03/06/95	7.1	124	0	3.48	1.55	<0.10	310	-	17	-	-	-	-	-	RAPZ4B2*

Well No. 4C - Lower Worthington sandstone

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	Cl	Zn	Coll. No.
02/14/95	7.1	182	0	22.30	0.39	3.72	107	320	344	52.3	14.9	27.4	3	3.63	4133392♦
02/14/95	7.9	173	0	13.80	0.39	1.80	90	-	346	-	-	-	-	-	RAPZ4C1*
02/28/95	7.1	174	0	0.87	0.20	0.73	74	256	18	-	12.9	27.8	3	-	4607082♦f
03/06/95	7.7	174	0	0.24	0.16	0.10	66	-	16	-	-	-	-	-	RAPZ4C2*

Table 4. Location descriptions and water quality chemical analysis results of surface water and mine drainage within the Indian Creek study area.

Sample Point - 1

Indian Creek at Forbes State Forest boundary 6000 ft east of the village Kregar

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/12/94	6.6	50	0	0.04	0.02	<0.13	48	568	4	32.8	3.6	108.0	1.2	210	<0.01
09/09/94	6.8	42	0	0.09	0.03	0.16	29	344	12	23.3	2.9	78.7	1.1	147	<0.01
10/17/94	6.6	48	0	<0.01	0.02	<0.13	37	452	2	32.6	4.2	92.9	1.6	202	<0.01

Sample Point - 2

Little Run at a trail crossing 250 ft upstream from the confluence with Indian Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/15/94	6.6	30	0	0.12	0.03	0.33	27	60	12	10.3	1.1	0.9	0.9	2	<0.01
07/12/94	6.4	32	0	0.14	0.03	<0.13	21	64	16	11.2	1.2	1.1	0.7	3	<0.01
09/09/94	6.5	24	0	0.16	0.03	0.19	<20	72	2	9.0	1.2	0.7	0.6	1	<0.01
10/17/94	6.5	32	0	0.14	0.05	<0.13	<20	68	2	21.2	3.3	49.5	2.0	4	<0.01

Sample Point - D0

Blair underground mine opening

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/05/95	3.2	0	114	4.91	1.10	4.63	51	650	8	12.2	7.4	111.0	2.2	285	0.11

Sample Point - D1

Mine drainage at Piper Mine Road unnamed triburary to Indian Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/15/94	3.2	0	128	12.70	2.00	6.50	115	440	<2	9.5	10.5	0.8	1.2	1	0.21
07/12/94	3.1	0	144	19.30	2.61	7.49	91	522	6	11.5	11.2	0.7	1.2	2	0.26
09/09/94	3.2	0	190	18.10	2.74	11.40	84	564	4	12.7	12.8	0.7	1.3	1	0.30
10/17/94	3.1	0	188	24.80	3.21	10.10	188	626	<2	14.5	15.1	0.7	1.7	2	0.33
11/26/94	3.1	0	186	18.80	2.36	13.00	154	488	6	13.6	12.9	1.0	1.4	1	0.35
04/05/95	3.2	0	132	10.00	1.78	7.69	101	344	4	9.1	8.7	0.6	1.6	2	0.21

Sample Point - D2

Mine drainage from a reclaimed surface mine, Morcoal Co. MDP 34A76SM2 - "Kalp" - Upper Kittanning coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/29/94	3.6	0	302	0.81	14.60	37.80	494	1302	-	58.9	46.9	1.4	4.1	1	1.55
11/26/94	3.6	0	258	0.64	11.40	34.20	414	972	4	55.2	47.4	1.8	3.49	1	1.42

Sample Point - 3

Indian Creek at T339 (Skyview Road), southeast of the village of Kregar

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	26	0	0.18	0.10	0.33	21	244	8	14.8	2.5	59.3	0.7	100	0.02
06/15/94	6.8	34	0	0.11	0.05	0.18	34	248	14	20.5	2.5	50.8	0.9	91	<0.01
07/12/94	6.5	36	0	0.12	0.05	<0.13	29	726	4	21.8	3.2	61.7	1.0	115	0.01
09/09/94	6.3	28	0	0.25	0.10	0.20	<20	228	<2	16.5	2.5	41.9	0.9	80	0.01
10/17/94	6.7	36	0	0.13	0.06	<0.13	27	262	<2	21.7	3.1	45.4	1.7	101	<0.01

Table 4. (continued)

Sample Point - 4

Unnamed tributary flowing from the southeast to Indian Creek at Horners Mill

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/26/94	5.5	9	8	0.05	0.06	0.13	20	24	4	2.3	1.1	0.3	0.8	1	0.02

Sample Point - 5

Indian Creek at PA Route 381 bridge crossing at Horners Mill

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/11/94	6.6	20	0	0.16	0.07	0.25	<20	148	8	10.2	1.7	28.6	0.7	50	<0.01
05/27/94	6.4	26	0	0.18	0.10	0.22	<20	226	6	14.3	2.5	55.0	0.8	99	0.02
06/15/94	6.8	32	0	0.07	0.04	<0.13	23	238	20	20.4	2.5	50.0	1.2	91	<0.01
07/12/94	6.4	36	0	0.09	0.02	<0.13	59	296	10	21.3	3.1	59.2	1.2	114	0.02
09/09/94	6.3	30	0	0.15	0.08	0.14	23	214	<2	16.1	2.4	39.5	1.1	78	<0.01
10/17/94	6.6	36	0	0.04	<0.01	<0.13	<20	278	2	11.3	1.4	1.1	1.5	110	0.08

Sample Point - 6

Unnamed tributary to Indian Creek at T914 (Schoolhouse Lane) bridge crossing, approximately 1.1 mi west of Horners Mill

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/17/94	6.9	72	0	0.58	0.15	0.41	37	258	8	30.3	6.7	42.9	2.1	74	<0.01
07/12/94	7.0	62	0	0.28	0.05	0.14	<20	220	14	21.4	4.8	23.0	1.7	55	0.01
10/17/94	6.8	70	0	0.22	0.12	<0.13	<20	296	<2	26.0	6.6	30.4	2.7	76	<0.01

Sample Point - 7

Unnamed tributary to Indian Creek - Ponded water at T337 bridge crossing, approximately 5400 ft west of Horners Mill

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/17/94	7.1	84	0	0.39	0.15	0.14	23	350	6	34.0	7.7	78.0	1.5	134	<0.01
07/12/94	6.9	72	0	0.24	0.18	<0.13	<20	346	2	26.3	6.2	68.1	1.6	109	0.01
10/17/94	6.9	78	0	0.10	0.23	<0.13	51	350	<2	30.0	7.4	60.5	2.2	129	<0.01

Sample Point - 8

Unnamed tributary to Indian Creek at T337, approximately 4000 ft west of Horners Mill

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/17/94	7.2	84	0	0.29	0.03	0.20	<20	272	2	33.5	7.8	30.2	3.0	64	<0.01
07/12/94	7.3	94	0	0.17	0.02	<0.13	59	336	2	33.0	7.8	30.5	2.4	84	<0.01
10/17/94	7.4	104	0	0.13	0.05	<0.13	29	328	<2	39.8	10.3	30.1	3.3	87	<0.01

Sample Point - 9

Camp Run at Pa. Route 381 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.3	22	0	0.05	0.15	0.21	<20	50	12	8.8	1.2	0.6	0.6	1	0.02
06/15/94	6.7	30	0	0.14	0.03	0.22	<20	40	28	11.7	1.1	0.8	1.0	2	<0.01
07/12/94	6.3	32	0	0.07	0.02	<0.13	<20	80	4	11.7	1.4	1.3	0.7	2	0.01
09/09/94	6.8	26	0	1.11	0.19	0.22	<20	42	10	19.7	4.8	11.0	0.6	2	0.02
10/17/94	6.6	30	0	0.06	0.01	<0.13	43	72	<2	10.7	1.4	0.8	1.1	2	<0.01

Table 4. (continued)

Sample Point - 10

Unnamed tributary to Indian Creek flowing from the southeast approximately 2200 ft NE of Pike Run Country Club clubhouse

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/12/94	4.9	7	8	0.05	0.36	0.25	<20	20	6	2.3	0.8	0.3	<0.5	2	0.06
09/09/94	4.6	7	14	0.08	0.15	0.32	<20	32	8	2.7	0.8	0.2	<0.5	<1	0.04
10/17/94	4.9	8	6	0.02	0.14	0.30	<20	34	<2	2.6	0.9	0.3	<0.5	2	0.04

Sample Point - 11

Unnamed tributary to Indian Creek flowing from the southeast at Pa Route 381 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	4.9	7	3	0.04	0.11	0.32	<20	40	10	2.6	1.0	0.3	<0.5	<1	0.05
06/15/94	4.9	7	36	0.04	0.15	0.26	<20	18	22	2.9	0.7	0.4	<0.5	<1	0.07
07/12/94	5.2	8	5	0.06	0.20	0.14	<20	36	<2	3.5	0.9	0.7	<0.5	1	0.06
09/09/94	5.0	9	12	0.15	0.03	<0.13	<20	32	18	9.2	1.2	0.8	<0.5	<1	<0.01
10/17/94	5.1	10	14	0.02	0.14	0.57	27	50	<2	3.0	1.0	0.5	0.8	1	0.05

Sample Point - 12

Indian Creek at Pa. Route 381 bridge crossing, approximately 750 ft north of Pa. Route 31 intersection

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/11/94	6.5	20	0	0.19	0.06	0.20	<20	104	8	8.8	1.6	15.7	0.6	27	0.02
05/27/94	6.4	28	0	0.25	0.08	0.21	<20	150	6	12.5	2.4	34.4	0.8	61	<0.01
06/15/94	6.8	34	0	0.13	0.03	<0.13	21	180	16	17.2	2.2	30.5	1.1	56	<0.01
07/12/94	6.4	36	0	0.14	0.04	<0.13	55	194	<2	17.0	2.5	34.2	0.9	68	<0.01
09/09/94	6.4	30	0	0.15	0.05	<0.13	<20	164	<2	13.3	2.2	23.4	0.9	50	<0.01
10/17/94	6.6	38	0	0.15	0.03	<0.13	23	188	<2	19.0	3.1	29.3	1.6	58	<0.01

Sample Point - 13

Unnamed tributary to Indian Creek flowing from the northwest approximately 300 ft upstream from Pa. Route 31 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/17/94	6.7	62	0	0.53	0.22	0.15	<20	208	<2	22.4	5.4	24.5	2.1	47	<0.01
07/12/94	8.5	62	0	0.28	0.05	<0.13	27	180	<2	17.8	4.1	15.7	2.0	34	<0.01
10/17/94	6.8	68	0	0.21	0.11	<0.13	<20	168	<2	19.9	5.0	13.2	2.5	31	<0.01

Sample Point - 14

Indian Creek 600 ft east of Pa. Route 711 and 1500 ft south of Pa. Rt. 31 bridge crossing on Indian Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/03/94	6.6	30	0	0.15	0.04	<0.13	26	162	8	13.9	2.2	29.2	0.9	49	0.05
06/15/94	6.7	32	0	0.26	0.04	<0.13	23	154	24	16.8	2.2	31.0	1.1	56	<0.01
07/12/94	6.5	36	0	0.13	0.02	<0.13	20	182	4	16.7	2.5	33.7	1.1	68	<0.01
09/09/94	6.4	30	0	0.16	0.04	<0.13	<20	152	4	13.6	2.3	23.6	1.1	47	<0.01
10/17/94	6.6	40	0	0.19	0.23	<0.13	25	178	<2	18.9	3.2	28.7	2.2	58	<0.01

Sample Point - 15

Unnamed tributary to Indian Creek flowing from the northwest at T307 (Mt. Olive Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.5	40	0	0.79	0.04	0.82	21	112	22	14.3	3.6	6.8	1.7	11	<0.01
06/15/94	6.9	46	0	0.34	0.04	0.27	28	88	16	16.1	3.5	7.3	2.1	8	0.01
07/12/94	6.3	56	0	0.46	0.04	0.40	39	92	30	15.4	3.9	9.6	2.1	13	<0.01
08/17/94	6.8	50	0	0.58	0.05	0.53	32	110	8	16.2	3.8	8.3	2.1	13	<0.01
09/09/94	6.4	44	0	0.37	0.02	0.24	<20	84	26	14.6	3.5	6.7	1.5	11	<0.01
10/17/94	6.9	58	0	0.15	0.02	<0.13	<20	150	16	17.0	3.7	5.9	2.8	10	0.02

Table 4. (continued)

Sample Point - 16

Indian Creek at SR1058 (County Line Road) bridge crossing at the village of Champion

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	28	0	0.30	0.05	0.22	<20	152	6	12.8	2.0	23.5	0.9	59	0.01
06/15/94	7.0	34	0	0.18	0.03	0.16	22	162	20	16.3	2.1	28.5	1.3	54	<0.01
07/12/94	6.5	40	0	0.25	0.04	<0.13	20	210	<2	17.0	2.6	34.8	1.0	71	<0.01
09/09/94	6.4	32	0	0.16	0.04	<0.13	<20	186	<2	13.3	2.4	23.7	1.1	48	<0.01
10/17/94	6.7	40	0	0.23	0.04	<0.13	21	198	<2	18.6	3.2	29.5	1.9	56	<0.01

Sample Point - 17

Unnamed tributary to Indian Creek flowing from the northwest at the SR 1058 (County Line Road) bridge crossing, approximately 2000 ft west of the village of Champion

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.3	34	0	1.30	0.08	1.30	20	74	70	11.3	3.0	2.4	1.0	3	<0.01
06/15/94	6.8	42	0	0.67	0.03	0.43	20	66	22	13.2	3.1	2.6	1.5	4	0.02
07/12/94	6.3	52	0	0.62	0.07	0.39	24	62	48	13.7	3.6	3.2	1.5	5	<0.01
08/17/94	6.6	40	0	0.66	0.10	0.51	20	72	<2	12.9	2.8	3.7	1.2	5	<0.01
09/09/94	6.3	34	0	0.37	0.04	0.30	<20	60	22	11.3	2.7	2.2	1.3	3	<0.01
10/17/94	6.8	52	0	0.29	0.08	<0.13	<20	100	<2	15.2	3.2	3.0	2.3	5	<0.01

Sample Point - 18

Pike Run along Pa. Route 31 across from the Pike Run Country Club entrance

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	20	0	0.19	0.03	0.22	<20	56	14	8.8	1.4	6.4	0.7	10	0.02
06/15/94	6.4	26	0	0.23	0.04	0.25	21	68	34	10.3	1.0	6.3	0.9	9	<0.01
07/12/94	6.3	28	0	0.14	0.03	<0.13	20	70	6	10.3	1.4	7.0	0.9	12	<0.01
09/09/94	6.7	24	0	0.07	0.16	0.26	<20	90	4	3.0	1.0	0.5	1.1	11	0.05
10/17/94	6.6	28	0	0.12	0.02	<0.13	33	94	<2	10.5	1.4	6.5	1.1	12	<0.01

Sample Point - 19

Roaring Run at a private road bridge crossing, located 1200 ft southeast of T332 (Tannery Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	19	0	0.05	<0.01	<0.13	<20	38	12	7.9	1.2	0.5	0.6	<1	<0.01
06/15/94	6.4	24	20	0.03	<0.01	<0.13	<20	42	18	9.3	1.0	0.5	0.7	<1	<0.01
07/12/94	6.3	26	0	0.07	<0.01	<0.13	23	58	4	8.7	1.3	0.7	0.7	1	0.01
09/09/94	6.7	22	0	0.07	<0.01	0.20	<20	58	4	8.2	1.2	0.5	0.8	1	<0.01
10/17/94	6.6	28	0	0.13	<0.01	<0.13	24	56	<2	8.9	1.3	0.5	1.1	1	<0.01

Sample Point - 20

Roaring Run at SR1058 (County Line Road) bridge crossing the village of Champion

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	17	0	0.11	0.02	0.15	<20	32	18	7.5	1.2	3.1	0.6	5	0.01
06/15/94	6.4	24	30	0.10	0.02	0.24	<20	42	16	9.5	1.1	3.4	1.0	4	<0.01
07/12/94	6.3	24	0	0.10	0.01	<0.13	22	50	18	9.1	1.3	3.7	0.8	6	0.02
09/09/94	6.7	22	0	0.07	0.01	<0.13	<20	68	<2	8.2	1.2	0.5	0.9	5	<0.01
10/17/94	6.6	28	0	0.03	<0.01	<0.13	<20	68	<2	8.9	1.3	3.5	1.2	7	<0.01

Table 4. (continued)

Sample Point - 21

Indian Creek at T733 (Durstine Road), approximately 1500 ft south of the Westmoreland/Fayette County Line

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	26	0	0.22	0.05	0.17	<20	116	10	11.0	2.0	23.5	0.7	40	0.01
06/15/94	6.7	28	0	0.14	0.03	0.15	<20	106	22	13.0	1.6	16.9	1.3	31	0.01
07/12/94	6.4	32	0	0.14	0.02	<0.13	<20	136	2	13.0	2.0	19.0	0.9	37	0.01
09/09/94	6.3	26	0	0.16	0.04	<0.13	<20	104	<2	13.6	2.3	23.6	0.8	27	<0.01
10/17/94	6.6	34	0	0.12	0.02	<0.13	<20	142	<2	14.6	2.4	16.7	1.6	32	<0.01

Sample Point - 22

Indian Creek at T729 (Nebo Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/05/95	6.8	22	0	0.27	0.06	0.27	16	124	10	11.1	2.0	34.0	1.4	58	0.01

Sample Point - 23

Unnamed tributary to Indian Creek flowing from the northwest at Pa Route 711 bridge crossing at the village of Maple Grove

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.5	46	0	1.12	0.06	0.80	<20	84	22	14.6	4.2	3.0	2.1	4	<0.01
06/15/94	6.8	64	0	0.11	0.04	<0.13	21	86	18	19.3	4.7	3.8	2.8	3	<0.01
07/12/94	6.4	72	0	0.22	0.23	<0.13	24	90	22	17.4	4.7	3.8	3.0	4	<0.01
08/17/94	6.8	56	0	0.63	0.12	0.22	21	84	<2	16.5	4.1	2.5	2.5	3	<0.01
09/09/94	6.4	38	0	0.64	0.07	0.27	<20	84	14	12.0	3.5	1.9	2.1	3	<0.01
10/17/94	7.0	80	0	0.26	0.04	<0.13	<20	132	<2	21.0	5.5	3.4	3.2	4	<0.01

Sample Point - 24

Indian Creek at the northeast corner of a reclaimed surface mine - Holliday Constructors, Inc. SMP 3375SM54 "Shaffer" - Middle Kittanning Coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/03/95	6.6	22	0	0.21	0.07	<0.13	16	170	<2	10.4	2.0	30.4	0.9	66	<0.01

Sample Point - 25

Indian Creek upstream from an unnamed tributary flowing from the northeast at the southwest end of SMP 3375SM54 permit area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/09/83	6.4	20	4	0.19	0.05	0.14	26	-	30	-	-	-	-	-	-
07/23/86	6.2	18	10	<0.30	<0.05	<0.50	<40	-	16	-	-	<10.0	-	-	-
12/27/94	6.9	24	0	0.24	0.07	<0.13	-	80	<2	11.0	2.2	18.5	1.1	25	0.24
02/03/95	6.6	22	0	0.19	0.09	<0.13	15	168	<2	9.5	1.9	29.9	1.0	68	0.04

Sample Point - 26

Unnamed tributary (Sample Point 25) - approximately 100 ft upstream from mine drainage originating on the SMP 3375SM54 reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/09/83	6.7	40	0	0.22	0.09	0.09	47	-	20	-	-	-	-	-	-
02/03/95	6.8	46	0	0.17	0.06	0.14	26	114	<2	15.0	3.9	4.2	1.4	7	<0.01

Table 4. (continued)

Sample Point - D3

Mine discharge - pond inflow - Historical and recent water quality results of untreated mine drainage originating from the SMP 3375SM54 reclaimed surface mine.

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/07/82	5.9	153	0	20.30	12.90	0.13	720	-	-	-	-	-	-	-	-
05/09/83	6.2	158	0	15.56	10.10	0.03	570	-	20	-	-	-	-	-	-
07/23/86	6.2	92	0	14.50	8.65	<0.50	357	-	24	-	-	14.3	-	-	-
12/04/87	6.5	58	0	8.85	3.04	<0.50	174	-	2	-	-	<10.0	-	-	-
11/15/88	6.3	102	0	13.90	5.78	<0.50	274	-	6	-	-	13.0	-	-	-
02/09/90	6.5	74	0	14.00	4.78	<0.50	259	-	17	-	-	11.5	-	-	-
03/26/91	6.8	92	0	6.18	2.29	<0.50	91	-	<2	-	-	<10.0	-	-	-
01/22/92	6.7	96	0	7.70	3.40	<0.50	166	-	<2	-	-	<10.0	-	-	-
08/27/92	6.5	98	0	6.44	3.02	<0.50	112	-	5	-	-	<10.0	-	-	-
01/20/93	6.4	90	0	10.50	3.32	<0.50	219	-	7	-	-	10.3	-	-	-
06/24/93	6.2	94	0	14.00	3.08	<0.50	147	-	12	-	-	10.3	-	-	-
12/16/93	6.1	90	0	18.40	3.50	<0.50	195	-	<3	-	-	11.7	-	-	-
4-14-94 06/16/94	6.2	80	0	13.70	2.74	<0.50	180	-	14	-	-	<10.0	-	-	-
07/11/94	6.8	[illegible]92	0	7.50	2.18	<0.50	90	-	10	-	-	<10.0	-	-	-
08/18/94	6.3	58	0	7.92	2.48	<0.50	128	-	12	-	-	<10.0	-	-	-

Sample Point - D4

Mine discharge - pond outflow - Historical and recent water quality results of untreated mine drainage originating from the SMP 3375SM54 reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/09/83	6.3	60	0	8.92	5.13	0.06	335	-	28	-	-	-	-	-	-
07/23/86	6.4	40	0	1.30	1.49	<0.50	124	-	30	-	-	<10.0	-	-	-
09/18/90	6.5	54	0	2.56	2.48	0.64	194	-	6	-	-	<10.0	-	-	-
02/03/95	6.4	64	0	4.77	2.78	<0.13	181	382	18	49.6	15.7	8.3	3.4	7	<0.01

Sample Point - 27

Unnamed tributary (Near Sample Point 2) - 25 ft downstream from the mine drainage pond outflow (D4)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
12/27/94	6.7	60	0	3.88	1.65	<0.13	74	180	14	35.9	10.6	7.2	2.0	6	<0.01
02/03/95	6.5	50	0	2.30	1.00	<0.13	78	186	12	26.9	7.9	5.6	1.9	7	<0.01

Sample Point - 28

Indian Creek 75 ft downstream from the unnamed tributary (Sample Point 27) confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/09/83	6.3	20	8	0.27	0.11	0.14	27	-	34	-	-	-	-	-	-
07/23/86	6.2	18	0	0.37	0.11	<0.50	<40	-	18	-	-	<10.0	-	-	-
12/27/94	6.9	24	0	0.23	0.07	<0.13	12	94	<2	11.1	2.2	18.1	0.8	25	<0.01
02/03/95	6.5	24	0	0.37	0.10	0.16	21	182	<2	10.0	2.0	29.3	1.2	68	0.02

Sample Point - D5

Ponded water on the Indian Creek floodplain immediately north of and upstream from the T904 (Fowl Hill Road) bridge crossing at the village of Coffman

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.6	100	0	4.86	0.98	<0.13	134	236	16	46.8	9.7	9.3	0.9	4	0.05
06/16/94	6.5	92	0	1.67	1.81	<0.13	350	654	12	105.0	20.7	14.1	2.3	4	<0.01
07/14/94	6.4	78	0	2.99	1.26	<0.13	400	622	20	92.2	19.1	13.6	3.0	4	0.02
08/16/94	6.4	70	0	4.39	1.34	<0.13	236	410	<2	67.4	12.9	11.1	2.1	6	<0.01
09/08/94	6.5	108	0	32.50	5.58	0.22	308	664	14	99.9	28.8	12.3	1.9	4	0.05
10/19/94	6.3	104	0	9.47	1.39	<0.13	338	474	30	88.9	18.3	11.7	2.3	5	<0.01
11/26/94	6.4	80	0	5.25	1.08	<0.13	97	244	2	41.0	8.2	7.6	2.0	6	<0.01
02/03/95	6.4	72	0	11.90	1.48	0.57	138	312	8	57.6	12.4	11.3	1.5	11	0.01

Table 4. (continued)

Sample Point - 29

Indian Creek at T904 (Fowl Hill Road) bridge crossing at the village of Coffman

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	26	0	0.25	0.04	0.19	<20	110	10	11.2	2.1	21.8	0.8	37	0.08
06/15/94	6.7	30	0	0.22	0.04	0.25	21	112	16	12.9	1.7	16.1	1.3	29	<0.01
07/12/94	6.4	32	0	0.31	0.04	<0.13	<20	134	6	13.3	2.1	19.1	1.1	35	<0.01
09/09/94	6.3	28	0	0.12	0.03	<0.13	<20	108	<2	11.1	1.8	13.7	0.9	27	<0.01
10/17/94	6.7	36	0	0.32	0.05	<0.13	<20	116	<2	15.2	2.6	15.9	1.9	30	<0.01
02/03/95	6.6	24	0	0.26	0.07	<0.13	18	166	4	10.0	2.0	29.9	1.0	68	<0.01
12/27/94	6.9	24	0	0.25	0.80	0.13	19	80	2	10.5	2.1	16.5	0.8	25	<0.01

Sample Point - 30

Indian Creek 300 ft upstream from the Champion Creek confluence at the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
12/27/94	6.9	26	0	2.38	0.24	1.21	22	64	4	13.1	2.6	19.8	1.2	25	0.21
02/03/95	6.6	24	0	0.31	0.08	<0.13	19	176	<2	10.3	2.1	28.1	1.0	64	<0.01

Sample Point - 31

Champion Creek headwater at T876 bridge crossing, on the Double-T Farm

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.2	17	2	0.32	0.04	0.21	22	204	4	5.8	2.0	0.8	1.0	3	0.05
06/14/94	6.5	26	0	0.28	0.05	0.16	28	48	8	6.3	2.5	0.9	0.9	2	0.05
07/13/94	6.5	32	0	0.23	0.04	<0.13	40	48	2	8.2	3.0	0.9	1.0	2	<0.01
08/16/94	6.6	36	0	0.29	0.13	0.14	<20	58	8	9.4	3.2	1.1	2.5	4	<0.01
09/07/94	6.5	24	0	0.41	0.08	<0.13	<20	68	14	6.9	2.5	1.0	1.9	3	<0.01
10/18/94	6.5	34	0	0.14	0.04	<0.13	<20	60	<2	9.0	3.0	1.1	1.7	3	0.01

Sample Point - 32

Champion Creek at the T878 (Thompson Road) bridge crossing on the Double-T Farm

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/14/94	6.6	32	0	0.73	0.08	0.28	45	70	6	8.5	2.9	1.0	1.3	2	<0.01
07/13/94	6.7	40	0	0.72	0.04	0.50	65	70	14	9.9	2.4	1.1	1.4	2	<0.01
08/16/94	6.6	38	0	0.79	0.06	0.38	43	98	2	10.7	3.1	1.1	2.0	3	<0.01
09/07/94	6.4	24	0	0.37	0.05	0.18	<20	52	10	7.6	2.2	1.0	1.3	2	<0.01
10/18/94	6.6	36	0	0.33	0.03	0.19	21	60	2	10.2	3.0	1.0	2.1	2	<0.01

Sample Point - 33

Unnamed tributary to Champion Creek flowing from the southwest 1200 ft upstream from the confluence with Champion Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.3	22	0	0.94	0.08	0.85	21	182	<2	8.1	2.1	1.4	0.9	3	0.05
06/14/94	6.7	40	0	0.54	0.07	0.40	31	68	28	11.4	2.7	1.7	1.3	2	<0.01
07/13/94	6.7	52	0	0.68	0.04	0.53	25	74	26	15.7	3.2	1.9	1.1	3	<0.01
08/16/94	6.5	36	0	0.55	0.06	0.57	42	68	20	12.3	2.4	2.0	1.1	4	<0.01
09/07/94	6.6	28	0	0.35	0.05	0.27	<20	68	22	7.3	1.8	1.3	0.9	3	<0.01
10/18/94	6.6	44	0	0.20	0.02	<0.13	<20	84	<2	13.7	2.7	1.7	1.0	3	<0.01

Table 4. (continued)

Sample Point - 34

Unnamed tributary to Champion Creek flowing from the northeast 1800 ft upstream from the confluence with Champion Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.4	32	0	0.67	0.25	0.39	27	316	14	21.1	6.3	33.1	1.2	70	0.05
06/14/94	7.0	66	0	0.13	0.09	<0.13	29	418	2	40.0	11.7	34.9	0.5	117	<0.01
07/13/94	6.9	72	0	0.10	0.08	<0.13	<20	640	8	45.5	12.8	47.7	0.6	145	<0.01
08/16/94	6.6	72	0	<0.01	0.27	<0.13	57	512	10	41.3	11.9	58.5	1.3	143	<0.01
09/07/94	6.7	48	0	0.20	0.60	<0.13	53	416	10	29.2	8.9	48.1	1.4	124	<0.01
10/18/94	6.6	54	0	1.34	2.15	0.87	<20	524	8	46.7	13.4	38.7	3.3	199	0.03

Sample Point - D6

Old underground (Upper Freeport coal) mine discharge located on V & B Excavating (non-coal; shale) surface mine - SMP 65892305

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/10/89	2.8	0	558	105.00	2.28	33.30	388	-	6	-	-	<10.0	-	-	-
12/28/89	2.8	0	1096	272.00	4.04	77.20	1144	-	95	-	-	<10.0	-	-	-
11/12/93	2.8	0	894	179.00	3.07	61.40	1000	-	10	-	-	<10.0	-	-	-

Sample Point - 35

Champion Creek 75 ft upstream from the SR1058 (County Line Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.4	22	0	0.20	0.05	0.17	27	154	2	10.2	3.4	4.6	0.8	10	0.07
06/14/94	6.8	38	0	0.14	0.04	<0.13	32	124	<2	16.2	5.8	3.3	1.7	8	0.01
07/13/94	6.7	42	0	0.16	0.02	<0.13	24	164	18	19.0	6.0	5.3	1.8	10	<0.01
08/16/94	6.6	38	0	0.13	0.07	0.18	43	136	8	17.1	5.3	7.3	1.7	17	<0.01
09/07/94	6.7	28	0	0.41	0.08	0.29	<20	106	18	11.7	4.0	5.8	1.4	13	<0.01
10/18/94	6.6	42	0	0.26	0.02	<0.13	30	158	<2	17.7	6.0	3.7	2.1	10	<0.01

Sample Point - D7

Toe of spoil
Historical mine drainage water quality - active mining phase - Milrock Mining, Inc. SMP 3375SM64 reclaimed surface mine - Champion #1" - no documented post mining discharges
Mahoning and Upper Freeport coals

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/16/85	6.5	94	0	0.80	1.20	<0.50	77	-	10	-	-	<10.0	-	-	-
06/23/86	6.6	118	0	1.30	2.28	<0.50	107	-	4	-	-	<10.0	-	-	-
10/06/86	6.5	98	0	2.35	2.06	<0.50	66	-	<2	-	-	12.0	-	-	-

Sample Point - D8

Historical mine drainage water quality - Milrock Mining, Inc. SMP 3375SM64

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/12/84	6.6	114	0	2.70	2.30	0.10	72	-	0	-	-	-	-	-	-
09/16/86	6.5	156	0	5.78	6.49	<0.50	66	-	<2	-	-	<10.0	-	-	-
10/22/87	6.7	138	0	5.75	2.22	<0.50	82	-	4	-	-	<10.0	-	-	-
07/20/88	6.6	126	0	1.57	2.63	<0.50	68	-	4	-	-	<10.0	-	-	-
09/27/88	6.6	116	0	2.03	1.59	<0.50	85	-	22	-	-	<10.0	-	-	-
10/19/88	6.5	134	0	3.84	2.00	<0.50	105	-	10	-	-	<10.0	-	-	-

Table 4. (continued)

Sample Point - D9

Spring downslope of toe of spoil
Historical mine drainage water quality - Milrock Mining, Inc. SMP 3375SM64

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/05/87	5.9	20	0	0.35	<0.05	<0.50	182	-	28	-	-	<10.0	-	-	-
08/14/87	6.6	140	0	5.13	2.78	<0.50	124	-	12	-	-	<10.0	-	-	-

Sample Point - 36

Unnamed tributary to Champion Creek flowing from the southwest - approximately 2000 ft upstream from the Champion Creek confluence at SR1050 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.3	22	0	1.27	0.05	1.13	28	158	12	7.0	2.5	1.0	1.0	2	0.05
06/14/94	6.5	26	0	0.74	0.05	0.50	34	52	44	7.0	2.7	1.9	0.9	2	<0.01
08/16/94	6.5	22	0	0.39	0.04	0.47	37	72	14	7.0	3.2	1.0	1.0	1	<0.01
09/07/94	6.4	18	13	0.32	0.03	0.32	<20	42	18	6.1	2.6	0.8	1.0	2	<0.01
10/18/94	6.4	32	0	0.15	0.05	<0.13	25	108	<2	9.7	3.5	1.4	2.1	2	0.01

Sample Point - 37

Unnamed tributary (Sample Point 36) - 50 ft upstream from the Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.4	24	0	0.95	0.03	0.99	21	108	20	9.1	2.5	1.8	0.8	2	0.04
06/14/94	7.3	198	0	0.30	0.51	0.38	26	232	28	61.2	7.8	7.9	0.7	7	<0.01
08/16/94	6.5	36	0	0.21	0.02	0.24	32	78	8	12.0	2.5	2.0	0.8	3	<0.01
09/07/94	6.8	30	0	0.55	0.04	0.36	26	80	18	10.7	2.6	1.7	1.0	3	<0.01

Sample Point - 38

Champion Creek at SR 1050 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.4	26	0	0.27	0.04	0.24	25	96	4	10.8	3.7	4.0	0.9	6	0.04
06/14/94	6.7	44	0	0.31	0.05	0.16	27	120	8	16.3	5.9	3.5	2.0	5	<0.01
07/13/94	6.7	48	0	0.30	0.03	<0.13	30	150	20	19.5	6.3	6.0	2.4	12	<0.01
08/16/94	6.5	40	0	0.33	0.11	0.15	38	120	<2	15.9	4.9	5.9	1.7	12	<0.01
09/07/94	6.8	32	0	0.65	0.09	0.20	35	118	6	12.4	4.4	5.3	1.3	12	<0.01
10/18/94	6.6	48	0	0.27	0.07	<0.13	35	154	<2	17.6	6.1	3.9	2.3	9	<0.01

Sample Point - 39

Minnow Run 3000 ft north of SR1058 (County Line Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/11/92	7.1	84	0	<0.30	<0.05	<0.50	58	-	4	-	-	98.9	-	-	-
03/12/93	6.6	24	0	<0.30	0.07	<0.50	24	-	<3	-	-	123.0	-	-	-
02/12/94	7.1	30	0	<0.30	<0.05	<0.50	27	-	<2	-	-	86.4	-	-	-

Sample Point - 40

Unnamed tributary to Minnow Run flowing from the northwest 2000 ft upstream from the confluence with Minnow Run

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/11/92	6.2	20	3	1.32	0.12	1.07	22	-	20	-	-	<10.0	-	-	-
03/12/93	6.0	9	4	<0.30	<0.05	<0.50	<20	-	<3	-	-	<10.0	-	-	-
02/12/94	6.4	11	2	<0.30	<0.05	<0.50	<20	-	<2	-	-	<10.0	-	-	-

Table 4. (continued)

Sample Point - 41

Minnow Run at T307 (Mt. View Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/11/92	6.9	78	0	<0.30	0.23	<0.50	74	-	9	-	-	82.0	-	-	-
03/12/93	6.6	26	0	<0.30	0.07	<0.50	34	-	<3	-	-	95.0	-	-	-
02/12/94	6.9	30	0	<0.30	0.08	<0.50	38	-	<2	-	-	70.3	-	-	-
05/24/94	6.6	50	0	0.29	0.14	<0.13	59	326	2	29.5	8.2	64.8	1.3	102	0.04
06/14/94	6.7	94	0	0.47	0.40	<0.13	132	596	4	60.2	19.3	88.2	2.5	137	<0.01
07/13/94	7.0	104	0	0.44	0.40	<0.13	128	674	34	63.6	18.1	93.6	3.2	159	<0.01
08/16/94	6.5	40	0	0.32	0.25	<0.13	86	588	<2	46.7	12.2	103.0	2.6	176	<0.01
09/07/94	7.2	74	0	0.44	0.15	0.14	57	388	12	31.7	8.2	65.0	2.6	110	<0.01
10/18/94	6.8	98	0	0.63	0.38	<0.13	101	530	<2	54.5	16.1	74.5	4.1	167	0.01

Sample Point - 42

Champion Creek at T722 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.6	34	0	0.33	0.07	0.16	28	180	6	17.8	5.6	23.4	1.1	38	0.05
06/14/94	6.6	66	0	0.31	0.18	<0.13	67	304	<2	34.0	11.3	37.8	2.4	61	<0.01
07/13/94	6.9	74	0	0.41	0.16	<0.13	60	298	46	34.1	10.0	36.6	3.2	64	<0.01
08/17/94	6.9	94	0	0.44	0.14	<0.13	49	254	6	25.8	7.6	32.8	2.2	57	<0.01
09/07/94	7.1	46	0	0.35	0.05	<0.13	33	190	20	18.5	5.7	23.4	2.0	43	<0.01
10/18/94	6.8	70	0	0.32	0.10	<0.13	60	328	<2	32.1	10.1	28.8	3.2	53	<0.01

Sample Point - 43

Unnamed tributary to Champion Creek flowing fron the north - at T722 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.3	24	0	0.41	0.02	0.30	38	76	12	10.2	2.5	3.7	1.0	4	0.04
06/14/94	6.5	68	0	0.45	0.46	0.14	24	140	<2	24.4	4.2	8.6	2.3	12	<0.01
08/17/94	6.4	26	0	0.18	0.02	<0.13	24	72	2	9.5	2.5	2.9	1.3	5	<0.01
09/07/94	6.7	32	0	0.19	0.01	<0.13	<20	84	16	11.1	2.9	3.2	1.4	7	<0.01
10/18/94	6.5	46	0	0.22	0.03	<0.13	20	122	<2	16.3	3.6	6.4	2.8	12	0.02

Sample Point - 44

Champion Creek at T729 (Kibe Road), 2000 ft upstream from the Little Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.5	46	0	0.30	0.09	<0.13	51	198	4	23.1	6.9	20.2	1.3	31	0.04
06/14/94	6.7	102	0	0.28	0.16	<0.13	105	408	4	53.9	16.7	29.2	3.1	50	<0.01
07/13/94	7.1	110	0	0.34	0.15	<0.13	95	418	30	51.6	14.3	34.7	4.2	63	<0.01
08/17/94	6.6	66	0	0.32	0.10	<0.13	55	256	<2	28.5	8.2	24.6	2.3	44	<0.01
09/07/94	7.0	54	0	0.42	0.08	0.18	39	180	18	21.5	6.5	18.2	2.0	32	<0.01
10/18/94	6.9	98	0	0.28	0.15	<0.13	79	346	<2	44.8	13.4	24.2	3.2	45	<0.01

Sample Point - D10

Stream bank discharge (left side looking upstream) at T729 (Kibe Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/18/94	6.6	104	0	16.30	3.75	<0.13	412	776	<2	106.0	47.9	3.0	2.8	5	<0.01

Table 4. (continued)

Sample Point - D11

Country bank mine -
Pre and post mining water quality associated with Pine Flats Coal Co. SMP 26823086(T) reclaimed surface mine - "LaRosa" - sealed with no documentation of continued post-mining flow

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/15/85	4.3	0	30	0.32	0.40	-	75	-	3	-	-	-	-	-	-
09/25/85	4.0	0	4	2.03	0.46	-	63	-	9	-	-	-	-	-	-
10/05/88	3.3	0	508	209.00	89.30	11.90	1644	-	12	-	-	<10.0	-	-	-
01/23/92	3.3	0	238	54.70	53.60	5.81	1342	-	<2	-	-	<10.0	-	-	-
03/03/93	3.5	0	480	137.00	80.30	7.97	1694	-	<2	-	-	<10.0	-	-	-

Sample Point - 45

Champion Creek 25 ft above Little Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/03/95	6.8	40	0	0.30	0.26	0.26	59	176	<2	26.5	8.3	11.5	1.4	22	0.01

Sample Point - 46

Little Champion Creek at SR 1051 bridge, near the village of White

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/24/94	6.4	24	0	0.60	0.05	0.43	53	142	12	17.4	4.7	2.1	0.9	3	0.04
06/14/94	6.3	24	0	0.26	0.02	0.15	51	142	6	19.4	5.4	2.9	1.6	5	<0.01
07/13/94	6.5	32	0	0.14	0.01	<0.13	44	48	34	19.0	4.7	4.1	1.3	6	<0.01
08/17/94	6.3	30	0	0.31	0.02	0.21	50	100	8	15.8	3.7	2.7	1.1	4	<0.01
09/07/94	6.7	28	0	0.24	0.02	<0.13	55	134	26	19.5	6.6	2.2	1.0	4	<0.01
10/18/94	6.4	30	0	0.05	0.01	<0.13	58	170	<2	20.9	6.3	2.7	2.7	4	<0.01
11/25/94	6.4	24	0	0.11	0.03	<0.13	35	72	10	14.0	3.7	2.2	1.2	3	0.02

Sample Point - 47

Unnamed tributary to Little Champion Creek flowing from the northwest - 50 ft upstream of the Little Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.3	22	0	0.88	0.26	0.49	65	214	20	17.5	7.8	2.4	1.1	3	0.01
06/14/94	6.3	30	0	0.64	0.22	0.21	100	216	14	31.3	12.5	3.6	2.8	5	<0.01
07/13/94	6.5	34	0	0.36	0.28	<0.13	81	194	28	25.4	10.9	2.9	2.1	4	<0.01
08/17/94	6.3	30	0	0.74	0.45	0.28	62	164	2	18.3	8.0	3.4	2.0	5	<0.01
09/07/94	6.6	26	0	0.64	0.31	0.15	68	188	22	19.8	9.5	2.3	1.9	4	<0.01
10/18/94	6.4	34	0	0.49	0.44	<0.13	77	204	2	22.9	10.7	3.1	4.2	5	0.01
11/25/94	6.2	17	0	0.35	0.28	<0.13	40	78	2	11.6	5.2	2.1	1.4	3	0.01

Sample Point - D12

Historic water quality results from an abandoned (now reclaimed) surface mine - William K. Tedesco MDP 3370BSM16 "Tedesco" Upper Freport coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/19/88	3.9	0	52	8.35	3.59	2.02	614	-	14	-	-	<10.0	-	-	-
04/03/95	6.3	132	0	10.6	0.79	<0.13	235	390	6	83.6	21.5	1.4	2.3	3	<0.01

Table 4. (continued)

Sample Point - D13

Mine drainage from William K. Tedesco reclaimed surface mine, approximately 1100 ft south of the village of White

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	4.1	3	28	15.60	4.29	0.84	204	380	78	60.0	14.7	1.0	1.7	<1	0.05
06/16/94	6.3	92	0	5.16	0.52	<0.13	606	1126	10	220.0	30.0	1.7	2.4	1	0.68
07/14/94	6.2	76	0	8.66	0.66	<0.13	822	1158	14	188.0	27.2	2.4	2.3	2	0.63
08/16/94	6.3	76	0	6.20	0.72	<0.13	534	1176	18	216.0	28.9	2.4	2.5	2	0.60
09/08/94	6.3	146	0	0.11	0.01	<0.13	221	586	2	12.9	1.8	4.4	3.2	2	<0.01
10/19/94	6.2	66	0	15.20	0.80	<0.13	756	1124	<2	205.0	29.0	1.7	2.5	2	0.78
12/04/94	6.5	80	0	6.58	0.74	0.17	612	1130	20	207.0	29.8	2.5	2.1	2	0.47

Sample Point - 48

Little Champion Creek at SR 1009 bridge, near the village of White

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.4	22	0	0.69	0.18	0.34	66	158	18	17.2	7.1	2.5	1.2	3	0.02
06/14/94	6.3	28	0	0.54	0.12	0.33	93	220	2	29.1	11.2	3.4	2.4	4	<0.01
07/13/94	6.2	32	0	0.38	0.12	0.17	88	180	46	24.6	10.2	2.9	2.3	4	<0.01
08/17/94	6.4	30	0	0.67	0.26	0.33	59	152	8	17.8	6.9	3.2	1.7	5	<0.01
09/07/94	6.7	26	0	0.47	0.20	0.15	65	170	36	19.4	8.7	2.4	1.5	3	<0.01
10/18/94	6.5	32	0	0.22	0.22	<0.13	78	206	<2	21.8	9.7	2.8	3.3	5	0.01
11/25/94	6.3	18	0	0.22	0.19	<0.13	40	72	4	11.9	4.8	2.1	1.5	3	<0.01

Sample Point - D14

Water accumulation in cut - active mining phase - Adam Eidemiller, Inc. surface mine MDP 2969BSM10 "Mastowski" site reclaimed 7/25/77 - no documented post-mining discharges. Middle Kittanning

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/24/71	5.1	0	14	1.50	-	-	85	-	-	-	-	-	-	-	-
03/29/73	6.2	16	0	0.40	-	-	420	-	-	-	-	-	-	-	-

Sample Point - D15

Water flowing through spoil - Adam Eidemiller, Inc. MDP 2969BSM10 - active mining phase

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/11/73	5.3	0	4	0.10	-	-	480	-	-	-	-	-	-	-	-

Sample Point - 49

Little Champion Creek approximately 0.68 mile downstream of SR1009 bridge at the village of White

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.6	42	0				77	202	16					4	-
06/14/94	6.8	76	0	0.18	0.03	<0.13	133	370	4	59.5	15.7	3.7	2.3	4	0.01
07/13/94	6.4	72	0	0.21	0.03	<0.13	128	494	32	47.0	13.6	3.4	2.5	4	0.07
08/17/94	6.7	44	0	0.18	0.03	<0.13	69	180	<2	26.5	7.9	3.8	2.0	6	<0.01
09/07/94	7.1	40	0	0.20	0.04	<0.13	69	196	14	26.1	9.2	2.7	1.7	4	<0.01
10/18/94	6.8	54	0	0.10	0.10	<0.13	95	250	<2	41.7	12.9	3.3	3.5	5	<0.01
11/25/94	6.4	26	0	0.13	0.06	<0.13	49	92	4	16.9	5.7	2.6	1.3	4	<0.01

Table 4. (continued)

Sample Point - 50

Unnamed tributary to Little Champion Creek flowing from the northwest at T819 (Chearney Road)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.4	24	0	-	-	-	34	114	20	-	-	-	-	13	-
06/14/94	6.3	32	0	1.47	0.67	0.28	<20	104	80	15.0	2.5	9.7	3.1	17	0.01
07/13/94	6.1	34	0	0.58	0.31	<0.13	<20	224	40	11.8	2.1	7.1	2.4	14	<0.01
08/17/94	6.3	26	0	0.41	0.32	<0.13	26	102	<2	10.0	2.0	6.8	1.9	13	<0.01
09/07/94	6.6	22	0	0.45	0.19	0.14	<20	100	22	11.5	2.3	7.1	2.4	14	<0.01
10/18/94	6.8	82	0	4.17	2.65	0.61	<20	168	18	17.8	3.4	14.8	16.5	174	<0.01
11/25/94	6.3	26	0	1.00	0.47	<0.13	24	98	<2	11.2	2.3	9.8	5.2	18	0.02

Sample Point - D16

Pit water accumulation - active mining phase - Genovese Coal Co. surface mine MDP 3372SM20 "Chearney"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/24/80	7.5	158	0	<0.50	0.03	<0.10	200	-	-	-	-	-	-	-	-
11/19/86	6.8	148	0	<0.30	<0.05	<0.50	136	-	<2	-	-	<10.0	-	-	-
05/08/87	6.7	162	0	<0.30	<0.05	<0.50	130	-	<2	-	-	<10.0	-	-	-
09/03/87	6.8	153	0	<0.30	<0.05	<0.50	114	-	<2	-	-	<10.0	-	-	-

Sample Point - 51

Unnamed tributary (Sample Point 50) to Little Champion Creek - 50 ft upstream of the Little Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.8	58	0	1.02	0.23	0.99	49	156	38	24.1	6.0	2.4	2.2	5	0.02
06/14/94	6.9	104	0	0.27	0.08	0.27	64	204	14	46.9	9.9	1.8	2.6	3	0.01
07/13/94	6.5	94	0	0.35	0.08	0.31	41	288	42	34.6	7.9	2.1	2.7	5	<0.01
08/17/94	6.9	70	0	0.59	0.12	0.57	45	180	10	26.6	6.6	2.1	3.2	5	<0.01
09/07/94	7.4	64	0	<0.30	0.10	0.48	30	170	22	26.1	6.1	2.4	2.2	5	<0.01
10/18/94	7.1	130	0	0.12	0.17	<0.13	44	250	<2	54.0	10.7	2.6	6.3	8	0.04
05/18/94	6.7	44	0	0.41	0.08	0.24	70	186	6	26.0	8.1	2.6	1.5	4	<0.01
06/14/94	6.8	84	0	0.16	0.05	<0.13	111	314	<2	55.5	14.0	3.1	2.3	3	<0.01
07/13/94	6.4	78	0	0.13	0.03	<0.13	88	240	46	42.0	11.5	2.9	2.5	4	<0.01
08/17/94	6.7	48	0	0.20	0.04	0.14	62	198	<2	25.9	7.7	3.4	2.0	6	<0.01
09/07/94	7.2	46	0	0.25	0.05	<0.13	42	198	16	25.9	8.0	2.7	1.7	4	<0.01
10/18/94	6.9	68	0	0.10	0.06	<0.13	79	228	<2	42.8	11.3	2.9	3.8	5	<0.01

Sample Point - 52

Little Champion Creek 50 ft downstream of the unnamed tributary (Sample Point 50) confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/18/94	6.7	44	0	0.41	0.08	0.24	70	186	6	26.0	8.1	2.6	1.5	4	<0.01
06/14/94	6.8	84	0	0.16	0.05	<0.13	111	314	<2	55.5	14.0	3.1	2.3	3	<0.01
07/13/94	6.4	78	0	0.13	0.03	<0.13	88	240	46	42.0	11.5	2.9	2.5	4	<0.01
08/17/94	6.7	48	0	0.20	0.04	0.14	62	198	<2	25.9	7.7	3.4	2.0	6	<0.01
09/07/94	7.2	46	0	0.25	0.05	<0.13	42	198	16	25.9	8.0	2.7	1.7	4	<0.01
10/18/94	6.9	68	0	0.10	0.06	<0.13	79	228	<2	42.8	11.3	2.9	3.8	5	<0.01

Table 4. (continued)

Sample Point - D17

Mine drainage - pre and post mining water quality - Amerikohl Mining Co. reclaimed surface mine SMP 26880101, "Prinkey" - Monitoring Point 8

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/13/87	3.5	0	40	0.50	2.30	-	130	-	1	-	-	-	-	-	-
11/16/87	3.5	0	43	0.40	2.10	-	140	-	0	-	-	-	-	-	-
12/09/87	3.8	0	28	0.40	1.40	-	99	-	12	-	-	-	-	-	-
01/04/88	3.8	0	30	0.40	2.20	-	91	-	<2	-	-	-	-	-	-
02/09/88	3.9	0	32	0.20	1.80	-	130	-	1	-	-	-	-	-	-
02/16/88	3.7	0	50	<0.30	1.89	3.94	85	-	<2	-	-	<10.0	-	-	-
03/28/88	3.9	0	34	0.20	1.95	-	130	-	5	-	-	-	-	-	-
06/21/89	4.9	7	32	1.49	0.43	<0.50	106	-	19	-	-	<10.0	-	-	-
03/05/90	3.6	0	52	<0.30	1.72	4.02	106	-	<2	-	-	<10.0	-	-	-
01/10/91	3.7	0	58	0.43	2.42	4.73	139	-	110	-	-	<10.0	-	-	-
02/25/92	3.6	0	56	<0.30	1.99	6.00	116	-	<2	-	-	<10.0	-	-	-
06/25/92	3.6	0	60	1.36	2.08	6.19	111	-	6	-	-	<10.0	-	-	-
09/11/92	3.7	0	58	1.01	2.34	6.26	103	-	<2	-	-	<10.0	-	-	-
12/17/92	3.8	0	36	0.42	1.46	3.86	77	-	8	-	-	<10.0	-	-	-
02/09/93	3.7	0	46	<0.30	1.69	4.76	122	-	<2	-	-	<10.0	-	-	-
06/28/93	3.4	0	46	2.75	1.54	2.76	101	-	<2	-	-	<10.0	-	-	-
04/01/94	3.8	0	34	<0.30	1.07	2.53	69	-	26	-	-	<10.0	-	-	-
07/08/94	3.5	0	44	1.80	1.13	0.92	82	-	14	-	-	<10.0	-	-	-

Sample Point - D18

Sedimentation pond water quality - Brant Coal Co. surface mine, MDP 3375SM33 - active mining phase - backfilled in 1983 - no documented post-mining discharges

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
12/10/76	6.9	35	0	1.90	0.00	-	30	-	-	-	-	-	-	-	-
04/01/77	7.5	45	0	0.80	0.00	-	60	-	-	-	-	-	-	-	-
04/26/78	7.4	85	0	0.90	0.00	-	84	-	-	-	-	-	-	-	-

Sample Point - D19

Toe of spoil discharge - Brant Coal Co. MDP 3375SM33 - active mining phase

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/17/80	6.6	10	0	0.93	0.12	0.30	12	-	<20	-	-	-	-	-	-

Sample Point - D20

Water quality - Brant Coal Co. MDP 3375SM33 - Monitoring Point 9 - active mining phase

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/17/80	7.1	10	0	4.00	1.67	1.60	140	-	84	-	-	-	-	-	-

Sample Point - D21

Mine drainage from previously disturbed area upslope of Brant Coal Co. surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/27/80	4.5	0	14	0.60	0.43	0.50	12	-	<20	-	-	-	-	-	-
10/27/80	7.0	179	0	0.27	2.03	0.10	330	-	<20	-	-	-	-	-	-

Table 4. (continued)

Sample Point - 53

Unnamed tributary (headwater) to Little Champion Creek flowing from the north - sample point located approximately 1500 ft upstream of the uppermost SR1007 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/12/94	6.8	66	0	0.24	0.12	<0.13	<20	174	<2	21.4	5.5	5.7	2.9	12	<0.01
08/16/94	6.9	66	0	0.47	0.17	0.16	52	134	<2	21.3	5.0	5.7	3.4	12	<0.01
10/18/94	6.7	66	0	0.64	0.12	0.28	<20	138	<2	18.6	5.1	3.9	5.6	11	<0.01
11/26/94	6.4	38	0	0.21	0.08	<0.13	<20	124	8	15.7	4.1	4.2	3.3	12	<0.01

Sample Point - 54

Unnamed tributary (Sample Point 53) to Little Champion Creek - approximately 750 ft west of the SR1007/T846 intersection

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.5	32	0	0.79	0.03	0.58	23	304	16	14.4	3.4	2.9	2.1	8	<0.01
06/14/94	6.5	42	0	0.49	0.03	0.45	<20	126	18	20.0	3.7	4.1	2.3	11	0.01
07/13/94	6.2	36	0	0.33	0.02	0.27	<20	72	50	15.4	3.1	2.0	1.6	8	<0.01
08/16/94	6.6	40	0	0.28	0.02	0.27	24	118	<2	15.6	3.7	3.3	2.4	9	<0.01
09/07/94	6.9	34	0	0.41	0.02	0.29	<20	96	22	13.9	3.4	2.4	1.9	7	<0.01
10/18/94	6.7	48	0	0.16	0.01	<0.13	<20	124	<2	21.1	3.9	3.5	2.9	10	<0.01
11/25/94	6.4	26	0	0.18	0.03	<0.13	<20	72	18	13.4	3.4	3.6	2.0	9	<0.01

Sample Point - 55

Unnamed tributary to the Sample Point 53 unnamed tributary - flowing from the north along T846 (Coffman Road) Sample obtained at SR1007 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.4	22	0	0.54	0.04	0.43	<20	92	8	8.5	2.8	3.0	1.2	6	<0.01
06/14/94	6.4	32	0	0.53	0.05	0.32	<20	96	8	10.4	3.3	11.3	2.0	15	<0.01
07/13/94	6.2	34	0	0.31	0.03	<0.13	<20	72	48	10.5	3.3	6.3	1.6	12	<0.01
08/16/94	6.4	28	0	0.22	0.05	<0.13	20	68	<2	9.0	2.9	3.9	1.4	7	<0.01
09/07/94	6.6	28	0	0.30	0.03	0.15	<20	88	10	9.0	3.1	4.5	1.3	8	<0.01
10/18/94	6.5	40	0	0.10	0.02	<0.13	<20	98	<2	11.9	3.3	6.3	2.8	12	<0.01
11/25/94	6.3	22	0	0.30	0.04	<0.13	<20	42	16	8.0	2.8	4.6	1.2	8	0.18

Sample Point - 56

Unnamed tributary (Sample Point 53) to Little Champion Creek at the lowermost SR1007 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.4	30	0	0.93	0.08	0.75	<20	100	16	11.8	3.2	3.2	1.9	7	<0.01
06/14/94	6.5	56	0	0.51	0.22	0.19	<20	136	10	21.6	4.6	14.8	1.7	27	0.07
07/13/94	6.3	54	0	0.62	0.20	<0.13	<20	428	36	33.1	7.3	46.0	2.2	114	<0.01
08/16/94	6.5	44	0	0.30	0.09	<0.13	69	104	<2	14.6	3.6	6.0	1.8	12	<0.01
09/07/94	6.9	36	0	0.36	0.07	<0.13	<20	96	10	13.2	3.3	3.2	1.8	7	<0.01
10/18/94	6.8	62	0	0.47	0.13	<0.13	24	128	<2	21.5	4.2	3.4	2.5	17	<0.01
11/25/94	6.4	30	0	0.39	0.07	<0.13	<20	74	8	11.6	3.2	5.2	1.9	10	<0.01

Sample Point - 57

Little Champion Creek - approximately 1100 ft downstream of the unnnamed tributary (Sample Point 53) confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.7	46	0	0.71	0.07	0.50	52	170	20	24.3	7.4	2.8	1.6	4	<0.01
06/14/94	6.9	86	0	0.15	0.03	<0.13	99	286	10	51.7	12.7	4.4	2.2	7	<0.01
07/13/94	6.5	98	0	0.24	0.03	0.15	85	288	24	46.8	12.2	5.1	2.5	11	<0.01
08/17/94	6.8	58	0	0.61	0.06	0.42	60	194	<2	28.7	7.5	3.1	2.1	6	<0.01
09/07/94	7.4	60	0	0.21	0.03	<0.13	39	208	10	31.0	8.7	2.8	2.3	5	<0.01
10/18/94	7.1	84	0	0.11	0.02	<0.13	71	262	<2	45.0	10.4	2.5	3.6	5	<0.01

Table 4. (continued)

Sample Point - D22

Mine drainage to Little Champion Creek flowing from the south on the hillside at the eastern end of the Purco Coal Co. reclaimed surface mine MDP 3371BSM6 "Coffman"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	6.9	158	0	1.65	2.29	<0.13	154	432	16	82.3	20.1	1.0	2.5	2	<0.01
07/14/94	6.5	166	0	1.70	3.20	<0.13	171	468	4	73.5	19.4	1.6	2.7	2	0.03
08/17/94	6.5	142	0	4.81	3.83	0.52	157	406	<2	67.7	17.5	1.2	2.6	2	<0.01
09/07/94	6.4	162	0	2.20	1.87	<0.13	206	422	2	78.2	19.7	1.3	2.5	2	<0.01
10/18/94	6.5	174	0	6.50	2.27	0.42	139	424	8	74.2	19.7	1.0	2.8	2	0.01
11/26/94	6.4	164	0	2.18	1.74	<0.13	129	356	42	60.4	15.1	0.7	2.4	2	<0.01

Sample Point - D23

Spring flow to Little Champion Creek along old haul road approximately 1600 ft SE of Sample Point D22

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/94	6.4	108	0	0.30	0.01	0.29	109	332	8	59.4	15.0	0.9	1.5	1	0.04
08/17/94	6.6	130	0	0.36	0.02	<0.13	229	382	<2	67.6	17.9	0.7	1.8	<1	<0.01
09/07/94	6.5	136	0	0.10	0.04	<0.13	99	308	10	57.8	14.9	1.1	1.5	1	<0.01
10/18/94	6.5	164	0	0.19	0.02	<0.13	194	424	<2	69.5	19.4	0.8	2.4	1	<0.01
11/26/94	6.7	152	0	0.11	0.01	<0.13	155	270	6	55.5	14.5	0.9	1.4	1	<0.01

Sample Point - 58

Little Champion Creek approximately 500 ft upstream from SR1050 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.8	58	0	0.30	0.05	0.16	74	220	8	32.0	9.9	2.5	1.7	4	<0.01
06/14/94	7.2	100	0	0.14	0.03	<0.13	126	348	<2	63.7	16.1	3.8	2.8	5	<0.01
07/13/94	6.4	110	0	0.14	0.03	<0.13	155	358	42	59.3	15.8	5.2	2.9	10	<0.01
08/16/94	6.8	54	0	0.27	0.04	<0.13	79	222	<2	32.3	8.6	2.8	2.3	5	<0.01
09/07/94	7.6	66	0	0.24	0.04	<0.13	66	256	10	39.4	11.2	2.5	2.2	4	<0.01
10/18/94	7.2	82	0	0.13	0.03	<0.13	85	264	<2	42.8	9.7	2.3	3.8	5	<0.01

Sample Point - D24

Impounded water along the haul road of the Genovese Coal Co. surface mine MDP 3375SM23 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/20/86	6.1	24	22	<0.30	0.07	<0.50	274	-	<2	-	-	<10.0	-	-	-
09/25/86	4.5	6	18	0.75	0.19	0.69	120	-	14	-	-	<10.0	-	-	-

Sample Point - D25

Pit water - Genovese Coal Co. surface mine MDP 3375SM23 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/25/86	6.3	46	0	0.45	0.17	0.51	148	-	16	-	-	<10.0	-	-	-
06/20/86	6.6	70	0	<0.30	0.51	<0.50	105	-	<2	-	-	<10.0	-	-	-

Sample Point - D26

Toe of spoil discharge - Genovese Coal Co. surface mine MDP 3375SM23 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/25/86	6.2	56	0	<0.30	0.35	<0.50	344	-	<2	-	-	<10.0	-	-	-
09/25/86	6.4	80	0	<0.30	95.60	<0.50	333	-	<2	-	-	<10.0	-	-	-
06/20/86	6.3	70	0	<0.30	0.47	<0.50	150	-	<2	-	-	<10.0	-	-	-

Table 4. (continued)

Sample Point - D27

Pit water - Pine Flats Coal Co. active surface mine SMP 26880133 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/18/91	7.4	74	0	0.33	1.03	<0.50	39	-	4	-	-	<10.0	-	-	-
09/21/93	7.2	172	0	1.13	0.40	1.35	374	-	24	-	-	2.3	-	-	-

Sample Point - D28

Water seepage at northwest portion of the permit area - Pine Flats Coal Co. active surface mine SMP 26880133 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/22/94	6.2	38	17	2.63	11.10	<0.50	350	-	<3	-	-	<10.0	-	-	-

Sample Point - D29

Sedimentation Pond 1 effluent - Pine Flats Coal Co. active surface mine SMP 26880133 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/22/94	7.6	80	0	1.27	0.19	0.95	151	-	12	-	-	<10.0	-	-	-

Sample Point - D30

Water flowing from the highwall of Pine Flats Coal Co. active surface mine SMP 26880133 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/22/94	6.4	60	0	8.07	0.65	<0.13	28	-	8	-	-	-	-	-	-

Sample Point - D31

Pit water - lower coal seam - Pine Flats Coal Co. active surface mine SMP 26880133 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
01/24/92	7.4	148	0	<0.30	0.34	<0.50	271	-	14	-	-	<10.0	-	-	-
02/19/93	7.5	210	0	<0.30	0.98	<0.50	356	-	<2	-	-	<10.0	-	-	-
04/03/93	7.2	194	0	0.32	0.89	<0.50	478	-	14	-	-	<10.0	-	-	-
03/22/94	7.2	236	0	0.38	0.39	0.49	521	-	<3	-	-	2.3	-	-	-
06/23/94	7.1	170	0	0.07	0.54	0.13	214	-	<3	-	-	1.7	-	-	-

Sample Point - D32

Sedimentation Pond 2 effluent - Pine Flats Coal Co. active surface mine SMP 26880133 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/22/94	6.2	13	2	1.43	0.22	1.28	<20	-	<2	-	-	<10.0	-	-	-
04/21/94	6.4	56	0	1.01	0.38	0.80	121	-	6	-	-	<10.0	-	-	-

Sample Point - 59

Unnamed tributary (headwater) to Little Champion Creek flowing from the southwest at T734 (Weyant Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.7	46	0	0.39	0.03	0.37	33	112	18	17.0	6.0	0.9	1.2	1	<0.01
06/14/94	6.6	54	0	0.39	0.03	0.39	38	126	14	22.9	6.5	1.4	1.9	3	<0.01
07/13/94	6.3	62	0	0.46	0.05	0.34	36	98	46	21.1	6.6	1.1	2.3	2	<0.01
08/17/94	6.6	50	0	0.39	0.04	0.37	30	114	4	18.2	5.0	1.0	2.1	2	<0.01
09/07/94	7.0	48	0	0.55	0.06	0.40	39	116	20	18.1	5.4	1.1	2.7	1	<0.01
10/18/94	6.9	64	0	0.23	0.04	0.22	27	146	<2	21.6	5.2	0.8	2.3	2	<0.01

Table 4. (continued)

Sample Point - 60

Unnamed tributary (Sample Point 59) to Little Champion Creek - approximately 1600 ft downstream of Sample Point 59

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.6	36	0	0.56	0.03	0.59	23	100	24	13.9	3.7	3.1	1.1	3	0.01
06/14/94	6.4	34		0.11	0.01	<0.13	46	118	16	22.4	5.0	4.5	1.8	6	0.01
07/13/94	6.1	32	0	0.14	0.02	<0.13	48	130	40	24.7	6.2	5.0	1.7	8	<0.01
08/16/94	6.6	38	0	0.34	0.02	0.38	26	128	<2	16.3	3.3	3.1	1.8	4	<0.01
09/07/94	7.0	36	0	0.12	<0.01	<0.13	<20	88	12	16.3	3.6	3.5	1.6	4	<0.01
10/18/94	6.7	42	0	0.05	<0.01	<0.13	31	140	2	20.8	3.6	3.1	2.5	6	<0.01

Sample Point - D34

Hillside flow exhibiting mine drainage characteristics - along and north of SR1050 approximately 1 mile east of the village of White

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	4.5	6	40	35.80	1.27	6.82	192	376	118	62.5	17.0	0.9	1.8	<1	0.22
08/16/94	3.4	0	144	37.70	2.08	6.08	480	1220	<2	132.0	32.6	1.5	2.4	1	0.42
09/08/94	6.3	32	1	7.37	0.81	<0.13	207	452	6	96.9	25.4	1.4	1.4	<1	<0.01
10/19/94	3.3	0	128	23.70	1.52	5.49	420	972	2	103.0	28.0	0.8	2.2	1	0.31
12/04/94	6.9	54	0	6.70	0.19	1.49	123	282	22	43.5	10.8	1.3	1.2	1	0.06

Sample Point - D33

Hillside flow exhibiting mine drainage characteristics - along and north of SR1050 approximately 1 mile east of the village of White upslope of Sample Point D34

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	6.0	15	36	0.38	0.32	1.46	217	418	18	66.9	16.4	0.5	1.2	1	0.17
07/14/94	6.2	22	3	1.26	0.22	2.56	201	434	36	56.0	14.9	1.0	1.6	1	0.11
09/08/94	6.8	68	0	0.41	0.08	0.25	141	280	6	46.2	11.9	0.6	1.4	<1	0.03
10/19/94	6.6	52	0	6.35	0.15	1.57	223	418	<2	66.0	18.0	0.7	1.5	1	0.06
12/04/94	6.8	74	0	0.63	0.09	0.21	104	240	8	34.6	8.8	0.5	1.2	1	0.02

Sample Point - D35

Mine drainage from Amerikohl Mining Co. reclaimed surface mine, SMP 26880110 "Ritenour I" - post-mining

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/11/91	6.6	96	0	<0.30	2.36	<0.50	167	-	4	-	-	<10.0	-	-	-
03/12/91	6.6	114	0	<0.30	2.12	1.19	186	-	<2	-	-	<10.0	-	-	-
03/30/92	7.2	98	0	0.42	5.32	<0.50	318	-	<2	-	-	<10.0	-	-	-

Sample Point - 61

Unnamed tributary (Sample Point 59) to Little Champion Creek at SR1050 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.6	32	0	0.16	0.03	<0.13	45	144	4	19.0	5.8	3.2	1.1	4	<0.01
06/14/94	6.5	40	0	0.07	0.04	<0.13	110	180	12	32.7	9.1	3.0	1.7	4	0.05
07/13/94	6.2	40	0	0.04	0.01	<0.13	72	168	34	29.7	8.9	2.7	1.8	4	<0.01
08/16/94	6.6	38	0	0.27	0.02	0.22	42	116	<2	18.6	4.3	3.1	1.8	4	<0.01
09/07/94	7.0	36	0	0.07	0.03	<0.13	48	156	4	23.8	6.8	2.8	1.7	3	<0.01
10/18/94	6.7	44	0	6.63	3.11	6.34	64	178	4	77.6	14.0	124.0	3.0	5	0.02

Table 4. (continued)

Sample Point - 62

Little Champion Creek at SR 1050 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.8	56	0	0.41	0.06	0.29	69	202	16	31.1	9.5	2.6	1.7	4	<0.01
06/14/94	7.1	94	0	0.14	0.04	<0.13	174	350	4	60.3	15.4	3.8	2.6	5	0.02
07/13/94	6.5	96	0	0.16	0.02	<0.13	133	358	30	61.8	16.8	5.2	2.8	10	<0.01
08/16/94	6.8	52	0	0.28	0.05	0.17	73	214	<2	30.6	8.1	2.9	2.2	5	0.01
09/07/94	7.5	62	0	0.21	0.03	<0.13	84	218	16	37.3	10.6	2.5	1.8	4	<0.01
10/18/94	7.2	82	0	0.09	0.03	<0.13	87	222	<2	37.9	7.8	2.1	3.3	5	<0.01

Sample Point - 63

Unnamed tributary to Little Champion Creek flowing from the north and through an area disturbed by Pine Flats Coal Co. surface mine SMP 26880113 "Becker"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.3	36	0	1.29	0.05	1.16	42	152	16	19.0	5.4	2.7	1.5	4	<0.01
06/14/94	6.7	62	0	0.41	0.05	0.31	157	342	22	63.9	14.6	4.2	2.2	2	0.02
07/13/94	6.3	64	0	0.34	0.04	0.25	157	330	44	58.7	14.7	4.2	2.0	2	<0.01
08/16/94	6.5	34	0	0.37	0.03	0.34	58	154	10	21.8	5.4	3.2	1.4	5	<0.01
09/07/94	7.0	42	0	0.28	0.02	0.22	71	216	12	31.0	7.9	2.9	1.8	3	<0.01
10/18/94	6.9	60	0	0.26	0.05	<0.13	170	330	14	53.2	9.3	3.0	3.5	2	<0.01

Sample Point - D36

Mine drainage to Little Champion Creek from Pine Flats Coal Co. reclaimed surface mine SMP 26823086T "LaRosa" (above Sedimentation Pond E6) - Approximately 1000 ft upstream of the Little Champion Creek/Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
01/20/89	4.6	9	72	1.79	33.20	4.75	984	-	34	-	-	<10.0	-	-	-
02/23/89	4.3	6	74	9.25	33.20	3.93	1002	-	40	-	-	<10.0	-	-	-
06/15/92	3.1	0	234	35.40	65.60	6.88	1694	-	8	-	-	<10.0	-	-	-
08/13/92	3.3	0	134	3.77	43.90	3.30	1506	-	5	-	-	<10.0	-	-	-
06/16/93	3.5	0	622	125.00	69.40	39.50	1548	-	8	-	-	<10.0	-	-	-

Sample Point - D37

Mine drainage to Little Champion Creek from Pine Flats Coal Co. reclaimed surface mine SMP 26823086T "LaRosa" (ditch east of Sedimentation Pond E6) - Approximately 1000 ft upstream of the Little Champion Creek/Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
01/20/89	3.3	0	468	88.60	102.00	22.50	1974	-	10	-	-	<10.0	-	-	-

Sample Point - 64

Little Champion Creek upstream of a stream bank discharge to Little Champion Creek approximately 500 ft upstream of Little Champion Creek/Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/28/91	7.7	76	0	<0.30	0.24	<0.50	121	-	<2	-	-	<10.0	-	-	-

Sample Point - D38

Stream bank discharge (iron affected) to Little Champion Creek (southwest) approximately 300 ft upstream of Little Champion Creek/Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/28/91	6.7	110	0	26.70	3.82	<0.50	416	-	<2	-	-	<10.0	-	-	-
08/13/92	6.3	94	4	40.70	6.97	<0.50	630	-	<2	-	-	<10.0	-	-	-

Table 4. (continued)

Sample Point - 65

Little Champion Creek downstream of the Sample Point D38 stream bank discharge

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/28/91	7.6	74	0	1.05	0.40	<0.50	117	-	2	-	-	<10.0	-	-	-
05/25/94	6.4	66	0	1.60	0.57	0.16	95	268	18	40.1	13.3	7.4	1.9	20	0.01
06/14/94	6.6	76	0	1.78	0.99	0.26	157	374	14	63.9	18.2	4.5	2.6	5	0.03
07/13/94	6.3	76	0	1.87	1.00	0.21	159	374	32	61.9	18.8	5.2	2.7	11	0.02
08/17/94	6.5	52	0	2.03	0.73	0.16	113	270	<2	38.9	11.7	3.1	2.3	4	<0.01
09/07/94	7.1	54	0	0.84	0.44	<0.13	92	254	10	36.5	11.2	2.7	2.1	4	<0.01
10/18/94	6.7	70	0	0.66	0.24	<0.13	130	290	8	51.0	8.5	3.9	3.4	5	<0.01
04/03/95	6.6	42	0	1.05	0.38	0.19	65	186	<2	32.1	10.1	2.6	1.6	4	<0.01

Sample Point - 66

Champion Creek downstream of Little Champion Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/11/94	6.7	28	0	0.36	0.17	0.20	53			15.6	5.1	6.4	1.3	10	0.01
05/25/94	6.5	48	0	0.33	0.29	0.18	68	188	28	30.0	10.0	12.3	1.7	24	<0.01
06/14/94	6.8	82	0	0.78	0.64	0.23	140	378	10	61.5	17.2	13.5	2.7	20	0.02
07/13/94	6.4	88	0	0.86	0.62	0.14	138	358	26	57.9	17.3	14.3	2.9	26	0.02
08/17/94	6.9	60	0	0.44	0.36	0.15	87	240	2	32.7	9.4	11.7	2.3	20	<0.01
09/07/94	7.3	54	0	0.38	0.28	0.14	65	238	6	28.9	8.7	9.3	2.1	15	<0.01
10/18/94	7.0	80	0	0.48	0.64	<0.13	108	298	<2	46.6	13.7	10.1	3.9	18	0.01

Sample Point - 67

Unnamed tributary (headwater) to Champion Creek flowing from the west at T729 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.4	32	0	0.22	0.01	0.20	<20	72	22	11.5	3.3	0.7	1.0	2	<0.01
06/14/94	6.5	46	0	0.24	0.02	0.25	24	76	14	17.4	4.1	0.9	1.4	2	0.05
07/13/94	6.3	44	0	0.20	0.02	0.20	64	84	34	17.2	4.3	0.9	1.5	1	0.08
08/16/94	6.8	42	0	0.46	0.02	0.53	32	88	16	15.0	3.5	0.9	1.3	2	<0.01
09/07/94	7.0	40	0	0.24	<0.01	0.21	<20	102	2	13.8	3.5	0.9	1.0	2	<0.01
10/18/94	6.8	52	0	0.05	<0.01	<0.13	<20	96	4	18.6	4.2	0.8	2.5	2	<0.01

Sample Point - D39

Mine drainage to an unnamed tributary to the unnamed tributary described at Sample Point 67 - Amerikohl Mining Co. reclaimed surface mine, SMP 26880110 "Ritenour I" - post-mining

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/05/91	6.9	184	0	24.7	7.75	<0.50	42	-	34	-	-	<10.0	-	-	-
03/12/91	6.9	268	0	36.3	10.8	0.96	137	-	54	-	-	<10.0	-	-	-
04/09/91	7.0	164	0	10.7	6.78	<0.50	87	-	92	-	-	<10.0	-	-	-
01/09/92	6.6	270	0	9.92	10.4	<0.50	158	-	26	-	-	<10.0	-	-	-
03/30/92	7.5	278	0	6.05	10.4	<0.50	122	-	27	-	-	<10.0	-	-	-
03/30/92	7.1	258	0	2.01	7.6	<0.50	146	-	8	-	-	<10.0	-	-	-
01/27/93	8.0	290	0	1.42	5.78	<0.50	205	-	12	-	-	<10.0	-	-	-
03/12/93	7.7	274	0	<0.30	5.31	<0.50	195	-	10	-	-	<10.0	-	-	-
03/22/94	6.4	64	0	0.79	2.3	<0.50	64	-	18	-	-	-	-	-	-

Table 4. (continued)

Sample Point - 68

Unnamed tributary to the unnamed tributary described at Sample Point 67 - Approximately 1400 ft downstream of Sample Point 67 - at a mine drainage breakout along T729

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.4	48	0	1.07	0.12	0.25	130			42.5	16.0	1.4	1.6	1	0.01
06/14/94	3.5	0	66	21.90	1.84	1.81	340	482	40	99.4	29.2	18.7	4.1	24	0.22
07/13/94	3.3	0	128	47.90	2.37	2.78	428	996	20	94.1	31.1	6.5	4.7	6	0.34
08/16/94	6.3	30	0	2.74	0.21	0.29	94	202	10	27.6	9.5	1.8	1.7	2	0.02
09/07/94	6.8	48	0	2.34	0.17	0.28	160	362	16	49.0	17.0	1.6	2.8	1	0.04
10/18/94	6.2	28	0	6.82	0.53	0.50	220	446	12	58.8	18.2	5.4	3.3	9	0.05

Sample Point - 69

Western trib. of Puzzle Run, 150 ft. above confluence with eastern ~~head~~ branch tributary to Puzzle Run (local name)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/16/94	6.4	16	0	0.19	<0.01	0.24	26	62	<2	4.9	2.4	0.7	1.3	<1	<0.01
09/07/94	6.3	15	3	0.23	0.02	0.19	<20	10	6	5.5	2.2	0.7	1.1	1	<0.01
10/18/94	6.2	15	0	0.14	0.02	0.21	20	66	<2	5.3	2.3	0.7	1.8	1	<0.01
11/~~20~~22/84	6.3	17	2	1.23	0.08	1.21	<20	58	2	4.6	2.0	0.5	1.3	1	0.01

Sample Point - D40

Acid mine drainage affected eastern tributary to Puzzle Run

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/16/94	3.2	0	186	6.69	6.86	20.10	364	964	4	104.0	15.9	1.1	1.5	2	0.36
09/07/94	3.3	0	164	7.92	6.12	15.90	280	728	<2	63.3	10.8	1.5	0.9	2	0.30
11/25/94	3.5	0	250	6.95	9.98	36.10	296	756	<2	64.8	14.2	1.0	0.9	2	0.47

Sample Point - 70

Puzzle Run - approximately 250 ft upstream from SR1007 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	4.6	7	24	0.33	0.73	2.16	45	114	120	11.1	3.7	0.9	0.8	1	0.05
06/14/94	4.0	3	82	1.02	2.83	11.70	122	402	26	38.5	8.0	1.2	1.7	2	0.20
07/13/94	4.0	2	120	0.12	4.92	16.60	191	604	48	45.0	10.8	1.2	2.1	2	0.30
08/16/94	6.2	11	1	0.16	0.16	0.30	33	56	6	7.9	2.6	0.7	1.0	<1	0.01
09/07/94	4.5	7	30	0.31	0.53	1.26	34	110	2	10.6	3.2	0.7	1.0	<1	0.04
10/18/94	3.7	0	60	0.22	1.88	5.87	113	304	6	23.7	5.4	0.7	1.5	1	0.11
11/25/94	4.7	9	18	0.55	1.02	2.95	55	110	2	11.7	3.7	0.8	0.9	1	0.05

Sample Point - 71

Champion Creek at railroad bridge just downstream of Puzzle Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.5	46	0	0.23	0.19	<0.13	70	224	4	29.3	9.7	10.7	1.4	20	<0.01
06/14/94	6.9	76	0	0.24	0.12	<0.13	181	376	8	61.2	16.8	13.3	2.9	18	0.02
07/13/94	6.4	82	0	0.15	0.08	0.20	170	368	28	49.5	15.9	15.2	2.8	25	0.02
08/17/94	7.0	54	0	0.26	0.18	<0.13	82	238	<2	31.6	9.0	9.9	2.2	16	<0.01
09/07/94	6.5	66	0	0.25	0.18	0.16	70	228	<2	29.1	8.8	9.3	1.9	15	<0.01
10/18/94	7.2	76	0	0.25	0.28	<0.13	118	326	16	42.6	11.8	8.7	3.6	18	<0.01

Table 4. (continued)

Sample Point - D41

Mine drainage - pooled water at the Melcroft underground mine opening - flowing to Champion Creek from the northeast - approximately 2000 ft upstream of PA Route 711 bridge at the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/12/94	3.3	0	82	7.45	3.77	5.36	158	369	3	26.3	11.4	3.4	3.3	1	0.17
05/25/94	3.2	0	100	8.16	4.10	5.87	151	370	14	29.5	13.3	4.3	3.3	<1	0.19
06/16/94	3.1	0	140	6.21	4.58	5.85	197	588	<2	37.1	14.6	5.6	3.9	1	0.19
07/14/94	3.1	0	118	3.26	4.45	5.53	233	522	<2	32.8	13.6	5.6	3.9	1	0.18
08/16/94	3.0	0	104	1.29	4.47	5.65	180	522	8	34.7	13.8	5.7	4.1	1	0.18
09/08/94	3.1	0	102	6.56	0.55	1.71	182	506	4	66.0	17.4	0.6	4.3	<1	0.11
10/19/94	3.1	0	108	0.83	4.16	5.75	196	456	4	31.6	13.6	5.0	5.0	1	0.17
12/04/94	3.2	0	90	1.28	4.07	[illegible] 6.29	181	442	14	30.7	12.9	4.8	4.1	1	0.17

Sample Point - D42

Mine drainage flowing to Champion Creek from the southwest approximately 1100 ft upstream of the PA Route 711 bridge at the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	5.1	7	18	5.24	0.55	0.49	140	274	10	18.9	13.1	1.0	1.6	<1	0.09
06/16/94	3.5	0	76	4.46	1.64	1.20	266	580	20	73.2	22.4	1.1	2.8	1	0.12
07/14/94	3.4	0	56	7.08	2.10	1.37	354	698	18	71.1	22.5	1.7	3.3	1	0.15
08/16/94	3.5	0	40	6.20	1.57	0.96	277	518	<2	58.5	18.5	1.4	2.6	1	0.11
09/08/94	3.7	0	36	5.42	2.01	<0.13	214	472	26	112.0	23.0	14.4	2.3	<1	<0.01
10/19/94	3.3	0	82	13.90	2.95	2.54	410	698	36	91.5	28.1	1.4	5.5	2	0.22
12/04/94	3.8	0	22	3.14	0.94	0.85	177	382	16	41.7	14.0	1.0	1.8	1	0.84

Sample Point - D43

Mine drainage to Champion Creek from the Melcroft mine flume upstream of the PA Route 711 bridge at the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	3.6	0	40	21.50	3.[illegible]92	0.29	240	488	48	67.4	20.9	7.9	2.6	6	0.05
06/16/94	4.5	8	74	34.80	4.54	0.31	386	778	86	98.1	26.3	13.1	4.4	7	0.04
07/14/94	4.9	12	66	45.40	5.25	0.14	522	898	76	99.0	27.5	10.0	4.1	5	0.05
08/17/94	5.6	17	13	18.30	3.10	0.38	244	538	4	65.4	16.7	12.3	3.6	5	0.05
09/08/94	3.9	0	60	1.12	4.51	5.82	394	810	66	34.4	14.6	5.1	4.1	6	0.17
10/19/94	5.1	15	64	44.00	5.55	<0.13	502	796	94	104.0	29.9	15.5	4.8	6	0.03
12/04/94	5.9	26	42	29.10	4.80	0.35	340	726	56	80.9	23.9	9.4	3.8	6	0.05

Sample Point - 72

Champion Creek at PA Routet 711 bridge at the village of Melcroft

DATE	pH,	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.4	38	0	0.96	0.35	0.65	85	236	18	30.9	10.3	8.9	1.3	16	0.02
06/14/94	6.7	40	0	2.63	0.64	1.78	201	438	18	65.1	18.2	12.7	2.9	16	0.13
07/13/94	6.0	32	0	3.47	0.82	2.07	207	424	30	57.0	18.9	14.2	3.1	22	0.08
08/17/94	6.5	40	0	1.91	0.46	9.95	108	258	4	35.0	10.0	9.7	2.4	16	0.04
09/07/94	6.3	42	4	1.19	0.36	0.65	81	240	8	30.9	9.4	9.2	1.9	14	0.03
10/18/94	6.6	44	0	3.22	0.76	1.59	166	360	16	49.1	13.4	8.2	4.0	16	0.07

Table 4. (continued)

Sample Point - D42

Mine drainage flowing to Champion Creek from the southwest approximately 1100 ft upstream of the PA Route 711 bridge at the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	5.1	7	18	5.24	0.55	0.49	140	274	10	18.9	13.1	1.0	1.6	<1	0.09
06/16/94	3.5	0	76	4.46	1.64	1.20	266	580	20	73.2	22.4	1.1	2.8	1	0.12
07/14/94	3.4	0	56	7.08	2.10	1.37	354	698	18	71.1	22.5	1.7	3.3	1	0.15
08/16/94	3.5	0	40	6.20	1.57	0.96	277	518	<2	58.5	18.5	1.4	2.6	1	0.11
09/08/94	3.7	0	36	5.42	2.01	<0.13	214	472	26	112.0	23.0	14.4	2.3	<1	<0.01
10/19/94	3.3	0	82	13.90	2.95	2.54	410	698	36	91.5	28.1	1.4	5.5	2	0.22
12/04/94	3.8	0	22	3.14	0.94	0.85	177	382	16	41.7	14.0	1.0	1.8	1	0.84

Sample Point - D43

Mine drainage to Champion Creek from the Melcroft mine flume upstream of the PA Route 711 bridge at the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	3.6	0	40	21.50	3.82	0.29	240	488	48	67.4	20.9	7.9	2.6	6	0.05
06/16/94	4.5	8	74	34.80	4.54	0.31	386	778	86	98.1	26.3	13.1	4.4	7	0.04
07/14/94	4.9	12	66	45.40	5.25	0.14	522	898	76	99.0	27.5	10.0	4.1	5	0.05
08/17/94	5.6	17	13	18.30	3.10	0.38	244	538	4	65.4	16.7	12.3	3.6	5	0.05
09/08/94	3.9	0	60	1.12	4.51	5.82	394	810	66	34.4	14.6	5.1	4.1	6	0.17
10/19/94	5.1	15	64	44.00	5.55	<0.13	502	796	94	104.0	29.9	15.5	4.8	6	0.03
12/04/94	5.9	26	42	29.10	4.80	0.35	340	726	56	80.9	23.9	9.4	3.8	6	0.05

Sample Point - 72

Champion Creek at PA Route 711 bridge at the village of Melcroft

DATE	pH,	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.4	38	0	0.96	0.35	0.65	85	236	18	30.9	10.3	8.9	1.3	16	0.02
06/14/94	6.7	40	0	2.63	0.64	1.78	201	438	18	65.1	18.2	12.7	2.9	16	0.13
07/13/94	6.0	32	0	3.47	0.82	2.07	207	424	30	57.0	18.9	14.2	3.1	22	0.08
08/17/94	6.5	40	0	1.91	0.46	9.95	108	258	4	35.0	10.0	9.7	2.4	16	0.04
09/07/94	6.3	42	4	1.19	0.36	0.65	81	240	8	30.9	9.4	9.2	1.9	14	0.03
10/18/94	6.6	44	0	3.22	0.76	1.59	166	360	16	49.1	13.4	8.2	4.0	16	0.07

Sample Point - D44

Mine drainage - North side of PA Route 711 - approximately 1100 ft south of the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	6.1	40	1	7.22	1.88	<0.13	334	728	6	123.0	34.3	2.0	3.1	<1	0.11
06/16/94	6.3	48	0	8.22	1.60	0.33	452	868	30	126.0	35.6	1.4	3.5	1	0.06
07/14/94	6.3	54	0	10.70	1.70	0.25	546	896	34	118.0	34.6	1.9	3.5	1	0.08
08/16/94	6.3	46	0	8.68	1.71	0.27	476	900	<2	131.0	36.7	2.0	3.9	1	0.07
09/08/94	6.4	48	0	5.15	1.28	0.83	494	926	32	56.1	19.1	1.0	3.6	1	0.11
10/19/94	6.3	46	0	9.58	1.70	<0.13	534	874	34	128.0	36.5	1.3	4.8	1	0.08
11/26/94	6.2	42	3	10.90	1.66	<0.13	526	878	-	117.0	33.0	1.4	4.5	2	0.08

Sample Point - 73

Unnamed tributary (headwater) to Indian Creek flowing from the northwest - flowing through the Pine Flats Coal Co., SMP 26813036T, surface mine permit area - "Hopewell"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/29/94	6.7	54	0	0.25	0.10	<0.13	45	74	<2	14.0	3.9	1.4	1.0	<1	<0.01
12/04/94	7.2	34	0	0.08	0.02	<0.13	34	80	14	10.8	3.1	0.7	<0.5	1	<0.01

Table 4. (continued)

Sample Point - 74

Unnamed tributary (Sample Point 73) to Indian Creek - approximately 1200 ft downstream of Sample Point 73

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/12/94	7.0	66	0	0.49	0.03	0.39	84	108	14	16.0	4.1	1.5	1.6	1	0.01
08/16/94	6.8	50	0	0.68	0.03	0.45	57	98	2	14.3	3.8	1.5	1.7	1	<0.01
09/09/94	6.8	46	0	0.43	0.03	0.41	<20	70	20	13.9	3.6	1.6	1.3	1	<0.01
09/29/94	7.0	56	0	0.22	0.02	0.16	<20	82	6	15.1	4.7	1.5	2.5	2	<0.01
12/04/94	7.4	40	0	0.27	0.02	0.24	47	84	20	11.3	3.2	1.3	1.2	1	<0.01

Sample Point - D45

Mine drainage flowing into the unnamed tributary (Sample Point 73) approximately 1800 ft downstream of Sample Point 74

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/09/94	6.7	168	0	1.19	1.03	1.19	119	368	28	65.5	20.7	3.9	2.4	<1	<0.01
09/29/94	7.0	222	0	1.27	0.94	0.60	142	494	<2	83.0	26.0	4.2	3.7	1	<0.01

Sample Point - 75

Unnamed tributary (Sample Point 73) to Indian Creek immediately downstream of Sample Point 74

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.7	66	0	0.61	0.06	0.48	31	140	24	24.2	7.2	1.6	1.1	1	<0.01
06/15/94	7.7	104	0	0.26	0.11	0.25	47	186	22	40.8	9.5	2.3	1.7	1	<0.01
07/12/94	6.6	118	0	0.16	0.10	0.17	44	192	22	35.9	9.9	2.9	2.4	2	<0.01
08/16/94	7.3	86	0	0.20	0.08	<0.13	94	150	<2	29.4	6.9	2.9	2.0	2	<0.01
09/09/94	7.3	80	0	0.18	0.05	<0.13	32	172	8	26.5	6.8	2.5	2.4	1	<0.01
09/29/94	7.5	96	0	0.17	0.06	<0.13	37	174	<2	30.2	8.6	3.2	2.4	3	<0.01
12/04/94	7.8	54	0	0.18	0.05	0.16	61	140	10	18.0	4.9	1.8	1.6	2	<0.01

Sample Point - 76

Unnamed tributary (Sample Point 73) to Indian Creek - approximately 2200 ft downstream from Sample Point 75

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/29/94	7.4	100	0	0.09	<0.01	<0.13	48	170	6	33.1	10.2	2.7	2.8	2	<0.01
12/04/94	7.7	56	0	0.12	<0.01	<0.13	62	128	16	20.2	5.7	1.6	1.6	2	<0.01

Sample Point - 77

Unnamed tributary to unnamed tributary (Sample Point 73) to Indian Creek flowing from the west immediately downstream from Sample Point 76

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
12/04/94	6.9	34	0	0.54	0.61	0.17	33	96	14	11.9	3.9	1.1	1.0	1	<0.01

Sample Point - D46

Mine drainage to Indian Creek - roadside ditch along the north side of PA Route 711 approximately 2500 ft south of the village of Melcroft

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/17/94	3.2	0	242	47.00	2.44	13.80	588	1360	24	104.0	36.2	2.9	3.4	3	0.60
07/14/94	3.0	0	232	49.10	2.58	14.70	528	1366	28	105.0	31.8	2.5	3.2	4	0.61
08/16/94	3.1	0	222	29.70	2.24	12.10	530	1272	4	97.9	29.3	2.8	3.4	3	0.57
09/08/94	3.4	0	264	66.60	2.56	14.20	498	1356	34	108.0	35.4	2.5	3.8	3	0.60
10/19/94	3.2	0	234	59.00	2.58	14.50	594	1306	2	111.0	36.0	2.5	4.1	3	0.61
11/26/94	3.4	0	236	55.70	2.17	14.40	486	1090	24	111.0	34.9	3.3	3.9	3	0.64

Table 4. (continued)

Sample Point - 78

Indian Creek immediately upstream from the Sample Point D46 discharge confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/03/94	6.6	30	0	0.37	0.12	0.16	30	152	6	16.5	3.5	16.4	1.2	28	0.06
06/15/94	6.8	32	0	0.40	0.10	0.15	42	130	28	19.7	4.0	15.5	1.2	26	<0.01
07/12/94	6.4	32	0	0.61	0.14	0.21	37	178	8	19.8	4.6	19.2	1.2	35	0.02
09/09/94	6.4	32	0	0.22	0.04	<0.13	27	134	4	11.9	2.0	13.7	1.1	24	<0.01
10/17/94	6.6	36	0	0.99	0.30	0.26	51	186	2	25.4	6.7	14.0	2.2	26	0.02

Sample Point - D47

Mine drainage to Indian Creek - Melcroft underground mine flume "Kalp" discharge at the village of Romney

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/84	3.2	0	300	61.30	2.03	11.60	552	1508	26	126.0	34.5	2.7	5.3	3	0.60
07/01/84	3.2	0	302	63.40	2.10	12.10	588	1574	10	131.0	35.7	2.8	5.2	3	0.59
03/16/94	3.1	0	284	65.90	2.34	13.10	444	1590	20	133.0	33.9	3.5	5.9	4	0.64
05/11/94	3.2	0	188	44.60	1.85	10.90	540	1164	10	140.0	33.6	2.5	5.4	4	0.61
05/25/94	3.2	0	222	45.10	1.86	11.30	487	1120	12	135.0	32.2	3.4	5.2	3	0.52
05/27/94	3.2	0	250	59.60	1.98	11.10	564	1520	8	138.0	33.6	3.3	5.1	4	0.56
06/16/94	3.2	0	268	55.50	1.98	10.80	508	1414	22	138.0	33.1	2.7	5.6	4	0.54
06/28/94	3.2	0	246	60.50	2.01	11.30	552	1492	14	140.0	34.0	3.2	5.3	4	0.56
06/29/94	3.2	0	300	62.30	2.02	11.30	570	1544	14	141.0	34.2	3.2	5.2	3	0.58
07/14/94	3.2	0	254	65.20	2.28	12.30	504	1500	16	123.0	28.4	2.6	5.6	4	0.62
07/21/94	3.2	0	268	67.70	2.23	12.70	600	1474	12	121.0	34.7	2.6	6.2	3	0.57
08/16/94	3.1	0	280	67.60	2.33	13.20	588	1616	<2	136.0	34.3	3.4	5.9	4	0.65
08/22/94	3.2	0	264	57.00	2.06	11.40	540	1474	-	119.0	31.9	2.3	5.2	3	0.52
08/26/94	3.1	0	314	67.30	2.50	14.40	538	1640	-	146.0	38.4	3.5	6.3	3	0.68
09/08/94	3.2	0	262	12.30	1.87	-	226	1612	20	142.0	41.3	1.5	5.9	3	0.09
09/15/94	2.9	0	246	63.60	2.27	12.10	684	1444	12	136.0	35.1	3.3	5.6	3	0.59
09/22/94	3.2	0	300	61.70	1.83	12.30	630	1586	16	130.0	34.1	3.5	6.3	3	0.62
09/29/94	3.2	0	300	69.80	2.31	13.00	570	1530	14	129.0	36.6	2.8	6.9	3	0.63
10/19/94	3.2	0	288	74.50	2.30	13.30	714	1484	14	131.0	33.8	2.8	7.0	3	0.62
11/03/94	3.3	0	304	80.50	2.37	14.00	720	1418	2	127.0	36.5	3.0	6.0	3	0.61
11/26/94	3.2	0	300	77.30	2.34	14.50	660	1366	-	127.0	33.1	2.8	6.7	3	0.56
12/04/94	3.2	0	312	79.50	2.55	14.70	606	1696	14	137.0	36.6	3.5	5.9	3	0.64

Sample Point - D48

Mine drainage to Indian Creek approximately 150 ft south of Sample Point D47 at the village of Romney

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	3.0	0	196	62.40	2.10	4.88	365	928	18	94.4	28.7	3.2	3.0	3	0.58
06/16/94	3.0	0	274	66.80	2.34	5.17	418	1334	56	105.0	28.9	3.2	3.1	2	0.61
07/14/94	3.1	0	194	67.80	2.43	4.94	366	1124	36	86.5	22.4	2.8	3.0	2	0.57
08/16/94	3.2	0	216	76.80	2.56	5.82	464	1206	2	108.0	29.7	3.9	3.5	3	0.63
09/08/94	3.2	0	236	61.10	2.36	13.30	488	1340	30	142.0	37.2	2.9	4.1	3	0.60
10/19/94	3.1	0	250	78.80	2.52	5.68	558	-	-	108.0	30.6	3.4	5.5	3	0.63
12/04/94	3.2	0	168	47.30	1.82	4.15	332	986	22	82.5	23.8	3.3	3.3	3	0.46

Sample Point - 79

Unnamed tributary to Indian Creek flowing fron the north - at a farm road crossing approximately 1200 ft upstream from PA Route 711 at the village of Romney

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	5.9	10	4	0.24	0.01	0.32	<20	52	6	3.5	1.5	0.6	<0.5	<1	0.01
06/15/94	6.1	14	5	0.60	0.05	0.60	<20	42	36	4.7	1.6	0.7	1.0	1	0.03
08/16/94	5.9	12	1	0.06	<0.01	<0.13	<20	32	26	4.3	1.5	0.5	1.0	<1	<0.01
09/09/94	5.8	10	14	0.42	0.02	0.49	<20	60	12	3.4	1.3	0.5	0.9	<1	<0.01
09/29/94	6.1	12	10	0.11	0.01	<0.13	<20	38	<2	3.6	1.6	0.4	1.0	<1	<0.01
12/04/94	6.5	12	0	0.05	<0.01	<0.13	<20	50	14	3.4	1.4	0.4	0.8	1	<0.01

Table 4. (continued)

Sample Point - D49

Mine drainage to Indian Creek approximately 500 ft south of the unnamed tributary at Sample Point 79

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/30/94	4.5	6	11	2.28	0.15	0.49	81	182	20	21.9	8.1	3.4	1.2	2	0.09
07/14/94	4.0	2	17	2.81	0.19	0.55	119	-	4	23.1	8.0	2.5	1.2	1	0.09
08/16/94	4.4	5	13	5.65	0.19	1.57	126	274	2	29.9	10.1	3.9	1.8	2	0.12
09/08/94	4.6	7	28	1.72	0.10	0.39	66	164	34	16.7	6.3	2.2	1.3	1	0.07
10/19/94	4.3	6	24	3.61	0.32	0.59	178	340	<2	37.4	11.2	9.7	2.7	8	0.18

Sample Point - 80

Indian Creek at the village of Davistown - Approximately 100 ft upstream from the Wash Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.1	17	0	3.00	0.24	0.79	61	192	12	22.4	5.8	18.9	1.2	32	0.05
06/15/94	6.3	20	3	2.28	0.21	0.59	79	208	30	26.6	5.9	14.5	1.7	25	0.04
07/12/94	6.1	22	0	2.27	0.23	0.50	70	204	22	25.3	6.2	18.3	1.6	32	0.03
09/09/94	6.0	17	4	0.52	0.15	0.21	68	230	8	17.2	4.3	13.1	1.2	23	<0.01
10/17/94	6.3	24	0	3.23	0.37	0.65	84	222	10	29.1	7.5	12.4	2.4	23	0.05
11/26/94	6.1	20	0	2.62	0.23	0.70	56	130	<2	16.5	4.1	8.8	1.5	17	0.02

Sample Point - 81

Wash Run (headwater) approximately 1.10 miles upstream from PA Route 711 at the village of Davistown

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.3	26	0	0.33	0.04	0.33	<20	58	8	7.2	2.2	1.2	0.6	<1	0.01
06/15/94	6.8	46	0	0.18	0.02	0.18	20	66	20	13.4	3.1	2.7	0.9	1	0.02
07/12/94	6.4	64	0	0.35	0.03	0.37	<20	94	10	15.4	4.1	4.0	1.0	1	<0.01
09/08/94	6.4	38	0	0.21	0.02	0.18	<20	58	12	10.1	2.7	2.3	1.8	<1	<0.01
10/17/94	6.9	66	0	0.11	0.01	<0.13	29	104	10	17.7	4.7	3.9	1.3	1	<0.01

Sample Point - 82

Wash Run - approximately 0.59 mile downstream from Sample Point 81

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.3	26	0	0.88	0.04	0.96	<20	82	10	8.3	2.4	0.7	0.8	1	0.01
06/15/94	6.8	38	0	0.29	0.03	0.26	<20	54	26	12.3	2.8	1.5	1.3	1	<0.01
07/12/94	6.5	44	0	0.95	0.04	0.94	30	76	16	12.0	3.2	1.8	1.4	1	0.03

Sample Point - 83

Wash Run - approximately 0.38 mile downstream from Sample Point 82

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.3	24	0	1.02	0.03	1.10	<20	52	28	8.2	2.4	0.8	<0.5	<1	0.01
06/15/94	6.8	36	0	0.31	0.03	0.27	<20	56	26	12.0	2.8	1.5	1.3	1	<0.01
07/12/94	6.4	40	0	0.72	0.03	0.73	<20	26	24	11.7	3.2	1.6	1.2	1	0.01

Table 4. (continued)

Sample Point - D50

Mine drainage to Wash Run - approximately 500 ft upstream from PA Route 711 at the village of Davistown

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/25/94	3.5	0	76	3.30	0.61	6.24	204	310	22	32.9	13.6	4.7	2.6	2	0.25
06/16/94	3.4	0	132	3.11	0.89	9.29	236	566	16	46.5	17.5	5.5	3.6	2	0.34
07/14/94	3.3	0	118	4.89	0.95	9.98	225	642	2	40.3	14.0	5.4	3.5	3	0.35
08/16/94	3.2	0	150	10.40	1.00	12.70	286	748	<2	49.9	18.7	7.4	3.8	3	0.36
09/08/94	3.2	0	174	13.70	0.92	13.30	546	824	8	43.9	20.4	6.8	3.7	3	0.33
10/19/94	3.1	0	196	11.90	1.13	16.80	310	788	28	56.0	22.1	7.8	5.0	3	0.37
11/26/94	3.2	0	212	26.90	0.99	17.10	330	808		52.2	19.5	8.2	4.9	3	0.31

Sample Point - 84

Wash Run - approximately 200 ft downstream from Sample Point D50

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.4	26	0	0.86	0.06	0.82	<20	52	26	8.7	2.5	0.9	0.8	<1	0.01
06/15/94	6.6	36	0	0.45	0.07	0.39	27	90	20	14.4	3.2	1.5	1.3	1	0.02
07/12/94	6.4	42	0	0.75	0.08	0.59	<20	94	14	14.6	3.5	1.8	1.3	1	0.01
09/08/94	6.3	30	6	0.69	0.10	0.75	25	102	12	13.4	3.5	1.4	1.2	<1	0.02
10/17/94	6.6	38	0	0.57	0.14	0.95	30	120	10	19.1	5.4	2.0	2.4	2	0.04

Sample Point - 85

Indian Creek - approximately 1000 ft downstream from Wash Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/11/94	6.5	18	0	0.84	0.11	0.37	20	92	24	11.9	2.8	8.1	0.9	15	0.02

Sample Point - D51

Mine drainage from the Sagamore underground mine to Indian Creek at the village of Sagamore

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/19/94	3.1	0	886	165.00	3.47	57.40	1160	2404	<2	61.9	44.6	2.8	3.7	2	1.45
12/04/94	3.2	0	638	160.00	3.06	54.80	558	2134	18	52.4	37.2	2.5	1.4	1	1.30

Sample Point - 86

Neals Run along T725 approximately 750 ft upstream from the Trout Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.4	20	0	0.10	0.01	0.14	<20	40	12	8.9	1.2	0.9	0.6	2	<0.01
06/15/94	6.5	28	0	0.11	0.01	0.21	<20	44	12	10.7	1.1	1.1	1.1	1	<0.01
07/12/94	6.4	28	0	0.15	0.02	0.14	21	50	14	9.7	1.4	1.3	0.8	2	0.03
10/17/94	6.6	32	0	0.02	<0.01	<0.13	<20	62	<2	10.2	1.4	1.1	0.9	2	<0.01
11/26/94	6.4	26	0	0.01	<0.01	<0.13	<20	36	<2	8.6	1.0	0.9	1.0	2	<0.01

Sample Point - 87

Unnamed tributary to Neals Run approximately 20 ft upstream from the Neals Run confluence at T725

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.7	36	0	0.32	0.03	0.33	<20	48	20	14.9	2.2	3.1	0.7	4	<0.01
06/15/94	6.7	54	0	0.17	0.02	0.21	21	88	14	20.1	2.3	3.1	1.3	3	<0.01
07/12/94	6.7	62	0	0.24	0.03	0.22	28	88	14	19.5	2.5	3.6	0.8	5	0.01
10/17/94	6.9	64	0	0.03	<0.01	<0.13	<20	106	<2	20.8	2.8	4.1	1.0	7	<0.01

Table 4. (continued)

Sample Point - 88

Trout Run approximately 250 ft upstream from SR1054 bridge crossing over Back Creek

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.5	24	0	0.16	0.02	0.16	<20	72	12	12.1	1.7	6.9	0.8	15	<0.01
06/15/94	6.5	30	0	0.16	0.02	0.23	<20	104	14	14.0	1.5	7.2	1.2	15	<0.01
07/12/94	6.4	32	0	0.14	0.01	<0.13	<20	116	6	14.9	1.9	9.0	1.0	22	0.01
10/17/94	6.6	34	0	0.04	<0.01	<0.13	<20	122	<2	13.8	1.8	7.3	1.1	19	<0.01
11/26/94	6.4	28	0	0.02	<0.01	<0.13	<20	72	<2	10.2	1.3	5.0	1.1	13	<0.01

Sample Point - 89

Unnamed tributary to Back Creek flowing from the northeast at SR1058 (County Line Road) bridge crossing over the unnamed tributary

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/17/94	4.7	8	8	0.28	0.22	0.31	<20	32	<2	1.5	1.3	0.4	<0.5	1	0.05
11/26/94	4.8	8	6	0.04	0.12	0.23	<20	38	8	1.8	1.4	0.5	0.7	<1	0.05

Sample Point - 90

Unnamed tributary (Sample Point 89) to Back Creek approximately 50 ft upstream from the T729 (Nebo Road) bridge crossing over the unnamed tributary

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/09/94	5.9	10	6	0.11	0.03	<0.13	<20	68	12	4.9	1.6	13.2	<0.5	22	<0.01
10/17/94	6.1	12	5	0.05	0.04	<0.13	<20	106	6	5.8	2.0	17.6	1.4	36	0.01

Sample Point - 91

Back Creek at T727 [redacted] (Stanton Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.5	24	0	0.14	0.01	<0.13	<20	54	16	11.1	1.6	4.1	0.8	9	<0.01
06/15/94	6.5	32	0	0.13	0.02	0.17	<20	80	20	13.6	1.4	4.3	1.1	9	<0.01
07/12/94	6.5	42	0	0.09	<0.01	<0.13	<20	80	14	13.9	1.8	5.3	1.0	9	<0.01
09/07/94	6.9	32	0	0.15	0.02	0.15	<20	110	2	13.8	1.9	7.3	1.2	10	<0.01
10/17/94	6.7	38	0	0.05	0.01	<0.13	<20	94	<2	13.2	1.7	4.2	1.4	10	<0.01

Sample Point - D52

Underground mine discharge at the northern end of the affected area of Better Mining Co., Inc. MDP 3375SM30 reclaimed (1983) surface mine - "Pritts" - Upper Freeport coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/13/93	6.7	48	0	2.05	0.06	<0.50	125	-	20	-	-	<10.0	-	-	-
12/16/93	6.3	70	0	<0.30	<0.05	<0.50	100	-	10	-	-	<10.0	-	-	-
06/15/92	6.9	54	0	0.66	<0.05	<0.50	137	-	5	-	-	<10.0	-	-	-

Sample Point - D53

Toe of spoil discharge at the northwest side of the affected area of Better Mining Co., Inc., MDP 3375SM30 reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/15/92	6.9	42	0	2.53	0.81	<0.50	232	-	40	-	-	<10.0	-	-	-
08/27/92	7.4	56	0	0.88	0.35	<0.50	239	-	19	-	-	<10.0	-	-	-
10/15/92	6.4	56	0	2.72	2.60	0.93	245	-	58	-	-	<10.0	-	-	-

Table 4. (continued)

Sample Point - D54

Main discharge in a collection ditch - (LTM3) - Better Mining Co., Inc., MDP 3375SM30, reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
6/15/92	5.3	11	22	5.44	2.86	0.73	153	-	6	-	-	<10.0	-	-	-
7/13/92	5.3	15	24	7.72	3.06	0.53	194	-	6	-	-	<10.0	-	-	-
8/27/92	5.5	20	24	11.30	3.31	0.53	206	-	9	-	-	<10.0	-	-	-
10/15/92	5.6	19	24	8.91	3.17	0.61	180	-	<2	-	-	<10.0	-	-	-
12/22/92	5.4	14	26	9.47	3.06	0.80	181	-	17	-	-	<10.0	-	-	-
1/20/93	5.5	22	26	11.20	3.83	<0.50	220	-	8	-	-	<10.0	-	-	-
2/25/93	5.5	22	28	10.50	4.08	<0.50	226	-	4	-	-	<10.0	-	-	-
4/13/93	5.7	20	24	9.48	3.61	<0.50	206	-	4	-	-	<10.0	-	-	-
6/24/93	4.5	13	14	1.85	3.34	<0.50	206	-	<3	-	-	<10.0	-	-	-
9/28/93	4.9	10	14	4.61	2.27	0.69	126	-	34	-	-	<10.0	-	-	-
10/22/93	5.0	12	24	7.07	3.54	0.66	189	-	<3	-	-	<10.0	-	-	-
12/16/93	5.6	24	30	9.25	3.35	<0.50	186	-	12	-	-	<10.0	-	-	-
1/28/94	5.4	10	14	1.97	0.92	<0.50	74	-	-	-	-	<10.0	-	-	-
4/01/94	5.6	12	9	3.35	1.40	<0.50	86	-	26	-	-	<10.0	-	-	-
4/20/94	5.7	22	32	9.61	3.48	0.52	184	-	4	-	-	<10.0	-	-	-
6/28/94	5.2	8	30	5.85	3.36	<0.50	152	-	16	-	-	<10.0	-	-	-
8/18/94	5.1	13	44	3.78	2.56	0.67	178	-	8	-	-	<10.0	-	-	-
9/29/94	6.0	20	28	14.20	3.16	0.16	226	424	12	42.4	20.1	1.0	2.9	-	<0.01

Sample Point - D55

Sedimentation Pond - (LTM4 - northernmost) - Better Mining Co., Inc., MDP 3375SM30, reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/15/92	4.5	4	11	<0.30	3.52	<0.50	166	-	<2	-	-	<10.0	-	-	-
08/27/92	5.7	9	0	<0.30	4.28	<0.50	196	-	6	-	-	<10.0	-	-	-
01/20/93	4.7	8	14	0.61	2.83	<0.50	207	-	9	-	-	<10.0	-	-	-
04/20/94	6.5	34	0	<0.30	1.12	<0.50	102	-	<3	-	-	<10.0	-	-	-
06/28/94	5.9	11	22	1.47	5.54	<0.50	131	-	14	-	-	<10.0	-	-	-
08/18/94	6.4	26	0	1.36	2.07	<0.50	103	-	<3	-	-	<10.0	-	-	-

Sample Point - D56

Underground mine discharge (LTM5) - south of Sample Point D55 - Better Mining Co., Inc., MDP 3375SM30, reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/13/92	6.3	60	0	11.20	7.47	<0.50	211	-	<2	-	-	<10.0	-	-	-
08/27/92	6.0	52	13	12.00	6.80	<0.50	204	-	6	-	-	<10.0	-	-	-
10/15/92	6.2	64	12	11.80	6.59	<0.50	222	-	<2	-	-	<10.0	-	-	-
02/25/93	6.1	36	0	<0.30	0.83	<0.50	123	-	<2	-	-	<10.0	-	-	-
04/13/93	6.3	38	0	<0.30	0.40	<0.50	129	-	6	-	-	<10.0	-	-	-
09/28/93	5.8	36	15	0.83	2.63	<0.50	124	-	14	-	-	<10.0	-	-	-
12/16/93	6.1	44	0	<0.30	0.20	<0.50	87	-	10	-	-	<10.0	-	-	-
04/01/94	6.0	24	0	<0.30	0.20	<0.50	82	-	14	-	-	<10.0	-	-	-
06/28/94	5.9	52	9	12.10	5.50	<0.50	146	-	10	-	-	<10.0	-	-	-
08/18/94	6.1	32	8	0.69	1.31	<0.50	111	-	12	-	-	<10.0	-	-	-

Sample Point - D57

Mine drainage - (LTM9) - in the hollow between middle and southern sedimentation ponds - Better Mining Co., Inc. MDP 3375SM30, reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/13/92	7.4	96	0	1.99	5.52	0.68	426	-	51	-	-	<10.0	-	-	-
06/28/94	6.4	88	0	9.62	5.16	<0.50	219	-	34	-	-	<10.0	-	-	-
08/18/94	6.6	66	0	3.45	2.31	<0.50	164	-	<3	-	-	<10.0	-	-	-

Table 4. (continued)

Sample Point - D58

Mine drainage along T723 at the southern end of affected area Better Mining Co., Inc., MDP 3375SM30 reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/15/92	4.0	0	70	0.44	7.68	4.68	454	-	<2	-	-	<10.0	-	-	-
06/24/93	6.4	22	0	1.23	1.24	<0.50	276	-	10	-	-	<10.0	-	-	-
06/29/93	4.0	3	26	1.60	9.78	2.44	702	-	16	-	-	<10.0	-	-	-

Sample Point - 92

Back Creek at T723 (Dahl Road) bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/27/94	6.5	26	0	0.10	0.01	<0.13	<20	58	16	11.3	7.8	4.1	0.8	8	<0.01
06/15/94	6.6	34	0	0.13	0.02	<0.13	<20	82	6	13.7	1.5	4.2	1.3	8	<0.01
07/12/94	6.9	44	0	0.12	0.01	<0.13	29	80	8	14.1	1.9	5.4	0.7	9	0.02
09/09/94	6.9	32	0	0.09	0.01	<0.13	<20	114	4	12.9	1.7	4.7	1.3	9	<0.01
10/17/94	6.7	38	0	0.04	0.02	<0.13	<20	94	<2	13.9	1.9	4.2	1.4	10	<0.01

Sample Point - 93

Indian Creek at the SR1054 bridge crossing at the village of Indian Head

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/11/94	6.6	20	0	0.53	0.07	0.26	<20	82	4	10.7	2.3	6.0	0.9	10	<0.01
05/27/94	6.3	24	0	0.81	0.11	0.27	33	98	20	15.7	3.5	13.0	1.2	22	0.02
06/15/94	6.4	20	0	0.95	0.22	0.17	73	192	16	25.4	5.3	11.7	1.7	20	0.02
07/12/94	6.1	20	0	1.21	0.26	<0.13	78	200	4	25.8	6.2	14.3	1.4	25	0.04
09/09/94	6.2	24	0	1.35	0.28	0.21	48	160	18	20.0	5.3	10.9	1.1	21	0.02
10/17/94	6.3	24	0	1.37	0.35	<0.13	88	194	<2	28.0	6.8	11.6	2.5	22	0.04
11/26/94	6.3	24	0	1.10	0.15	0.29	39	86	<2	13.7	3.1	7.6	1.3	14	0.01

Sample Point - 94

Unnamed tributary to Indian Creek flowing from the northwest at PA Route 711 bridge crossing - approximately 0.60 mile south of the village of Indian Head

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/26/94	6.4	28	0	0.56	0.02	0.53	<20	90	20	11.3	3.3	2.0	0.9	2	0.01
06/15/94	6.8	40	0	0.15	<0.01	<0.13	30	106	12	15.8	3.9	2.2	1.7	2	<0.01
07/12/94	6.3	48	0	0.67	0.02	0.87	27	100	48	15.1	4.2	2.9	1.9	4	0.02
09/08/94	6.3	36	0	0.37	0.01	0.33	20	108	6	14.5	3.7	2.5	1.6	3	<0.01
10/17/94	6.6	42	0	0.21	0.05	0.15	25	104	18	16.6	4.4	2.5	3.4	5	0.02

Sample Point - D59

Underground mine discharge to Indian Creek - Gallentine Mine opening - between PA Route 711 and Indian Creek approximately 1.04 miles south of the village of Indian Head

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/21/94	3.9	0	136	53.50	1.70	4.10	342	784	10	69.9	26.0	3.1	4.5	3	0.23
08/12/94	3.9	0	132	55.30	1.57	3.50	334	812	8	77.3	25.5	3.4	4.0	3	0.21
08/16/94	3.9	0	130	57.10	1.71	3.58	396	918	<2	82.1	25.7	3.3	4.2	3	0.18
09/08/94	4.1	4	144	59.20	1.75	3.24	378	888	10	84.9	26.0	3.8	4.1	3	0.21
10/19/94	4.0	3	132	56.10	1.68	3.07	430	828	<2	84.0	26.2	3.2	4.8	3	0.20
12/04/94	4.1	5	140	58.40	1.70	3.32	406	902	14	83.2	25.6	3.8	4.4	3	0.20

Table 4. (continued)

Sample Point - 95

Indian Creek 50 ft upstream from the Poplar Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/09/94	6.5	24	0	0.74	0.18	0.20	47	168	14	20.5	5.0	12.2	1.3	20	<0.01
10/17/94	6.3	22	0	0.87	0.34	0.19	83	222	<2	26.6	7.1	11.5	2.6	22	0.04

Sample Point - 96

Poplar Run (headwater) at T830 bridge crossing west of the village of Clinton

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/21/80	5.9	10	0	0.07	0.89	0.10	45	-	-	-	-	-	-	-	-
09/08/94	6.0	10	4	0.23	0.08	0.26	24	36	12	5.2	1.7	1.4	0.9	3	<0.01
10/21/94	6.2	19	2	0.19	0.04	<0.13	25	60	<2	6.7	1.7	2.0	2.1	4	0.02

Discharge area associated with the Nicholson and Shepler surface mine on the Brookville-Clarion coal, MDP 3375SM14. This area is now backfilled and part of an Abandoned Mine Land reclamation site

Sample Point - D60

Mine drainage at a 4" French drain at the V. Hawk residence foundation

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/21/80	3.0	0	179	23.70	12.60	4.60	400	-	-	-	-	-	-	-	-
06/08/81	3.1	0	282	81.80	18.32	4.60	410	-	-	-	-	-	-	-	-

Sample Point - D61

Spring at the toe of spoil - in the middle of the disturbed area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/21/80	4.3	0	38	0.69	1.60	2.60	70	-	-	-	-	-	-	-	-

Sample Point - D62

Mine drainage below the 4 mailboxes at the T830/T719 intersection

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
01/27/81	4.2	0	41	0.43	1.33	-	48	-	-	-	-	-	-	-	-

Sample Point - D63

Toe of spoil discharge

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/08/81	2.9	0	270	20.33	20.42	9.34	405	-	-	-	-	-	-	-	-

Table 4. (continued)

Discharge area associated with the now backfilled Rondell Coal Co. surface mine, MDP 3373SM17 - "Correal" Brookville-Clarion coal

Sample Point - D64

Mine drainage to Poplar Run from the ~~north central~~ southeast part of the affected area (MP-10(A3)) near T828

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/18/88	4.9	7	16	<0.30	0.43	<0.5	54	-	6	-	-	<10.0	-	-	-

Sample Point - D65

Mine drainage to Poplar Run at the old haul road at T828/SR1050 intersection

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/19/93	4.6	10	40	<0.30	4.67	6.57	201	-	<3	-	-	<10.0	-	-	-
04/05/95	4.5	10	116	0.37	21.30	9.11	423	720	28	81.0	40.0	7.0	2.3	6	0.95

Sample Point - D66

Runoff from the main erosion area at T828

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
01/12/93	3.8	0	96	20.60	5.82	28.60	90	-	-	-	-	<10.0	-	-	-

Sample Point - D67

Toe of spoil discharge to Newmyer Run at a pipe drain - T828

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/17/88	2.7	0	2100	225.00	221.00	158.00	4081	-	<2	-	-	<10.0	-	-	-
09/26/88	2.9	0	892	96.60	93.40	84.90	1722	-	<2	-	-	<10.0	-	-	-
10/18/88	2.8	0	2080	262.00	201.00	207.00	3190	-	16	-	-	<10.0	-	-	-
11/15/88	2.9	0	1242	143.00	113.00	99.80	1932	-	20	-	-	<10.0	-	-	-
01/12/89	2.9	0	1758	270.00	150.00	153.00	2387	-	<2	-	-	<10.0	-	-	-
01/12/89	3.0	0	660	86.20	58.30	68.90	996	-	182	-	-	<10.0	-	-	-
04/05/95	2.8	0	1598	73.40	62.00	81.70	1468	5118	12	144.0	121.0	1.6	0.9	2	3.29

Sample Point - D68

Discharge to Newmyer Run from a pond at the ~~western~~ eastern part of the affected area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/17/88	2.7	0	1480	95.10	136.00	133.00	3014	-	<2	-	-	<10.0	-	-	-
10/18/88	3.1	0	832	111.00	110.00	104.00	1590	-	4	-	-	<10.0	-	-	-
01/12/89	3.2	0	506	57.90	52.50	48.80	960	-	<2	-	-	<10.0	-	-	-

Sample Point - D69

Drainage from an old test hole (reported as the Brookville coal)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/30/73	3.5	0	54	0.20	-	-	160	-	0	-	-	-	-	-	-

Table 4. (continued)

Discharge area to Poplar Run associated with the now backfilled Charles Kravetsky surface mine, MDP 3377SM27 "Nicholson"

Sample Point - D70

Toe of spoil discharge

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/02/81	4.8	0	8	0.09	1.01	1.00	46	-	-	-	-	-	-	-	-
03/03/81	4.1	0	123	0.47	1.21	5.50	76	-	-	-	-	-	-	-	-
03/17/82	4.3	0	50	0.23	3.30	10.50	168	-	-	-	-	-	-	-	-
03/03/81	3.5	0	145	5.28	2.64	8.10	280	-	-	-	-	-	-	-	-
05/18/81	3.0	0	126	12.02	2.48	3.28	170	-	-	-	-	-	-	-	-

Sample Point - D71

Diffuse seep area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/02/81	3.5	0	197	6.60	10.90	33.00	360	-	-	-	-	-	-	-	-
03/02/81	4.0	0	129	0.44	2.88	17.10	174	-	-	-	-	-	-	-	-
05/18/81	3.9	0	100	0.90	2.76	11.50	-	-	-	-	-	-	-	-	-

Sample Point - D72

Discharge to Poplar Run at the treatment pond sump

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/12/83	3.0	0	582	62.56	24.84	1.79	600	-	36	-	-	-	-	-	-
10/14/83	2.9	0	636	110.77	9.44	1.12	450	-	-	-	-	-	-	-	-
11/22/83	2.9	0	492	146.68	8.86	1.94	720	-	-	-	-	-	-	-	-
01/03/84	3.0	0	554	223.44	9.96	1.98	670	-	-	-	-	-	-	-	-
02/07/84	3.0	0	554	220.59	10.15	1.50	744	-	100	-	-	-	-	-	-
10/16/84	3.1	0	472	214.00	9.40	2.80	840	-	20	-	-	-	-	-	-
03/11/85	3.3	0	418	232.40	9.78	2.90	678	-	24	-	-	-	-	-	-
03/11/85	3.3	0	418	232.00	8.79	2.91	678	-	24	-	-	-	-	-	-
05/15/85	3.3	0	492	245.67	8.61	4.31	816	-	32	-	-	-	-	-	-

Discharge area associated with the now backfilled C & A Coal Co. [redacted] surface mine, MDP 3375SM12 "Secrist"

Sample Point - D73

Pit water quality - various areas

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/06/78	3.2	0	360	7.50	-	-	600	-	-	-	-	-	-	-	-
06/06/78	3.0	0	1000	15.20	-	-	690	-	-	-	-	-	-	-	-
06/06/78	4.1	0	52	0.10	-	-	450	-	-	-	-	-	-	-	-
11/17/78	3.7	0	150	1.55	-	-	345	-	-	-	-	-	-	-	-

Sample Point - D74

Toe of spoil discharge

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/06/78	7.0	15	0	1.50	-	-	330	-	-	-	-	-	-	-	-

Table 4. (continued)

Sample Point - D75

Toe of spoil discharge northern area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/06/78	3.5	0	210	1.10	-	-	450	-	-	-	-	-	-	-	-
06/06/78	3.8	0	150	0.80	-	-	375	-	-	-	-	-	-	-	-

Sample Point - D76

Treatment pond water

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/06/78	4.1	0	40	0.05	-	-	134	-	-	-	-	-	-	-	-

Sample Point - D77

Flow from a small pond in a mine spoil area

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/06/78	3.2	0	300	7.00	-	-	375	-	-	-	-	-	-	-	-
11/17/78	3.1	0	64	2.80	-	-	630	-	-	-	-	-	-	-	-

Sample Point - D78

Pit water at a southeast pit

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/06/78	3.2	0	280	3.50	-	-	540	-	-	-	-	-	-	-	-
11/17/78	3.4	0	300	2.50	-	-	525	-	-	-	-	-	-	-	-

Sample Point - 97

Unnamed tributary (headwater) to Poplar Run at the eastern terminus of T719 - downslope of the Bureau of Abandoned Mine Reclamation site

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/08/94	4.3	7	28	0.62	10.30	0.92	235	462	6	47.2	23.1	1.6	2.9	3	0.17
10/21/94	6.2	26	1	0.75	6.80	<0.13	173	302	<2	39.0	16.0	1.5	6.7	7	0.05
04/05/95	5.3	10	17	0.47	3.40	0.51	87	214	10	22.5	10.4	1.1	1.7	4	0.09

Sample Point - 98

Poplar Run at T834 bridge crossing, south of the village of Clinton

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	4.5	9	24	0.20	2.82	1.50	110	268	8	25.9	11.5	2.2	1.9	5	0.22
07/13/94	4.5	7	132	0.34	3.55	1.32	100	270	12	23.5	10.3	2.0	1.7	4	0.20
09/08/94	4.8	8	10	0.25	1.28	0.41	60	140	14	16.2	6.4	2.0	1.5	3	0.07
10/21/94	5.4	9	7	0.37	1.36	0.37	51	166	<2	17.7	6.3	2.1	3.9	7	0.08
12/04/94	5.3	9	1	0.25	0.75	0.39	41	138	14	11.9	4.7	1.9	1.1	3	0.07

Table 4. (continued)

Sample Point - D79

Underground mine drainage to Poplar Run monitored (MP11) in conjunction with Purco Coal Co. active surface mine, SMP 26703078 (MDP 3370BSM23) "Layman"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
12/19/79	5.1	4	41	0.18	5.19	-	337	-	25	-	-	-	-	-	-
10/03/80	5.1	40	3	0.80	3.41	-	675	-	-	-	-	-	-	-	-
09/23/81	4.7	1	36	0.18	6.93	-	570	-	1	-	-	-	-	-	-
12/14/81	4.7	1	64	1.82	8.50	-	990	-	-	-	-	-	-	-	-
12/22/87	5.9	30	18	0.33	0.33	1.57	498	-	8	-	-	-	-	-	-
02/26/88	6.1	34	0	<0.30	0.10	1.10	528	-	84	-	-	-	-	-	-
05/25/88	6.4	30	0	0.62	0.16	1.48	439	-	8	-	-	-	-	-	-
06/24/88	6.0	24	4	<0.30	0.21	1.21	606	-	2	-	-	-	-	-	-
09/28/88	4.8	11	58	<0.30	0.40	7.41	738	-	10	-	-	-	-	-	-
11/30/88	4.7	11	72	0.89	0.47	8.38	624	-	8	-	-	-	-	-	-
01/24/89	6.1	19	0	<0.30	0.28	1.20	606	-	12	-	-	-	-	-	-
05/22/89	6.7	32	0	<0.30	0.05	<0.50	570	-	7	-	-	-	-	-	-
12/28/89	4.2	5	92	1.27	0.57	13.60	864	-	8	-	-	-	-	-	-
08/24/90	6.7	18	0	1.45	0.15	1.53	351	-	81	-	-	-	-	-	-
03/20/91	5.1	11	14	0.00	0.69	0.44	552	-	21	-	-	-	-	-	-
04/09/91	5.6	15	12	0.89	0.45	3.91	462	-	19	-	-	-	-	-	-
07/19/91	4.4	8	72	0.60	0.88	11.90	672	-	6	-	-	-	-	-	-
10/28/91	4.6	11	86	<0.30	1.44	13.10	780	-	3	-	-	-	-	-	-
01/28/92	4.9	10	26	0.40	0.52	5.38	504	-	8	-	-	-	-	-	-
06/29/92	4.8	10	38	<0.30	0.66	5.60	798	-	5	-	-	-	-	-	-
12/17/92	4.8	11	40	1.10	0.73	9.58	660	-	29	-	-	-	-	-	-
02/19/93	5.8	17	8	<0.30	0.57	2.80	588	-	10	-	-	-	-	-	-
06/16/93	6.8	9	7	0.07	0.57	-	610	-	4	-	-	-	-	-	-
09/27/93	5.0	2	32	0.44	0.96	-	730	-	14	-	-	-	-	-	-
03/31/94	4.0	56	0	<0.30	0.64	1.39	372	-	4	-	-	-	-	-	-
08/26/94	5.8	17	42	<0.30	1.68	1.96	607	-	<3	-	-	-	-	-	-
12/04/94	6.2	20	0	0.03	1.09	1.15	714	-	24	-	-	-	-	-	-
04/05/95	6.4	42	0	0.03	0.44	0.56	494	836	12	116	34.3	2.3	2.9	1	0.09

Sample Point - 99

Poplar Run approximately 1000 ft downstream from the D79 discharge confluence with Poplar Run

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/08/94	5.9	12	12	0.35	0.60	0.48	130	266	22	34.8	11.5	2.5	1.8	3	0.03
10/21/94	5.8	12	9	0.22	0.19	<0.13	112	232	2	29.4	9.4	2.9	6.2	7	0.04
04/05/95	5.9	10	13	0.12	0.34	<0.13	63	118	8	12.4	4.2	1.9	1.2	5	0.04

Sample Point - 100

Unnamed tributary to Poplar Run at T834 bridge crossing - upslope from an area affected by Emerald Energy Enterprises, Inc. surface mine, MDP 3377SM13 "Marston" and Myers Coal Co. surface mine, MDP 3377SM6 "Poplar Run"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/27/80	6.8	<10	0	0.16	0.12	0.20	15	-	-	-	-	-	-	-	-
06/16/94	6.3	15	4	0.07	0.04	<0.13	<20	20	2	6.8	1.4	0.7	0.5	2	<0.01
07/13/94	6.3	18	0	0.11	0.03	<0.13	34	68	<2	8.2	1.7	1.8	0.8	2	<0.01
09/08/94	6.2	12	8	0.15	0.13	0.16	<20	36	18	7.6	1.9	0.7	0.8	2	<0.01
10/21/94	6.3	15	0	0.08	0.06	<0.13	20	78	2	7.7	1.6	0.7	1.8	2	0.01
12/04/94	6.5	12	0	0.04	0.10	0.19	<20	42	16	5.7	1.6	0.6	0.8	1	0.02

Table 4. (continued)

Sample Point - D80

Water quality of mine drainages from the "Marston" and "Poplar Run" surface mined areas

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/12/80	6.3	18	40	<0.05	6.60	0.30	345	-	-	-	-	-	-	-	-
03/12/80	3.7	0	20	16.10	6.60	-	675	-	-	-	-	-	-	-	-
03/12/80	3.5	0	105	1.03	13.70	12.50	525	-	-	-	-	-	-	-	-
03/12/80	3.8	0	72	0.40	7.10	8.60	98	-	-	-	-	-	-	-	-
03/27/80	5.5	<10	30	30.90	7.30	0.60	675	-	-	-	-	-	-	-	-
03/27/80	5.9	<10	7	0.16	5.60	0.40	252	-	-	-	-	-	-	-	-
06/11/82	4.7	<10	29	10.30	6.90	0.20	400	-	-	-	-	-	-	-	-

Sample Point - 101

Unnamed tributary to Poplar Run (Sample Point 100) immediately upstream of the unnmaed tributary confluence with Poplar Run

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/12/80	5.1	<10	30	1.42	1.34	0.80	98	-	-	-	-	-	-	-	-
09/08/94	6.6	38	0	0.55	0.42	0.25	173	312	4	48.4	11.0	1.3	1.7	1	<0.01
10/21/94	6.5	40	0	0.28	0.22	<0.13	168	282	<2	48.4	10.8	1.4	2.8	2	0.01
04/05/95	6.4	20	2	0.49	0.34	<0.13	68	108	18	16.6	4.2	0.8	1.0	2	0.01

Sample Point - 102

Poplar Run approximately 50 ft upstream of the Newmyer Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	6.5	24	0	0.36	0.34	<0.13	209	430	<2	60.1	18.6	2.3	1.0	2	0.03
07/13/94	6.3	22	0	0.39	0.34	<0.13	237	434	6	57.2	14.7	2.1	1.9	3	0.03
09/08/94	6.4	19	3	0.32	0.44	0.23	105	266	18	40.1	11.4	2.4	1.9	3	0.03
10/21/94	6.4	18	6	0.28	0.20	0.18	112	260	<2	33.4	9.5	2.4	3.9	6	0.02
12/04/94	6.7	13	0	0.18	0.38	0.15	56	-	-	18.3	5.6	2.2	1.0	3	0.05

Sample Point - 103

Newmyer Run (headwater) at a farm lane crossing off T832

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/08/94	4.8	8	11	0.22	0.30	0.28	<20	6	2	3.3	1.0	0.5	0.5	<1	0.04
10/21/94	5.0	10	4	0.24	0.25	0.24	<20	42	<2	3.0	0.9	0.4	1.1	2	0.04

Sample Point - 104

Newmyer Run at SR1050 bridge crossing - northeast of the village of Clinton

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	3.9	0	84	0.72	9.57	8.17	186	488	<2	28.5	21.3	2.2	2.2	3	0.42
07/13/94	4.1	4	120	0.69	7.76	5.53	171	396	<2	26.3	14.0	2.6	2.1	3	0.32
09/08/94	4.2	6	60	0.65	6.79	7.18	102	386	4	19.4	15.2	1.7	1.2	2	0.32
10/21/94	4.2	5	64	0.91	7.99	8.34	161	358	<2	22.9	15.8	1.8	3.0	4	0.34
12/04/94	4.4	7	16	0.50	2.53	2.58	50	56	8	10.3	5.8	2.5	0.9	2	0.15

Table 4. (continued)

Sample Point - 105

Unnamed tributary to Newmyer Run flowing from the north at T731 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	7.1	102	0	0.93	0.30	0.60	115	258	12	43.7	10.5	5.7	3.4	6	<0.01
07/13/94	7.1	100	0	1.43	0.21	1.13	123	250	16	41.8	8.5	5.5	3.7	8	0.01
09/08/94	6.9	74	0	0.44	0.18	<0.13	76	204	16	34.4	7.2	2.5	1.5	3.0	<0.01
10/21/94	6.9	86	0	0.46	0.41	<0.13	98	214	<2	33.9	6.6	4.4	2.5	6	<0.01
12/04/94	7.2	50	0	0.51	0.27	0.27	55	140	16	23.0	4.4	2.8	1.1	3	0.01

Sample Point - 106

Newmyer Run approximately 1.04 miles upstream from Poplar Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/08/94	4.7	8	22	0.13	3.20	1.96	121	268	10	24.8	11.8	2.4	1.4	2	0.16
10/21/94	4.9	11	28	0.07	4.06	2.47	143	268	<2	27.2	14.0	3.0	3.8	4	0.22

Sample Point - D81

Mine drainage - primary discharge from a backfilled/abandoned surface mine Marsolino Coal & Coke Co. MDP 3376SM14 - "Leighty"

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/26/88	3.3	0	862	55.30	66.70	98.60	2268	-	78	-	-	19.2	-	-	-
08/26/88	3.0	0	658	7.30	59.40	64.40	1812	-	<2	-	-	11.4	-	-	-
04/23/92	3.5	0	346	12.70	32.30	49.10	1566	-	5	-	-	12.9	-	-	-
06/25/92	3.5	0	406	29.40	39.20	48.10	1560	-	12	-	-	17.3	-	-	-
12/17/92	3.7	0	220	21.90	23.50	28.90	984	-	38	-	-	11.5	-	-	-
02/19/93	3.5	0	446	13.50	33.40	50.60	1529	-	16	-	-	<10.0	-	-	-
06/04/93	3.5	0	406	15.50	31.20	45.80	1668	-	<3	-	-	10.3	-	-	-
02/08/94	3.6	0	412	3.59	32.30	53.90	1609	-	8	-	-	<10.0	-	-	-
03/15/94	3.5	0	308	4.64	25.40	40.70	1070	-	20	-	-	<10.0	-	-	-
04/11/94	3.6	0	220	2.00	22.10	22.30	1114	-	-	-	-	<10.0	-	-	-
06/16/94	3.4	0	288	10.70	25.90	36.30	1145	-	-	-	-	<10.0	-	-	-
09/08/94	3.5	0	442	12.40	27.10	44.20	1410	3142	20	202.0	169.0	6.3	3.8	1	1.75
10/21/94	3.6	0	282	19.30	23.30	27.00	1210	2356	<2	191.0	174.0	5.5	4.6	2	1.30
12/04/94	3.4	0	340	28.60	24.90	35.40	1330	3220	16	182.0	101.0	5.9	3.3	1	1.51

Sample Point - D82

Combined discharge flow to Newmyer Run - Marsolino Coal & Coke Co., MDP 3376SM14

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/08/94	3.4	0	334	5.86	28.30	37.70	1540	2990	12	209.0	166.0	8.5	3.7	1	1.72
10/21/94	3.4	0	260	-	-	-	1270	2558	2	-	-	-	-	2	-
04/05.95	3.5	0	288	6.77	18.2	23.30	1126	2252	14	149.0	92.1	5.6	3.5	1	1.07

Sample Point - 107

Unnamed tributary to Newmyer Run flowing from the north - at a private road off SR1009 - approximately 1.14 miles south of the village of White

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/13/94	6.8	80	0	0.29	0.45	<0.13	67	180	4	36.8	4.9	4.0	2.0	5	<0.01
09/08/94	6.7	34	0	0.07	0.02	<0.13	36	132	16	23.3	4.1	3.2	1.6	3	<0.01
10/21/94	6.7	56	0	0.05	0.03	<0.13	71	190	<2	30.4	4.9	6.3	3.8	8	<0.01
12/04/94	6.6	28	0	0.08	0.01	0.16	34	96	[redacted] 18	16.3	2.9	2.9	1.5	4	0.01

Table 4. (continued)

Sample Point - D83

Discharge to unnamed tributary to Newmyer Run, Marsolino Coal & Coke Co., MDP 3376SM14

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/15/94	3.5	0	168	2.17	23.00	20.80	1080	-	20	-	-	<20.0	-	-	-
06/16/94	3.4	0	272	4.26	31.90	31.10	1267	-	8	-	-	<20.0	-	-	-

Sample Point - 108

Unnamed tributary to Newmyer Run (Sample Point 107) upstream of the access road off SR1009 to Marsolino Coal & Coke Co., MDP 3376SM14 abandoned surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	3.6	0	202	3.22	23.70	18.80	1188	2508	<2	186.0	160.0	6.1	3.9	1	1.08
07/13/94	3.5	0	206	3.87	26.70	19.50	846	2642	<2	186.0	85.2	5.8	3.7	2	0.97
09/08/94	3.9	0	96	2.71	14.20	11.00	588	1254	20	116.0	64.1	4.5	2.9	2	0.55
10/21/94	3.8	0	106	2.41	15.70	12.30	846	1470	<2	125.0	102.0	4.5	4.0	3	0.64
12/04/94	4.8	9	16	1.06	4.45	3.23	212	424	18	44.0	22.3	2.8	1.6	3	0.16

Sample Point - 109

Newmyer Run at SR1054 bridge crossing - approximately 250 ft upstream from Poplar Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/03/94	4.8	11	74	1.03	9.65	8.47	480	1068	24	106.0	60.8	5.3	2.6	3	0.65
06/15/94	4.7	10	82	1.61	12.30	9.99	648	1564	32	144.0	87.5	5.3	2.9	2	0.63
07/13/94	4.8	9	52	1.93	11.40	7.56	888	1384	28	127.0	81.6	6.0	3.3	2	0.51
09/08/94	4.8	9	68	0.98	8.20	8.13	564	1030	28	110.0	50.5	4.3	2.7	2	0.42
10/21/94	4.7	10	36	0.21	8.88	6.29	408	748	8	85.7	43.0	4.2	5.2	4	0.38
12/04/94	6.7	19	0	0.70	2.57	2.11	209	460	18	49.1	20.3	2.5	2.0	2	0.13

Sample Point - 110

Poplar Run - approximately 200 ft downstream from Newmyer Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	4.9	12	42	1.10	7.20	5.88	506	1032	14	102.0	51.1	4.3	2.5	2	0.37
07/13/94	5.2	9	30	1.39	6.43	3.82	520	988	18	96.1	38.3	3.9	2.5	2	0.27
09/08/94	5.0	9	22	0.82	5.15	4.74	346	694	30	82.7	37.2	3.3	2.1	2	0.25
10/21/94	5.1	10	10	0.65	3.49	2.31	249	460	<2	49.4	21	2.8	3.9	5	0.16
12/04/94	6.3	15	0	0.44	1.34	0.96	130	290	20	32.7	12.6	1.6	1.3	2	0.08

Sample Point - D84

Abandoned underground mine discharge to Poplar Run - approximately 350 ft downstream from Newmyer Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/17/94	3.9	0	106	45.30	5.64	0.15	422	858	30	82.8	34.9	3.0	2.2	2	0.01
07/14/94	3.6	0	104	57.90	5.88	<0.13	408	834	66	80.9	29.8	2.4	2.3	2	0.01
08/16/94	4.1	4	92	51.20	5.76	<0.13	400	854	36	83.1	30.4	2.8	2.3	1	0.01
09/08/94	5.4	12	130	61.00	5.88	<0.13	410	876	32	82.6	33.5	2.5	2.6	1	<0.01
10/19/94	3.7	0	104	37.00	5.05	<0.13	398	732	26	72.4	29.2	2.8	2.5	2	<0.01
12/04/94	3.7	0	80	29.30	4.86	<0.13	342	692	34	66.2	27.6	5.9	1.7	5	0.03

Table 4. (continued)

Sample Point - 111

Poplar Run approximately 50 ft downstream from the discharge entry of Sample Point D84

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/08/94	4.7	10	40	1.39	5.33	5.27	320	686	22	65.5	31.0	3.2	2.1	2.0	0.27
10/21/94	5.0	10	15	1.26	3.36	2.44	249	440	22	56.0	24.4	3.5	5.0	5	0.17

Sample Point - 112

Unnamed tributary to Poplar Run flowing from the northeast at Jockey Knob - approximately 25 ft upstream from SR1009 bridge crossing over the unnamed tributary

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/03/94	6.5	28	0	0.69	0.03	0.74	<20	86	20	10.5	2.6	2.4	1.5	4	0.11
06/15/94	6.7	36	0	0.43	0.03	0.46	36	80	28	14.9	2.9	2.5	1.6	4	<0.01
07/13/94	6.3	38	0	0.40	0.02	0.40	<20	78	34	12.4	2.8	2.7	1.6	4	0.02
09/08/94	6.2	30	3	0.12	0.02	0.16	<20	80	8	11.0	2.6	2.3	1.2	3	<0.01
10/21/94	6.6	42	0	0.13	0.02	<0.13	<20	94	<2	14.4	3.2	2.6	2.2	5	0.01
12/04/94	7.1	26	0	0.10	<0.01	<0.13	24	74	16	9.6	2.4	2.4	1.4	3	<0.01

Sample Point - 113

T840

Poplar Run at [redacted] bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	5.0	11	28	1.29	5.12	2.67	448	890	18	90.7	43.7	4.0	2.4	2	0.30
07/13/94	5.9	13	4	2.17	4.69	1.63	420	842	12	90.5	34.3	3.8	2.4	2	0.23
09/08/94	4.7	8	28	1.40	4.75	4.08	292	626	20	63.2	30.6	3.0	2.1	2.0	0.23
10/21/94	5.4	10	18	0.78	3.33	1.03	245	296	<2	49.8	22.8	3.1	4.8	5	0.15
12/04/94	6.0	10	0	0.67	1.39	0.87	96	236	26	22.0	9.5	1.9	1.3	3	0.08

Sample Point - 114

Unnamed tributary (headwater) to Poplar Run flowing from the northwest draining from Bologna Mining Co., MDP 3374SM72, reclaimed surface mine - "Nicholson" (SP6)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/09/85	5.7	14	0	0.30	0.21	-	34	-	20	-	-	-	-	-	-
11/01/86	6.0	16	0	1.45	1.85	-	38	-	2	-	-	-	-	-	-
03/04/89	7.6	15	9	0.05	0.10	-	28	-	4	-	-	-	-	-	-
03/15/90	5.6	6	4	0.08	0.25	-	19	-	20	-	-	-	-	-	-
03/29/91	5.6	8	6	0.25	0.16	-	<10	-	15	-	-	-	-	-	-
03/30/92	5.8	2	4	0.09	0.32	-	31	-	4	-	-	-	-	-	-
03/31/93	6.2	15	1	0.11	0.06	-	<10	-	7	-	-	-	-	-	-

Sample Point - D85

Mine drainage inflow to treatment pond (TP1) Bologna Mining Co. reclaimed surface mine, MDP 3374SM72

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/14/93	5.0	16	12	<0.30	2.26	0.65	84	-	<3	-	-	<10.0	-	-	-
09/28/93	5.1	8	11	0.35	2.01	0.63	80	-	6	-	-	<10.0	-	-	-
03/15/94	4.7	7	18	<0.30	1.80	0.54	82	-	16	-	-	<10.0	-	-	-
06/24/94	6.0	15	7	<0.30	3.16	<0.50	124	-	<3	-	-	<10.0	-	-	-
08/22/94	4.7	7	19	<0.30	2.20	0.83	122	-	<3	-	-	<10.0	-	-	-
08/22/94	5.4	12	16	0.68	1.34	<0.50	103	-	<3	-	-	<10.0	-	-	-

Table 4. (continued)

Sample Point - D85.1

Mine drainage outflow from treatment pond (TP1) Bologna Mining Co. reclaimed surface mine, MDP 3374SM72

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/28/93	5.3	10	9	0.33	1.87	0.65	79	-	8	-	-	<10.0	-	-	-
10/23/93	5.4	8	8	<0.30	1.76	<0.50	119	-	<3	-	-	<10.0	-	-	-
01/25/94	5.3	10	7	<0.30	1.68	0.61	80	-	10	-	-	<10.0	-	-	-
03/15/94	4.9	7	17	<0.30	1.73	<0.50	85	-	18	-	-	<10.0	-	-	-
04/14/94	5.1	9	10	<0.30	1.55	<0.50	78	-	<3	-	-	<10.0	-	-	-
06/24/94	6.4	28	0	<0.30	1.84	<0.50	129	-	<3	-	-	<10.0	-	-	-
08/22/94	5.1	8	17	0.32	1.79	0.60	141	-	<3	-	-	<10.0	-	-	-

Sample Point - D8C

Mine drainage inflow to treatment pond (TP2) Bologna Mining Co. reclaimed surface mine, MDP 3374SM72

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/14/93	6.2	34	3	2.20	2.40	5.00	34	-	8	-	-	<10.0	-	-	-
09/28/93	6.2	28	0	3.70	2.82	<0.50	37	-	8	-	-	<10.0	-	-	-
09/28/93	6.2	28	0	3.70	2.82	<0.50	37	-	8	-	-	<10.0	-	-	-

Sample Point - D86.1

Mine drainage outflow from treatment pond (TP2) Bologna Mining Co. reclaimed surface mine, MDP 3374SM72

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
09/28/93	6.1	20	0	1.21	1.35	<0.50	31	-	8	-	-	<10.0	-	-	-

Sample Point - D87

Mine drainage inflow to treatment pond (TP3) Bologna Mining Co. reclaimed surface mine, MDP 3374SM72

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/14/93	4.4	22	22	3.00	6.62	1.68	292	-	<3	-	-	<10.0	-	-	-
03/15/94	4.3	6	40	<0.30	6.54	3.07	320	-	18	-	-	<10.0	-	-	-
08/22/94	4.3	5	24	<0.30	3.72	1.44	214	-	<3	-	-	<10.0	-	-	-

Sample Point - D87.1

Mine drainage outflow from treatment pond (TP3) Bologna Mining Co. reclaimed surface mine, MDP 3374SM72

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/23/93	5.9	12	4	<0.30	0.85	<0.50	157	-	<3	-	-	<10.0	-	-	-
01/25/94	5.2	9	8	<0.30	1.81	0.73	130	-	8	-	-	<10.0	-	-	-
03/15/94	4.7	7	22	<0.30	2.96	1.30	168	-	18	-	-	<10.0	-	-	-
04/14/94	4.9	9	12	<0.30	2.42	0.89	168	-	<3	-	-	<10.0	-	-	-
08/22/94	5.2	7	11	1.36	1.17	1.19	94	-	32	-	-	<10.0	-	-	-

Sample Point - 115

Unnamed tributary (Sample Point 114) to Poplar Run 50 ft upstream from Poplar Run confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	5.5	11	11	0.05	0.14	<0.13	170	340	8	35.5	17.0	4.4	1.8	2	0.02
07/13/94	5.7	8	6	0.10	0.09	<0.13	159	310	8	31.2	12.4	6.7	1.4	2	0.02
09/08/94	5.9	11	7	0.11	0.16	0.15	123	256	8	28.7	11.8	2.7	1.2	4	<0.01
10/21/94	5.9	12	8	0.02	0.23	<0.13	186	376	<2	40.7	18.0	4.6	2.3	5	0.03
12/04/94	6.2	11	1	0.07	0.17	<0.13	70	168	12	17.0	7.9	1.8	1.2	3	0.02

Table 4. (continued)

Sample Point - D88

Mine drainage to Poplar Run - western end of Adam Eidemiller, Inc., MDP 3376SM11, backfilled surface mine - "Miller-Pritts" (ES2-west)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/27/92	2.8	0	294	9.05	10.50	33.40	442	-	<2	-	-	<10.0	-	-	-
04/28/92	2.8	0	322	12.80	11.20	32.40	402	-	8	-	-	<10.0	-	-	-
12/22/92	3.2	0	114	0.60	7.24	8.49	200	-	7	-	-	<10.0	-	-	-
12/16/93	3.1	0	158	0.84	9.57	16.60	358	-	<3	-	-	<10.0	-	-	-
08/22/94	3.1	0	96	0.34	4.36	5.80	142	-	10	-	-	<10.0	-	-	-

Sample Point - D89

Mine drainage to Poplar Run - western end of Adam Eidemiller, Inc., MDP 3376SM11, surface mine (ES2-east)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/27/92	5.7	8	6	<0.30	<0.05	<0.50	27	-	<2	-	-	<10.0	-	-	-
04/28/92	5.8	11	0	<0.30	0.66	<0.50	25	-	4	-	-	<10.0	-	-	-
03/15/94	5.8	10	9	<0.30	<0.05	<0.50	<20	-	20	-	-	<10.0	-	-	-
12/26/94	5.2	11	9	0.28	0.97	0.99	51	104	18	11.7	5.6	0.5	1.7	1	0.06

Sample Point - 116

Poplar Run at PA route 711 bridge crossing

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
04/05/95	6.1	11	13	0.54	1.05	1.06	111	248	20	22.0	9.1	2.2	1.4	3	0.07

Sample Point - D90

Mine drainage to Poplar Run - Adam Eidemiller, Inc. backfilled surface mine, MDP 3376SM11

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/02/80	5.1	16	46	0.96	12.00	-	872	-	19	-	-	-	-	-	-
10/17/80	5.4	19	50	1.10	11.90	-	864	-	<10.0	-	-	-	-	-	-
10/31/80	4.8	11	50	0.50	15.70	-	988	-	<10.0	-	-	-	-	-	-
11/11/80	5.3	13	24	1.08	11.60	-	904	-	<10.0	-	-	-	-	-	-
12/05/80	4.9	15	25	0.59	12.10	-	964	-	17	-	-	-	-	-	-
02/25/81	4.2	10	76	0.74	9.70	-	852	-	<10.0	-	-	-	-	-	-
12/22/92	6.1	20	9	<0.30	2.31	0.96	270	-	11	-	-	<10.0	-	-	-
03/18/93	6.4	22	0	<0.30	1.12	<0.50	352	-	4	-	-	<10.0	-	-	-
06/17/93	6.5	38	0	<0.30	1.61	1.19	582	-	<3	-	-	<10.0	-	-	-
09/28/93	6.6	44	0	<0.30	1.01	<0.50	374	-	16	-	-	<10.0	-	-	-
12/16/93	6.4	42	0	<0.30	1.39	1.30	458	-	<3	-	-	<10.0	-	-	-
03/15/94	6.2	24	4	<0.30	0.78	<0.50	221	-	18	-	-	<10.0	-	-	-
06/16/94	6.4	42	0	0.30	1.29	1.45	452	-	6	-	-	<10.0	-	-	-
04/05/95	6.0	15	10	0.63	0.32	0.41	638	1088	6	118	39.3	2.3	3.9	1	0.05

Sample Point - 117

Poplar Run - approximately 1800 ft downstream of PA Route 711 bridge crossing over Poplar Run

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/16/94	6.1	13	11	0.13	2.73	0.20	386	730	4	83.1	38.5	4.0	2.4	2	0.16

Table 4. (continued)

Sample Point - D91

Mine drainage to Poplar Run - Adam Eidemiller, Inc., MDP 3376SM11, backfilled surface mine (ES6)

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/27/92	4.5	6	38	<0.30	5.28	4.52	828	-	<2	-	-	<10.0	-	-	-
04/28/92	4.7	8	13	<0.30	2.80	1.79	846	-	4	-	-	<10.0	-	-	-
06/23/92	4.7	7	18	<0.30	0.48	0.77	906	-	3	-	-	<10.0	-	-	-
07/28/92	4.3	5	22	<0.30	2.02	1.34	834	-	<2	-	-	<10.0	-	-	-
08/26/92	4.4	7	22	<0.30	2.55	1.62	906	-	5	-	-	<10.0	-	-	-
06/17/93	4.4	10	12	<0.30	0.87	0.97	852	-	<3	-	-	<10.0	-	-	-
12/16/93	4.8	10	30	<0.30	2.50	2.74	610	-	<3	-	-	<10.0	-	-	-
06/03/94	5.7	20	14	0.15	0.94	0.39	672	1230	8	165.0	64.1	2.6	2.8	<1	0.84
06/16/94	4.7	8	13	<0.30	0.61	0.85	653	-	<3	-	-	<10.0	-	-	-
07/14/94	6.1	28	0	0.62	4.86	<0.13	618	1344	4	165.8	51.8	2.1	0.9	<1	0.08
07/21/94	6.1	40	0	1.80	7.88	0.26	750	1270	32	159.0	56.6	2.0	1.9	<1	0.07
08/16/94	6.3	28	0	0.56	1.70	<0.13	660	1078	2	155.0	48.3	2.0	2.7	<1	<0.01
08/22/94	5.0	8	22	<0.30	2.49	0.61	328	-	10	-	-	<10.0	-	-	-
09/08/94	6.3	24	1	0.47	0.87	0.17	588	1138	12	165.0	68.4	2.9	3.5	<1	0.02
10/21/94	6.3	38	0	1.07	1.33	<0.13	732	1236	2	181.0	57.0	2.4	7.3	2	0.02
12/04/94	6.7	26	0	2.29	0.30	0.8	540	1104	18	153.0	48.8	2.8	6.7	1	0.03
12/16/94	5.0	13	28	0.90	4.62	4.57	651	1174	6	160.0	70.2	2.3	4.9	1	0.39
04/05/95	6.1	15	13	0.06	0.12	0.20	638	1042	8	166	68.2	1.8	4.3	2	0.06

Sample Point - D92

Mine drainage to an unnamed tributary to Poplar Run - eastern end of Adam Eidemiller, Inc., MDP 3376SM11, backfilled surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/23/94	4.5	7	42	0.39	3.49	3.69	368	-	10	-	-	<10.0	-	-	-
10/25/94	6.5	42	0	0.12	2.78	<0.13	930	1644	10	286	6.3	2.6	5.3	1	0.03
12/16/94	4.6	11	54	0.33	6.17	7.74	709	1252	<2	147	62.8	1.8	3.9	1	0.35
04/05/95	4.7	10	48	0.10	3.40	3.87	688	1298	20	121	48.3	2.4	3.7	2	0.19

Sample Point - D93

Mine drainage to an unnamed tributary to Poplar Run - eastern end of Adam Eidemiller, Inc., MDP 3376SM11, backfilled surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
08/23/94	6.5	16	0	<0.30	1.62	<0.50	356	-	16	-	-	<10.0	-	-	-
10/24/94	6.3	42	0	0.02	1.42	0.26	762	1364	<2	227	61.1	2.3	4.8	1	0.06
12/16/94	6.2	19	1	0.02	1.63	0.70	679	1100	2	157	57.2	1.9	3.6	1	0.11
04/05/95	5.1	11	18	0.04	1.29	1.08	652	1188	8	127	48.3	2.5	3.7	2	0.12

Sample Point - 118

Unnamed tributary to Poplar Run - eastern end of Adam Eidemiller, Inc., MDP 3376SM11, backfilled surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
12/22/92	6.1	11	14	<0.30	1.53	1.84	202	-	24	-	-	<10.0	-	-	-
03/18/93	6.3	13	0	0.44	0.98	1.51	135	-	22	-	-	<10.0	-	-	-
06/17/93	6.5	34	0	<0.30	0.36	<0.50	446	-	10	-	-	<10.0	-	-	-
12/16/93	6.2	16	8	<0.30	1.18	1.21	251	-	<3	-	-	<10.0	-	-	-
03/15/94	6.1	12	12	0.51	0.85	1.24	117	-	<2	-	-	<10.0	-	-	-
06/03/94	6.6	34	0	<0.30	0.50	0.15	450	876	<3	117.0	39.7	14.9	1.7	2	0.05
06/15/94	6.5	30	0	0.04	0.04	<0.13	702	1402	30	171.0	51.1	44.6	2.1	<1	<0.01
06/16/94	6.7	52	0	<0.30	<0.05	<0.50	682	-	<3	-	-	131.0	-	-	-
07/13/94	6.1	24	0	0.06	0.02	<0.13	954	1414	<2	179.0	54.2	6.2	2.3	<1	0.01
09/08/94	6.3	32	0	0.02	0.60	0.21	486	1058	<2	142	48.9	16.1	3.2	2	0.01
10/21/94	6.5	32	0	<0.30	0.06	<0.13	690	1222	2	185.0	53.0	3.8	5.2	3	<0.01
12/04/94	7.2	30	0	<0.01	0.02	<0.13	238	458	6	64.5	20.6	3.3	2.4	4	<0.01

Table 4. (continued)

Sample Point - 119

Poplar Run - approximately 500 ft upstream from the Indian Creek confluence

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/03/94	6.1	14	15	0.35	2.23	0.45	272	528	4	66.5	27.0	4.1	1.9	3	0.25
06/15/94	6.2	13	10	0.07	2.00	<0.13	350	722	12	88.4	34.4	4.0	2.5	2	0.13
07/14/94	6.0	14	7	0.05	1.13	<0.13	406	730	<2	76.9	31.3	4.8	2.4	3	0.07
09/08/94	5.7	10	13	0.56	2.80	1.20	314	594	8	68.2	28.1	3.8	1.9	3	0.15
10/21/94	6.2	13	0	0.11	2.29	<0.13	224	456	<2	52.4	21.9	3.2	4.6	4	0.10
12/04/94	6.7	14	0	0.42	1.03	0.47	105	234	18	27.0	10.4	2.5	1.5	3	0.06

Sample Point - D94

Mine drainage to Indian Creek - Laurel Ridge Coal, Inc., MDP 3378BC16, abandoned (rough backfilled) surface mine - "Speyer" - Lower Freeport coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
03/23/81	4.7	2	74	0.34	34.16	7.27	1440	-	-	-	-	-	-	-	-
04/13/81	5.0	4	48	0.19	36.05	5.20	1180	-	19	-	-	-	-	-	-
07/22/81	4.5	15	230	0.27	37.20	15.79	1380	-	0	-	-	-	-	-	-
09/23/81	3.0	0	220	16.35	12.54	18.19	445	-	2	-	-	-	-	-	-
10/01/81	4.6	14	138	0.28	34.90	16.61	1560	-	24	-	-	-	-	-	-
11/23/81	4.5	<10	108	0.28	37.60	13.90	1500	-	-	-	-	-	-	-	-
08/12/82	4.6	15	152	0.14	37.80	11.40	1500	-	-	-	-	-	-	-	-
05/11/83	4.7	13	182	0.11	30.78	10.75	1920	-	-	-	-	-	-	-	-
01/14/86	5.8	38	0	<0.30	23.02	0.66	804	-	12	-	-	-	-	-	-
12/03/86	5.8	62	52	<0.30	16.30	<0.50	1188	-	<2	-	-	-	-	-	-
03/16/88	6.5	60	0	<0.30	10.70	<0.50	1002	-	4	-	-	-	-	-	-
11/14/88	6.3	80	0	<0.30	8.26	<0.50	1464	-	<2	-	-	-	-	-	-
02/28/89	6.2	70	0	<0.30	7.49	<0.50	1068	-	<2	-	-	-	-	-	-

Sample Point - 120

Unnamed tributary (north branch) to Indian Creek upslope from Laurel Ridge Coal, Inc., MDP 3378BC16 abandoned surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/03/95	6.5	22	0	0.33	0.02	<0.13	20	62	10	8.1	2.2	3.4	1.6	6	<0.01
04/05/95	6.6	24	0	0.95	0.04	0.95	15	62	34	7.5	1.8	3.0	1.7	6	0.01

Sample Point - 121

Unnamed tributary (south branch) to Indian Creek upslope from Laurel Ridge Coal, Inc., MDP 3378BC16 abandoned surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/03/95	6.3	14	8	0.16	0.01	<0.13	15	34	2	4.3	1.8	1.1	1.4	2	<0.01
04/05/95	6.4	15	4	0.28	0.02	0.33	13	12	22	4.1	1.6	1.1	1.7	3	<0.01

Sample Point - 122

Unnamed tributary (mouth) to Indian Creek downslope from Laurel Ridge Coal, Inc., MDP 3378BC16 abandoned surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/03/95	6.5	22	0	0.60	0.19	0.22	42	88	18	13.4	4.4	2.6	1.5	4	0.01
04/05/95	6.5	26	0	0.85	0.17	0.51	40	94	26	11.0	3.5	1.8	1.5	5	<0.01

Table 4. (continued)

Sample Point - D95

Mine drainage - Ann Minerals Co., Inc., MDP 3375SM53, reclaimed surface mine - "Showman" - Lower ~~Upper~~ Freeport coal

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/08/84	4.1	3	144	0.40	7.80	10.6	302	-	-	-	-	-	-	-	-
10/22/85	3.6	0	276	6.50	23.20	27.90	774	-	-	-	-	-	-	-	-
02/25/86	4.4	6	62	0.50	6.80	4.60	252	-	-	-	-	-	-	-	-

Sample Point - D96

Mine drainage - Ann Minerals Co., Inc., MDP 3375SM53, reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
05/08/88	4.1	3	94	0.10	2.70	4.80	172	-	-	-	-	-	-	-	-
07/03/85	4.1	4	58	0.30	4.00	4.50	220	-	-	-	-	-	-	-	-
10/22/85	3.7	0	538	0.60	44.10	70.00	2118	-	-	-	-	-	-	-	-
02/25/86	3.8	0	720	0.60	51.60	106.00	2490	-	-	-	-	-	-	-	-

Sample Point - 123

Unnamed tributary (west branch) to Indian Creek draining from Ann Minerals Co., Inc., MDP 3375SM53, reclaimed surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
11/18/75	6.6	10	0	0.20	-	-	19	-	-	-	-	-	-	-	-
12/12/79	5.7	40	16	0.18	4.25	0.7	188	-	-	-	-	-	-	-	-
01/29/82	6.4	12	0	0.30	1.70	0.3	115	-	-	-	-	-	-	-	-
02/28/86	5.9	12	16	0.30	3.00	0.5	210	-	-	-	-	-	-	-	-

Sample Point - D97

Mine drainage - Laurel Ridge Coal Co., MDP 3375SM38, surface mine - "Warrick" - from spoil along the haul road northeast part of the mine site

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/21/90	3.9	0	84	0.31	10.20	13.30	415	-	5	-	-	-	-	-	-
04/06/90	4.0	2	70	<0.30	8.70	10.50	411	-	5	-	-	-	-	-	-

Sample Point - D98

Mine drainage - Laurel Ridge Coal Co., MDP 3375SM38, surface mine - from spoil along the haul road northcentral part of the mine site

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/21/90	3.7	0	166	0.34	27.40	23.50	774	-	2	-	-	-	-	-	-
03/02/90	4.4	4	26	<0.30	5.50	3.50	268	-	<2	-	-	-	-	-	-
04/06/90	4.5	0	18	<0.30	5.89	2.49	472	-	14	-	-	-	-	-	-

Sample Point - D99

Mine drainage - Laurel Ridge Coal Co., MDP 3375SM38, surface mine - from spoil along the haul road - southwest of sedimentation pond #1 - northcentral part of the mine site

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
02/21/90	4.3	4	32	<0.30	7.89	4.00	678	-	<2	-	-	-	-	-	-
04/06/90	3.8	0	92	<0.30	16.00	12.90	678	-	8	-	-	-	-	-	-

Table 4. (continued)

Sample Point - D100

Mine drainage - Laurel Ridge Coal Co., MDP 3375SM38, surface mine - northwest part of the mine site

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/12/89	3.6	0	408	<0.30	31.10	65.90	1001	-	2	-	-	-	-	-	-
02/21/90	3.6	0	498	<0.30	31.00	75.70	822	-	<2	-	-	-	-	-	-
03/02/90	3.6	0	210	12.50	14.00	28.90	684	-	3	-	-	-	-	-	-
04/06/90	3.6	0	482	<0.30	25.80	77.20	1362	-	11	-	-	-	-	-	-

Sample Point - 124

Unnamed tributary (west branch) to Indian Creek draining from Laurel Ridge Coal, Inc., MDP 3375SM38, surface mine

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
06/12/89	6.1	16	0	<0.30	1.11	<0.13	119	-	2	-	-	-	-	-	-
02/21/90	5.9	10	14	<0.30	1.02	0.66	109	-	2	-	-	-	-	-	-
03/02/90	6.3	9	4	<0.30	1.08	0.51	99	-	<2	-	-	-	-	-	-

Sample Point - 125 Indian Creek - Old railroad bridge at Rogers Mill

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
07/12/94	6.1	18	0	0.36	0.28	<0.13	98	272	6	31.3	8.6	13.2	1.7	24	0.02
09/09/94	6.5	22	0	0.42	0.35	<0.13	65	202	10	24.2	7.2	11.5	1.5	20	0.02
10/17/94	6.5	32	0	0.94	0.40	0.29	90	230	<2	27.4	8.5	10.8	3.2	20	0.02

Sample Point - D101

Melcroft flume discharge to Charles Run

DATE	pH	Alk	Acid	Fe	Mn	Al	SO4	DS	SS	Ca	Mg	Na	K	Cl	Zn
10/22/94	3.2	0	254	49.60	2.99	14.80	606	139	<2	123.0	35.1	3.2	4.8	3	0.35

Table 5. Benthic macroinvertebrate occurrence and subjective relative abundance Champion Creek, Little Champion Creek, and Minnow Run. May, June and July 1994.

	Little Champion Creek					Champion Creek					Minnow Run
Station	48	62	45	45	35	44	66	66	66	72	41
Date	7/27	7/27	6/28	7/27	7/27	7/27	5/11	6/28	7/27	7/27	7/27
Mayflies											
Stenonema	-	-	-	X	X	-	-	-	X	-	-
Cinygmula	-	-	-	-	-	-	X	-	-	-	-
Danella	-	-	X	-	-	-	-	X	-	-	-
Baetis	-	X	-	X	X	X	-	-	-	-	-
Acentrella	-	-	-	X	-	-	-	-	X	-	-
Cloeon	-	-	-	-	-	-	-	-	X	-	-
Paraleptophlebia	X	X	X	X	-	-	X	X	-	-	-
Stoneflies											
Leuctra	X	X	X	X	X	-	-	X	-	X	X
Haploperla brevis	-	-	-	-	-	-	C	-	-	-	-
Alloperla	-	-	-	-	-	-	X	-	-	-	-
Sweltsa	X	-	-	-	-	-	X	-	-	-	-
Chloroperlidae	-	-	-	-	X	-	-	-	-	-	-
Acroneuria	X	X	X	X	X	-	X	X	X	-	-
Paragnetina	-	-	-	X	-	-	-	-	-	-	-
Yugus	-	-	-	-	X	-	-	-	-	-	-
Caddisflies											
Rhyacophila fuscula	X	X	X	X	-	X	X	X	-	-	X
R. carolina	X	-	-	-	-	X	-	-	-	-	-
Glossosoma	-	A	-	X	-	X	-	-	C	-	X
Dolophilodes	X	X	X	-	-	-	-	X	-	-	-
Chimarra	-	-	-	-	-	A	-	-	-	-	A
Polycentropus	-	-	X	-	-	-	X	X	-	-	-
Isychomyia	-	X	-	-	-	-	-	-	-	-	-
Hydropsyche sparna	X	X	X	X	-	A	X	-	C	X	A
H. slossonae	X	A	-	-	-	-	X	-	-	-	-
H. alhedra	-	-	X	X	-	X	-	X	-	X	A
H. betteni	-	-	-	-	-	-	X	-	-	-	-
H. bifida group	-	-	X	X	-	-	-	X	C	-	-
Diplectrona modesta	A	-	-	-	A	-	-	-	-	-	-
Cheumatopsyche	A	X	-	-	A	-	-	-	-	-	-
Pycnopsyche	-	-	-	-	-	-	-	-	-	-	X
Neophylax	-	X	-	-	-	-	X	-	-	-	X

A = Abundant, C = Common, X = Present

Table 5. (continued)

	Little Champion Creek					Champion Creek					Minnow Run
Station	48	62	45	45	35	44	66	66	66	72	41
Date	7/27	7/27	6/28	7/27	7/27	7/27	5/11	6/28	7/27	7/27	7/27
Beetles											
Elmidae	-	-	-	-	-	-	-	-	-	-	C
Optioservus	X	-	-	-	X	-	-	-	X	-	-
Stenelmis	-	-	-	-	X	-	-	-	-	-	-
Oulimnus	-	-	-	X	X	-	-	-	-	-	-
Damselflies/Dragonflies											
Calopterygidae	-	-	-	-	X	-	-	-	-	-	-
Boyeria	-	-	-	-	-	X	-	-	-	-	-
Fishflies/Alderflies											
Nigronia	-	X	X	X	X	C	X	X	X	-	-
Sialis	-	-	-	X	-	X	-	-	X	-	-
True Flies											
Chironomidae	A	A	X	X	X	A	X	X	X	X	A
Tipula	X	-	-	-	X	-	-	-	-	-	X
Hexatoma	-	X	X	X	X	X	X	X	X	-	X
Limnophila	-	-	X	-	-	-	-	X	-	-	-
Antocha	-	X	-	X	-	X	-	-	-	-	X
Dicranota	X	X	-	-	X	X	-	-	-	-	-
Atherix	-	-	-	-	X	-	-	-	-	-	-
Empididae	-	-	-	-	-	-	-	-	-	-	X
Misc. invertebrates											
Oligochaeta	X	-	-	-	-	-	-	-	-	-	-
Cambaridae	X	-	-	X	-	-	-	-	X	-	-
TOTAL TAXA	17	17	14	19	18	14	15	13	13	4	14
No. EPT Taxa	11	13	10	12	8	7	12	9	7	3	9
No. Mayfly Genera	1	2	2	4	2	1	2	2	3	0	0

A = Abundant, C = Common, X = Present

Table 6. Benthic macroinvertebrate occurrence and subjective relative abundance Indian Creek. May, June and July 1994

Indian Creek

Station	1	3		5	12			21	22
Date	6/28	7/08	8/16	5/11	5/11	6/28	8/16	8/16	6/29
Mayflies									
Caenis	-	-	-	-	-	-	-	X	-
Stenonema	-	-	-	-	X	-	X	X	-
Cinygmula	-	-	-	-	X	-	-	-	-
Epeorus	-	X	-	-	X	-	-	-	-
Ephemerella	-	-	-	-	X	X	-	-	-
Danella	-	-	-	-	-	X	-	-	X
Baetis	X	X	X	-	X	-	-	-	-
Acentrella	-	-	-	-	-	X	-	-	X
Cloeon	-	-	-	-	-	X	-	-	-
Paraleptophlebia	-	-	-	-	-	-	-	X	-
Habrophleboides	-	-	X	-	-	-	-	-	-
Isonychia	-	-	-	-	X	X	X	X	-
Ephemera	-	-	-	-	X	-	-	X	X
Stoneflies									
Leuctra	-	-	-	-	-	X	-	X	X
Amphinemura	-	X	-	-	X	-	-	-	-
Peltoperlidae	-	X	X	-	-	X	X	X	-
Suwallia	X	X	-	-	-	-	-	-	-
Alloperla	-	-	-	-	X	-	-	-	-
Sweltsa	-	X	-	-	-	-	-	-	-
Acroneuria	-	X	-	-	-	X	X	-	-
Isoperla	-	-	-	-	-	-	-	-	-
Yugus	A	-	X	-	-	-	X	-	-
Pteronarcys	C	X	C	X	-	X	-	-	-
Caddisflies									
Rhyacophila fuscula	X	X	X	X	X	X	-	-	-
R. sp.	X	-	-	-	-	-	-	X	-
Glossosoma	X	A	X	-	-	X	X	C	-
Dolophilodes	X	C	X	-	-	X	-	-	X
Chimarra	-	-	-	-	X	A	A	X	X
Polycentropus	-	-	-	-	X	-	-	-	-
Hydropsyche sparna	C	-	X	X	-	C	C	C	-
H. slossonae	-	-	-	-	X	C	X	X	-
H. alhedra	C	X	C	-	-	C	-	X	-
H. betteni	-	-	-	-	-	-	X	-	-
H. bifida group	-	-	-	-	X	C	A	A	X
H. bronta	-	-	-	-	-	-	-	-	-
Diplectrona modesta	C	X	X	X	X	X	-	-	-
Cheumatopsyche	-	-	-	-	-	-	X	X	-
Hydropsychid pupae	-	-	-	-	-	-	-	-	-
Neophylax	-	-	-	-	X	-	X	X	-
Micrasema	-	-	-	-	-	-	X	X	-
Brachycentrus	-	-	-	-	-	-	-	-	-

A = Abundant, C = Common, X = Present

Table 6. (continued)

	Indian Creek								
Station	1	3		5	12			21	22
Date	6/28	7/08	8/16	5/11	5/11	6/28	8/16	8/16	6/29
Beetles									
Elmidae	X	X	-	-	-	X	X	X	X
Stenelmis	-	-	-	-	-	X	-	-	-
Optioservus	-	-	-	-	-	-	-	-	-
Dragonflies									
Aeshnidae	-	-	-	-	-	X	-	-	-
Fishflies/Alderflies									
Nigronia	X	-	X	-	X	X	C	X	-
Sialis	-	-	-	-	-	-	-	-	X
True Flies									
Chironomidae	X	X	A	X	X	C	X	X	X
Simuliidae	-	X	-	-	-	-	-	X	-
Tipula	-	-	-	-	-	-	-	-	-
Hexatoma	X	-	X	-	-	-	X	C	X
Antocha	-	-	-	-	-	-	-	X	X
Dicranota	-	-	-	-	-	X	X	-	-
Atherix	-	X	C	-	-	-	C	X	-
Misc. invertebrates									
Oligochaeta	X	-	-	-	X	-	-	X	-
Cambaridae	-	-	-	-	X	-	-	-	-
Ferrissia	-	-	-	-	-	-	X	X	-
TOTAL TAXA	16	17	15	5	20	23	19	26	12
Number EPT Taxa	11	13	11	4	16	18	14	17	7
Number Mayfly Taxa	1	2	2	0	7	5	2	5	3

A =Abundant, C = common, X = Present

Table 6. (continued)

Indian Creek

Station	78		85			93		
Date	7/08	8/16	5/11	7/08	8/16	5/11	7/08	8/16
Mayflies								
Caenis	X	-	-	-	-	-	-	-
Stenonema	-	X	-	-	-	-	-	-
Cinygmula	-	-	X	-	-	-	-	-
Epeorus	-	-	-	-	-	X	-	-
Ephemerella	X	-	-	-	-	A	-	-
Danella	-	-	-	-	-	-	-	-
Baetis	X	X	-	-	-	C	X	-
Acentrella	-	-	-	-	-	A	-	-
Cloeon	-	-	-	-	-	-	-	-
Paraleptophlebia	-	-	-	-	-	-	-	-
Habrophleboides	-	-	-	-	-	-	-	-
Isonychia	-	-	X	-	-	X	-	-
Ephemera	-	-	-	-	-	X	-	-
Stoneflies								
Leuctra	-	-	-	-	-	-	-	-
Amphinemura	-	-	-	-	-	-	-	-
Peltoperlidae	-	-	-	-	-	-	-	-
Suwallia	-	-	-	-	-	-	-	-
Alloperla	-	-	-	-	-	-	-	-
Sweltsa	-	-	-	-	-	-	-	-
Acroneuria	-	X	X	-	-	X	-	-
Isoperla	-	-	X	-	-	-	-	-
Yugus	-	-	-	-	-	-	-	-
Pteronarcys	-	-	-	-	-	-	-	-
Caddisflies								
Rhyacophila fuscula	X	-	-	-	-	C	-	-
R. sp.	-	-	-	-	-	-	-	-
Glossosoma	X	X	-	-	-	-	-	-
Dolophilodes	-	-	-	-	-	-	-	-
Chimarra	C	X	-	-	-	-	-	-
Polycentropus	-	-	X	-	-	-	X	-
Hydropsyche sparna	-	C	-	-	-	-	X	-
H. slossonae	-	-	X	-	-	X	-	X
H. alhedra	C	C	X	-	-	X	-	-
H. betteni	-	-	-	-	-	C	-	-
H. bifida group	A	A	-	-	-	-	X	X
H. bronta	-	X	-	-	-	-	-	-
Diplectrona modesta	-	-	X	-	-	-	-	-
Cheumatopsyche	-	-	-	-	-	X	-	-
Hydropsychid pupae	-	-	-	X	-	-	-	-
Neophylax	-	X	-	-	-	-	-	X
Micrasema	-	-	-	-	-	-	-	-
Brachycentrus	-	X	-	-	-	-	-	-

A = Abundant, C = Common, X = Present

Table 6. (continued)

	Indian Creek							
Station	78		85			93		
Date	7/08	8/16	5/11	7/08	8/16	5/11	7/08	8/16
Beetles								
Elmidae	-	X	-	-	-	-	-	-
Stenelmis	X	-	-	-	-	-	-	-
Optioservus	-	-	-	-	-	-	X	-
Dragonflies								
Aeshnidae	-	-	-	-	-	-	-	-
Fishflies/Alderflies								
Nigronia	-	X	X	-	-	-	-	-
Sialis	-	-	-	-	-	-	-	-
True flies								
Chironomidae	X	X	X	-	-	X	X	X
Simuliidae	X	-	-	-	-	-	-	-
Tipula	-	-	X	X	-	-	-	-
Hexatoma	X	-	-	-	-	-	-	-
Antocha		-	-	-	-	-	-	-
Dicranota	-	-	-	-	-	-	-	-
Atherix	X	X	-	-	-	-	-	-
Misc. invertebrates								
Oligochaeta	X	-	-	-	-	-	-	-
Cambaridae	-	-	X	-	-	-	-	-
Ferrissia	-	-	-	-	-	-	-	-
TOTAL TAXA	13	15	12	2	0	14	6	4
Number EPT Taxa	7	11	8	1	0	13	3	3
Number Mayfly Taxa	3	2	2	0	0	6	1	0

A =Abundant, C = common, X = Present

Table 7. Benthic macroinvertebrate occurrence and subjective relative abundance in tributaries to Indian Creek. July 1994.

	Little Run	Camp Run	Pike Run	Roaring Run	Back Creek	Trout Run
Station	2	9	18	19	91	88
Date	7/28	7/29	7/07	7/07	7/30	7/30
Mayflies						
Stenonema	X	C	-	X	X	-
Epeorus	-	-	X	-	-	-
Heptagenia	-	-	X	X	X	-
Leuctrocuta	-	-	-	-	-	-
Ephemerella	-	-	X	-	-	-
Danella	-	-	-	X	-	-
Drunella cornutella	-	-	X	X	X	X
Baetis	-	X	X	-	X	X
Acentrella	-	-	-	X	-	-
Centroptilium	X	-	-	-	-	-
Paraleptophlebia	-	X	-	-	-	-
Habrophleboides	-	-	-	-	X	-
Isonychia	-	X	X	C	X	-
Ephemera	-	X	-	-	X	-
Stoneflies						
Leuctra	X	X	X	X	X	-
Amphinemura	X	-	-	X	-	X
Peltoperlidae	A	X	X	A	X	X
Sweltsa	-	-	-	X	-	-
Suwallia	X	-	-	-	-	-
Acroneuria	X	X	-	X	X	X
Isoperla	X	-	X	C	-	-
Yugus	-	-	-	X	-	-
Remenus bilobatus	-	-	-	X	-	-
Pteronarcys	C	X	X	X	X	-
Caddisflies						
Rhyacophila fuscula	X	X	X	X	X	X
R. carolina	-	-	X	X	-	X
Glossosoma	C	X	X	-	X	X
Agapetus	-	-	-	A	-	-
Dolophilodes	A	A	X	X	C	C
Hydropsyche sparna	-	C	-	-	X	X
H. slosonae	-	-	-	-	X	-
H. alhedra	-	-	-	-	-	X
Diplectrona modesta	X	X	X	X	-	-
Hydroptilidae	-	-	X	-	-	-
Pycnopsyche	-	-	X	X	-	-
Goera	-	-	-	-	-	X
Neophylax	-	X	X	X	-	X
Micrasema	-	-	X	-	-	-

A =Abundant, C = common, X = Present

Table 7. (continued)

	Little Run	Camp Run	Pike Run	Roaring Run	Back Creek	Trout Run
Station	2	9	18	19	91	88
Date	7/28	7/29	7/07	7/07	7/30	7/30
Beetles						
Elmidae	X	X	X	-	X	X
Oulimnus	-	X	-	X	X	X
Promoresia	-	X	X	-	-	-
Ectopria	-	-	-	-	-	-
Ptilodactylidae	-	-	-	-	X	-
Dragonflies						
Lanthus	-	-	-	-	-	-
Fishflies/Alderflies						
Nigronia	-	X	-	-	-	X
Sialis	-	-	-	-	-	-
True flies						
Chironomidae	X	X	X	X	X	X
Tipula	-	-	-	-	X	-
Hexatoma	-	-	-	-	-	-
Limnophila	-	-	-	-	-	-
Dicranota	-	-	-	X	X	X
Atherix	-	X	-	X	X	X
Psychodidae	-	-	-	-	-	-
SimuliIdae	-	-	X	X	-	-
Empididae	-	-	X	-	-	-
Misc. invertebrates						
Oligochaeta	-	-	-	X	X	-
Asellus	-	-	X	-	-	-
Cambaridae	X	X	-	-	X	-
TOTAL TAXA	16	22	25	28	25	19
Number EPT Taxa	13	15	19	22	16	13
Number Mayfly genera	2	5	6	6	7	2

A = Abundant, C = Common, X = Present

Table 7. (continued)

	Wash Run	Poplar Run		Newmyer Run	Poplar Run
Station	84	98	104	109	117
Date	7/29	7/26	7/26	7/26	7/26
Mayflies					
Heptagenia	C	-	-	-	-
Leurocuta	X	-	-	-	-
Baetis	X	-	-	-	-
Stoneflies					
Leuctra	C	-	-	-	-
Peltoperlidae	A	-	-	-	-
Acroneuria	X	-	-	-	X
Caddisflies					
Glossosoma	A	-	-	-	-
Diplectrona modesta	C	-	-	-	-
Dragonflies					
Lanthus	X	-	-	-	-
Beetles					
Elmidae	X	-	-	-	-
Ectopria	X	-	-	-	-
Fishflies/Alderflies					
Sialis	X	-	-	-	-
True flies					
Chironomidae	X	-	-	-	X
Hexatoma	X	-	-	-	-
Limnophila	X	-	-	-	-
Dicranota	X	-	-	-	-
Psychodidae	X	-	-	-	-
Misc. invertebrates					
Oligochaeta	X	-	-	-	-
Cambaridae	-	X	X	X	-
TOTAL TAXA	18	1	1	1	2
Number EPT Taxa	8	0	0	0	1
Number Mayfly genera	3	0	0	0	0

A = Abundant, C = Common, X = Present