

## RECOMMENDATIONS

### GENERAL

The report recommends a program for abating the mine drainage pollution in the area streams of Bennetts Valley between Penfield and Mt. Pleasant Church (east of Benezette). This program consists of a series of remedial projects. It is recognized, due to the costs involved, that a planned program over a period of years would be necessary to fully abate mine drainage in the area.

### PRIORITIES

The priorities determined for various remedial projects within each watershed (Plate 80) are based on a number of considerations as follows:

1. Benefit/cost ratio and total acid abated.
2. Sub-watershed basis where practical, including importance of sub-watershed to total area and the percentage of stream miles which can be successfully cleaned.

The water quality of Trout Run is marginal at its mouth. The acid discharge sources are concentrated into isolated areas. With 57 square miles, the watershed comprises one-half of the 106 square mile study area. Over 92 percent of Trout Run is outside of the coal reaches and is not acidic. Therefore, it was recognized that relatively small expenditures here would provide large benefits on a sub-watershed basis (\$455,000 to abate 856 ppd of acid).

Similar characteristics of Bell Hollow (tributary to Laurel Run) which would eliminate the few acid mine discharge problems that exist in Laurel Run watershed (\$394,000 to abate 1,880 ppd of acid).

Because of the desires of local population, the Moose Run to Hollywood region should also be considered high on the list of priorities.

The large deep mines which individually cover many square miles make such a study very complex. Because of the interconnecting deep auger and strip mining, corrective measures in one particular watershed may have the desired effect of abating AMD in an adjacent but more critical watershed. For example, reversing the terrace to provide fast runoff of a stripping (and hence limit AMD production) such as S-123 in Kersey Run will have its most predominant effect in abating AMD in Cherry Run. The

reason is the large interconnecting Shawmut No.41-42 Mine (D209) which will route water caught in the strip mine to its water course near Cardiff (an abandoned mining village).

### RECOMMENDED REMEDIAL PROGRAM

Total abatement costs are estimated at \$10,468,000. The abatement program should proceed in two phases. The first phase includes the source correction type projects estimated to cost \$4,502,000. The second phase includes treatment facilities and closely allied remedial projects estimated at \$5,966,000.

The latter facilities capital costs (1973) are itemized as follows:

1.	4 MGD AMD treatment plant at Hollywood	\$2,930,000
2.	3.5 MGD AMD treatment plant at Caledonia	2,451,000
3.	2.0 MDG silo-type AMD treatment plant at Cardiff	310,000
4.	0.7 MGD silo-type AMD treatment plant at Tyler Reservoir	80,000
5.	0.6 MGD silo-type AMD treatment plant at Tyler	95,000
6.	0.6 MGD silo-type AND treatment plant at B&S Railroad Dike	60,000
7.	0.3 MGD silo-type AMD treatment plant East of Tyler)	40,000
		\$5,966,000

The total twenty year average annual operating costs for treatment is estimated at \$3,451,000. The seven treatment facilities are estimated to remove 22,600 lbs/day of acid from within the study area (42 percent of the loading upstream from Trout Run).

## INTRODUCTION

### A. PURPOSE

This report contains the results of an engineering survey performed by Berger Associates, Incorporated. The purpose of the study was to locate the sources of pollution, determine the amount of pollution, recommend measures by which acid mine drainage could be abated, and estimate the corresponding costs for abatement. The area of the study consists of 34.5 miles in the Bennett Branch of Sinnemahoning Creek watershed, situated in Huston Township, Clearfield County; Fox, Jay, Benzette and Benzinger Townships, Elk County; and Shippen Township, Cameron County. (See Scope of Study below and Index Plans - Plates 2 and 3 for specific area of the engineering survey.)

Act 394 of the General Assembly of the Commonwealth of Pennsylvania "Clean Stream Law", as amended, provides for the preservation and improvement of the purity of the water of the Commonwealth. In consideration of the problems existing in this area, the project was authorized by the Department of Environmental Resources in accordance with the provisions for such action as contained in Act 443, "The Land and Water Conservation Reclamation Act" of 1968.

Designated Project SL-195 by the Department of Environmental Resources, it is one of the areas scheduled for study and possible remedial actions under the Operation Scarlift Program. This is a comprehensive program to begin the task of restoring the more than 3,000 miles of Pennsylvania streams containing acid mine drainage. This engineering survey was specifically authorized under the terms and conditions of Agreement Number ME-4558, dated December 11, 1972.

### B. SCOPE OF STUDY

While there has been some mining activity west of the Village of Penfield, the water quality of Bennett Branch at Penfield (Sampling Station BB-1) is marginally good and displays predominately an alkaline characteristic.

In order to define the scope of the study, Department personnel took a series of grab samples in August, 1972, from Penfield to Driftwood. The samples were taken on Bennett Branch and the confluence of its tributaries with Bennett Branch.

Most of these tributaries, from Penfield to and including the tributary at Mt. Pleasant Church, were acidic and therefore were included

in the scope with the major exceptions of Wilson Run, Laurel Run and Medix Run. Wilson Run has some AMD discharges, but at its confluence with Bennett Branch has recovered somewhat to become marginal at this point. Laurel Run is a large unpolluted stream except for the Bell Hollow subwatershed adjacent to Bennett Branch. Medix Run is a good quality stream.

In addition to Bennett Branch itself, the area which received precedence for investigations consists of the subwatershed drained by Moose Run, Mill Run, Tyler Run, Tyler Reservoir Run, McComber Run west of Scattertown, Cherry Run, Kersey Run, Bell Hollow, Dixon Run at Caledonia, Trout Run and Mt. Pleasant Church Run.

Grab samples were taken in the tributaries downstream to Driftwood in order to confirm good quality water along this reach of Bennett Branch. Some regular sampling was performed at the heavily acidic Dents Run (BB220), and at Driftwood (BB233) to monitor the total Bennett Branch watershed.

### C. STATEMENT OF PROBLEM

Bennett Branch joins the Driftwood Branch, a generally good quality stream, at the Village of Driftwood to form Sinnemahoning Creek. Near the Village of Keating in Clinton County the Sinnemahoning Creek joins the West Branch of the Susquehanna River.

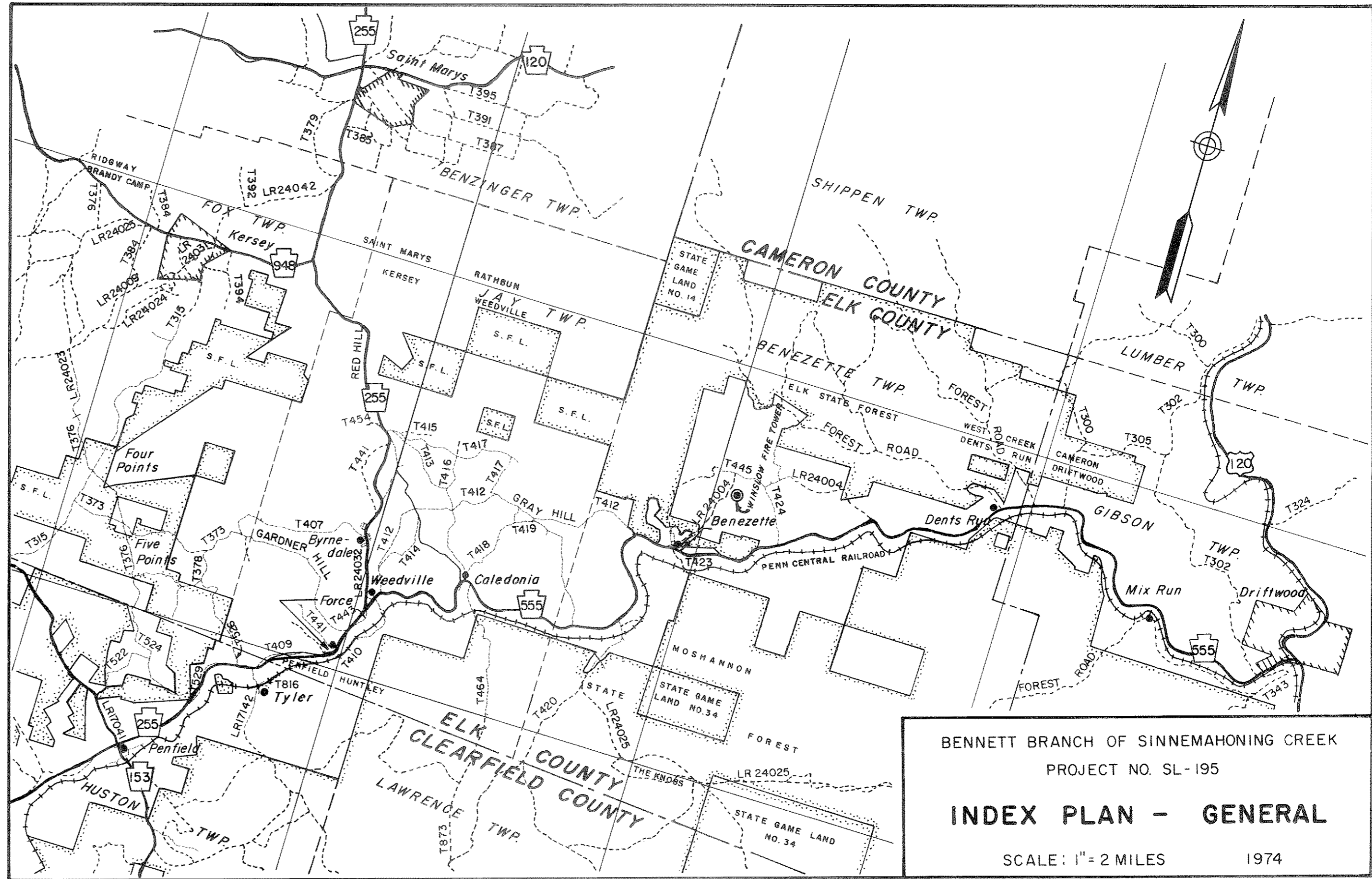
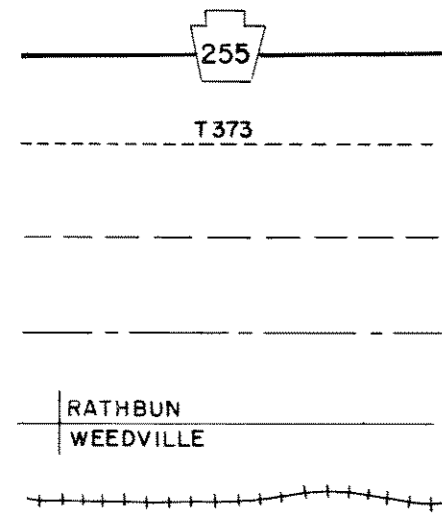
Bennett Branch drains an area of approximately 387 square miles and on an average day will discharge an excess of 454 MGD of water into the Sinnemahoning Creek at Driftwood.

As stated above, Bennett Branch contributes a heavy concentration of acid which contaminates the remainder of the Sinnemahoning to its confluence with the West Branch of the Susquehanna at Keating. The West Branch is strongly acid and this acid condition prevails to the area between Lock Haven and Williamsport where major tributaries with alkaline characteristics, such as Bald Eagle Creek and Pine Creek, begin to neutralize the water.

Bennett Branch traverses an area which has been commercially mined since the 1850's. The sub-watersheds, which, will be discussed in the text, have been stripped or deep mined exhibit acid characteristics in varying degrees of intensity.


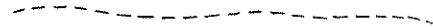


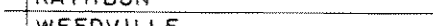

Many, but not all, of the streams which were investigated are acidic from their source, not conducive to aquatic life, and are unsuitable for recreational or commercial purpose. Some of the tributaries, however, notably Medix Run, Hicks Run, Laurel Run, and Mix Run display

**LEGEND**

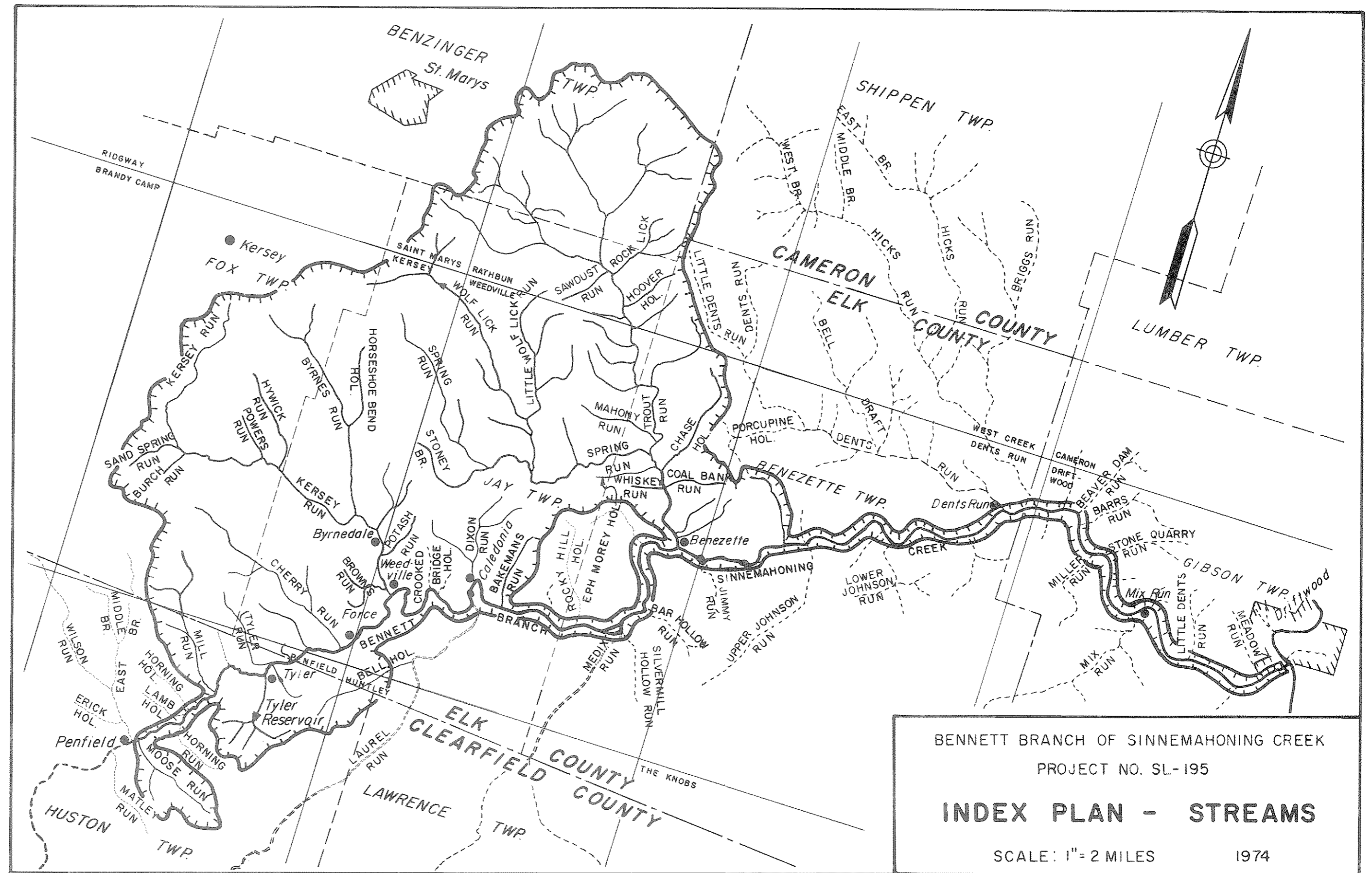
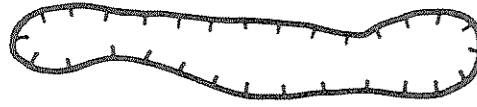


BENNETT BRANCH OF SINNEMAHONING CREEK  
 PROJECT NO. SL-195  
**INDEX PLAN - GENERAL**  
 SCALE: 1" = 2 MILES 1974

**LEGEND**

-  PROJECT AREA STUDY STREAMS
-  STREAMS NOT MONITORED
-  TWP. LINES
-  COUNTY LINES
-  U.S.G.S. QUADRANGLES
-  STUDY AREA

RATHBUN  
WEEDVILLE



BENNETT BRANCH OF SINNEMAHONING CREEK  
PROJECT NO. SL-195  
**INDEX PLAN - STREAMS**  
SCALE: 1" = 2 MILES 1974

good water characteristics and have a neutralizing effect on Bennett Branch even though their volume is not sufficient to counteract the acidity. All streams in the area exhibit flash runoff characteristics with typically low alkalinity reserves and somewhat less than average ability to assimilate acid mine drainage.

During periods of high flow, acid loads in excess of 60,000 lbs/day have been measured in Bennett Branch directly below the Trout Run confluence (BB136).

#### D. METHODOLOGY

The study was performed in accordance with the general guidelines established in Appendix A, Scope of Work, of the Engineering Agreement. Basically the work was divided into four general phases as follows:

1. Preparation and completion of a program of field work consisting of water quality sampling and flow measurements.
2. A thorough study of all available information regarding geology, mining, hydrology, etc.
3. The analysis of all accumulated data.
4. Preparation of this report, containing recommendations for remedial action.

#### E. HISTORY AND DESCRIPTION OF PROJECT AREA

Elk County was created in 1843 from portions of Clearfield, Jefferson and McKean Counties totaling 807 square miles. The county seat, originally at Caledonia, is now located at Ridgway.

The County is named for the elk herds which once existed in large numbers throughout the area. Currently, the herd is protected and numbers 80 to 100 animals within a range between St. Marys and the village of Caledonia.

The first settler in the Valley was John Bennett, who with his father came up the Susquehanna in 1787 to hunt beaver. They built a cabin at a point where Caledonia is now located. It is believed therefore, that Bennetts Valley derived its name from this pioneer.

Coal mining in the area dates generally from the late 1850's. As early as 1815, coal was discovered in Elk County by a survey party. One of the first small coal mines opened was in 1843 near Caledonia.

In the earlier years lumber was an important industry, reaching its peak between 1893 and 1910. Besides the lumber and coal mining industries, there were also smaller industries such as tanneries, brick works, grist mills and even oil (western part of Elk County).

#### 1. Transportation

During the nineteenth century, transportation for raw materials was still a major factor. The proximity of Elk County's bituminous coal to New York and New England caused users to investigate the area for new supply sources which could be developed and provide lower transportation costs than those of Southwestern Pennsylvania or West Virginia. Even today, most of the coal mined in the area is delivered to power plants in Buffalo rather than Pittsburgh.

As with most mining development in this country, that in Elk County was directly associated with the development of the railroads. Bennett's Valley at its peak had three railroads in close proximity to each other and each line served only a limited number of mines.

The Pennsylvania Railroad, Bennetts Valley Route, was known as the Low Grade Line. The railway connected to other lines at Falls Creek west of DuBois. Until 1934, as many as seven passenger trains a day served the valley. Freight traffic from the area consisted mainly of coal and lumber. Farther west the Pennsylvania oil fields generated much traffic until 1886 when the fields began to decline. The Low Grade Line is still in service; the only one of three railroads which once existed in the valley.

The main route of the Pennsylvania Railroad in Elk County is north of the project area through St. Marys to Emporium, partly along Pennsylvania Route 120 (this line is now proposed for abandonment in the Federal Reorganization Act). Although considered the main line, from the standpoint of county lumbering and coal deposits, it is poorly located and has two high summits to traverse.

The B&O Railroad (formerly the Buffalo and Susquehanna) paralleled the Pennsylvania through Bennetts Valley to Driftwood, often only a scant number of yards away. It was abandoned east of Medix Run in 1956. The tracks through the remainder of the valley were removed in 1973, during the period of this study.

The Pittsburgh, Shawmut and Northern Railroad resulted from a merger of several smaller lines and followed the eastern continental divide through Kersey and St. Marys, and on into New York State. In 1900



the Shawmut Company organized the Kersey Railroad to transport the coal from the Kersey Mining Company in the Byrnedale, Weedville and Tyler areas. This line operated as a separate "construction line" from 1902 to 1947 and was never merged with the PS&N. The history of the PS&N is clouded with financial problems and was terminated March 31, 1947, after the longest receivership for a railroad (40 years). Nothing is left today of this railroad except the roadbed which is still apparent in isolated areas. Branches of the line had extended as far south as the Proctor No.1 and Procter No.2 Mines at Hollywood.

Two major highways provide access to the study area: Pennsylvania Route 255 parallels Bennett Branch from Penfield to Weedville and then traverses northerly through St. Marys; Pennsylvania Route 555 follows Bennett Branch from Weedville to Driftwood.

## 2. Natural Gas

In Bennetts Valley, natural gas production started in the early 1950's. The most successful wells are south of Bennett Branch in Clearfield County. Following several years of good production in the wells began to decline. Some wells are still producing gas, but on a greatly reduced scale. Some new wells are still being drilled, and recently exploration work has been done on a greatly expanded scale for new reserves throughout the entire study area.

In March, 1974, the Driftwood-Benezette Gas Storage Field was created. This gas storage field is 18-1/2 miles long and 6 miles wide, containing 37,223 acres, and will be able to store approximately 266 billion cubic feet of gas, making it the largest east of the Mississippi and possibly the world. Seventy-two percent of the field is to be on state-owned Moshannon and Susquehannock State Forests in Cameron, Elk and Clearfield Counties.

## 3. Population Data

The villages within the study area originate for the most part as company towns; first for the lumber industry and then for the coal mines. They were boom towns which have been severely affected by the decline of industry in the region. The village of Tyler, for example, once had a population exceeding 3,000; today there are less than 100 people. The village of Cardiff in Cherry Run once had a population of 200. Today, it is one of the three known ghost towns in the area.

The Bennett's Valley villages in order of settlement are as follows:

Benezette	1812
Medix Run	1812
Weedville	1813
Caledonia	1815
Penfield	1853
Cardiff	1899 (Ghost)
Byrnedale	1900
Force	1902
Tyler	1904
Coalville	? (Ghost)
Five Points	? (Ghost)
Hollywood	1924

Elk County Population Growth Data:

1840 - 585
1850 - 3,501
1860 - 5,815
1890 - 22,231
1930 - 33,431
1950 - 34,503
1970 - 37,770

The peak employment in deep mines in Elk County was reached in 1905 with 2,424 miners and a production estimated by others at 1,350,000 tons in the same year. Over the years some 200 firms operated coal mines in the Elk County coal fields.

Elk County's industry is concentrated in the larger towns and currently employs 7,700. About 225 men are presently working in the coal market.

#### 4. Terrain

The study area covers 106 square miles along Bennett Branch from Penfield to Mount Pleasant Church, and accounts for all polluting tributaries (excluding Dents Run) or sources which affect the Sinnemahoning Creek at Driftwood. The region lies, for the most part, in Elk County. Portions of the study extend to Clearfield and Cameron Counties.

The project relief extends from an elevation of 2,308 feet at Red Hill summit near the village of Fairview to 790 at Driftwood. The Bennett Branch itself drops 450 feet over the 34.5 mile reach.

The region terrain is basically a severely eroded plateau whose valley walls are heavily forested.

Eighty-eight percent of Elk County is forest (451,000 acres) and of the total, 48 percent is forest land owned by State and Federal agencies. These areas serve dual uses of recreation and timber production.

Six percent of the land is used for agriculture and five percent of the people make their living in farm related work. This endeavor is restricted by limited markets, the rugged terrain and a short growing season. Many of the local farmers have sold their land and the farms have been strip mined in several sections throughout the study area.

1,390 acres have been strip mined within the past thirty years and currently there are at least eighteen Mine Drainage Permits being processed to increase this acreage by as much as 50 percent. The principal recovery method used in the past has been contour mining; however, with larger available equipment and improved extraction methods, some of the higher elevation veins which have been bypassed are now scheduled to be taken using mountain top or area mining techniques.

#### F. SURVEY PROCEDURES

The watershed survey was accomplished by completing comprehensive programs of field sampling and flow measurements, laboratory testing, and office-field studies of these data, along with the available data published on this general area. The following is a resume of the various procedures employed:

##### 1. Field

###### a. Location of Sampling Stations.

Subsequent to a general study of the geology, past mining, and drainage of the area, all known points of discharging mine drainage were located. An in-depth watershed reconnaissance survey was conducted which included walking the croplines and streams to establish the condition of each watershed in the study area. Information from personnel at the Division of Mine Area Restoration, Bureau of Resources Management, Department of Environmental Resources was utilized to locate sources.

In addition to flow measurements and water analyses at all of the points of suspected AMD, it was desirable to obtain information at various points where water from one mine or area came in contact with water from a different source. Sampling stations for this purpose were located at the confluence of the major streams of the watershed and in certain cases in a stream below the point where a major source of mine drainage entered the stream. Test results of samples taken at these points were used to ascertain the effect on chemical characteristics of mixing of the various waters.

All stations were located as near to the point of discharge as was possible. All known AMD into the watershed was sampled. The sampling program remained flexible through the term of the project; that is, when a minor source was proved to be marginally acid, sampling was discontinued. Conversely, in a few cases when additional sources were found through further investigations, a partial sampling program was started and was continued for the balance of the water year.

Subsequent to the review of the known sources of pollution, a system of numbering acid mine drainage sampling stations was developed. The basic water sample identification system utilized letter prefixes as follows: letter prefix MO - Moose Run; M - Mill Run; T - Tyler Run; TR - Tyler Reservoir Run; SC - Scattertown Area; C - Cherry Run; K - Kersey Run; ST - Spring Run; CA - Caledonia Area; TT - Trout Run; CH - Chase Hollow; W - Whiskey Run; BB - Bennett Branch; BH - Bell Hollow. In addition, prefix UN identified abandoned deep mine discharges flowing directly into Bennett Branch near the Village of Force. Plates No.39 through No.47 list the source type, measurement type and location of sampling stations,

## 2. Laboratory

a. Test Program. The standard group of tests performed on AMD samples included pH, alkalinity, acidity, total iron, ferrous iron, and sulfates.

b. Procedures and Specifications. All of the standard tests were performed in accordance with the procedures as outlined in the 13th Edition of Standard Methods for the Examination of Water and Wastewater, as published by the American Public Health Association and others.

3. Other. Prior to and during the study, numerous sources of data were consulted and various methods of obtaining information were employed. The more significant categories of information required and obtained consisted of:

a. Mine Maps. The project area has generally been heavily deep mined. Maps of underground mining are necessary to understand the complex subsurface hydrology in this area. Some of these maps were obtained from the Department of Environmental Resources' files in their Ebensburg office. WPA Mine maps were obtained from the Harrisburg Offices of PennDER and many other mine maps were located in the State archives. The bulk of the underground mining in the project area was from Penf ield to Caledonia, cropline to cropline. In this area the Caledonia Syncline coincides generally with Bennetts Valley. Early maps of workings controlled by the large companies are quite thorough, however, maps of some of the smaller workings and "country bank" mines are not available.

b. Weather Data. During the course of the study period, precipitation was monitored with a Taylor 11-inch rain gauge which was located in Benzinger Township, just east of the Borough of St. Marys and directly adjacent to the study area. Plate No.36 lists the daily record of precipitation measured at this rain gauge. Additional general information from the U. S. Department of Commerce Weather Bureau and other published data from various sources were also used.

c. Geologic Data. The geologic data were developed by making use of all available published and unpublished information, maps and numerous personal interviews with mining engineers, mine owners and operators. Certain information was gathered during the course of the routine field program and special field trips.

### G. EL CAMTON PROJECT

Approximately two miles north of Benezette, the U. S. Bureau of Mines has completed portions of a strip mine reclamation demonstration as a part of the Bureau's El Camton Project (see Plates No.4 and No.5).

The purpose of this project was to evaluate techniques and costs of five different methods of secondary backfilling of strip pits. The results were published in 1966 as the Bureau of Mines' Report of Investigations 6772.

Another phase of the project involved revegetation using grass, legumes and trees, and the results were published in 1968 as RI 7075. The project was conducted in association with the Soil Conservation Service and the Forest Service of the U. S. Department of Agriculture, Pennsylvania Department of Mines and Mineral Industries, Pennsylvania Department of Forests and Waters, and the Pennsylvania Game Commission.

The original surface slope for these test areas was about 14° and was heavily forested.

The highwall ranged from 60 to 80 feet high and the floor of the abandoned strip pits had been roughly regraded toward the highwall, according to pre-1964 legislative requirements.

1. Method A (see Plate No.5) consisted of bulldozing the spoil into the pit until the regraded surface sloped about 3° away from the highwall. This method, while inexpensive, did not meet the requirements of the 1964 Pennsylvania Strip Mine Law because the highwall, while reduced in height, exceeded the 45° maximum slope requirement. Cost was \$5.18 per lineal foot of stripping.

2. Method B consisted of pushing spoil towards the highwall by bulldozers with grading to the original contour almost attained. This method, which cost \$15.73 per lineal foot, attributed its high cost to difficulty encountered with buried timbers. If no timbers had been buried in the backfill, and had the work been done immediately after the stripping operations, it is stated that the cost might have been reduced by as much as two-thirds.

3. Method C involved bulldozing the highwall down at about a 25° angle to meet spoil bulldozed into the pit from below until the height of the highwall was reduced to about one-half. Results are gentle slopes and easy grades. Costs were \$11.70 per lineal foot.

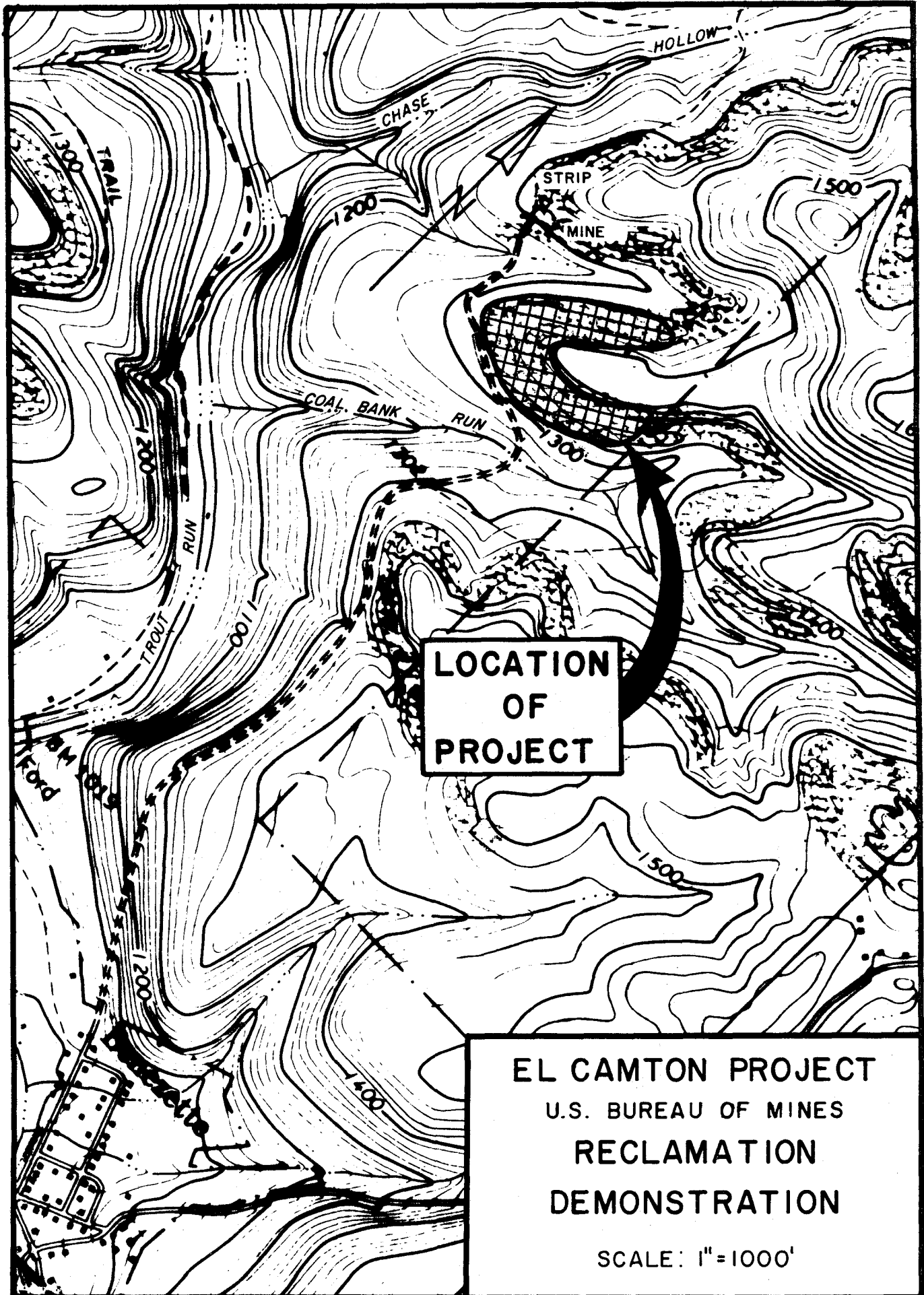
4. Method D involved reducing the angle of the highwall only by four rows of vertical drill holes and blasting into the strip pit to a resultant highwall angle of approximately 25°. No work was performed on the terrace. Cost was \$14.08 per lineal foot.

5. Method E which was not demonstrated at this site but on a strip pit in adjacent Bark Camp Hollow, Clearfield County, is similar to the fourth method except the highwall was sheared to a maximum of 45° from the horizontal by use of a single line of slant drill holes and blasting the highwall into the pit. The method was designed to perform the minimum amount of work to bring the site into compliance with the 1964 Law. Since this law permitted a terrace sloped towards the highwall, again no work was done on the terrace. Cost was \$8.84 per lineal foot.

One drawback to these methods, which involved work above the highwall, was the loss or destruction of natural forest. After ten years of growing time the project has displayed a heavy grass or legume cover throughout. The trees, either volunteer or planted, have not successfully replaced themselves on the steeper slopes. The revegetation experiments demonstrated the great importance of the addition of, lime, at least to a pH of 5.5, and of a good mixture of grasses and legumes. The much reduced importance of the addition of fertilizer was also demonstrated.

#### H. HOLLYWOOD EXPERIMENTAL ACID MINE DRAINAGE TREATMENT FACILITY

The experimental acid mine drainage treatment facility located at the Village of Hollywood was developed and constructed under various agreements and grants between the former Pennsylvania Department of Mines and Mineral Industries, the former Federal Water Pollution Control Administration, and The Pennsylvania State University. The respective project representatives were Dr. David R. Maneval, Mr. Ronald D. Hill, and Dr. Harold L. Lovell.

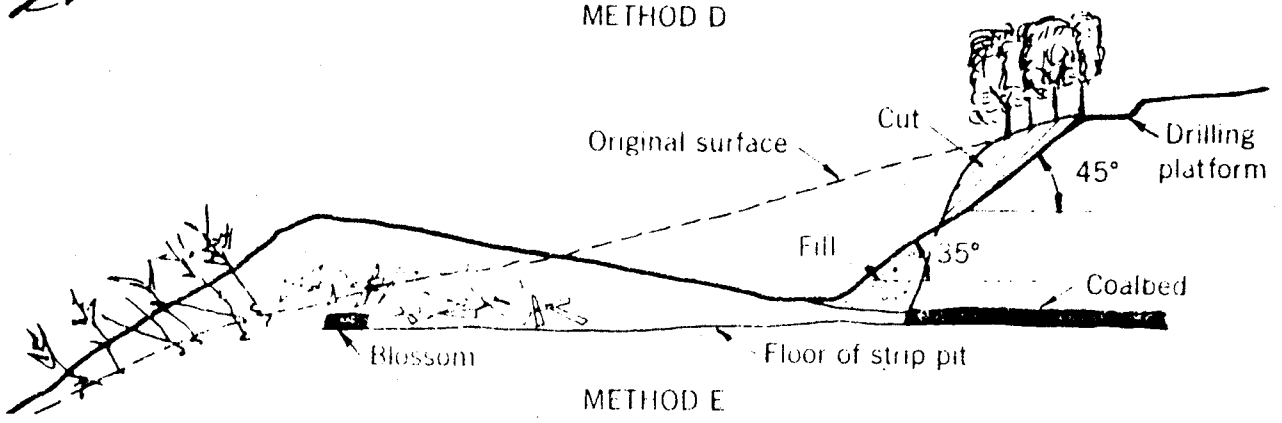
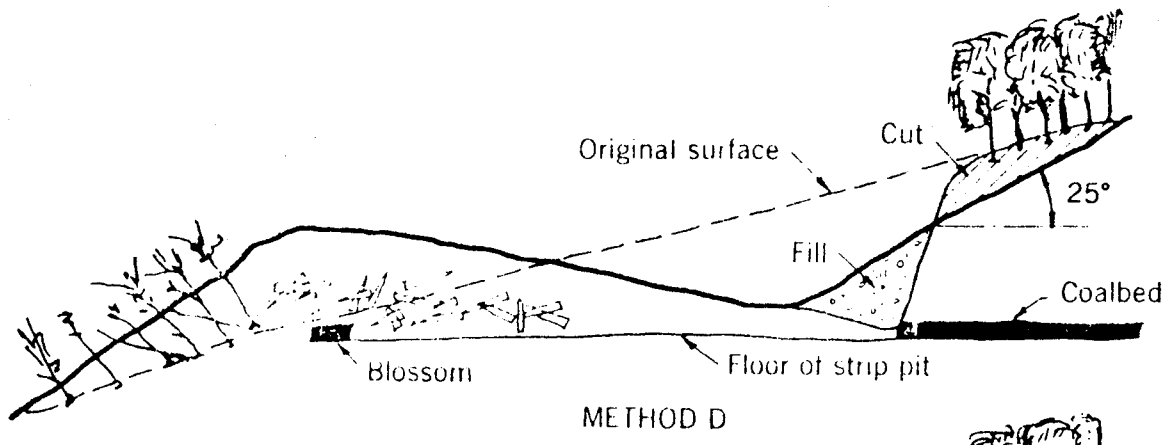
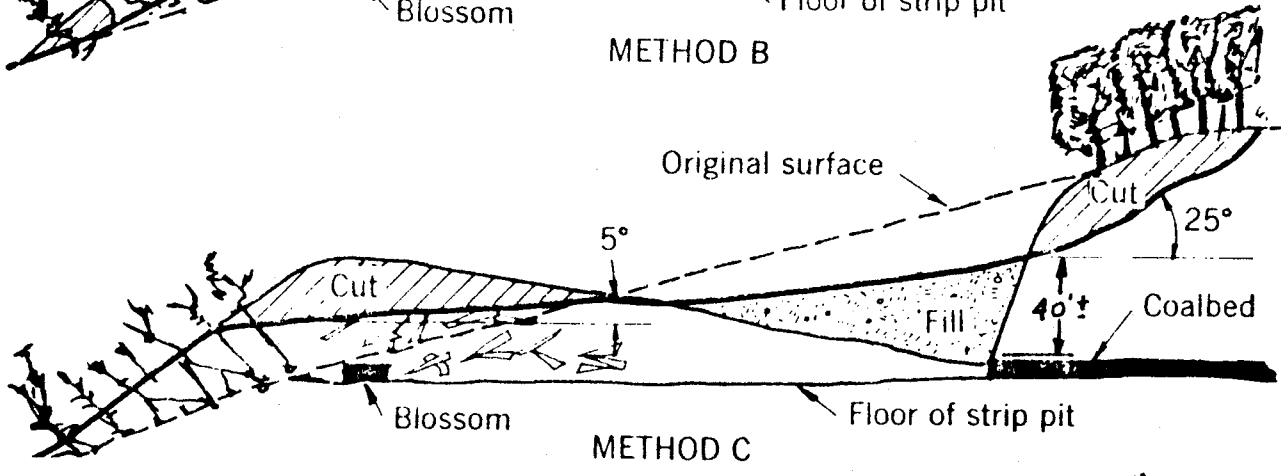
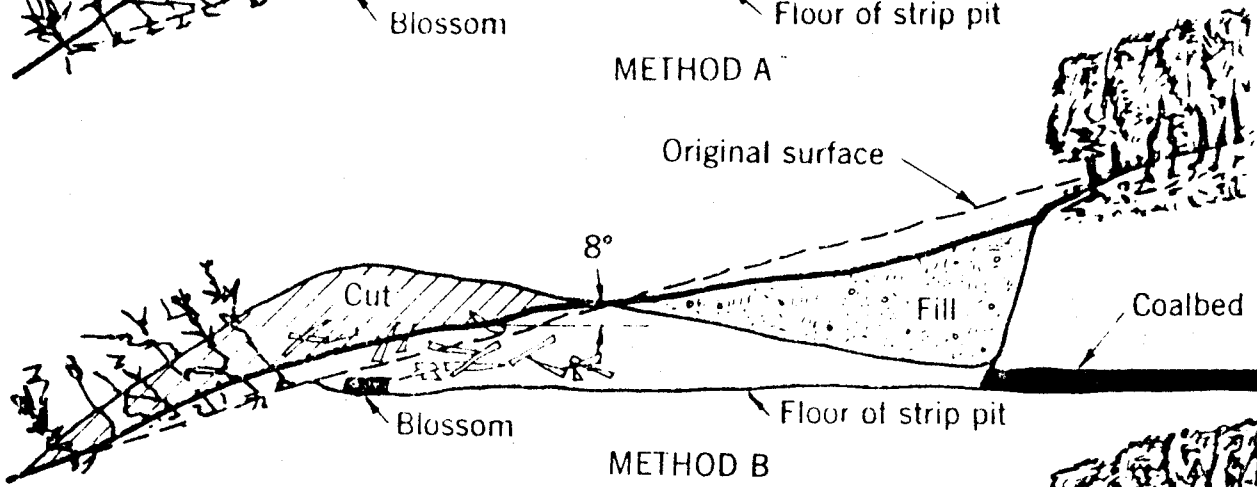
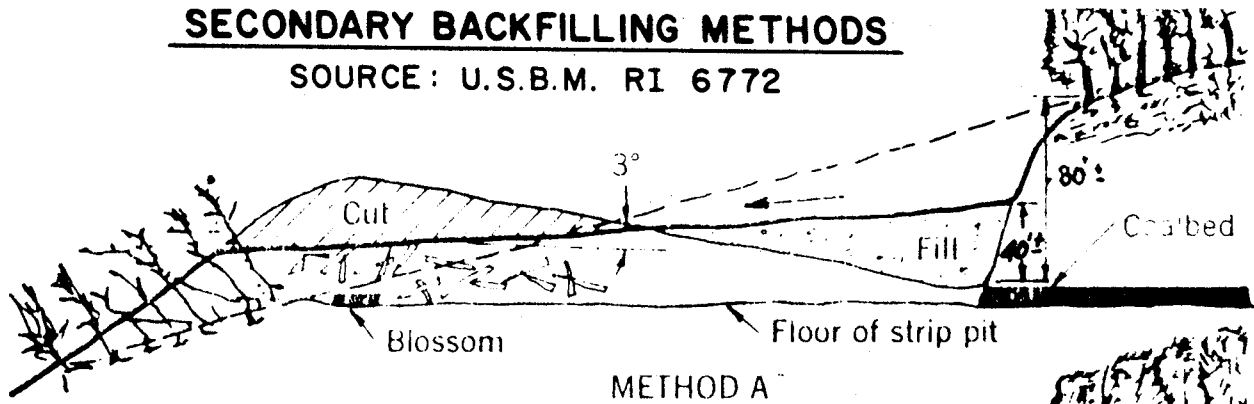


**LOCATION  
OF  
PROJECT**

**EL CAMTON PROJECT**  
U.S. BUREAU OF MINES  
**RECLAMATION  
DEMONSTRATION**  
SCALE: 1"=1000'

# SECONDARY BACKFILLING METHODS

SOURCE: U.S.B.M. RI 6772





The approximate cost of the facility was \$1,200,000, including engineering. Maximum capacity of the plant is 500,000 g.p.d. Construction of the plant started in March, 1968 and it was dedicated June 27, 1970.

It operated by utilizing one of three 350 g.p.m. pump stations at a time and has the capability of treating water from the Proctor No.1 Mine, Proctor No.2 Mine, Tyler Run, and Bennett Branch, hence it can treat varying qualities of AMD.

The original purpose was a demonstration of the treatment of acid mine waters by neutralization. Investigations of five basic treatment processes comprised the actual demonstration study. These five processes were as follows: (1) Flash mixing, aeration and settling; (2) Flash mixing, aeration, thickening, settling; (3) Thickening (with lime), sludge recycle, supernatant discharge; (4) Biological oxidation, thickening, limestone reactor settling; and (5) Trickling filter, thickening, limestone reactor, settling.

Unique equipment designs included a rotary limestone reactor, biochemical surface reactor, settling lagoon, and sludge drying basin. The various alternate equipment allowed a direct comparison between various waters, processes, and reagents in operating a full size plant on an experimental basis.

Because the Hollywood plant was designed as an experimental treatment facility and can accept only a 350 gpm influent, it has been determined that the existing arrangement will be insufficient to continuously treat AMD at an effective level. This plant is an excellent laboratory and should be maintained by the Commonwealth in this capacity.

The initial evaluation for expanding the Hollywood Plant to an operational unit would be to utilize the three existing pumps concurrently. This will, at the least possible cost, treat 1.5 MGD. Because of the instrumentation abilities, treatment capacity and site restrictions, the suggested treating would be by calcium hydroxide coupled with aeration. The sludge settlement basin is an expanded version of the existing design which relies on gravity flow to the sludge pumping stations.

#### Proposed Flow Process (See Plates No.6 and No.7)

1. Raw AMD will be pumped from three sources, Proctor No.2 (D206), Proctor No.1 (D208), and Tyler No.14 (D210), to two raw water holding lagoons. The purpose of these lagoons is to provide one-half day storage and also to provide for the mixing of the three different flows into a consistent raw water mixture (est. acidity = 950 mg/l and Ferrous Iron 275 mg/l).

**PROPOSED ADDITIONS AND ALTERATIONS  
TO THE EXISTING  
ACID MINE DRAINAGE TREATMENT PLANT  
HOLLYWOOD, PA.**

BY BERGER ASSOCIATES  
HARRISBURG PA.  
DATE SEPT. 27, 1973  
(PRELIMINARY PROPOSAL)

EXISTING  
PROPOSED  
LIQUID FLOW  
SLUDGE FLOW

AMD INFLUENT  
(PROCTOR NO. 1)

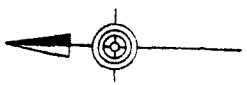
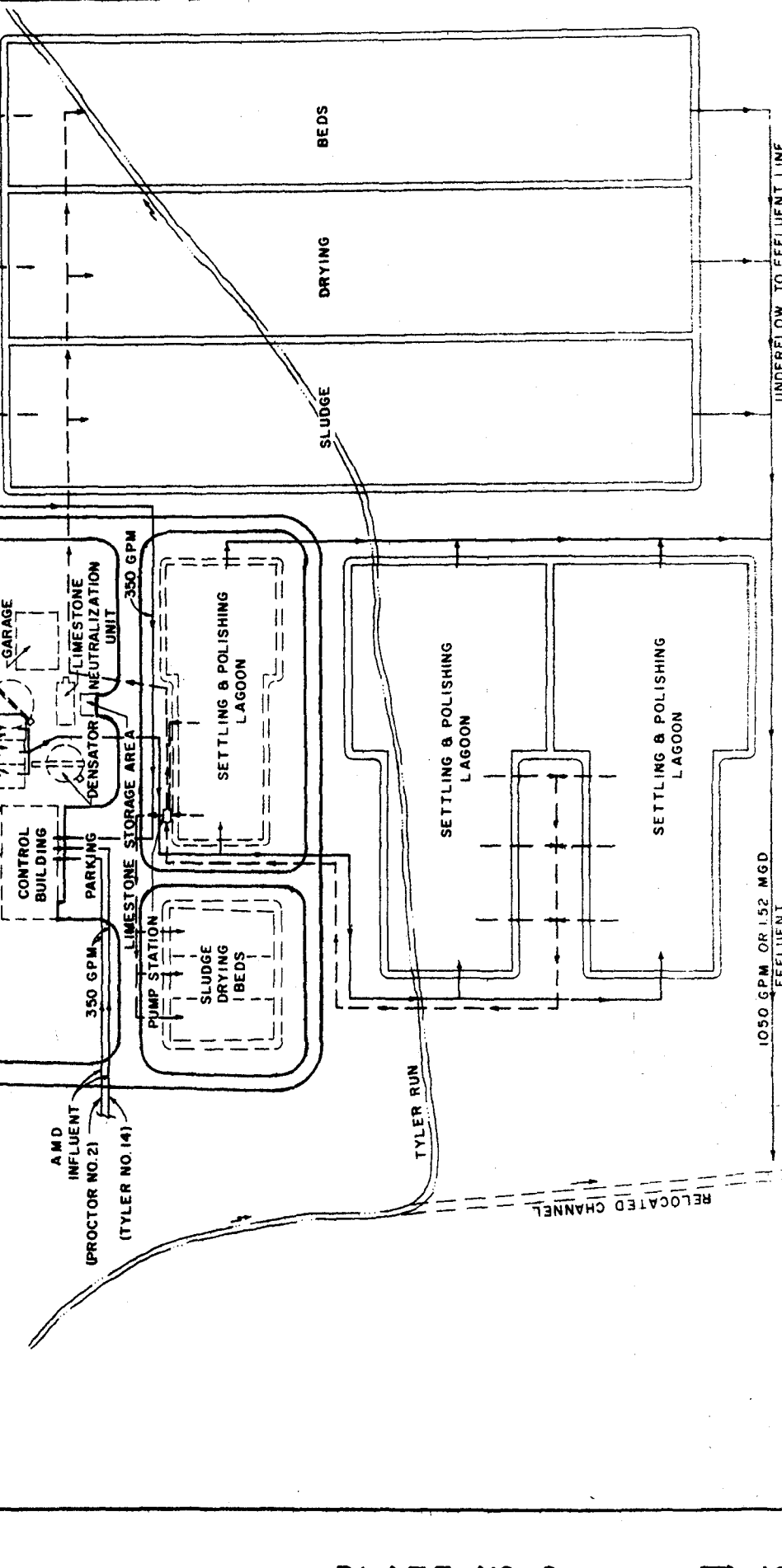
AMD INFLUENT  
(PROCTOR NO. 2)  
(TYLER NO. 14)

350 GPM  
350 GPM

350 GPM

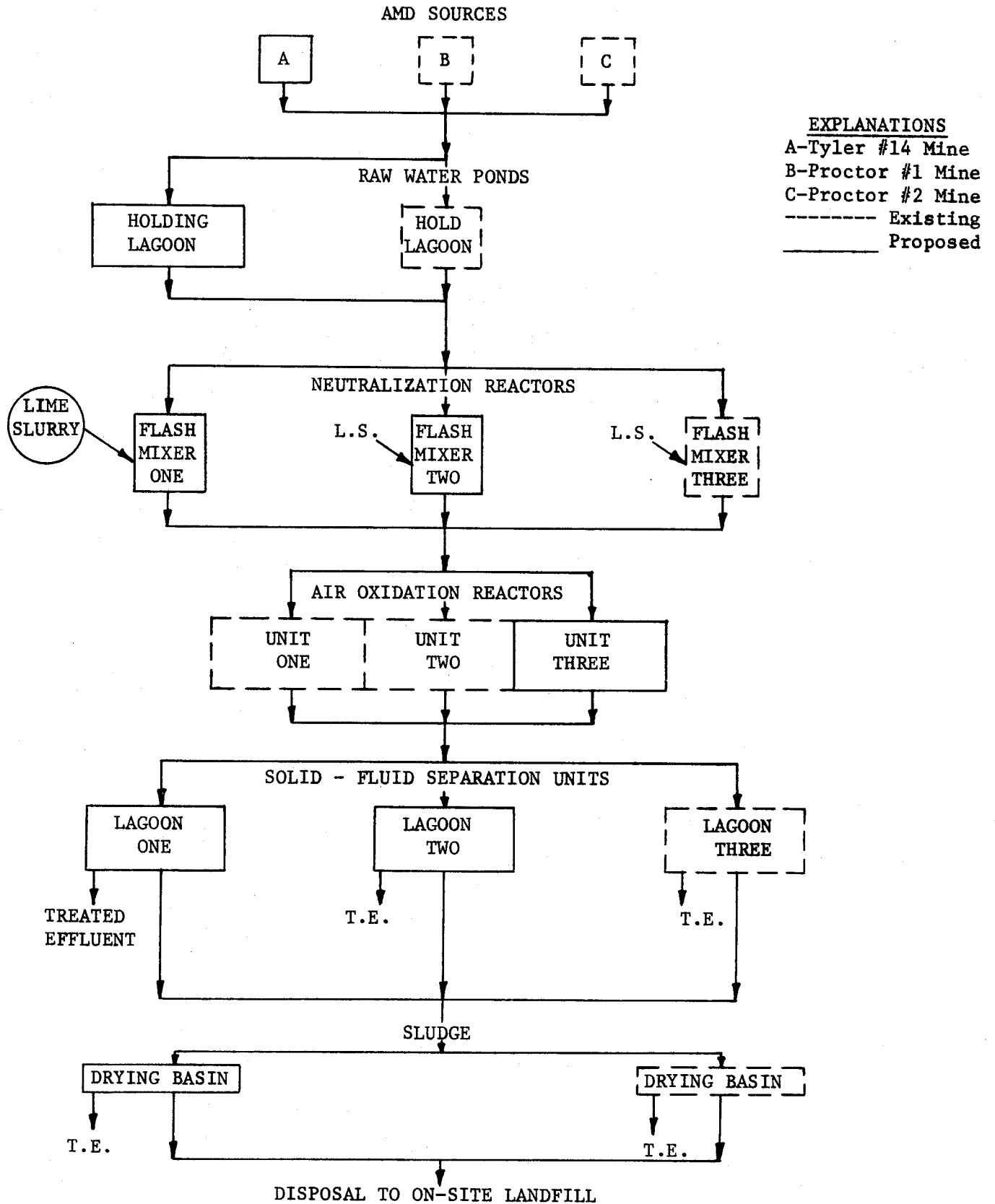
1050 GPM OR 1.52 MGD  
EFFLUENT

DRIED SLUDGE TO LANDFILL



0 50' 100'  
SCALE

# SCHEMATIC FLOW DIAGRAM OF PROPOSED AMD TREATMENT PLANT EXPANSION HOLLYWOOD, PENNSYLVANIA



2. The mixed raw water will then flow to three flash mixing tanks (two new and one existing) where a lime slurry solution will be introduced and mixed for 5 minutes to adjust the pH to approximately 7.5 or greater.
3. After mixing, the partially treated water will flow by gravity to three oxidation tanks (one new and two existing) where three surface aerators will provide the oxygen and mixing for 30 minutes to oxidize Ferrous Iron to Ferric.
4. Effluent from the oxidation tanks will then flow by gravity to two new settling and polishing lagoons where approximately 12 hours of settling and one day of polishing is provided. The existing settling and polishing lagoon will be left intact and will provide standby operation.
5. Treated effluent will then be discharged to Tyler Run.
6. Sludge will be removed from the settling lagoons automatically utilizing mechanical sludge removal devices. The sludge will be allowed to dry on three new sludge drying beds and the existing sludge drying beds.
7. Dried sludge will be disposed to an adjacent landfill (enlarged borrow pit).

Additional Comments

1. Major process units will be sized so that if one unit becomes inoperative, temporary diversion of its flow to its parallel unit will not adversely affect the overall quality of the treated effluent.
2. A cost for standby power generation equipment to keep the plant operable during power outages has not been included, since no flow will arrive at the plant if an outage occurs. However, if the permit agency deems standby power necessary, this would have to, of course, be included in the preliminary estimate.

PRELIMINARY ESTIMATE  
 PROPOSED ADDITIONS AND ALTERATIONS  
 TO THE EXISTING  
 ACID MINE DRAINAGE TREATMENT PLANT  
 HOLLYWOOD, PENNSYLVANIA

<u>Item</u>	<u>Cost</u>
1. Modification of Influent Piping to Raw Water Holding Lagoons	\$15,000
2. New Raw Water Holding Lagoon	46,000
3. Modifications to Effluent Piping from Raw Water Holding Lagoons	26,000
4. Structural Modifications to Control Building for New Flash Mixing Tanks	12,000
5. New Flash Mixing Tanks, Incl. Local Piping	21,000
6. Modifications of Influent Piping to Oxidation Tanks	23,000
7. New Oxidation Tank, including Aerator	28,000
8. Modifications to Effluent Piping from Oxidation Tanks	27,000
9. New Settling and Polishing Lagoons and Sludge Piping to Existing Sludge Pumping Station	154,000
10. New Sludge Drying Bed, including Piping	150,000
11. Treated Effluent Outfall Piping	37,000
12. Tyler #14 Pumping Station, including Masonry Mine Seal and Interceptor Pipes	50,000
13. Force Main Tyler #14 Pump Station to Existing Force Main at Bennett Branch	27,000
14. Cleaning of Existing Force Mains	5,000
15. Demolition of Existing Barn	1,000
16. Relocation of Tyler Run to Bennett Branch	10,000
17. Landscaping and Fencing	23,000
18. Miscellaneous (System Start-up, Rehabilitation Necessary Pumps and Interior Piping)	15,000
19. Instrumentation	<u>15,000</u>
	Sub-Total \$685,000
	+ 10% Contingency <u>69,000</u>
	Total Estimated Cost \$754,000