PROJECT SL 192
PINEY CREEK WATERSHED
CLARION COUNTY, PENNSYLVANIA

INTRODUCTION

On May 30, 1975, the Department of Environmental Resources of the Commonwealth of Pennsylvania contracted Gwin, Dobson and Foreman, Inc., Consulting Engineers to conduct a study of the Piney Creek Watershed of Clarion County, Pennsylvania. An examination of the general agreements and provisions of the contract is presented below. The study of the Piney Creek Watershed included:

1) Establishing the natural watershed boundaries.
2) Collecting and analyzing stream (grab) samples to determine the location and degree of pollution of tributaries in the watershed.
3) Establishing monitoring stations on the main stream and its' tributaries as a check of flow and water quality.
4) Locating and investigating active and non-active strip mines, deep mines, oil or gas wells.
5) Conducting a large scale sampling program on the entire watershed and its' tributaries.
6) Monitoring and analyzing acid mine drainage at its' source throughout the watershed.
7) Through engineering analysis, recommending abatement methods for the sources of pollution found in the watershed area.

The study initially involved an investigation into the sources of acid mine drainage generated within the watershed. Data was subsequently collected and analyzed to determine the quality and quantity of water being produced. The combined research effort resulted in recommendations in the form of engineered design projects that were directed to eradicate severe sources of acid mine drainage. The selection of a project area was determined not only by the immediate benefits to a local stream but also the effect the abatement would have on overall water quality within the basin relative to its' cost. With this objective in mind, priority numbers were assigned to the project areas. The proposed abatement work, if meeting the approval and requirements of the Department of Environmental Resources, will dramatically upgrade the quality of water within the Piney Creek Watershed. The obvious economic and esthetic benefits would result in an improved quality of life for the people in the immediate area.

PURPOSE AND SCOPE OF PINEY CREEK WATERSHED STUDY

The Piney Creek Watershed, located in Clarion County, Pennsylvania, was investigated in order to determine the extent of acid mine pollution being produced and discharged from the watershed area. The watershed area contains extensive coal reserves which have been recovered by both deep mine and strip mining operations. These natural deposits have been mined and the land exploited until recently when legislation was passed to control present and future mining. However, remnants of past mining operations remained and additional legislation was needed in order to provide funds for studies and reclamation work to repair the scars on the environment. This report is one such endeavor.

Acid mine drainage is the result of weathering of sulfide minerals present in strata intercepted by strip mines, deep mines, gas wells, oil wells and other methods of resource recovery. The main stream (Piney Creek) and its' tributaries are the direct recipients of this discharge; which is then responsible for further contamination. Therefore, it is necessary to reduce the pollution potential of the source to completely erase the contaminating agent. In order to completely evaluate the watershed area to find a means of controlling and eliminating stream pollution, the geology, hydrology and chemistry of the area was analyzed. The geology information included data regarding the various coal seams (structure, strike and dip, thickness of beds) and related beds and rock formations. The hydrology and chemical, data includes directional flow, flow measurement, water analysis, source location and extent of pollution in the watershed. All of this data, plus all available public information, was used in the preparation of this report.

In July of 1975, the start of the watershed study, random grab samples were taken in order to determine the sources (polluting streams and/or areas) of the watershed. A complete series of 32 flow measurement stations were then established in order to check the flow and analyze the discharge from the watershed area. These stations were monitored periodically while a portion of them were observed monthly. The results of these monitoring stations are illustrated in the stream quality evaluation section of this study. In order to monitor the sources more directly, a system of 300+ weirs (flow measurement and water sampling points) were established. These points monitored specific areas throughout the watershed whose data was later used to determine the degree of pollution, thus establishing the project areas of the watershed. These project areas consist of abandoned deep mines, strip mines, gas and oil wells and remnants of other resource recovery operations. They are further discussed in the proposed abatement portion of this report.

After these areas were identified, the methods of reclamation and cost were considered. The abatement measures considered were hydraulic deep mine seals, removal

and/or burial of refuse, clay blanketing, grouting, clay packing, slurry trenching, impervious covering, water management, backfilling, contouring and revegetating. Recommendations were then formulated and entered into this report.

The Piney Creek Watershed is not entirely contaminated as the data compiled reflects only certain areas of the basin responsible for the pollution. From this investigation, recommendations have been made to correct these problem areas through proven engineering methods in acid mine drainage abatement. If these measures are implemented, the Piney Creek Watershed will once again be a source of clean, potable water.

LOCATION AND DESCRIPTION

The Piney Creek Watershed is located in east central Clarion County, rising northeast of Kingsville, Pennsylvania and flows generally westward. The watershed drains approximately 70 square miles with an approximate length of 19 miles to its confluence with the Clarion River. The watershed is located approximately two miles south of Clarion and parallels I-80.

The watershed is bounded on the east and south by tributaries to Redbank Creek, on the west by the Clarion River and on the north by tributaries to Mill Creek. Piney Creek is fed by four major tributaries; Brush Run, Little Piney Creek, Reids Run and Sloan Run and several smaller feeder streams located about the watershed area.

The topography of the watershed varies from steep hillsides and valleys in the west to sloped hillsides with wide valleys to the south and rolling hills to the east. The central portion contains a mixture of all of these topographic features.

Several small communities are drained by Piney Creek. They are the villages of Reidsburg, Frogtown, Limestone, Williamsburg, Kingsville, Mechanicsburg and portions of the boroughs of Corsica and Strattanville. The watershed also falls within the limits of seven municipal townships. In order of decreasing area they are Limestone, Monroe, Clarion, Piney, Redbank, Porter and Union (Jefferson County). Agriculture and coal mining (strip) are the main economic activities in this rural area.

Various major transportation networks in the form of railroads and highways service the area. The major highway arteries include Interstate 80 and U.S. 322 that traverse east-west while Pa. routes 68 and 66 run north-south. The main purpose of the railroads are to service the coal tipples located along their routes. The Penn Central and Lake Erie, Franklin and Clarion Railroads run in a northwest-southeast direction and converge at Summerville; a main railroad station east of the watershed.

The climate is typified by invasions of subtropical air masses in the summer and polar air masses in the winter with an average precipitation of 44 inches per year.

PREVIOUS INVESTIGATIONS

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

The office of Water Resources Programs of the Environmental Protection Agency (Wheeling Office) conducted a stream quality survey titled, "The Appalachia Water Resources Survey". This 1967 report utilized twelve sampling stations situated along the Clarion River. Piney Creek station #515 (Water Resources Survey) was located just upstream from its' confluence with the Clarion River. From the period of May 1967 to October 1967, the station recorded an average flow of 10,935 gpm with a total net acid load (less alkalinity) of 19,272 ppd. Approximately 100 mining sites and an estimated 1,800 acres of surface mined land were investigated. Seventy-nine (79) of these sites were monitored and were found to have discharged a total net acid load of 10,941 ppd to Piney Creek. Of these sources, twenty-four (24) locations were identified as principal pollution sources and accounted for 88% of the total acid load measured.

During this same time period (1967), a cooperative study by the Environmental Protection Agency and the Pennsylvania Department of Mines (now the Pennsylvania Department of Environmental Resources) was conducted on the principle mine drainage problem areas in the Clarion River Basin. Single samples were taken and analyzed. Station #4283 of this study was located at station #515 (Water Resources Survey) and a flow of 6,827 gpm and an average acid load of 1,638 ppd was registered at this site

The Mineral Industries Division of Gwin Engineers, Inc., now Gwin, Dobson and Foreman, Inc., published a report entitled "Preliminary Report of Mine Drainage Abatement and Land Reclamation for the Department of the Army Corps of Engineers in May of 1970. Results for Piney Creek show totals of acid and flow of 8,275 ppd and 15,625 gpm respectively.

The United States Geological Survey is presently conducting a geologic and hydrologic study of Redbank Creek and the Clarion River in which acid loadings will again be monitored for Piney Creek and surrounding tributaries.

SUMMARY

The study of the Piney Creek Watershed Has shown that mine-related pollutant sources occur predominately in Little Piney Creek, Brush Run, the Headwaters of Piney Creek and the Shamburg area. The main causes of pollution can be traced to individual sources located within each area. These sources can be identified as drainage discharged from deep mines, abandoned wells, active tipples, refuse piles, abandoned strip mines with improper and inadequate backfilling, and subsurface sources (e.g. wells, springs). In regard to subsurface drainage, an exploratory drilling program, when deemed appropriate, should be undertaken to determine the sources of the groundwater contamination.

The Headwaters of Piney Creek in its' upper reaches are severely degraded from strip mining activities. However, this condition soon changes as Poe Run, Sloan Run, Glade Run, and other alkaline tributaries enter Piney Creek.

Acid water discharged into the main stream by Little Piney Creek changes the quality of water from an alkaline (pH +6.0) to a variable (pH 5.0 - 6.0) condition. The sources of contamination in the form of strip mine and tipple drainage originate at the Headwaters of Little Piney Creek in the northeastern part of the watershed.

The Shamburg area is a very active strip mine district. The recovery of deeper seams was facilitated by the advent of more modern equipment for extraction. A significant change in topography has resulted. Major pollution sources can be attributed primarily to strip mining and deep mining to a lesser degree. It should be noted that a tipple in this area radically increases the acid load to Piney Creek.

Brush Run, in the northern portion of the watershed, has been extensively deep mined, strip mined and has several flowing abandoned wells. This area is the major cause for concern as the highest pollution loads can be attributed to this region.

The main sources of alkalinity occur naturally within the southern portion of the watershed. This alkalinity can attributed to the stratigraphy of the area as the Vanport limestone outcrops and the beds are more pronounced in the southern region. This geologic formation is the main reason why Piney Creek for a considerable portion of its' length is not in a predominately acid condition.

It should be noted that sewage pollution is added to Piney Creek and its' tributaries throughout the entire study area as none of the communities have facilities for treatment of wastes. The soil conditions in eighty percent of the study region are not capable of renovating sewage.

It is felt that pollution control at the source is the most economical method of abating acid mine drainage. A treatment plant concept has been dismissed because of the high capital cost needed to construct the plants, the treatment of large volumes of water, and the continuous operation and maintenance of the plant itself.

RECOMMENDATIONS

It has been established that in order to control acid mine drainage, the cause of the pollution should be controlled rather than the end result of the pollution. This conclusion thereby eliminates the method of water treatment (neutralization) which requires continuous maintenance and expense. Therefore, the recommendations of this study are centered around restoration of the mine sites. All project areas of this report, which are acceptable to reclamation, contain some type of source reclamation. It is also understood that continuous surveillance be maintained on all work approved project areas of this watershed to determine the effectiveness of reclamation methods in use. The following pollution abatement methods have been recommended for use in this watershed.

1. Deep Mine Sealing

Projects of this type will consist of the construction of deep mine hydraulic seals and the pressure grouting of adjacent strata. These seals will be installed in mines discharging acid mine water or in mines interconnected with mines discharging acid water.

2. Strip Mine Reclamation

Restoration of abandoned strip mined land can be of two types. The first is backfilling to original contour which involves restoring the land as closely as possible to its original state before stripping. The other method is to backfill the spoil into terraces that permit water to run off rather than be held within the spoil.

3. Water Management

Water management involves the channeling of water away from areas to prevent recharge of strip or deep mines by means of diversion ditches, jute matting and/or riprap channels. Diversion ditches are cut in undisturbed material to channel water away from an area. They are especially useful above highwalls to prevent surface runoff from entering the strip or deep mine.

Jute matting is constructed for temporary use which is to prevent erosion by water from an area. Its usefulness is temporary, for it is designed to last only long enough until natural erosion control is developed.

Riprap channels are designed to be permanent structures and are constructed to transport runoff without erosion and dissipation into the ground. The channels are lined with riprap to protect the ground as well as reduce the velocity of the run off.

Also a major factor in water management is the seeding and planting of grass and/or trees to act as a long term agent to reduce erosion and water dissipation in to the ground surface. It is deemed necessary to plant all newly stripped areas as a follow up to the backfilling and contouring of the area.

4. Impervious Cover

Two methods are recommended to prevent percolation of water into strip mine spoil. The first is the use of Dowell M 170 or equivalent. This material forms an impervious gel layer under the surface. The other is to cover the entire surface of the strip mine with an impervious layer such as clay covered with topsoil, if required for vegetation.

5. Grout Curtain

The construction of a grout curtain involves drilling a line of holes in undisturbed material to a depth below the coal measure. Grout is a mixture of several materials such as cement, flyash, bentonite, etc. The grout is pumped under pressure into the substrata where it fills fractures and voids in the rock layers. The curtain forms a perched water table to a predetermined height, inundating the coal measure.

6. Clay Packing

This involves packing clay along the toe and up over the spoil for a short distance in order to inundate the coal measure. The clay may be covered with top soil and revegetated to prevent erosion.

7. Clay Blanket

To construct a clay blanket a trench must be excavated to a depth below the coal measure. Clay is placed in the trench and compacted in layers to a predetermined height necessary to inundate the coal measure. The rest of the trench is filled and compacted with layers of fine grained spoil material and the area is revegetated.

8. Slurry Trench

As a slurry trench is dug, a mixture of bentonite and water is pumped into the void. This mixture supports the sides of the trench and prevents it from collapsing. This allows the digging of vertical wall trenches and decreases the amount of excavation that is necessary. When the digging is completed the area is covered and revegetated. The slurry material forms an impervious barrier which creates a perched water table that inundates the position of the coal measure.

9. Gas and Oil Wells

Abandoned gas and oil well management involves the excavation, grouting and plugging of the holes.

10. Tipples

The Piney Creek Watershed contains at least six active coal tipples, some of which contribute heavily to the pollution of the streams in the watershed.
In order to determine the status of key located tipples, monitoring points were established as a check at their locations.

Tipple A (C & K Coal Company tipple, northeast of Shamburg, located on T-16030)

Located closest to the mouth of Piney Creek, C & K's tipple was monitored (PY-M5, PY-M6) during the last seven months of the study at the regular sampling periods. Because of its' location on the main stream of Piney Creek, flow (gpm) used is that of the cross-section stations located nearby. (See table 2, page 23 and Appendix B)

The average acid load contributed to Piney Creek was 8,360 ppd based on seven samples collected. This is equivalent to 26.5% of the total acid contributed to Piney Creek. The C & K tipple is radically the worst single source of pollution of the entire watershed.

Tipple B (Mauersburg Limestone tipple, on T-16071, east of Limestone)

Located on the main stream, runoff from this tipple enters Piney Creek just below the location where Glade Run merges with Piney Creek. Monitoring points PY-Ml and PY-M2 were established to check the runoff.

The data collected shows no significant acid increase of decrease. We must assume that this tipple is not responsible for further pollution loadings to Piney Creek. (See Appendix B, Tipple Monitoring Points).

Tipple C (Glacial Minerals Strattanville tipple, located in Strattanville)

Located on an unnamed tributary flowing into Brush Run, runoff from this tipple merges with the headwaters of the tributary and then empties into Brush Run just west of the Rehoboth Church.

The data collected (PY-M3 and PY-M4) shows no indication that this tipple is contributing to the pollution of Piney Creek, and is not considered a problem to the watershed. (See Appendix B, Tipple Monitoring Points)

Tipple D (W.P. Stahlman, now C & K Coal Col, tipple, southwest of Corsica on T-16009, near Holden)

Being the largest and only wet tipple of the three located at the headwaters of Little Piney Creek, this coal processing facility, which has been constantly monitored, has proven to be a highly polluting source. Monitoring points were not established as performed with other tipples because of its' location, but weirs PY 423, 427 and 430 and flow measurement station PX-25 were used to monitor discharge. It has been determined that this tipple is a highly polluting source and makes up a portion of Project Area Number 8 of this study.

Tipple E (R.E.N. tipple, west of Corsica, on T-16009, northwest of Holden)

Located on the northern bank of Little Piney Creek, this tipple is monitored by weir numbers PY 432, 424, 425 and flow measurement station PX-25. Again its' location made it improbable to establish monitoring points about the tipple and existing measurement points were used. It is concluded that this tipple is a heavy polluter of the headwaters of Little Piney Creek and is also a part of Project Area Number 8 of this study.

Tipple F (Corsica tipple, west of Corsica on T-16009 and north of Holden).

Located on the east side of T-16009 and on the northern bank of Little Piney Creek, this tipple is new and is operated on a part time basis. It is a simple operation involving stockpiling and loading and because of this, no attempt is made to control runoff through the tipple yard. Discharge is monitored by flow measure ment station POX 26. This tipple is also a part of Project Area number 8 of this study

We recommend that these tipples be inspected by Department personnel and the owners be informed of existing laws and corrective action that may be required. Suggested corrective reclamation methods may include diversion ditches for runoff, set - tling ponds with artificial liners and treatment of pond runoff and other flows.