PHASE I

ERNEST MINE COMPLEX

Project Objectives

The objective of the project was to develop an economically feasible, safe method of diverting all flows from the Ernest Mine Complex to a central discharge point where a single facility could provide treatment before discharge to Crooked Creek and its tributaries. The major constraints of the proposed scheme were that it must optimize construction and operation costs of the abatement and treatment facilities, as well as ensuring the safety of the public, in relation to personal injury and property damage.

General Site Conditions

The Ernest Mine Complex encompasses an area of approximately 21 square miles and borders the northern and western limits of Indiana, Pennsylvania. The Boroughs of Ernest, Creekside, and Fulton Run are situated along Crooked Creek and adjacent to the western extremities of the Ernest Mine workings. Reportedly, all mining activities were ceased in the mid-1960's by the owner and operator, Rochester and Pittsburgh Coal Company. The main processing plant and coke ovens are located adjacent to McKee Run (a tributary of Crooked Creek). The location of all known mine entries, shafts, and boreholes documented on the available mine maps are presented on Dwg. No. 70-108-M1.

Mining of the Upper Freeport coal seam in the Ernest Mine Complex has resulted in acid mine drainage into Crooked Creek from two known locations: (1) the Cummings Shaft, a large rectangular vertical shaft located approximately one mile north of the Borough of Ernest, below the Cummings Dam; and (2) four boreholes at a location designated as E-4, which is situated adjacent to Crooked Creek and about one mile south of Creekside, Pennsylvania. Although other entries are open into the mine, their ground surface elevations are higher than Cummings Shaft and E-4, and, prior to work on the project, were not draining.

Mine Drainage Abatement Study

Review of Available Documentation: With the assistance of personnel from the Rochester and Pittsburgh Coal Company and the Department of Environmental Resources' Harrisburg and Ebensburg offices, an extensive study of available geological and groundwater literature, mine maps, and related documentation was undertaken to establish the areas within or adjacent to the Complex that would be directly affected by the project. Surficial site studies were also conducted to verify and supplement the information provided on the mine maps.

Drawing No. 70-108-M1 shows the locations of all known mine shafts, boreholes, and entries found at the site or depicted on the mine and topographic maps. The adjoining coal complexes also shown on the drawing are:

1. The Seneca Coal Mining Complex - north of Ernest Mine,
2. The Lucerne Mine Complex - southeast and southwest of Ernest Mine, and
3. The McIntyre Mine Complex - west of Ernest Mine.

Although it was understood that these mine complexes, or portions thereof, were inactive, appropriate consideration was given to them in the development of the acid mine water abatement scheme for the Ernest Mine Complex.

Existing Mine Water Pools: Originally, two pools of acid mine water, existed in a portion of the Ernest Mine Complex southwest of the E-2 entry. The approximate extent of the pools is shown on Dwg. No. 70-108-M2. The upper pool is relatively small in surface area and extends outside the E-2 entry at approximately El. 1062. Apparently, this pool is constantly recharged and occurs in a high elevation area between the E-2 entry and the in by portions of the mine.

Northeast of the E-1 entry, a pool of water appears to exist in the mine between E-1 and the Cummings Shaft. The original water elevation in this area was approximately El. 1061, the same elevation as the discharge point from Cummings Shaft. However, search of the mine maps indicated that several masonry barriers had been constructed in the headings causing some doubt as to the existence of a single pool throughout the workings. Therefore, it was concluded that the removal of one or more barriers in addition to raising the level of the outfall at the Cummings Shaft would be necessary to divert the flow from Cummings Shaft to the E-1 entry.

Implementation of Project Objectives

To accomplish the project objectives, it was established by research of the available mine maps and coordinated field investigations that diversion of the flow from the Cummings Shaft to the E-1 opening at McKee Run and piping of the flow into the mine southwest of McKee Run at the E-2 opening would be feasible. The pool at the E-2 entry (El'. 1062) would rise and spill over into the lower pool in that portion of the mine. Simultaneously, the E-4

boreholes would be sealed, causing the lower pool to raise to the elevation of the E-3 entry (El. 1050) with subsequent discharge from that point. The elevation of the lower pool would be raised from El. 1015 to El. 1050, or approximately 35 feet. Gravity flow was planned from the discharge point at E-3 to the proposed treatment plant location.

All entries, boreholes, and shafts influenced by the increased hydraulic head would require permanent seals to prevent seepage or flow from these openings.

Adoption of the proposed diversion scheme included the assumption of risks by the Commonwealth of Pennsylvania relating to the possibility of mine drainage seepage breakouts through the overburden soil and rock materials or at unmapped or undiscovered boreholes or shafts having ground surface elevations below El. 1050. Since the concept of diverting all mine drainage to one location depended greatly on the existing conditions in the mine, which could vary significantly from that shown on the available mine maps, controlled hydraulic seals were adopted for critical sealed openings; i.e., in an emergency, the seals at E-4 and Cummings Shaft could be opened to lower the mine pools to permit an evaluation of the problem and performance of remedial work.

Critical Mine Shafts, Entries and Boreholes: As shown on Dwg. No. 70-108-MI, there are numerous shafts, entries, and boreholes into the Ernest Mine Complex. Those of interest for this study are as follows:

1. Cummings Shaft - One of two locations discharging acid mine drainage into Crooked Creek. The invert of the previously existing discharge point was approximate El. 1061.

2. E-1 Entry - A main entry into the Ernest Mine Complex northeast of McKee Run has an approximate ground surface elevation of El. 1066.

3. E-2 Entry - A main entry into the Ernest Mine Complex southwest of 'McKee Run. Mine water was pooled at this entry at approximate El. 1062 prior to this project.

4. E-3 Entry - Two main entries into the Ernest Mine Complex south of McKee Run, having an approximate ground surface elevation of El. 1050.

5. DDH-44 in the Borough of Creekside - A diamond drilled core boring located in the Borough of Creekside. Ground surface elevation at the approximate location of the borehole is El. 1078.

6. Crooked Creek Borehole - An abandoned borehole drilled into the mine workings from an approximate ground surface elevation of 1020. A similar second borehole was found in the general area during construction and was subsequently sealed.

7. E-4 Boreholes - The second known location where mine acid drainage was discharging into Crooked Creek from three large diameter boreholes prior to this project. A suspected fourth borehole was found in the area during the course of this project. Elevation of ground surface is approximately El. 1016.

8. Fulton Run Shafts - Two abandoned man and/or equipment shafts located in the Borough of Fulton Run that had been partially backfilled when the workings were abandoned. Ground surface elevation of the shafts is approximately El. 1041 and El. 1056. A third shaft was suspected to exist in the area, but could not be located during construction.

All other known shafts and boreholes shown on Dwg. No. 70-108-M1 have ground surface elevations above those influenced by the proposed abatement scheme.

Mine Drainage Abatement Procedure: The proposed abatement scheme for the project is briefly described below:

1. Seal Cummings Shaft in a manner that would raise the elevation of the pool in the shaft to the proposed invert elevation of the outlet works proposed for E-1. Raise the shaft walls sufficiently to discharge the flow at E-1 without overtopping the Cummings Shaft walls. Install a valve at Cummings Shaft to permit drawdown back to El. 1061, if required by emergency conditions.
2. Transport flow from E-1 to the E-2 entry using a buried pipe approximately 500 feet long, thereby discharging the E-1 flow into the mine workings south of McKee Run.

3. Plug the boreholes at E-4 causing the elevation of the lower mine pool to rise from El. 1015 to El. 1050, the ground surface elevation at the E-3 entry. Install valves on the E-4 boreholes to permit draw down of the mine pool for emergencies.

4. Transport the resulting flow from E-3 by gravity flow to the proposed treatment plant location.

5. Seal without valves all other known boreholes and shafts having ground surface elevations below El. 1050 including, but not necessarily limited to the DDH-44 borehole in Creekside, the Crooked Creek boreholes and the Fulton Run shafts and associated boreholes. The ground surface elevation at the DDH-44 borehole is about 1078, or 28 feet above the E-3 entry. However, the borehole is located in a hillside residential area overlooking Crooked Creek with the soil-rock interface situated approximately between El. 1058 and El. 1048. Accordingly, a breakout could occur as seepage from the hillside at the interface after the pool in the mine is raised to El. 1050.

6. Assume, based on confirming study of the mine maps, that the drainage transported from E-1 to E-2 would mix with the rising pool from the E-4 area and eventually discharge at the E-3 entry.

7. Install piezometers at critical locations to observe the water level in the mine prior to and following discharge from E-5.

8. Log the location of all shafts and boreholes penetrating tie Ernest Mine Complex, but plan no work for those with ground surface elevations above El. 1050±, unless otherwise noted.

Effect on Existing Mine Water Pools: Drawing No. 70-108-M4 presents three subsurface profiles through the Ernest Mine Complex showing the ground surface elevation, depth of overburden above the mine, the proposed pool elevations in the mine, and those existing in the mine prior to the project. The plan location of the sections is shown on Dwg. No. 70-108-M1. Drawing No. 70-108-M2 presents the approximate limits of the lower pool when discharging at the E-3 entry.

As shown in Section C-C on Dwg. No. 70-108-M4, the hillside adjacent to and south of Crooked Creek is an area of concern since seepage could occur along the valley wall when the mine pool is at El. 1050 providing the rock overburden is sufficiently fractured and broken. Several piezometers were installed to monitor the water level in the mine. Careful field observation of this area was also planned.

Adjoining Mine Complexes: The influence of raising the pool in Ernest Mine on adjacent mines was investigated.

1. Lucerne Mine: A continuous barrier of solid coal separates the abandoned Lucerne Mine from Ernest Mine except for one concrete sealed heading.

Raising the pool elevation to 1050 in the Ernest Mine will

have a negligible effect on the existing conditions in the Lucerne Mine, since the elevation of the concrete seal is at El. 1069.

2. McIntyre Mine: A single heading approximately 2000 feet in length connects Ernest Mine to the McIntyre Mine, located to the southwest. Although the entry is unsealed, the McIntyre Mine dips toward the Ernest Mine Complex and raising the. pool level 35 feet in the Ernest Mine will back water only a minimal distance into the connecting entry and adjacent areas of McIntyre Mine.

3. Seneca Mine: An open heading connects the Seneca Mine to the Ernest Mine Complex. The Seneca Mine borders the north section of the Complex near the Cummings Shaft. Raising the pool elevation from about 1061 to 1066 will not affect the Seneca Mine since the base of the Ernest Mine raises to about El. 1075 at the heading connected to the Seneca Mine. Therefore, a five-foot rise in the pool at the Cummings Shaft will not influence the existing conditions in the Seneca Mine.

Effects on Residential Water Supply: The majority of residents in the Borough of Creekside obtain water from the Creekside Water Company. Another private water company supplies water to Ernest. To determine if the Ernest Mine Complex has been used as an emergency water supply source in the

past, an investigation was undertaken by the Department of Environmental Resources. Mr. Harry A. Dewire, Chief Facility Section, Division of Water Supply and Sewage, Commonwealth of Pennsylvania, reported that no emergency permits have been issued in the last 20 years to either water company.

Throughout the duration of the project, it was our understanding that residents of the Borough of Creekside obtained their water supply from the Creekside Water Company whose supply was believed to be from surface water sources. However, following closure of the E-4 valves, reports were received by the Ebensburg office, Department of Environmental Resources, of a significant change in water quality in those homes serviced by the Creekside Water Company as well as those serviced by private wells. An investigation determined that the Creekside Water Company uses three wells as its main supply during the months of June through November. Residents not using the Creekside Water Company obtained their water from individual wells or springs.

A feasibility study was undertaken to determine the best means of resolving the water quality and supply problems of the Creekside Water Company. The results and recommendations of this study were presented to the Department of Environmental Resources in Harrisburg and in an EDCE report entitled "Report, Feasibility Study, Domestic Water Quality and Supply, Creekside Water Company, Creekside, Pennsylvania," dated August 1972.

It is our understanding that the Borough of Fulton Run obtains its water supply from surface reservoirs located above the town. Reportedly, the Borough of Ernest is serviced by a local water company which draws water from McKee Run, treats, and distributes it to the residents. To our knowledge, there have been no reports to date of unsatisfactory water quality in the Boroughs of Fulton Run and Ernest.

Proposed Treatment Plant: A treatment plant planned at Creekside is part of the Crooked Creek mine drainage abatement project. The plant is being designed by L. Robert Kimball, Consulting Engineers, and is not included in the scope of this project. The proposed location of the treatment facility is about 250 feet northeast of the E-3 entry. The elevation at the proposed plant site is approximately El. 1033 or 17 feet below the E-3 discharge. The discharge from Ernest Mine will flow from E-3 to the plant site through a 24-inch diameter buried pipe. The proposed layout of the plant facility and the plan and logs of the test borings drilled at the site are presented in Appendix A. To monitor the water elevation in the mine at the proposed plant location, three piezometers were installed by the Pennsylvania Drilling Company, Pittsburgh, Pennsylvania, in the original Borings Nos. 1, 5, and 8 at the request of the Ebensburg office of the Department of Environmental Resources. Borings Nos. 5 and 8 were drilled into the mine void, whereas Boring No. 1 was stopped approximately 23 feet above the top of the Upper Freeport coal seam. As described in a later section, these piezometers were reinstalled in 1971.

The proposed treatment plant location is attractive since the site is relatively flat and can utilize gravity flow from the E-3 discharge point to the proposed plant site. It is understood that the design of the treatment plant is completed and that construction will not commence until the effectiveness of the mine drainage diversion scheme has been established. More specifically, the items to be considered by the Department of Environmental Resources concerning the treatment facility are as follows:

1. Evaluation of the water quality at E-3 to establish the required treatment procedure.

2. Evaluation and establishment of the emergency operating procedures during plant breakdowns. The discharge from the mine will be continuous with no provisions for storage; therefore, consideration of storage facilities or of the consequences of discharging untreated water directly into Crooked Creek must be incorporated into the plant design.

The above items are outside of the scope of this project.

Water Quality Tests: A water quality testing program was conducted by the Department of Environmental Resources to record the water quality changes at critical points prior to and following the diversion of mine drainage from the Ernest Mine Complex. All data related to this phase of the work is being maintained by the Department of Environmental Resources at their Ebensburg office.