PHASE V

PIEZOMETER MONITORING PROGRAM

General

The piezometer monitoring program officially began on August 23, 1971, when the E-4 valves were closed and all construction was completed. On January 4, 1972 (4-1/2 months following closure), water began discharging from the E-3 entry at an approximate rate of 1800 gallons per minute. The flow rate at E-3 and the water level in the mines remained relatively constant for an additional 6-1/2 months (until July 13, 1972) at which time the valves were reopened due to mine water contamination of local water wells and "breakouts" at ground surface in Creekside Borough. On approximately September 11, 1972 (2 months following opening of the valves), the water level in the mines reached a relatively constant elevation at about El. 1025 or 2.4 feet above the highest invert elevation of the E-4 valves. A chronological plot of these events is shown on Fig. 2. It is noted that during the period of raising and lowering of the mine water in the E-4 area, there was no discharge from E-1 into E-2. The Department of Environmental Resources did not want to mix the Cummings mine water with the E-2 mine area water until the quality of the water discharging from E-3 could be determined. Therefore, a section of the E-1 - E-2 transfer pipe was removed to allow flow from E-1 to discharge directly into McKee Run. Reportedly, the pipe section was to be replaced prior to January 1973 to permit flow from E-1 into the E-2 entry. Presented herein is a discussion of the objectives of the program, piezometer monitoring procedures, and a presentation of the data.

Objectives: The primary objective of the piezometer monitoring program was to serve as an early warning system of unexpected mine water

seepage or breakouts before and following mine water discharge from the E-3 entry. In conjunction with the regular readings taken by the Department of Environmental Resources personnel from the Ebensburg Office, a surficial investigation was conducted in the areas of probable seepage, such as the hillside adjacent to Crooked Creek, and other suspect areas with surface elevations below 1050; i.e., the proposed site for the treatment plant, Fulton Run A shaft at the Crooked Creek boreholes.

A secondary objective of the piezometer monitoring program was to record the rate of increase in elevation of the mine pool after closing the valves at the E-4 boreholes. It was thought that areas of hydraulic blockages within the mine, if any, would be indicated by the piezometer readings. Accordingly, the piezometer information could be incorporated in the drawdown analysis (presented in Fig. 1) to more accurately predict the actual drawdown characteristics of the mine pool following opening of the E-4 valves.

Also of interest, the periodic piezometer readings made possible a prediction of when the water would begin discharging from the E-3.

Treatment Plant Piezometers: Three piezometers were installed (under a separate contract) as part of the subsurface exploration program for the proposed treatment plant. These piezometers, designated as T-1, T-2, and T-3, are located in plan on Drawing 70-108-M2. Piezometer T-1 was drilled town elevation about 28 feet above the top of the Upper Freeport Coal seam, whereas T-2 and T-3 extended into the mine void. All three piezometers were originally installed in the test boreholes and gravel backfill was placed making no effort to seal the piezometers. Therefore, as the mine pool elevation raised to a level higher than the existing ground surface in the proposed treatment plant

area (El. 1033), an overflow would have occurred through the backfill around the piezometer pipes.

Since the unsealed piezometer pipes provide additional openings for mine water to escape, it was decided to grout the boreholes but maintain the piezometers for monitoring. Therefore, new piezometers were installed with valves, caps and cement grout seals. The borehole for Piezometer T-1 was drilled into the coal seam but did not encounter a mine void. The piezometer wellpoint was placed in the coal and the pipe was grouted to ground surface in the normal fashion.

Procedures: To determine immediately whether mine water would successfully discharge from the E-3 entry and whether any seepage or breakouts would occur, the following procedure was adopted:

1. Discharge was permitted at the Cummings Shaft (valve open) thereby limiting any flow from the Ernest Mine workings north of McKee Run into the E-2 entry. A-modification to this procedure was made by removing a section of the E-1 - E-2 transfer pipe and bypassing flow from E-1 into McKee Run following closure of the Cummings valve.
2. The E-4 valves were closed and the mine pool elevation observed prior to and following discharge at the E-3 entry.
3. After the water quality at E-3 had been satisfactorily determined and the nature of mine water breakouts evaluated, the E-1 - E-2 transfer pipe section would be replaced and water permitted to flow from E-1 into E-2.

4. When it was apparent that flow from E-2 had successfully reached E-3 and equilibrium conditions were established at E-3, plans for constructing a treatment plan could be finalized.

The E-4 valves were closed on August 23, 1971 after sealing the second borehole at Crooked Creek. Following closure of the E-4 valves, the following events (as shown in detail on Fig. 2) were observed:

1. Between August 23 and October 20, 1971, the water level in the mine rose uniformly with no incident (59 days).

2. On October 20, mine seepage was noted at the site of the proposed treatment plant. The source of seepage appeared to be abandoned test boring holes drilled for the subsurface investigation.

3. Piezometer T-l, whose wellpoint tip was placed into a coal pillar, did not reflect the mine water rise until October 27, 1971, when the pressure began to approximate that observed in Piezometers T-2 and T-3 (wellpoint tips placed in the mine void). The pressure head increased ten feet within a two week period.

4. During November 1971, a few Creekside residents complained that their domestic well water quality had changed appreciably. A feasibility study[1] was undertaken by EDCE to establish the

[1] "Report, Feasibility Study, Domestic Water Quality and Supply, Creekside Water Company, Creekside, Pennsylvania," dated August 1972.

change in water quality, if any, and recommend alternate measures for resolving the water quality and supply in Creekside Borough.

5. On January 4, 1972, mine water began discharging from the E-3 entry. Total number of days to divert the discharge was 135.

6. Between January 4, 1972 and May 17, 1972, seepage was observed from abandoned wells at four different properties.

7. Flow from E-1 was observed on February 23, 1972 following closure of the Cummings valve on January 31, 1972. A total of 23 days to effect discharge at E-1.

8. On July 7 and 10, 1972, seepage was observed along Crooked Creek near the railroad bridge and on property owned by Arthur Watson.

9. Due to contamination of several water wells in the Creekside Borough area and considerable surface seepage from various properties, the Department of Environmental Resources decided to lower the water in the mines. On July 13, 1972, the E-4 valves were opened and on July 10, 1972, the Cummings valve was opened. Several days following opening of the valves, seepage at all previously reported areas stopped.

10. On September 11, 1972, the mine water elevation leveled at approximately El. 1025 (60 days following opening of the E-4 valves).

Piezometer readings by personnel from the Department of Environmental Resources, Ebensburg's Office of Engineering and Construction, have continued

past September 26, 1972. These data are available at the Ebensburg Office and are not shown on Fig. 2.

Water Quality Tests of the E-3 Discharge

Water quality tests of the discharge at E-3 are being coordinated through the Ebensburg Office and the Harrisburg Office of the Department of Environmental Resources. Evaluation of the mine water quality is outside the scope of this project.

Piezometer Readings

The piezometer readings obtained through September 29, 1972 are presented in Table IV. Figure 2 is a plot of the mine pool elevation as a function of time for a11 piezometers.

As shown in Fig. 2, Piezometers P-1 and P-3 reflect the pool in the Ernest Mine Complex north of McKee Run and have no relationship to the pool elevation south of McKee Run. The P-1 and P-3 readings were relatively uniform throughout the piezometer monitoring program until the Cummings Shaft valve was closed and water permitted to discharge from the E-1 entry.

Prior to discharge from E-3, piezometer readings at P-4 and P-5, located above the E-3 entries, remained relatively constant. A small pool of water at about El. 1047 appeared to be present in the mine at this location. However, this pool was not connected to the lower pool below E-4, Fulton Run, and the Crooked Creek boreholes. Piezometers P-6, P-7, P-9, P-10, and P-11 and the treatment plant Piezometers T-1, T-2, and T-3 reflected the rising elevation of the mine pool after closing the E-4 valves.

As shown in Fig. 2, those piezometers requiring the use of a pressure gage (P-9, T-l, T-2, T-3), consistently indicated erratic readings. Whereas, the remaining piezometers, P-4, P-5, P-6, P-7, and P-11, were read using a water

level indicator and showed a uniform rise in elevation until January 4, 1972. Piezometer P-10 was initially read with a water level indicator and behaved similar to P-4, P-5, and P-6. However, after December 28, 1971, the mine water elevation rose above the ground surface elevation of Piezometer P-10 requiring the use of a pressure gage, at which time its readings became erratic, similar to those for P-9, T-1, T-2, and T-3.

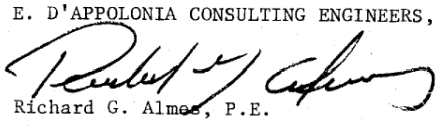
CONCLUSIONS

The mine drainage abatement system for the Ernest Mine Complex has been completed. This report has presented the developmental, design, construction, and monitoring phases of the project. The mine drainage abatement scheme functioned as proposed. However, the occurrence of contamination of water wells in the Creekside Borough and seepage at several areas indicated that, before adopting the abatement scheme, the Department of Environmental Resources must resolve the Creekside Borough water quality and supply problems, and determine the most feasible and economical method to treat the mine acid drainage using the present abatement scheme. Alternative solutions to resolving these issues are presently being considered by the Department.

In undertaking this project, our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

Respectfully submitted,

E. D'APPOLONIA CONSULTING ENGINEERS, INC.



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