I. INTRODUCTION

PURPOSE OF THIS REPORT.

Acid Mine Drainage (AMD) from abandoned deep and strip mines is the major pollution source of the Wyoming Valley streams. The purpose of this study was to locate, determine the magnitude of, and recommend abatement measures for the sources of AMD discharges within the 30 square miles of the study area watersheds. These watersheds are the Nanticoke, Warrior and Solomon Creeks which are tributaries to the North Branch of the Susquehanna River. For the location of the study area limits, see FIGURE NO. 1 (pocket), accompanying this report. In addition to the pollution emanating from the present and past surface mining activities within each of the study area watersheds, the Solomon and Nanticoke Creeks are recipients of large concentrated AMD discharges from mine pools in the abandoned deep mining operations. These mine pools extend beyond the limits of the study area and are also associated with basement flooding and subsidence problems on both sides of the Susquehanna River. An understanding of these mine pool movements and their related effects was considered essential to the basic purpose of the study.

SCOPE OF STUDY.

Initially, the study was limited to the surface waters within the selected watersheds, with primary emphasis given to the location and evaluation of surface water losses into the deep mines. A detailed examination of past deep mining operations, existing barrier: pillar conditions, mine pool water movements, and other subsurface conditions related to water balance was beyond the original scope.

The elimination or reduction of the present surface water losses will limit recharge of the mine pools, lower mine pool levels and subsequently reduce mine, pool discharges. Therefore, correlation between mine pool fluctuations, surface water losses and the rate of AMD discharges is essential for the determination and the evaluation of abatement measures in the applicable watersheds.

During the course of the study, it became evident that the predominant AMD pollution in the study area is from mine pool outfalls. Two major groups of interconnected mine pools, underly the study area. The major group of mine pools, located Southeast of the Susquehanna River, is called the South-East Mine Pool Complex. With the exception of some isolated mine pools, the group of mine pools located Northwest of the River is called the North West Mine Pool Complex. These mine pools and their recharge sources extend beyond the limits of the study area watersheds. A preliminary draft report, submitted in March, 1974 concluded and recommended that the evaluation and the abatement of the study area AMD pollution should also include the study of conditions and characteristics of the adjacent watersheds, related to the mine pool discharges in the original study area limits.

Three major mine pool discharges are polluting the lower stretches of the study area streams which are tributaries to the Susquehanna River. The evaluation of these discharges and their effect on the quality of the study area streams was within the original scope of this study. However, the effect of these discharges on the quality of the Susquehanna River required information beyond the original scope of the study. Therefore, the study was extended to include the evaluation of river quality, both upstream and downstream of the study area streams' confluence with the Susquehanna River.

Examination of river flow records, made in conjunction with the analysis of river quality, indicated that there may be river losses into the deep mines upstream of the Wilkes-Barre River gaging station. This indication is reflected by the change in the flow relationship between the Danville and Wilkes-Barre stations, after 1970, as compared to the flow ratio that prevailed prior to 1970. Since losses from the river into the deep mines can occur only at river stages above the mine pool elevations, the study was extended to verify conditions related to river losses, upstream of the Wilkes-Barre gaging station. This additional investigation indicated that the water level fluctuation in the North-West Mine Pool Complex is directly related to the

fluctuation of the river stages and is independent of local precipitation, rendering additional supporting evidence to the suspected river losses into the deep mines. Interpretation of the latter findings provided the basis for the investigation recommended in this report, related to the source and the abatement of the Buttonwood Tunnel AMD discharges.

In addition to AMD discharges, subsidence, flooding, mine fires and the discharge of untreated sewage are conditions encountered in the study area. Coordination of proposed abatement' measures with local land use planning and community needs was also considered in order to maximize the benefits of the study efforts and to optimize the cost of the proposed abatement measures.

SEQUENCE AND METHOD OF STUDY.

The initial phase of the study consisted of collection and review of available pertinent data and field reconnaissance.

Based on these investigations, monitoring stations were established on the main stems and tributary streams of Solomon, Warrior and Nanticoke Creeks. The locations of these stations are shown in FIGURE 11. Of the 44 established monitoring stations, 19 are in the Solomon Creek watershed, 8 in the Warrior Creek watershed, and 17 are in the Nanticoke Creek watershed. The aforementioned stations include 5 locations where data had been previously recorded by others (See TABLE 1, overleaf).

Flow measurements, water temperature and pH were recorded monthly for each of the stations. In addition to the above, water samples were collected at each station and shipped to B & H Laboratories, York, Penna. The field information obtained to date, together with the laboratory test results are appended to this report. Additional sampling and flow measurements were conducted, as required, to define a particular problem or to verify specific flow and quality, data. A description of the flow measurement methods employed is appended to this report. Comparison of flow records between successive monitoring stations enabled direct determination of "in stream" surface water losses. Annual "offstream" losses of surface runoff into deep mines were derived by means of hydrologic analysis of long term records available for

* Pocket

the Solomon Creek stream gaging station. Records of precipitation, fluctuations of mine pools and measured mine pool discharges were used for the determination of recharge to the mine pools during the study period. Comparison between mine pool recharge and streambed losses enabled the allocation of total surface water losses to specific areas within the watersheds.

Correlation of the study area mine pool discharges with the duration of daily flow in the river and the available river quality records enabled an evaluation of the effect of AMD discharges from the study area on the quality of the Susquehanna River. Interpretation of available fish kill records* in the River enabled a determination of the AMD discharge sources and conditions that caused maximum degradation in River quality during the reported fish kill incidents.

TABLE I

DESCRIPTION OF PREVIOUSLY ESTABLISHED MONITORING STATIONS

STATION NO.	DESCRIPTION	REMARKS
S-1	SOLOMON CREEK AT PUMPING STATION AND LEVEE OUTLET TO SUSQUEHANNA RIVER.	EXISTING STAFF GAGE. STAGE-DISCHARGE CURVE WAS PROVIDED BY THE U.S. ARMY CORPS OF ENGINEERS
S-2	OUTLET OF THE BUTTONWOOD DRAINAGE TUNNEL, NE OF BUTTONWOOD	DISCHARGE AND WATER QUALITY RECORDS WERE AVAILABLE PRIOR TO THIS STUDY
S-3	THREE 36" BOREHOLES IN SOUTH WILKES-BARRE	DISCHARGE AND WATER QUALITY RECORDS WERE AVAILABLE PRIOR TO THIS STUDY
S-4	USGS STREAM FLOW RECORDING STATION OFF DIVISION STREET	DAILY FLOW RECORDS HAVE BEEN AVAILABLE SINCE 1940 FROM USGS
N-4	36" BOREHOLE OFF DUNDEE ROAD (ASKAM BOREHOLE)	DISCHARGE AND WATER QUALITY RECORDS WERE AVAILABLE PRIOR TO THIS STUDY

* Pennsylvania Fish Commission