CHAPTER I

INTRODUCTION

AUTHORITY

The Pennsylvania Department of Environmental Resources, in response to the Commonwealth of Pennsylvania Legislative Act 443, "Land and Water Conservation and Reclamation Act," authorized engineering surveys of a number of major watersheds in the Commonwealth. The purpose of these studies was to locate the sources of acid mine drainage pollution stemming from abandoned deep and strip mines, to recommend abatement measures, and to estimate the cost of abatement.

One of the major watersheds found to be affected by mine drainage pollution was the Redstone Creek Watershed located in Fayette County (see Figure 1). A portion of the Redstone Creek Watershed is underlain by the Uniontown Syncline, a major structural feature which intersects the Redstone Creek Watershed and which influences the majority of the mine drainage pollution problems within the Redstone Creek Watershed. Thus, in order to analyze the mine drainage pollution in the Redstone Creek Watershed, it was determined early in the study that certain portions of the Uniontown Syncline adjacent to the Redstone Creek Watershed should be included in the project area. Hence, the project area was extended to include the northeast portion of the Uniontown Syncline in the Youghiogheny River Basin, and the southwestern portion of the syncline in the Browns Run Watershed between the Redstone Creek Watershed and the Georges Creek Watershed. The study area encompasses 142 square miles, or approximately 28% of the area of the county.

PURPOSE

The purpose of the acid mine drainage study of the Redstone Creek Watershed and portions of the Uniontown Syncline was to:

A. Perform field reconnaissance to assess the water quality of streams and to determine the number and type of acid mine drainage sources.

B. Establish sampling and flow measurement stations along streams and at locations of acid mine drainage sources.

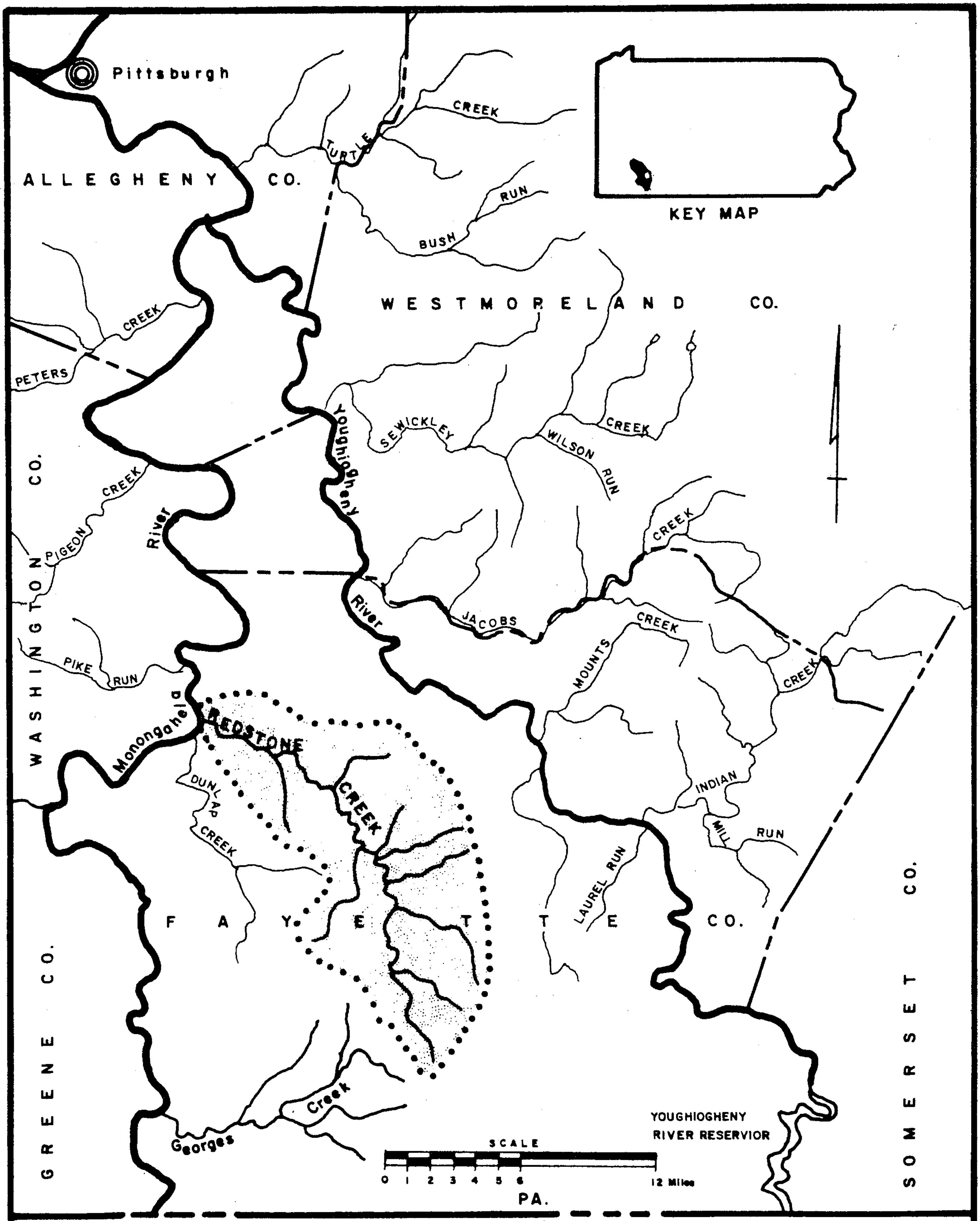
C. Sample and measure the discharge of identified streams and acid mine drainage sources.

D. Collect geological, hydrological, mining and other pertinent data for studying mine drainage conditions.

E. Determine feasible methods of abating acid mine drainage based on analysis of water quality results, studies of mining and geological data, and field investigations.

F. Estimate costs and benefits of abatement for all major and minor sources of acid mine drainage.

G. Recommend a mine drainage pollution abatement plan.



WATERSHED MAP

FIGURE 1

PREVIOUS SURVEYS IN THE PROJECT AREA

Previous acid mine drainage studies were performed in the study area in 1967 by the West Virginia Field Station of the Federal Water Pollution Control Administration (FWPCA), now known as the Environmental Protection Agency (EPA). (1)* The largest acid discharge (known locally as the "Phillips Discharge") in the Redstone Creek Watershed was studied in 1972 under the Commonwealth of Pennsylvania Project No. SL 141 (2). The pollution abatement study incorporated the idea of combined sewage and mine drainage treatment. Also, the Youghiogheny River Basin Mine Drainage Pollution Abatement Project, SL 103, September 1972 (3), included a description of the major acid mine drainage pollution sources from the Uniontown Syncline which flowed into the Youghiogheny River Basin. The data provided in these previous studies has been updated by the present study. The source numbering system used in Project SL 103 is the same system used in the present survey for coinciding acid mine drainage discharges. The Georges Creek Watershed Mine Drainage Pollution Abatement Project, SL 186 (4) includes the southwestern portion of the Uniontown Syncline, which is located to the southwest of the Redstone Creek Watershed. Available data from the Georges Creek study was interpreted and included in this report for assistance in the determination of mine pool levels for the Uniontown Syncline, and for analysis of the major mine discharges in the Redstone Creek Watershed. The location of these previous studies with respect to the present study area is shown on Figure 2.

STUDY METHODS

COMPILATION OF DATA

Topographic maps of the project area drainage basin were obtained from the United States Geological Survey. These maps were of the 7-1/2 minute quadrangle series.

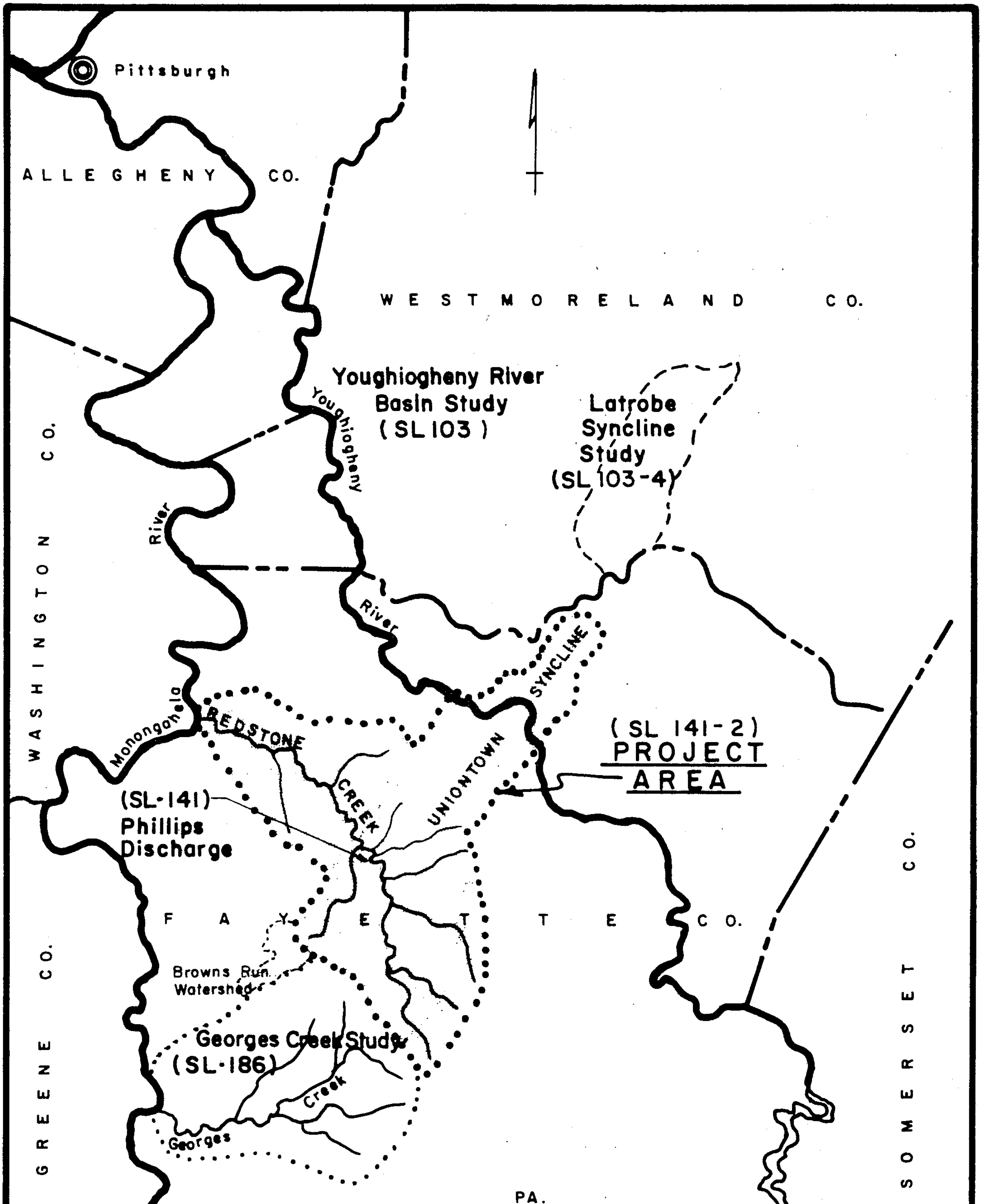
WPA mining maps for the project area were obtained from the U. S. Bureau of Mines, Mine Map Repository. Some detailed mine maps were obtained where possible from mining companies, individual private collections, or the U. S. Bureau of Mines.

Aerial photograph enlargements of the project area were obtained from the U. S. Department of Agriculture, Soil Conservation Service, Pittsburgh, Pennsylvania.

Weather statistics for the area were obtained from monthly publications of the National Climatic Center, U. S. Department of Commerce, Ashville, North Carolina.

Flow data from the Redstone Creek gauging station at Waltersburg was obtained from the U. S. Geological Survey, Water Resources Division.

*Refer to References



RELATIONSHIP OF THE REDSTONE CREEK STUDY AREA TO PREVIOUS SL PROJECTS

FIGURE 2

LOCATION OF SOURCES OF POLLUTION

The location and identification of pollution sources were performed by the stream walking method. The method required walking the lengths of identifiable streams and tracing waterflows to their point of origin. The search was initiated at the mouths of the major tributaries of Redstone Creek and proceeded upstream into minor tributaries. In the process of stream walking, all pollution sources identified by field pH were numbered in sequence in each subwatershed for purposes of future study. Many sources were red-flagged so that subsequent field identification would be facilitated. Sampling stations were also established on major streams, principal tributaries, and large areas of ponded water. The locations of all stations are shown on the Project Area Map.

The initial field reconnaissance for pollution sources began in April, 1974, and was completed during July, 1974. As the study progressed beyond July, 1974, a number of stations were added as additional pollution from the northeast portion of the Uniontown Syncline was documented. With the accumulation of information, some stations were deleted because their pollution content was insignificant for purposes of this study.

SAMPLE DESIGNATION

Mine drainage pollution sources that were documented in the Redstone Creek Watershed were designated by a prefix denoting the subwatershed in which the source was located. For example, mine drainage source WL5 was the fifth mine drainage source to be located in the West Leisenring Subwatershed. Although the northeast portion of the Uniontown Syncline was divided into five subwatersheds, all source identification nomenclature in the extension area consisted of either the prefix "US" for Uniontown Syncline or "M" if the pollution sources coincided with documented sources in the previous Youghiogheny River Basin Mine Drainage Survey (SL 103). All mine drainage sources documented in the Brown's Run portion of the study area were given the prefix "N." All stream samples were given the prefix "RS" if they were taken within the Redstone Creek Watershed and "YR" for Youghiogheny River if the stream samples were obtained from the northeast portion of the Uniontown Syncline, and "BR" if obtained in the Brown's Run Watershed.

SAMPLE COLLECTION AND LABORATORY TESTING

Samples of water and corresponding flow measurements were obtained once per month at all sources of AMD pollution and designated stream sampling stations during the 12-month period from August, 1974 through July, 1975. Three monthly samples were obtained from the Browns Run area between April and June, 1976. The locations of all sampling stations are shown on the Project Area Map included in the rear pocket of this report.

The pH and the discharge flow rate were recorded in the field at the sampling stations. The water at each sampling point was collected into two bottles. One of the bottles was acidified in the field to maintain the solubility of ferric iron. The collected samples were shipped to the Department's designated laboratory and analyzed for total iron, ferrous iron, sulfate, pH, alkalinity and acidity.

DISCHARGE MEASUREMENT

Weirs were constructed where feasible at sampling stations to facilitate flow measurements. Repairs were performed as necessary after intervals of heavy flow or after periods of ice formation to keep the weirs operable over the study period.

Stream flows at each of the monitoring stations were measured by one of the following four methods: current meter, weir, surface velocity flow, or timed bucket flow, each of which is discussed below:

Current Meter: The current meter method of measurement was normally used where large flows were encountered. The measuring device was a Gurley Pygmy Type Current Meter (No. 625F). In this method, a measurement of the stream cross-sectional area is obtained and velocity rates are recorded with the Gurley Meter at small intervals across the stream. The product of area and velocity provides a measurement of flow.

Weir Flow: Where channel and discharge measurements were appropriate, rectangular, cipoletti, and a combination of sharp crested rectangular and 90 degree V-notch weirs were installed. Discharge was then calculated using the dimensions of the weir crest and the height of water flowing over the weir.

Surface Velocity Cross Section Flow: The surface velocity method was used to estimate flow on small streams or discharges where current meters or weirs could not readily be utilized. An estimate of the cross-sectional flow area was obtained, and an average velocity was estimated using measured time intervals for floating objects. The product of area and velocity provides an estimated flow quantity which is then adjusted by an empirical correlation between surface velocity and mean velocity.

Timed-Bucket Flow: Timed-bucket flow measurements were used as frequently as possible throughout the project because of their inherent accuracy and ease of application, particularly in small streams and at pollution sources. This method consists of determining the amount of time needed to fill a calibrated bucket.

WATER QUALITY EVALUATION

Water samples obtained at all sampling stations were analyzed by the Department's designated laboratory for pH, acidity, alkalinity, iron, and sulfate content. Stream loadings and source loadings were calculated from the analysis and reported in pounds per day. The results of these tests and calculated values of source and stream loadings are tabulated in Volume II of this report.

The quality of streams in the Redstone Creek project area was evaluated at high flow and low flow periods. The principal criteria used for evaluation were pH, iron, and net alkalinity (alkalinity less acidity). Stream quality results are provided in this report and are tabulated in Volume II. Averages of mine drainage and stream water quality are also reported in Appendices A and B respectively.

FIELD RECONNAISSANCE AND ABATEMENT PLAN DEVELOPMENT

General structure contours were constructed on the base of the Pittsburgh Coal to determine the direction of subsurface gravity flow for deep mines. The WPA coal maps and available deep mine maps were used to establish the overall subsurface drainage trends of the basin.

An extensive and detailed field reconnaissance was performed throughout the project area. The objective of this reconnaissance was to survey the surface features related to mine drainage production and mine drainage abatement. Features which were documented included active and abandoned strip mines, water courses, areas of restricted drainage, deep mine subsidence areas, coal refuse banks, and degrees of vegetation, along with physical evidence of mine openings, coal outcrops, and mine pool levels.

The field reconnaissance was complemented by aerial photographs with a scale of 1 in. = 660 ft., dated 1969. These photographs aided in identifying surface features and estimating the areal extent of strip mines.

During the course of reconnaissance and abatement plan development, certain evidence indicated the possibility of distinct mine pool elevations within the Uniontown Syncline. Accordingly, to determine these elevations, a drilling program was developed. The objective was to select four drilling locations thought to have the different mine pool elevations. The sites were chosen to minimize the amount of drilling and difficulty of access. The drilling program was not implemented.

A priority system to categorize the severity of polluted stream reaches within the study area was developed and a corresponding abatement plan was then developed to improve the water quality of the polluted stream reaches. Cost estimates were made for each recommended abatement plan based on our analysis of field conditions. The primary AMD control methods considered were surface reclamation, deep mine sealing, daylighting and treatment plants. Cost estimates were prepared for alternative plans, and a final plan was selected for each polluted stream reach based upon cost-effectiveness.