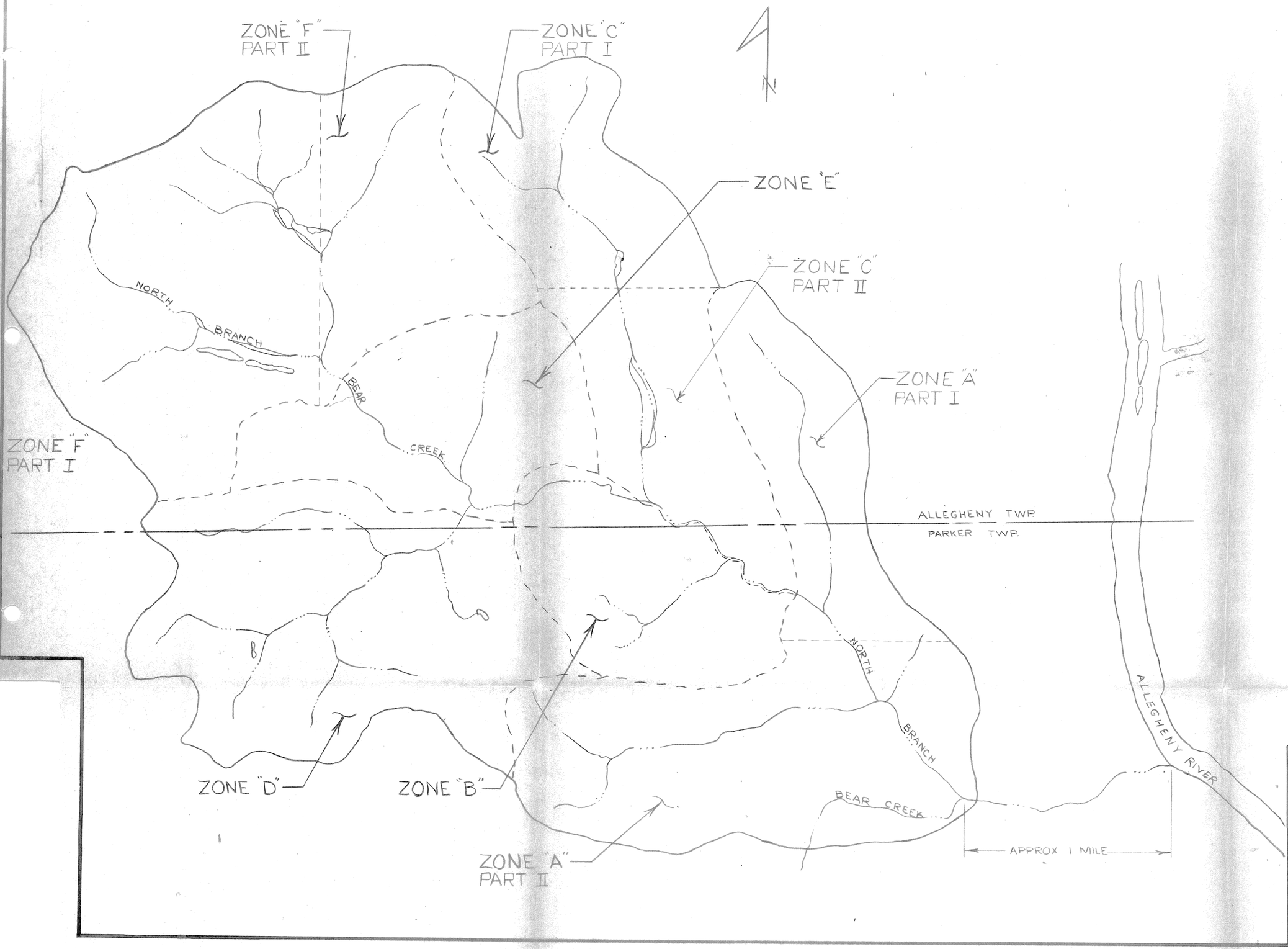
VI DESCRIPTION OF THE PRESENT STUDY

In August 1973, Mr. A. E. Molinski, P.E., District Engineer, Ebensburg District, Office of Resources Management, directed an investigation into the effect of mining and abandoned oil and gas wells on stream quality of North Branch Bear Creek Watershed.

It is the intent of the study to recommend the measures necessary to effectively abate the pollution and improve the quality of water. The results of this investigation are based on the collection and analysis of detailed field data, the study of published reports and knowledge gained from engineers and conservationists concerned with the reclamation of the area. Particular interest should be given to the fact that our investigation and the studies originated by Butler County Planning Commission resulted in a concerted cooperative effort.

U.S.G.S. quadrangle maps were used to develop the watershed boundary and base map which is shown in Figure 10. When a fundamental knowledge of the watershed has been developed, the first phase of the field procedures began. A field inspection was conducted to familiarize oneself with the terrain, roads, streams, mine sites, and gas and oil wells. Water quality sampling stations were established to monitor the chemical characteristics. Stations were established near pollution sources on all major tributaries and along the main stream where accessible from roads. Figure 11 indicates the location of all sampling stations established throughout the watershed. Samples were collected at each



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT
EBENSBURG DISTRICT

NORTH BRANCH BEAR CREEK WATERSHED BOUNDARY BASE MAP

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BUTLER CO. PENNSYLVANIA

SCALE 1" = 2000'

ZONE "F" PART II

ZONE "C" PART I

N

ZONE "E"

ZONE "C" PART II

ZONE "A" PART I

77

NORTH BRANCH

W2

W1

66 TO 75

BEAR CREEK

W8

W4

CREEK

53

52

51

50

47

48

49

46

45

44

43

42

33

79

78

W3

60

57

ALLEGHENY TWP.

PARKER TWP.

W7

W6

NORTH BRANCH

W5

W9

16

ALLEGHENY RIVER

BEAR CREEK

ZONE "F" PART I

ZONE "D"

ZONE "B"

ZONE "A" PART II

APPROX 1 MILE TO ALLEGHENY RIVER FROM CONFLUENCE OF NORTH BRANCH WITH BEAR CREEK

LEGEND

△ WEIR LOCATIONS

⬡ SAMPLING POINTS

MODERATELY ACID STREAM

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NORTH BRANCH BEAR CREEK
LOCATION OF SAMPLING POINTS
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BUTLER CO. PENNSYLVANIA

SCALE 1" = 2000'

station periodically and tested analytically for water quality. Nearly 35 samples were taken at intervals of two weeks and subjected to water quality tests. Appendix I describes the pollution sources and abatement measures.

In order to secure flow data for use in computing the pounds per day discharge of the various pollutants, V-notch sharp crested weirs were installed and also rectangular weirs with end contractions. At places where the weirs could not be installed, an estimate was made of the quantity depending on the drainage area. A factor of 0.15 was used for the coefficient of runoff.

,A. WATER QUALITY ANALYTICAL METHODS:

Water samples were collected in 16 oz. plastic bottles and were designated as to location, time, and date. The samples were returned to the laboratory as soon as possible. The testing procedures were adopted from "Standard Methods for the. Examination of Water and' Waste Water", 13th Edition published by A.P.H.A., A.W.W.A., and W.P.C.F. The Water Analysis Results are shown in Appendix II.

The criteria used for classifying streams in this project are listed below:

Non-Polluted	Any water with net alkalinity.
Moderately Acid	Any water with an acid concentration up to 178 mg/l.
Severely Acid	Any water with an acid concentration of 178 mg/l or greater.

B. MAJOR FINDINGS

1. The most severe acid mine drainage conditions are exhibited in

these Zones F and D. The drainage areas of the two Zones measure 7.59 square miles. They discharge an average of 1669 pounds of acid per day into North Branch Bear Creek.

2. The main stream was found to be acid for its entire length from the headwaters to its confluence with Bear Creek.

The North Branch Bear Creek has the potential of becoming a biologically fertile stream once again if the problem of acid mine pollution can be eliminated. The physiology of the stream, with its clean bottom and turbulent waters is such that it possesses the natural ability to recover from the pollution if the sources were removed. Being a fast flowing, turbulent stream, constantly saturated with oxygen, it would purify itself much faster than a slower stream.

C. MAIN STREAM WATER QUALITY:

The North Branch Bear Creek exhibited acid conditions from the headwaters right down to its confluence with Bear Creek. Water quality records at Weir No. 1 and Sampling Point No. 76 indicated this to be so, as a result of acid discharges from the sub-watersheds.

VII GENERAL RECOMMENDATIONS

Abandoned deep mines produce acid-mine drainage when percolating water passes through the disturbed coal and associated strata containing sulphur minerals which are oxidized, picking up the resulting acid and heavy metal compounds and carrying them to surface streams. Abandoned strip mines produce acid mine drainage primarily when surface runoff waters erode the acid spoils and carry the resulting products off into streams. Since the acid production on strip mines is associated primarily with exposed, eroding acid spoil, it comes from a source area, rather than a point source and is thus usually harder to accurately locate for abatement.

In deep mines the most successful method of source abatement is flooding by sealing all openings. This keeps most oxygen away from the coal and gob material except for dissolved oxygen in the water.

Experience at numerous places to date has shown that a combination of regrading and vegetation with good water management practices can be very beneficial in reducing pollution from surface mined areas. The advantages of source abatement for acid mine drainage control are in the long term costs and benefits.

SOURCE ABATEMENT FOR STRIP MINES:

There are approximately 1400 acres of unreclaimed strip mines in North Branch Bear Creek Watershed. If all areas are regraded and seeded, it would cost $4,200,000.00. Further, this cannot be accomplished within the intent of the Bond Issue Act_

The degree of regrading needed on strip mines is determined by the existing condition causing acid formation. Some regrading may be necessary to bury excessively toxic or stony material which cannot be treated satisfactorily with lime, fertilizer or soil conditioners to provide an adequate seedbed for establishment of vegetative cover. Undrained depressions which collect runoff water and hold it long enough to drown vegetation and which have a fluctuating water level tend to be acid sources. These areas should be provided with adequate surface drainage by regrading or rechanneling.

Three types of regrading are generally used: contour, terrace, and selected grading.

Contour backfilling involves pushing the spoil to the top of the backfill and regrading to contours which fit with the natural contours of the area as closely as possible. This type of regrading would be recommended where the highwall,is weathering badly and is a source of acid production.

Terrace backfilling involves constructing benches of nearly level land with steep slopes between. The highwall would remain standing with drainage away from the base of the highwall.

Rechanneling is a method which is not as effective as total reclamation but should reduce the, flow of water entering the exposed deep mines and coal outcrops. Improvement of the drainage through the strip mines will add unpolluted water to the streams which should increase the natural alkalinity of the streams and neutralize some of the acidity.

The choice of the type of regrading will depend on the requirements

to stabilize the area to eliminate acid: formation. The type which requires the least amount of disturbance of the existing surfaces should be used, since any disturbance could cause an increase in stream pollution from the runoff water during and for a period following construction. In all cases, the final grade should be away from the foot of any highwalls and, except for the rock face of a sound highwall, no slopes within the mined area should be left greater than 50%.

Pollution loads from strip mines in the North Branch Bear Creek Watershed is considerable and are outlined in Appendix I. Zones B through F have a total of 670 acres of strip mines that'need to be rechanneled and/or regraded.

The same strip mine numbers have been assigned different priorities for future evaluation of the reclamation work. Zones A to F represent the various tributaries and their drainage areas. By cleaning up each zone-separately, a quick determination of miles of stream cleaned can be made.

Maps have been prepared showing strip mines and property owners. Majority of areas belong to private property owners. A few areas are owned by the Pennsylvania Game Commission. Figures 13 through 21 show property owners and Appendix III their names.

It is understood that strip mining is pre-act and as such no operator responsibility exists. If proper steps are taken, future mining operations should not affect the proposed reclamation projects. SOURCE: ABATEMENT FOR DEEP MINES:

The approximate location of deep mine opening is shown in Figure 12. This opening has been sealed off; however, the mine water pool is coming out of other locations in zone F.

Stations W1 and W2 indicate the total flow from Zone F, which include strip mines and deep mines. Since the mine water pool flows into strip mines at a number of places, complete isolation of strip mine flow and deep mine flow has not been possible for purposes of measurement. The anticipated head for proposed sealing is approximately twenty (20) feet.. Exploratory drilling will be required to determine the nature of strata for sealing. If the opening can be approached, then a pipe may be installed through the mine seal with a manually operated valve for controlling the head. If a remote type seal is established then the head will not be controlled.

Augered areas have to be sealed by the construction of a clay liner against the highwall. Compaction tends to force the clay into the auger holes and into cracks in the highwall, causing a tight seal. The extent of barrier between strip mine and deep mine is unknown. This barrier has been punctured at a number of places by auger mining.

Strip mine reclamation in Zone F around deep mine may only be partially successful if no action is pursued on the deep mine.

It is noted that a large part of acid pollution to the North Branch of Bear Creek is from Zone F and this zone alone contributes almost as much as all the other areas combined. Also, the abatement costs are the least when considered on a per pound basis. In other words, this area should be Priority 1. Mohawk Mining Company may or may not have the responsibility and this has to be determined from a legal point of view. OTHER POLLUTION PROBLEMS ON THE WATERSHED:

A large part of the North Branch Bear Creek Watershed is underlain by

oil and gas pools and the area is covered by both producing and abandoned oil wells. Three abandoned wells were found discharging acid water and had high sulfate contents. They are identified in Appendix I as Sources 66, 67 and 69 and are shown in Figure 12.

Contact has been made with the Division of Oil and Gas for information pertaining to the abandoned wells. The division has no knowledge of history or ownership of wells.

No workable coal seams are intersected by wells. Source No. 66 is located just outside of the strip mine. It does not contribute to strip mine pollution.

Standard specifications are availabe for plugging gas and oil wells. A knowledge of logs, well depths, etc is not required for plugging these wells.

It is not known whether water will emerge at other locations.

GENERAL

North Branch of Bear Creek gets its worst pollution sources from Zones D, E, and F. When these are reduced by 80%, then it is highly probable that the creek would be biologically fertile for its entire length of approximately six miles.

Bear Creek will be a cleaner stream, but because of industrial wastes from South Branch, it will still be polluted.

Total stream mileage recovered would be approximately ten (10) miles including tributaries.

The major pollution load is from the headwaters. As such, any work undertaken downstream is not expected to provide a clean stream.

WATER PERMIT NO. 1070302
MOHAWK MINING CO.

MINE OPENING SEALED OFF

ZONE "F" PART II

ZONE "C" PART I

N

ZONE "E"

ZONE "C" PART II

ZONE "A" PART I

ZONE "F" PART I

NORTH BRANCH BEAR CREEK

CREEK

ALLEGHENY TWP.

PARKER TWP.

ALLEGHENY RIVER

ZONE "D"

ZONE "B"

ZONE "A" PART II

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20

LEGEND

= STRIP MINES TO BE RECLAIMED

= LIMIT OF MINING PERMIT MOHAWK MINING CO.

(S1) = STRIP MINE NO.

⊙ = ABANDONED GAS WELLS

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NORTH BRANCH BEAR CREEK POLLUTION AREAS

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SCALE 1" = 2000'