Appendix A

Previous Reports and Surface Water Quality Data

This appendix contains copies of various reports and surface water quality data used as reference materials during the course of this investigation. The contents are as follows:

June 19, 1949 - Report of Pollution
Filed by James H. Banning, State Fish Warden

June 20, 1949 - Report of Fish Killing Filed by L. S. Morgan,
Division Engineer

April, 1950 - Mashudda Strip Mine, Reinspection Report

March, 1951 - Mashudda Strip Mine, Reinspection Report

1974-1977 Historical Surface Water Quality of the Glade Run Watershed Source: Penns Woods West Chapter Trouts Unlimited

October, 1980 Survey on Glade Run Watershed SL 103-9-101.6
Fayette County Prepared by Lou M. Scott, H.E.T.A., DER

July, 1982 - Mashudda Mine Drainage Abatement Study
Phase I - Data Collection, Field Reconnaissance,
Initial Sampling, and Feasibility Study Program Development Prepared by R. E. Wright Associates, Inc. for PADER

Original Copy
Sanitary Water Board

SANITARY WATER BOARD
DEPARTMENT OF HEALTH
COMMONWEALTH OF PENNSYLVANIA

REPORT IN RE POLLUTION OF THE WATERS OF THE STATE

ame of stream **Dunbar Creek** Tributary to **Youghiogheny River**

wn **Dunbar** Township **Dunbar** County **Fayette**

s pollution acute or chronic? **Acute**

acute, give date and time of damage **Sunday June 19, 1949**

fish killed, state number and kind **Personally only noted 10 dead trout, and hundreds were** k and unable to standany current. Could be picked up by hand very easily and made no ther damage effort to get away.

rthest upstream point damage reported **Vicinity of junctin of Dunbar Creek and Little** unbar Creek.

haracter of water in stream above point of damage. **Slightly muddy.**
(If polluted, give name and kinds of industries up-stream)

Only Industry on the stream above area affected is.
Mashuda Coal Company... Strip mine
I am informed this Company have quit operating, Equipment is being moved out, and the strip cuts have not been backfilled.

Was the flow of stream when fish killing occurred high, low or normal **High from hard rains On Saturday.**

life present above? **Unable to report on this at this time.**

ather conditions **Stormy. Rain Friday and Saturday.**

haracter of suspected harmful discharge **Mine acid water**

uantity Color **None** Odor **None**

ids Reaction

haracter of stream below suspected discharge
(How far below point of entry is stream affected)
Sick fish were noted a far down as Limestone Run.

fish life present below? **Yes.**

ame, location and kind of establishments suspected;

Mashuda Coal Company, Dunbar, Pa. Strip Mine

ame and addresses of observers or witnesses: **Richard Miller, Connellsville, Pa.**
John Craig, Connellsville, Pa.
Harry Pierce, Connellsville, Pa.
Frank Sullivan, Fairchance, Pa.

(OVER)

Remarks

(In reference to interviews with officials or natives, etc.)

Sick and dead fish were first noted by fishermen Sunday morning about 10 A.M. Stream high Saturday night from heavy rains. Sick trout were noted by me in thearea from Limeston Run to Little Dunbar Creek. This section was stocked with 1500 brown trout on Friday June 10. The stream was patrolled by me on June 10, 12, 13, 14 and 15 and no fish were dead, dying or sick during that period.

Date of investigation June 19, 1949 Date of report June 19, 1949

Name of Deputy Field Agent James H. Banning

Title State Fish Warden

Address Connellsville, Pa.

(SEND THIS REPORT IN QUADRUPLICATE PROMPTLY TO YOUR SUPERIOR FOR ROUTING TO SECRETARY, SANITARY WATER BOARD, DEPARTMENT OF HEALTH.)

If samples are collected, add the following information and send samples immediately to CHEMICAL LABORATORIES, PENNSYLVANIA DEPARTMENT OF HEALTH, HARRISBURG. Also state on the descriptive blank which you will find in the sample bottle shipping box, the kind of pollution suspected of causing the fish killing.

Was flow of stream when samples were taken high, low or normal High

Time and date samples collected Sample 1 and 2 1.30 P.M June 19, 1949
Sample No 3, 4. P.M. June 19, 1949.

Samples should be taken of the polluting material at the point of discharge, also of the stream water above and below that point.

Exact location sample taken

(No. 1) Dunbar Creek about 50 yds above Little Dunbar Creek

(No. 2) Little Dunbar Creek, above mouth of stream

(No. 3) Strip mine cut in vicinity of Paul Flats, Dunbar Twp.

Sample of polluting material and stream water

(No. 1) Stream Water

(No. 2) Stream Water

(No. 3) Water flowing from strip mine

Samples collected by James H. Banning.

(Samples should be shipped in clean gallon jug or bottle with clean stoppers and should be carefully labelled for identification) Bottles should be well filled.

FISH KILLING DUNBAR CREEK
DUNBAR TOWNSHIP
FAYETTE COUNTY

June 20, 1949

On June 19, 1949 Fish Warden James Banning of Connellsville called the writer on the telephone and said he had just received word from some Fishermen that there had been a fish killing in Dunbar Creek above Limestone Creek and that the fish were dying and others were definitely distressed. Investigation was immediately made by representatives of the Division Engineer's and District Engineer's office. Personnel engaged were Division Engineer Morgan, Chemist Earl Newell, District Engineer Kremer, and Chemical Engineer Barnhart.

An investigation was started on Dunbar Creek above the Borough of Dunbar and the stream was followed up to and above all the principal tribuaries coming in from the left where the major part of the watershed is located.

Samples were collected at a number of points and field pH Values were taken, as were temperatures and dissolved oxygen determinations, in the field and alkalinity, acidity and pH Value results were determined in the laboratory on June 20, 1949. The results of the analyses are as follows.

Sample #1 - Elkrock Run at mouth.

Field pH - 7.3

Sample -#2 - Tucker Run at mouth.

Field pH - 7.5

Sample #3 Dunbar Creek 100 ft. upstream from confluence with Tucker Run.
Field pH - 6.5

Sample #4 - Limestone Run at mouth.
Field pH - 6.9. Lab. pH - 6.8.
Alkalinity to bromphenol blue - 12 parts per million
Hot phenolphthalein alkalinity - 2 parts per million

Sample #5 - Dunbar Creel; 100 ft. upstream from Limestone Run.
Field pH - 6.2 Lab. pH - 6.23
Alkalinity to bromphenol blue 12 parts per million.
Hot phenolphthalein acidity - 2 parts per million.

Sample #6 - Glade Run 100 ft. above mouth.
Field pH - 4.8 lab. pH - 4.56
Alkalinity to bromphenol blue 8 parts per million
Hot phenolphthalein acidity - 8 parts per million.

Sample #7 - Dunbar Creek 100 ft. upstream from mouth of Glade Run.
Field pH - 7.3 Lab. p11 - 7.0
Alkalinity to bromphenol blue - 32 parts per million.
Hot phenolphthalein alkalinity - 4 parts per million.

There are no ferrous irons in these samples and all the sulphates were less than 50 parts per million. Samples were collected in the field and fixed for dissolved oxygen by the investigators from the District Engineer's office and samples titrated in the Greensburg laboratory on Monday.

The results of the dissolved oxygen determinations are as follows.

Sample #5 - Dunbar Creek from Limestone Run
Temperature 19° C Dissolved Oxygen 8.06 p.p.m,
% Saturation D.O. - 86

Sample #6 - Glade Run 100 ft, above mouth.
Temperature 18°C Dissolved Oxygen 9.5 p.p.m.
% Saturation D.O. 99.5%

Sample #7 - Dunbar Creek 100 ft. upstream from Glade Run.

Temperature 19°C Dissolved Oxygen 8.45 p.p.m.
% Saturation D.O.- 90%

Stream temperatures were relatively high for this stream on account of the abnormally hot spell but the parts per millionof dissolved oxygen and the percent saturation of dissolved oxygen was sufficient for all types of fish life, including trout.

The stream waters were all alkaline in character with the exception of the sample taken at the mouth of Glade Run and the water at that point was neutral in character.

In the traverse of the stream the writer saved one dead trout and several distressed trout. The dead trout was about 7" in length and was of the brown type. The distressed trout were finding it difficult to move in the current of the stream and were seeking the shallow pools toward the banks of the stream. Various fishermen along the stream reported that they had seen a few dead fish in the stream and had also seen trout going downstream with the current, too distressed to fight the current and to feed in the riffles. The area of the stream in which dead trout were seen by the fishermen and in which the one dead trout was seen by the writer and the distressed trout were also noticed, was between Glade Run and Limestone Run, a distance of approximately 1.5 to 2 miles along the stream. There are no reports of dead fish in what is known as Little Dunbar Creek which is Dunbar Creek above Glade Run.

Further investigation is being made to determine whether there is any mine drainage being discharged into Glade Run or any of its tributaries which may have caused the low pH Value at the

mouth of the stream and also the fact that the grater was neutral in character at that point.

ADDENDUM REPORT

Fish Killing - Dunbar Creek
Dunbar Township, Fayyette County

June 21, 1949

On June 20, 1949 Mining Engineer Chapman and Assistant Rutherford continued the investigation along Glade Run to determine the possible source of any acid wastes from stripping operations.

They uncovered a stripping operation near the headwaters of Glade Run in Wharton Township, Fayette County, south of Game Land 751 and just east of and adjacen to Township Road #722.The stripping operation was not working at the time of the investigation and information from local residents indicated that it was owned by a daughter of Charles Turner, reputed to live in Uniontown, and being stripped by Baird Brothers of Uniontown, Pennsylvania. Efforts to locate Charles Turner's daughter by telephone were unsuccessful and it was learned through the telephone company that Charles Turner had roved from Uniontown to Weirton, West Virginia. It was further determined that Baird Brothers had a Uniontown telephone and their address is Beck Hollow Road, Uniontown, Pennsylvania but efforts to reach the Baird Brothers by telephone were unsuccess-ful because of the fact that the line was out of order.

There was no actual actual discharge at the tine of the investigation but there was water standing in the strip cut. and evidence that there had bean an overflow recently at the lower end of the strip and out of a dam at the side of the strip and seepage through the spoil banks, into Glade Run. A dam has been thrown up

across Glade Run in the vicinity of the strip and water is backed up for a considerable distance in Glade Run because of this dam.

A sample of the water standing in the stripping pit showed it to have a pH Value of 3.9, an acidity to bromphenol blue of 2 parts per million, a hot phenolphthalein acidity of 130 parts per million, indicating it to be acid in character and there appeared to be evidence of recent heavy rain in this area on Sunday at the tine of the original investigation. Thus, there may have been a discharge of acid water from this strip as a result of a rainfall into Glade Run.

A sample of water taken from Glade Run below the strip showed it to have a pH Value of 5.08, an alkalinity to bromphenol blue of 10 parts per million and a hot phenolphthalein acidity of 4 parts per million. Another sample of Glade Run below evidence of seepage showed a pH Value of 5.1, an alkalinity to bromphenol blue of 10 parts per million and a hot phenolphthalein acidity of 4 parts per million. Glade Run 100 feet above the strip had a pH Value of 5.2, an alkalinity to bromphenol blue of 10 parts per million and a hot phenolphthalein acidity of 4 parts per million. Another tributary of Glade Run, where Route T-788 crosses in Stewart Township, Fayette County, had a pH Value of 5.23, an alkalinity to bromphenol blue of 8 parts per million and a hot phenolphthalein acidity of 4 parts per million. Still another tributary of Glade Run in Dunbar Township, Fayette County in the vicinity of State Game Refuge #51A had a pH value of 5.1, an alkalinity to bromphenol blue of 8 parts per million and a hot phenolphthalein acidity of 4 parts per million.

Therefore, all these streams, while low in pH Value, were alkaline in character at the time of the investigation.

It is believed possible that a discharge from the stripping operation reportedly being mined by Baird Brothers may have actually reached Glade Run and caused a lowering of the pH Value and may have been partially responsible at least for the low pH Value found at the mouth of Glade Run and the neutral water there on Sunday, Jung 19, 1949.

In September 1947 some of these streams were analyzed for pH Value. At that time, Glade Run 50 feet before it discharged into Dunbar Creek showed a pH Value of 7.1, in contrast to the present pH Value of 4.56 and neutral water present in the stream. Dunbar Creek presently, at a point 100 feet upstream from Limestone Run, had a pH Value of 6.23, whereas in 1947 the pH Value 200 feet above Limestone Creek was 7.1. Thus, it can be seen that between 1947 and the present time, the pH Values of Glade Run and Dunbar Creek below Glade Run have been very materially reduced.

There is no record that Baird Brothers, Strippers, Beck Hollow Road, Uniontown, Pennsylvania, have ever made application for a stripping operation in Wharton Township, Fayette County, and it is believed that this stripping operation is, therefore, illegal since application has not been made or a permit received from the Sanitary Water Board. It is further believed that this stripping may have resulted in the discharge of acid water into Glade Run although no actual evidence is available, the evidence being merely

circumstantial.

It is recommended that a cease and desist order be issued to Baird Brothers, c/o Albert Baird, Beck Hollow Road, Uniontown, Pennsylvania, regarding the stripping operation on Glade Run in Wharton Township, Faith County, and that they also be ordered to cease the discharge of any acid water from this strip into Glade Run or any of its tributaries.

An old stripping operation, that of Frank Mashuda of Milwaukee, Wisconsin, Application #8716-IW, Dunbar Township, Fayette County, is being further investigated in relation to any possible discharge of acid water from that operation.

Additional information received from Fish Warden Banning of Fayette County revealed that he had inspected the stripping operation of Frank Mashuda on Sunday, June 19, 1949 and had found an actual discharge of drainage from this stripping operation into an unnamed tributary of Glade Run. This unnamed tributary is south of Primary State Game Refuge #51-A. This stripping operation was began in 1947. Frank Mashuda, 5556 West Roosevelt Drive, Milwaukee, Wisconsin was the stripper and made Application ,#8716-IW to the Sanitary Water Board for the approval of a strip located in Dunbar Township, Fayette County, with drainage there from into Glade Run and Limestone Run, both tributaries of Dunbar Creek. The Sanitary Water Board authorized the issuance of a permit approving the plans of drainage from the strip mine under the condition there shall be no discharge to waters of the Commonwealth of any drainage which would be acid in character or which would contain objectionable amounts of iron.

A sample of this discharge was collected by Fish Warden Banning on June 19, 1949 and analyzed in the Pennsylvania Department of Health Laboratory at Harrisburg. It showed a pH Value of 3.1, an acidity to a pH of 4.0 of 86 parts per million and a hot phenolphthalein acidity of 156 parts per million and was, therefore, acid in character. The flow is unknown but Fish Warden Banning estimated it to be what he calls sufficient to fill a 2" pipe. This does not give any indication of the actual quantity discharged but it was evidently in more than a negligible amount.

A sample of water which he collected, presumably from Glade Run about 50 yards above the mouth of Little Dunbar Creek$_s$ showed a pH Value of 4.4, an alkalinity to a pH of 4.0 of 8 parts per million and a hot phenolphthalein acidity of 10 parts per million so that it was practically neutral in character, which is the same conclusion reached by the writer's investigation insofar as the waters of Glade Run are concerned.

A sample collected from Little Dunbar Creek a short distance above its mouth, which is construed to mean above Glade Run, had a pH Value of 5.9, an alkalinity to a pH of 4.0 of 30 parts per million and was, therefore, alkaline in character.

Mr. Banning further advised that he could account for about ten dead fish in his investigation and saw a great nary more fish which were sick and had not enough strength to swim the currents in the stream.

Since there was an actual discharge of acid mine drainage from the Frank Mashuda stripping operation, it is recommended that

the authorization previously granted for the issuance of a permit to Frank Mashuda be withdrawn and that he be ordered to cease the discharge of acid mine drainage from the stripping operation in Dunbar Township, Fayette County, into Glade Run or any of its tributaries, or into Limestone Run, or any of its tributaries and that he further notifies the Sanitary Water Board when the cessation of the discharge has been accomplished.

Respectfully submitted,

L. S. Morgan

L. S. Morgan
Division Engineer

Mashudda Strip Mine
Reinspection Report
April, 1950

Reinspection Report

Frank Mashuda
Dunbar Township
Fayette County

Application #8716-IW

Locations: The Frank Mashuda Mine is located in Dunbar and Stewart Township Townships, Fayette County, about 5 1/2 miles southeast of Connellsville, Penna., near the intersection of Routes 26047 and T-529.

General Information

A study of the data in the file of the Frank Mashuda Company permit for Application #8716-IW discloses that this Company assumed the operation of a mining property formerly operated by Walter J. Walsh under Application #8487-IW; that this permit. (Application #8716-1W) was subject to the "no acid discharge condition" and was revoked June 23, 1949, when a reinspection revealed that acid mine water was being; discharged from the operation into the waters of the Commonwealth; that this Company was issued an additional order to "cease and. desist" other mining operations being carried on without a permit in areas adjacent to that covered by this permit.

The streams which receive the discharge from this mine were considered to be clean and are used extensively for recreational purposes

A reinspection of this operation covered eight abandoned strip mines, three of which were in the area covered by the application, the other five in adjacent areas. (The location of each strip, with an identifying number, has been plotted an a topographic map which is included with this report as an aid in presenting the description of conditions found in the various strips),

Strip #1

Strip #1 contains about one and one-half miles of backfilled and abandoned operation in the Upper Freeport seam of coal and covers an area of about 20 acres on the properties of Melvin Spruell, Lemont Furnace, Penna., and the Frank Stewart Heirs, Washington, D. C. It followed the coal outcrop, about on the contour, around the headwaters of an unnamed tributary of Glade Run, as indicated on the topographic map.

Drainage existed at various intervals throughout the entire strip and reached natural drainage channels through ditches made in the spoils banks Samples and weirings taken of these discharges are listed and summarized on a supplementary page of this report under' the regular heading, Mine Drainage Analyses. The relative location of these discharges within the strip is indicated on the topographic map by the number of the corresponding sample.

Summary of Strip #1

The analysis report snows that 163 lbs./day of acid are being discharged into an unnamed tributary of Glade Run from strip #1, thus causing this tributary to be acid in character (Sample #1677). Glade Run is slightly acid above (Sample #1672) the mouth of the polluted tributary and slightly alkaline below (Sample #1675), indicating that it was, at the me of this inspection, only slightly affected by the above pollution.

Wastes Division
Form MWD 9-Revised

Strip #1

Mine Inspector's Dist.# 5

REINSPECTION REPORT

Application No. 8716 IW

1. APPLICANT: Name: Frank Mashuda Company
P.O. Address: 5556 West Roosevelt Drive, Milwaukee, Wisconsin

2. MINE: Name: Frank Mashuda Mine Type: Strip Coal Seam: U.Freeport ?
Location: Dunbar Township Fayette County
U.S.G.S.Quad. Coordinates: Uniontown Quad.
Latitude: 10.4" N Longitude: 3.3" W

3. WATERSHED: Monongahela River-Youghiogheny R. Sub-Watershed: Dunbar Creek
Receiving stream: Glade Run - Unnamed Tributary Mileage Index: MYDbrGl-Trib.

ORIGINAL STREAM ANALYSES:

Above Drainage Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Below Drainage Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.
		Samples taken by				Mouth of Glade Run	7.1				
		R.J.Protzeller 9-10-47				Dunbar Cr.below Glade Run	7.1				

ORIGINAL MINE DRAINAGE ANALYSES:

Sample Number	pH Value	Alkalinity B. P. B.	Alkalinity Pht.	Acidity B. P. B.	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day

4. PERMIT: Granted: (date) December 16, 1948 Refused: (Date) Revoked: 6-23-49
Permit Conditions: "That no acid or objectionable amounts of iron be discharged into the streams of the Commonwealth". Permit revoked June 23, 1949.

* *

1st REINSPECTION: By L.Renner & R.Garrison Date: April 4, 1950
Is any acid entering receiving stream? Yes
Mine Drainage Analyses: Collected: 4-4-50 Analyzed: 4-6-50

Sample Number	pH Value	Alkalinity B. P. B.	Alkalinity Pht.	Acidity B. P. B.	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
1671-RG	3.95	0.0			28.0			

Mine drainage samples are listed on supplementary page.

Stream Analyses:

Above Drainage Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Below Drainage Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.
1671-RG	4.35	4.0			6.0	1671-RG	5.15	6.0			4.0

REMARKS: See attached sheet

RECOMMENDATIONS:

SAMPLES FROM STRIP #1

Reinspection by: L. Renner and Ralph Garrison

Is any Acid entering receiving stream? YES

Mine Drainage Analysis: Collected: 4/4/50 Analyzed: 4/6/50

Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Total Iron	Flow G/D	Acid lb./day
1656 R.G.	5.0	8.0			8.0	0	274	0.0
1657 R.G.	4.3	6.0			8.0	0	575	.04
1658 R.G.	5.1	6.0			4.0		3300	0.0
1659 R.G.	4.72	6.0			4.0	0	575	0.0
1660 R.G.	4.7	6.0			4.0	0	575	0.0
1661 R.G.	3.08			76.	242.0 ←	14.56	41500	83.9
1662 R.G.	3.76			4.	100.0	0.56	101	0.01
1663 R.G.	3.95	0.0			40.0	0.56	41500	13.9
1664 R.G.	4.3	4.0			8.0	0.56	5750	0.4
1665 R.G.	3.5			14.	72.0	1.68	51500	31.0
1666 R.G.Pond	4.8	6.0			4.0	0.0		
1667 R.G.	3.15			46.	128.0	2.8	28500	30.3
1668 R.G.Pond	3.65			8.	40.0	1.12		
1669 R.G.	3.04			60.	128.0	3.36	3300	3.5
1670 R.G.Pond	4.62	6.0			4.0	0.56		

Total from strip #1
163 lb./day

REINSPECTION REPORT

Frank Mashuda
Dunbar Township
Fayette County

Application #8716-1W

Strips #2, #3 and #4

Watershed: Monongahel a - Youghiogheny Rivers - Jonathan Run and Blackberry Run

Mileage Index: MYJon
MYJonBkb

1st REINSPECTION: BY: Luther Renner & Ralph Garrison Date: March 21, 1950
Is any acid entering receiving stream? Yes
Mine Drainage Analyses: Collected: 3-21-50 Analyzed: 3-22-50

Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
1633-RG	3.05			94.0	388.0	15.68	13,400	43.4
1634-RG	4.85	8.0			16.0	2.80	9,060	1.2
1635-RG	3.2			54.0	174.0	11.2	10,900	15.8

Stream Analyses:

Above Drainage Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.
1633-RG	5.75	6.0			2.0

Below Drainage Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.
1636-RG	4.32	6.0			22.0
1637-RG	5.95	10.0			2.0

Strips #2, #3 and #4

Strip #2 covers an area of about 3 acres on the property of Frank Leonard, Dunbar, Penna., R.D. #2, in what is believed to be the Mahoning coal seam. It extended completely around a knoll, leaving about 3 acres of unmined coal in the center. Backfilling was complete except for about 30" on the east side whore the coal had been left exposed for a future deep mine entrance.

Three acid discharges from this mine form at the base of the backfill and flow in ditches through the spoils banks to natural drainage. Two of these discharges (Samples #1633 and #1634) flow into the headwaters of Honey Run causing it to be acidic (Sample #1036) at a point about ½ mile below the source of pollution. The remaining discharge (Sample #1635) flows into a tributary of Jonathan Run but apparently has little effect on it, since this tributary is shown to have an alkalinity (Sample #1637) about the same as Jonathan Run above the mouth of the polluted tributary (Sample #1638).

Mines #3 and #4 are on the property of Melvin Spruell; Lemont Furnace, Penna., in what is believed to be the Mahoning coal seam.

Mine #3 which extends for about 1000' along the east slope of the mountain, near its summit, and comprising an area of approximately 3 acres, is completely backfilled and has no visible discharge.

Mine #4$_j$ having an area of about 3 acres, extends around a knoll leaving about 1 ½ acres of unmined coal in the center, it was completely backfilled except, for about 20' on the southwest side where the coal had been left exposed for a deep mine entrance.

There was no visible drainage from this mine at the time of the inspection.

REINSPECTION REPORT

Frank Mashuda
Dunbar Township
Fayette County

Application #8716-IW

Strips #5, #6, and #7

Watersheds: Monongahela River - Youghiogheny River - Laurel Run

Mileage Index: MYLa

1st REINSPECTION: BY: Luther Renner & Ralph Garrison Date: April 5, 1950
Is any acid entering receiving stream? Yes
Mine Drainage Analyses: Collected: 4-11-50 Analyzed: 4-12-50

Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
1687-RG	4.0	0.			116.0	0	3300	3.2
1688-RG	4.65	4.0			8.0	0.56	274	.001

Stream Analyses:

Above Drainage Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Below Drainage Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.
						1687 &					

Strips #5, #6 & #7

Mines #5 and #6, each with an area of about 3 acres, are on the property of Frank Roebuck, Dunbar, Penna., R.D.#2, in what is believed to be the Mahoning coal seam. Both of these mines were completely backfilled and neither had any visible drainage, Mine #5 contained one small pool of water which is slightly acid (Sample #1686).

Mine #7 is on the property of Nelvin Spruell, Lemont Furnace, Penna,, in the Upper Freeport coal seam. This strip, with an area of about 2 acres, extended along the outcrop for about 1000' and was completely backfilled,

Two acid discharges flowed from this mine, one of these (Sample #1687) drained around the western end of the strip; the other drained through a ditch in the spoils banks near the middle of the strip (Sample #1688). Both of these discharges flow into the headwaters of Laurel Run which was found to be acid at the crossing of Route T-587 (Sample #1691).

Fayette County

REINSPECTION REPORT

Frank Mashuda
Dunbar Towmship

Application #8716-IW

Strip #8

Watersheds Monongahela River - Youghiogheny River - Dunbar Creek - Limestone Run

Mileage Index: MYDbrLi

1st REINSPECTION: BY: Luther Renner & Ralph Garrison Date: April 5, 1950
Is any acid entering receiving stream?
Mine Drainage Analyses: Collected: 4-11-50 Analyzed: 4-12-50

Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
1689-RG	3.75			4.0	30.0	6.16	Pit sample	
1690-RG	5.35	6.0			2.0		Pit Sample	

Stream Analyses:

Sample Number	pH Value	Above Drainage Alkalinity BPB	Above Drainage Alkalinity Pht.	Above Drainage Acidity BPB	Above Drainage Acidity Pht.	Sample Number	pH Value	Below Drainage Alkalinity BPB	Below Drainage Alkalinity Pht.	Below Drainage Acidity BPB	Below Drainage Acidity Pht.
None						1689 & 1690-RG	6.45	8.0			2.0

Strip #8

Strip mine #5 covers an area of approximately two acres on the property of Melvin Spruell, Lemont Furnace, Penna., in the Upper Freeport coal seam, It extended about 700' along the outcrop and was completely backfilled.

Two ponds of water existed in this strip, one near the eastern end of the strip tested acid (Sample #1689), the other toward the western end tested alkaline (Sample #1690). Both of these ponds probably seep through the spoils banks and into the soil although no evidence of this could be detected.

General Summary

Sample ##1675, taken near the mouth of Glade Run, Sample #1673 taken in Dunbar Creek below the mouth of Glade Run, Sample #1676 taken at the mouth of Limestone Run and Sample #1677 taken from Dunbar Creek below the mouth of Limestone Rum all show a mild alkalinity in the main streams below the total discharge of this entire operation.

An analysis of all the preceding data in this report shows that mines #1-2-7 are each contributing acid bearing water to what are considered to be clean streams of the Commonwealth in an area used extensively for recreational purposes, Mine #8 is a possible source of acid drainage but it did not appear, at the time of the inspection, to be polluting any stream. Four other mines, #3- 6, had no visible drainage and, due to their proximity to the summits of the mountain, are not likely to develop any injurious water.

REINSPECTION REPORT

Frank Mashuda Company
Dunbar Township
Fayette County

Application #8716-IW

ANALYSES OF SAMPLES

Collected: 3-21-50
4-4-50

Analyzed: 3-22-50
4-6-50

Sample No.	Location	pH	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Total	Ferrous	Ferric	Sulphate
1633	Disc.at N.E.part of Str.#2	3.05			94.	388.	15.68	0.56	15.12	651
1634	Middle disc.of Strip #2	4.85	8.			16.	2.8	0.56	2.24	166
1635	Disc.at S.E.part of Str.#2	3.2			54.	174.	11.2	1.12	10.08	288
1636	Headwaters of Honey Run at crossing of Rt.26047	4.34	6.			22.				
1637	Unnamed trib.of Jonathan Run at crossing of Rt.T-788	5.95	10.			2.				
1638	Jonathan Run at crossing of Rt.26047	5.75	6.			2.				
1639	Jonathan Run below trib. carrying sample #1635	5.65	6.			2.				
1656	Disc.from southern half of Strip #1	5.0	8.			8.		0.		-5
1657	" " "	4.3	6.			8.		0.		-5
1658	" " "	5.1	6.			4.		0.		-5
1659	" " "	4.72	6.			4.		0.		-5
1660	" " "	4.70	6.			4.		0.		-5
* 1661	" " "	3.08			76.	242.		14.56		331
* 1662	" " "	3.76-			4.	100.		0.56		214
1663	" " "	3.95	0.			40.		0.56		104
1664	" northern half of Strip #1	4.3	4.			8.		0.56		-5
* 1665	" " "	3.5			14.	72.		1.68		131
1666	A pond in northern Half of Strip #1	4.8	6.			4.		0.		-5
* 1667	A disc.from northern half of Strip #1	3.15			46.	128.		2.8		211
1668	A pond in northern half of Strip #1	3.65			8.	40.		1.12		85
1669	A disc.from northern half of Strip #1	3.04			60.	128.		3.36		155
1670	A pond in northern half of Strip #1	4.62	6.			4.		0.56		
1671	Below disc.of str.#1 in unnamed trib.of Glade Run	3.95	0.			28.				
✓ 1672	Glade Run above mouth of trib.carrying disc.from Str.1	4.85	4.			6.				
1673	Dunbar Cr.2000' below mouth of Glade Run	5.9	8.			2.				
1675	Glade Run at mouth	5.15	6.			4.				
1676	Mouth of Limestone Run	6.45	8.			2.				
1677	Dunbar Cr.2000' below mouth of Limestone Run	6.6	8.			2.				
1686	Pond in Strip #5	3.6			12.	50.		1.12		103
1687	Disc.from West end of Str#7	4.0	0.			116.		0.		218
1688	Disc.from middle of Str.#7	4.65	4.			8.		0.56		-5

Mashudda Strip Mine
Reinspection Report
March, 1951

2nd REINSPECTION REPORT

Frank Mashuda
Dunbar & Stewart Townships
Fayette County

Application #8716-IW

Watershed: Monongahela River - Youghioghony River - Dunbar Creek - Glade Run

Mileage Index: MYDBrG1--Trib.

Location: The Frank Mashuda Mine is located in Dunbar and Stewart Townships, Fayette County, about 51 miles southeast of Connellsville, Penna,, near the intersection of Routes 26047 and T-529,

History: The history and general information concerning this application, as presented in the initial reinspection report, shows that eight (8) separate strips are covered, Three of these strips, identified on the topographic map which accompanied the first reinspection report, as #1, #2, and #7, had acid drainages in violation of Act #177, The other strips had none or negligible drainages and all eight were backfilled.

Explanatory Note:

In presenting the following report, the same strip identification numbers as used in the first reinspection are used. Strips #1 and #8 will be considered separately; strips #2, #3, and #4 will be considered as a group; and strips #5, #6 and #7 will be considered as a group..

Reinspection of Strip #1

Location: Strip #1 is located as indicated on the topographic map accompanying the first reinspection report. All drainage from this strip goes into an unnamed tributary of Glade Run.

Conditions Found:

This strip remains in the same general condition as a year ago when it was completely backfilled It has not been disturbed in any way. It contains about twelve drainages, of which only four were taken on the second reinspection since they made up 97.6% of last year's drainage. At the present, these four discharges are contributing about 31.3 lbs. of acid daily to the stream as compared with about 159 lbs. one year ago. There has been a gratifying reduction in the total acidity of each of these discharges and one of them, Sample #1663-RG, has changed from an acid to an alkaline drainage (Sample #127-LR). There is, however, enough acid still being discharged from Strip #1 to cause the receiving stream to be acid near its mouth (Sample #130-LR) although slightly less acid than a year previous (Sample #1671-RG). These discharges also cause Glade Run to change from neutral above (Sample #131-LR) to a very mild acidity below (Sample #146-LR).

MWD 2 Revised

Strip Mo. 1
Sheet Two

Application # 8716-IW

2nd REINSPECTION: By: Luther Renner Date: (March 21, 1951)
Is any acid entering receiving stream? Yes
Mine Drainage Analyses: Collected: 3-21-51 Analyzed: 3-29-51

Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
LR-126	3.4			22.	76.	13.	30,000	19.
127	4.5	8.			2.	0.	30,000	0.0
128	3.7			4.	24.	6.2	38,000	7.6
129	3.8			2.	28.	3.4	20,000	4.7

Stream Analyses: Above Drainage — Below Drainage 31.3 Total

Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.
						LR-126-129	4.1	2.			20.

REMARKS See attached sheet

Frank Mashuda
Dunbar & Stewart Townships
Fayette County

RECOMMENDATIONS:

* *

3rd REINSPECTION By: Date:
Is any acid entering receiving stream?
Mine Drainage Analyses: Collected: Analyzed:

Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day

Stream Analyses: Above Drainage — Below Drainage

Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.

REMARKS:

RECOMMENDATIONS:

10. STREAM AND MINE DRAINAGE ANALYSES

Date Samples Collected: 3-29-51 / 3-29-51 / 3-21-50 / 4-4-50

Date Analyzed: 3-30-51 / 3-29-51 / 3-22-50 / 4-6-50

Sample No.	Sampling Point	pH Value Field	pH Value Lab	Laboratory Chemical Results in p.p.m. Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Iron Total	Iron Ferrous	Iron Ferric	Sulfate	Other
LR-126	1661		3.4			22.	76.	13.	12.	1.	150.	
RG-1661			3.08			76.	242.	14.56	14.56	0.	331.5	
LR-127			4.5	8.			2.	0.	0.	0.	-50	
RG-1663			3.95	0.			40.	.56	.56	0.	104.7	
LR-128			3.7			4.	24.	6.2	1.1	5.1	130.	
RG-1665			3.5			14.	72.	1.68	1.68	0.	131.6	
LR-129			3.8			2.	28.	3.4	1.1	2.3	95.	
RG-1667			3.15			46.	128.	2.8	2.8	00.	211.	
LR-130			4.1	2.			20.					
RG-1671			3.95	0.			28.					
LR-131			4.85	4.			4.					
RG-1672			4.85	4.			6.					
LR-146	3-29-51		4.75	4.			6.					
RG-1675			5.15	6.			4.					

11. DESCRIPTION OF SAMPLING POINT LOCATION

#126-LR Mine drainage same as #1661-RG as indicated on map with first reinspection.

#127-LR Mine drainage same as #1663-RG as indicated on map with first reinspection.

#128-LR Mine drainage same as #1665-RG " " "

#129-LR Mine Drainage same as #1667-RG " " "

#130-LR Same as #1671-RG - Unnamed trib. of Glade Run below Strip #1.

#131-LR Same as #1672-RG - Glade Run above mine drainage from Strip #1.

#146-LR Same as #1675-RG - Mouth of Glade Run.

Reinspection of Strips #2, #3, and #4

Application #8716-IW

2nd Reinspection: By: Luther Renner Date: March 21, 1951

Is any acid entering receiving stream? Yes

Mine Drainage Analyses: Collected: 3-21-51 Analyzed: 3-30-51

Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
LR-139	3.2			46.	128.	10.	3,000	3.2
LR-140	3.11			44.	144.	6.7	10,000	12.

Stream Analyses:

Sample Number	pH Value	Above Drainage Alkalinity B.P.B.	Above Drainage Alkalinity Pht.	Above Drainage Acidity B.P.B.	Above Drainage Acidity Pht.	Sample Number	pH Value	Below Drainage Alkalinity B.P.B.	Below Drainage Alkalinity Pht.	Below Drainage Acidity B.P.B.	Below Drainage Acidity Pht.
						LR-139	6.4	12.	2.		
						LR-140	4.4	8.			16.

Analyses of Samples - Strips #2, #3, and #4

Collected: 3-21-51, 3-21-50 Analyzed: 3-30-51, 3-22-50

Sample Number	Sampling Point	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Total Iron	IRON Ferrous	IRON Ferric	Sulphate
LR-138		6.4	12.	2.						
LR-139		3.2			46.	128.	10.	.56	9.	320.
RG-1635		3.2			54.	174.	11.2	1.12	10.08	288.8
LR-140		3.11			44.	144.	6.7	.56	6.	450.
RG-1633		3.05			94.	388.	15.68	.56	15.12	651.2
LR-141		4.4	8.			16.				
RG-1636		4.34	6.			22.				

Description of Sampling Point Locations

LR-138 - Headwaters of Jonathan (unnamed tributary) at crossing of Route T-788 below #139
LR-139 - Same as RG-1635 - Southeast mine discharge from Strip #2 to Jonathan Run.
LR-140 - Same as RG-1633 - Mine drainage from Strip #2 to headwaters of Honey Run.
LR-141 - Same as RG-1636 - Honey Run at the crossing of Route 26047 below #140.

2nd Reinspection of Strips #2, #3 and #4

Watershed: Monongahela River - Youghiogheny River - Jonathan Run and Blackberry Run

Mileage Index: MYJon
MYJonBkb

Location: These strips are located as indicated on the topographic map which accompanied the first reinspection report.

Conditions Found:

There is no visible drainage from Strips #3 and #4, and there is no evidence that they have been disturbed since last year's inspection.

Strip #2 remains backfilled, as on the previous inspection, except for about 30 ft. of exposed coal seam on the east side. A small deep mine has been started here between the time of the two inspections by Frank Clements of R. D. #1, Dunbar, Penna. There was as yet no drainage from

this deep mine but two drainages came from the strip. One of these (Sample LR-139) is contributing about 3.2 lbs. of acid to the headwaters of Jonathan Run but seemingly has no adverse affect on it since the stream is alkaline (Sample LR-138) about ¼ mile below the drainage. The other drainage (Sample #140-LR) flows into the headwaters of Honey Run and causes it to be acid (Sample #141-LR) about ¼ mile below at the crossing of Route 26047.

A comparison of samples #138-LR, and #1635-RG; Samples #140-LR and #1633-RG, shows both drainages to contain considerable less acid now than a year ago when the R.C. samples #1635 and #1633 were taken.

Reinspection of Strips #5, 6, and #8

2nd Reinspection: By: Luther Renner Date: 3-29-51
Is any acid entering receiving stream? Yes
Mine Drainage Analyses: Collected: 3-29-51 Analyzed: 3-30-51

Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
LR-144	3.95	0.			32.	0.	Small	Small

Stream Analyses:

Above Drainage Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Below Drainage Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.
						LR-144	5.1	4.			2.

Analyses of
Samples - Strips #5, #6 and #7

Collected: 3-29-51-LR, 4-4-50-RG Analyzed: 3-30-51-LR, 4-6-50-RG

Sample Number	Sampling Point	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	IRON Total	IRON Ferrous	IRON Ferric	Sulphate
LR-144		3.95	0.			32.	0.	0.	0.	120.
RG-1688		4.65	4.			8.				
LR-145		5.1	4.			2.				
RG-1691		3.6			6.	18.				

Description of Sampling Point Locations

LR-144 - Same as RG-1688 - Mine drainage near middle of Strip #7 to Laurel Run.
LR-145 - Same as RG-1691 - Laurel Run at the crossing of Route T-545.

2nd Reinspection of Strips #5, #6 and #7

Watershed: Monongahela River - Youghiogheny River - Laurel Run

Mileage Index: MYLa

Location: These strips are located as indicated on the topographic map which accompanied the first reinspection report.

Conditions Found:

Strips #5 and #6 are still in their undisturbed backfilled condition with no visible drainage. Strip #7 now has one small acid drainage (Sample #144-LR) which has no measurable affect on Laurel Run which is mildly alkaline (Sample #145-LR), below at the crossing of Route T-545. Sample #144-LR is more acid on the second reinspection than at the time of the first reinspection (Sample #1688-RG). However, Laurel Run has changed from acid (Sample #1691-RG) a year ago, to alkaline at the present time (Sample #145-LR).

Reinspection of Strip #8

2nd Reinspection: By: Luther Renner Date: March 29, 1951

Is any acid entering receiving stream?

Mine drainage Analyses: Collected: 3-29-51 Analyzed: 3-30-51

Sample Number	pH Value	Alkalinity B.P.B.	Alkalinity Pht.	Acidity B.P.B.	Acidity Pht.	Total Iron	Flow g.p.d.	Acid lb./day
LR-142	5.65	8.			4.	2.2	Small	Small
LR-143	3.64			6.	28.	3.9	3,000	.7

Stream Analyses:

Above Drainage Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	Below Drainage Sample Number	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.
						LR-143	6.5	10.			2.

Analyses of Samples - Strip #8

Collected: 3-29-51 Analyzed: 3-30-51

Sample Number	Sampling Point	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	IRON Total	IRON Ferrous	IRON Ferric	Sulphate
LR-142		5.65	8.			4.	2.2	0.	2.2	-50
RG-1689		3.75			4.	30.				
LR-143		3.64			6.	28.	3.9	0.	3.9	-50
LR-148		6.5	10.			2.				
RG-1676		6.45	8.			2.				

Description of Sampling Point Locations

LR-142 - Same as RG-1689 - Pond in Strip #8.
LR-143 - Seepage below pond in Strip #8.
LR-148 - Same as RG-1676 - Mouth of Limestone Run.

2nd Reinspection of Strip #8

Watershed: Monongahela River - Youghiogheny River - Dunbar Creek - Limestone Run

Mileage Index: MYDbrLi

Location: This strip is located as indicated on the topographic map which accompanied the first reinspection report.

Conditions Found:

This strip remains in the same backfilled condition and has not been disturbed. One pond of water was found which was alkaline (Sample #142-LR). A small seepage at the base of the spoils bank below the above pond was acid. This seepage had no measurable affect on Limestone Run which is slightly more alkaline now (Sample #148-LR) than a year ago (Sample #1676-RG).

General Summary:

The above data shows definitely that two streams, Glade and Honey Runs, are being polluted by Strip #1 and #2, but to a much less degree than a year ago, Honey Run is a small run not stocked with fish, while Glade Run is a fishing stream used extensively for recreation. The present pollution does not seem to have any adverse affect on the aquatic life of either Glade Run or Dunbar Creek which is alkaline below the mouth of Glade Run (Sample #149 -LR).

Recommendations:

Since the drainage from this operation has shown a gratifying decrease in total acid output over the past year, and is not adversely affecting Glade Run, it is recommended to the Sanitary Water Board that no action be taken at this time.

Respectfully Submitted,

Luther T. Renner
Chemist

C. E. Baer
Sanitary Engineer

George A. Morrison
Principal Mining Engineer

LTR:kk

April 9th, 1951.

[illegible] Mountain
Dunbar & Stewart Townships
Fayette County

Application #8716-TW

ANALYSES OF SAMPLES

Collected: 3-21-51 & 3-29-51

Analyzed: 3-29-51 & 3-30-51

Sample No.	Sampling Point	pH Value	Alkalinity BPB	Alkalinity Pht.	Acidity BPB	Acidity Pht.	IRON Total	IRON Ferrous	IRON Ferric	Sulphate
126-LR	Mine Drainage - Strip #1	3.4			22.	76.	13.	12.	1.	150.
127	Mine Drainage - Strip #1	4.5	8.			2.	0.	0.	0.	-50
128	Mine Drainage - Strip #1	3.7			4.	24.	6.2	1.1	5.1	130.
129	Mine Drainage - Strip #1	3.8			2.	28.	3.4	1.1	2.3	95.
130	Unnamed trib. of Glade Run below Strip #1	4.1	2.			20.				
131	Glade Run above tributary-Sample #130	4.85	4.			4.				
138	Headwaters of Jonathan Run at crossing of Rt.T-788 below Sample #139	6.4	12.			2.				
139	South east Mine Drainage from Strip #2 into Jonathan Run	3.2			46.	128.	10.	.56	9.	320.
140	Mine Drainage from Strip #2 into headwaters of Honey Run.	3.11			44.	144.	6.7	.56	6.	450.
141	Honey Run at the crossing of Rt.26047 - below Sample #140	4.4	8.			16.				
142	Pond of Water in Strip #8 -	5.65	8.			4.	2.2	0.	2.2	-50
143	Seepage from Strip #8 to Limestone Run	3.64			6.	28.	3.9	0.	3.9	-50
144	Mine Drainage from middle of Strip #7	3.95	0.			32.	0.	0.	0.	120.
145	Laurel Run at crossing of Rt.T-545	5.1	4.			2.				
146	Mouth of Glade Run	4.75	4.			6.				
147	Glade Run above mouth of Limestone Run	6.85	12.	0.						
148	Mouth of Limestone Run	6.5	10.			2.				
149	Dunbar Creek ½ mile below mouth of Limestone Run	6.7	6.			2.				

Historical Surface Water Quality of the Glade Run Watershed

Source: Penns Woods West Chapter
Trout Unlimited

HISTORICAL SURFACE WATER QUALITY - STATION GR-56

Date	pH (S.U.)	Acidity (mg/l)	Alkalinity (mg/l)	Net Acidity (mg/l)	Sulfate (mg/l)	Fe Total (mg/l)
5/18/74	4.7	-	-	-	15	0.12
5/23/74	-	13	3	10	-	-
6/15/74	4.7	17	4	13	55	0.40
7/21/74	3.6	34	0	34	56	0.07
8/18/74	3.6	35	0	35	75	0.12
9/29/74	3.7	15	0	15	24	-
10/74	3.6	21	0	21	32	0.55
11/3/74	3.6	21	0	21	32	0.0
11/24/74	4.7	16	5	11	25	0.23
2/22/75	5.1	-	-	-	-	-
3/16/75	4.8	16	2	14	48	2.3
6/75	4.2	23	1	22	-	0.3
8/75	4.1	21	-	21	-	0.1
10/75	3.95	9	0	9	35	0.3
12/75	4.1	18	1.4	16.6	-	0.1
2/22/76	4.5	17	2.0	15	-	1.90
2/22/76	5.1	-	-	-	-	-
4/76	4.3	19	1.5	17.5	-	0.5
6/76	4.1	22	0	22	-	0.2
3/20/77	5	9.1	<6.8	>2.3	-	0.7
4/17/77	<5.5	11.4	<6.84	>4.56	-	0.7
5/15/77	5.5	-	-	-	-	0.7
7/17/77	5	22.8	2.27	20.5	-	1.0
8/21/77	5.2	9.1	6.8	2.3	-	0.7
9/18/77	4.4	20.0	6.8	13.2	-	-
10/16/77	5.2	9.1	<6.84	>2.3	-	-
9/30/80	3.94	29	0	29	60	1.5
11/6/80	4.04	29	0	29	67	1.4
12/3/80	4.8	22	0	22	59	0.7

HISTORICAL SURFACE WATER QUALITY - STATION HR-90

Date	pH (S.U.)	Acidity (mg/l)	Alkalinity (mg/l)	Net Acidity (mg/l)	Sulfate (mg/l)	Fe Total (mg/l)
6/15/74	4.4	10	4	6	10	0.11
7/21/74	3.6	12	0	12	10	0.08
8/18/74	4.0	8	0	8	10	<0.05
9/29/74	3.6	13	0	13	13	-
11/3/74	4.6	13	3	10	7	0.09
12/29/74	4.7	10	3	7	13	0.05
1/8/76	4.3	7	-	?	9	0.13
2/22/76	4.75	9	3	6	10	0.46
3/20/77	5.2	6.8	6.8	0	-	0.3
4/17/77	5.4	6.8	6.8	0	-	0.9
5/15/77	5.5	6.8	6.8	0	-	-
7/17/77	5	6.8	6.8	0	-	-
8/21/77	5.3	9.1	6.8	2.4	-	0.4
9/18/77	5.3	13.7	<6.8	>6.9	-	-

HISTORICAL SURFACE WATER QUALITY - STATION BP-83

Date	pH (S.U.)	Acidity (mg/l)	Alkalinity (mg/l)	Net Acidity (mg/l)	Sulfate mg/l)	Fe Total (mg/l)
6/15/74	4.4	13	4	9	-	Ø.11
7/21/74	3.4	22	Ø	22	-	<Ø.Ø5
8/18/74	3.9	9	Ø	9	-	<Ø.Ø5
9/29/74	3.8	12	Ø	12	-	<Ø.Ø5
1Ø/74	3.8	14	Ø	14	-	Ø.Ø5
11/3/74	3.8	14	Ø	14	-	Ø.Ø5
12/29/74	4.4	14	2	12	-	Ø.15
1975	NO DATA AVAILABLE ----------					
1/8/76	4.3	13	-	-	19	Ø.38
2/22/76	4.Ø	19	2	17	18	Ø.51
3/2Ø/77	5.3	9.1	6.8	2.3	-	Ø.5
4/17/77	5.2	9.1	6.8	2.3	-	1.4
5/15/77	4.7	13.7	<6.8	>6.9	-	Ø.4
7/17/77	5.2	11.4	6.8	4.6	-	-
8/21/77	4.9	11.4	6.8	4.6	-	Ø.8
9/18/77	5.7	11.4	6.8	4.6	-	-
1Ø/16/77	5	9.1	<6.84	2.26	-	Ø.2

HISTORICAL SURFACE WATER QUALITY - STATION BP-82

Date	pH (S.U.)	Acidity (mg/l)	Alkalinity (mg/l)	Net Acidity (mg/l)	Sulfate (mg/l)	Fe Total (mg/l)
4/50	3.95	28	0	28	-	-
3/51	4.1	20	2	18	-	-
6/15/74	4.6	13	5	8	10	0.10
5/18/74	-	-	-	-	10	0.10
2/23/75	4.3	13	0	13	18	0.72
3/16/75	4.60	13	2	11	11	0.20
5/75	4.4	10	1	9	-	0.3
7/75	4.1	12	1	11	-	0.2
10/75	4.5	9	3	6	17	0.3
11/16/75	4.5	8	2	6	14	0.95
12/27/75	4.8	-	-	-	-	-
1/8/76	4.2	10	-	-	12	0.23
2/22/76	4.6	11	2	-	15	-
2/22/76	4.8	6.84	-	-	40	-
4/76	4.8	10	0	10	-	0.4
6/13/76	5.25	-	-	-	-	0.5
6/27/76	4.8	-	-	-	-	0.4
3/20/77	5	9.1	6.8	2.3	-	0.5
4/17/77	4.9	9.1	<6.8	>2.3	-	0.5
5/15/77	5.3	11.4	<6.8	>4.6	-	0.4
7/17/77	5.5	11.4	0	11.4	-	-
8/21/77	5.5	2.3	6.84	-4.5	-	0.5
9/18/77	6.3	9.1	6.8	2.3	-	1.0
10/16/77	5.0	9.1	6.8	2.3	-	0.1
7/30/80	4.79	7	5	2	24	1.2
12/3/80	4.67	18	2	16	43	0.1
2/2/80	4.63	12	1	11	30	0.3

HISTORICAL SURFACE WATER QUALITY - STATION GR-50

Date	pH (S.U.)	Acidity (mg/l)	Alkalinity (mg/l)	Net Acidity (mg/l)	Sulfate (mg/l)	Fe Total (mg/l)
9/10/47	7.1	-	-			
6/20/49	4.8	8	8	0		
4/50	5.15	4	6	-2	-	-
3/51	4.75	6	4	-2	-	-
5/18/74	5.1	11	5	6	16	0.1
5/23/74	NA	11	5	NA	NA	NA
3/01/75	4.8	10	3	7	12	0.08
3/16/75	4.85	10	3	7	12	<0.05
4/20/75	4.9	10	4	6	25	0.20
5/31/75	5.8	4	5	-1	20	0.18
7/13/75	4.5	6	6.75	-0.75	17	<0.20
9/06/75	4.6	7	7	0	17	0.27
11/16/75	5.2	7	4	3	14	<0.2
2/22/76	4.7	10	3	7	16	0.41
2/22/76	5.4	6.84	<6.84	>0	-	-
4/76	5.1	8	<6	>2	-	-
6/76	4.8	12	<6	>6	-	0.2
9/05/76	7.0	5.7	<17.	>11.3	-	0.3
4/17/77	6	6.84	6.84	0	-	-
5/15/77	6	6.84	6.84	0	-	-
7/17/77	6	<4.7	6.84	<-2.14	-	-
8/21/77	6	4.7	6.84	-2.14	-	-
9/18/77	7	6.84	6.84	0	-	-
1/14/79	4.89	14	4	10	28	0.3
10/9/80	6.34	11	7	4	36	-

SURVEY
ON
GLADE RUN WATERSHED
SL 103-9-101.6
FAYETTE COUNTY

PREPARED BY:

LOU M. SCOTT, H.E.T. II DIVISION OF
ABANDONED MINE RECLAMATION
DEPARTMENT OF ENVIRONMENTAL
RESOURCES

GLADE RUN WATERSHED SL 103-9-101.6

Project Location

The majority of the Glade Run Watershed is located within State Game Lands No. 51, in Fayette County, Pennsylvania. Topographic features of the area consist of steep, wooded slopes, high plateaus along the east and west sides and top of Chestnut Ridge, and large flat grassy areas near the headwaters. Glade Run merges with Little Dunbar Creek to form the headwaters of Dunbar Creek. Dunbar Creek, stocked annually with over 15,000 trout by the Pennsylvania Fish Commission and Dunbar Sportsmen's Club, is heavily used by anglers from surrounding areas.

Purpose of Project

In October of 1980, a field investigation and water sampling program was conducted on Glade Run and its tributaries. The purpose of this investigation was to determine the extent and location of acid mine drainage (AMD) problems within the Glade Run Watershed. The investigation consisted of: collecting water samples at pre-selected locations, locating and mapping any discharges, locating active coal mining operations and other notable features. All water samples were sent to Hawk Run for laboratory analyses. Refer to the attached maps 1 and 2 and flow diagrams for location and magnitude of AMD source areas, sampling points, coal mine operations and other notable features.

Results of Investigation

1. Water quality - the headwaters of Glade Run has reasonably good water quality with a pH of 6.06, a net alkalinity concentration of 38 mg/L and a total iron concentration of 0.2 mg/L. However, Glade Run begins to deteriorate almost immediately with the introduction of several tributaries. From the first tributary to its confluence with Rock Run and Little Piney,

according to the laboratory analysis, Glade Run maintains poor water quality with pH ranging from 3.9 to 4.90, a net acidity concentration range of 28 to 13 mg/L and a corresponding total iron concentration range of 1.4 to 0.3 mg/L. Glade Run from the confluence of Rock Run and Little Piney to its confluence with Little Dunbar improves in quality, pH increases to 6.34, net acidity decreases to 4 Mg/l and total iron decreases to 0.0 mg/l.

The tributaries flowing into Glade Run, with the exception of Rock Run, have a pH range of 4.44 to 5.58, a net acid-alkaline range of 24 mg/l of acidity to 11 mg/l of alkalinity, and total iron of .10 to 1.5 mg/l. Rock Run maintains good water quality throughout its course with a pH of 6.35, a net alkalinity of 2 mg/l and total iron of 0.0 mg/l. The above information derived from the laboratory analyses of the water samples, would appear to indicate more of an acid problem than an iron one.

2. Abandoned Coal Mines - Two abandoned coal mines, within Glade Run Watershed, seem to have a significant impact on the quality of Glade Run. They are the Mashudda Strip, an abandoned strip mine, and the Old Morrison Mine, an abandoned deep mine. The Mashudda strip mine, according to information on file, is on the lower Kittanning seam and the Old Morrison deep mine is on the Lower Freeport seam but from available W.P.A. mine and U.S.G.S. topographic maps this information would appear incorrect. A more logical presentation would be for Mashudda mining the lower Freeport and Old Morrison mining the lower Kittanning. The Mashudda strip mine has been reclaimed; however, discharges and seeps have developed through the backfill and highwall. Presently, a portion of the Old Morrison Mine is an unreclaimed strip mine. Information derived from a meeting with Steve Beam, Trout Unlimited, and with members of Dunbar Sportsmen's Club suggest that the problem with Glade Run occurs after a heavy rainfall. The Mashudda strip recharges and a "slug" of acid mine water flushes out into Big Piney which in turn flows into Glade Run. It is this sudden "slugging"

that is believed to have a devastating impact on Glade Run, which is marginal to begin with. After a rainfall, Glade Run and Mashudda were revisited and samples taken of the two streams and of four discharges which were found flowing from Mashudda. The discharges originate out of the highwall. The evidence of a deep mine located behind Mashudda leads to the possibility of a mine pool which during a heavy rainfall could be overflowing and causing the AMD to flow through the highwall of the Mashudda strip area. The discharges were flowing in a range of approximately 30 to 219 GPM with a pH range from 4.19 to 4.63, an acidity concentration of 10 to 30 mg/l and a total iron concentration of 0.1 to 4.1 mg/l.

3. Active Coal Mines - there are two active coal companies presently operating within the Glade Run Watershed; West Penn Coal and Construction Company and Purco Coal Company. Refer to attached Map No. 2 for location of companies. Steve Beam, Trout Unlimited, had indicated that the West Penn Coal and Construction Company had been in violation but the DER Bureau of Mining and Reclamation District Office in Greensburg, Pennsylvania could not confirm this.

4. Notable Features – a. Limestone Barriers - Three barriers have been constructed by Dunbar Sportsmen's Club on two tributaries of Glade Run. Two barriers have been constructed on Little Piney, and one barrier on Big Piney which receives the drainage from the Mashudda strip. At the time of this investigation, the barriers, constructed using No. 2B limestone, had become seriously eroded from past heavy flows. A major portion of the limestone has washed out of the normal stream bed. Also, the barriers have become heavily silted with sediment making them ineffective. b. Rock Run - Rock Run is a major tributary to Glade Run. Rock Run is a notable feature in that approximately 150 yards from its confluence with Glade Run the stream enters a sink hole and "disappears". A search of the general area did not reveal any exit for the captured water. c. Beaver Ponds - during

the field investigations, several beaver dams were discovered across Glade Run. (See attached Map No. 1.) While fresh cuttings could not be found, indicating recent activity, the dams appeared strong and in good condition. These dams and the resultant ponds appear to be acting as natural settling ponds. The laboratory analysis of the water samples indicate a lower iron concentration below the dam than above it. According to a soil survey report of Fayette County by the U.S.D.A. Soil Conservation Service, the major soils in Glade Run Watershed are of the Upshar and Dekalb series. These soils range from neutral to medium acid (pH 7.3 - 5.6) for the Upshar series to strongly to very strongly acid (pH 5.1 - 4.5) for the Dekalb series

Conclusions and Recommendations

Based upon the field investigation and the laboratory analyses, it was concluded that the major AMD source region is the Mashudda and Old Morrison abandoned mine areas and that Glade Run is naturally acidic and the improvement of pH above 6.0 is probably not possible.

Therefore, based on the above findings, the following is recommended:

1. Further sub-surface investigation of Mashudda and Old Morrison Mines be conducted. This sub-surface investigation would be directed towards determining the origin of the discharges, the boundaries of the deep mine, the possible existence of and extent of a mine pool, and the abatement measures that can be taken.
2. A twice-a-month water quality sampling program be established, with alternate readings taken during periods of rainfall. This program would involve the collecting of fifteen (15) water samples and measuring of flows at two (2) weirs. (See attached Map No. 3 for sampling stations and weir locations.) These sampling stations and weirs will enable monitoring of water quality flows from the abandoned mine areas, the active coal operations, and their effect on Glade Run. Presently, Trout Unlimited has offered to collect the water samples and take flow readings for this project.

3. Rock Run should be investigated further. The water is of such quality that its addition to Glade Run could only improve the quality of Glade Run. Possibly a dye tab test could be conducted to locate the effluent of Rock Run.

4. The limestone barriers on Little Piney and Big Piney should be cleaned and repaired. The repair of these barriers would not eliminate the need for sub-surface investigation of Mashudda. The barriers were most likely installed, by Trout Unlimited, with the purpose of increasing the pH level of a stream of which has marginal quality in its natural state. These barriers while helping to raise the pH level of Little Piney and Big Piney, and thus neutralize Glade Run, are not able to counter act the "slug" from Mashudda after a heavy rainfall.

Glade Run would appear to be on that fine line between being able to support aquatic life and not being able to support aquatic life. According to a report by the U. S. Environmental Protection Agency, February 1973, Fish and Food Organisms in Acid Mine Waters of Pennsylvania, a stream should have a pH level of 5.5 or greater and an acid concentration of less than 5 ppm to meet minimal life supporting conditions. Thus, for the restoration of Glade Run, in priority, the following action is proposed: 1. elimination of discharges from Mashudda, 2. repair of present limestone barriers and 3. construction of additional barriers on Glade Run. However, all barriers should be designed so as not to make them so readily susceptible to siltation.

Original Copy
Sanitary Water Board

SANITARY WATER BOARD
DEPARTMENT OF HEALTH
COMMONWEALTH OF PENNSYLVANIA

REPORT IN RE POLLUTION OF THE WATERS OF THE STATE

ame of stream **Dunbar Creek** Tributary to **Youghiogheny River**

own **Dunbar** Township **Dunbar** County **Fayette**

pollution acute or chronic? **Acute**

f acute, give date and time of damage **Sunday June 19, 1949**

. fish killed, state number and kind **Personally only noted 10 dead trout, and hundreds were ick and unable to standany current. Could be picked up by hand very easily and made no** her damage **effort to get away.**

arthest upstream point damage reported **Vicinity of junction of Dunbar Creek and Little nbar Creek.**

haracter of water in stream above point of damage. **Slightly muddy.**
(If polluted, give name and kinds of industries up-stream)

Only Industry on the stream above area affected is.
Mashuda Coal Company... Strip mine
I am informed this Company have quit operating, Equipment is being moved out, and the strip cuts have not been backfilled.

as the flow of stream when fish killing occurred high, low or normal **High from hard rains on Saturday.**

s life present above? **Unable to report on this at this time.**

eather conditions **Stormy. Rain Friday and Saturday.**

haracter of suspected harmful discharge **Mine acid water**

uantity Color **None** Odor **None**

olids Reaction

haracter of stream below suspected discharge
(How far below point of entry is stream affected)
Sick fish were noted a far down as Limestone Run.

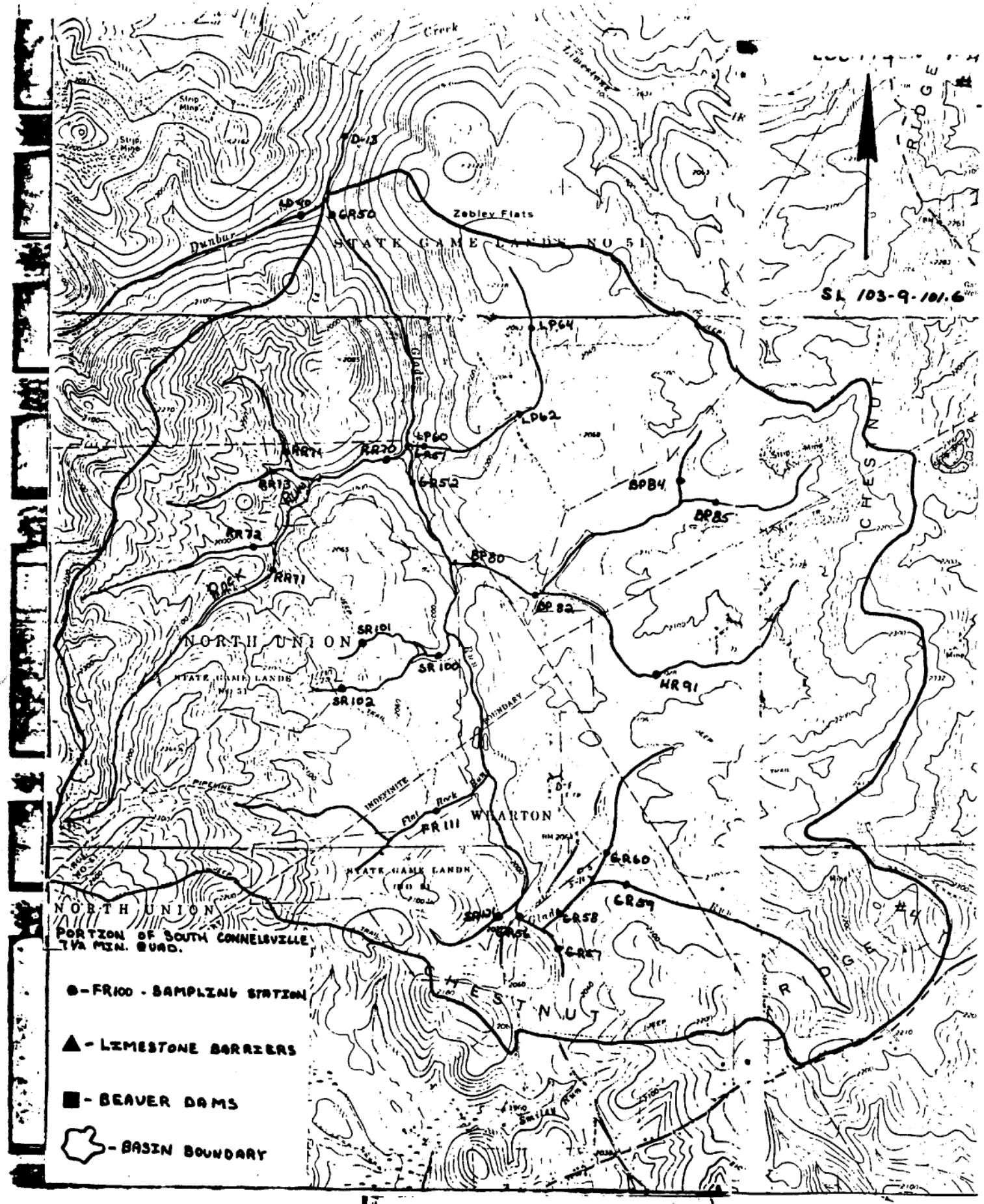
s fish life present below? **Yes.**

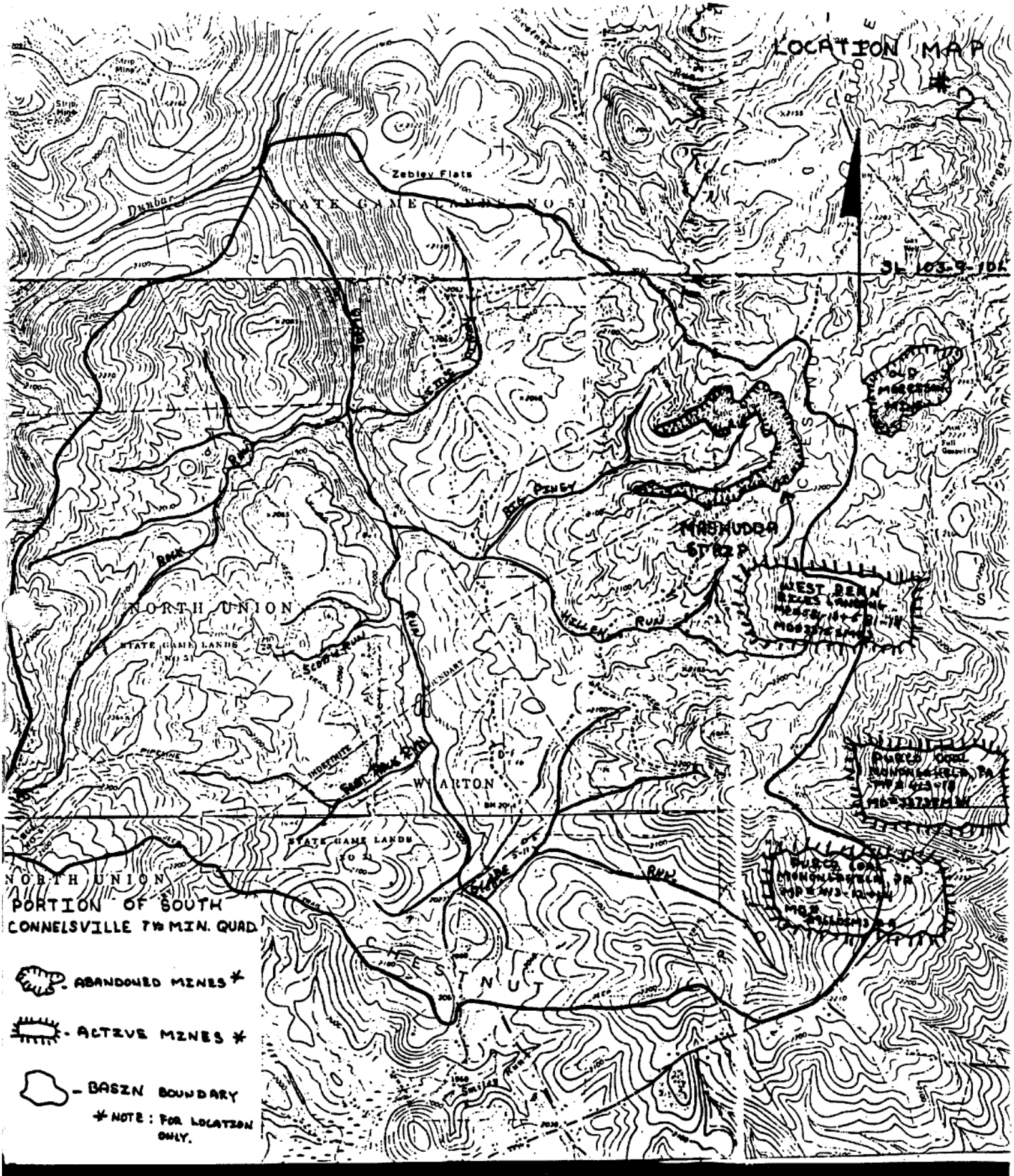
ame, location and kind of establishments suspected;

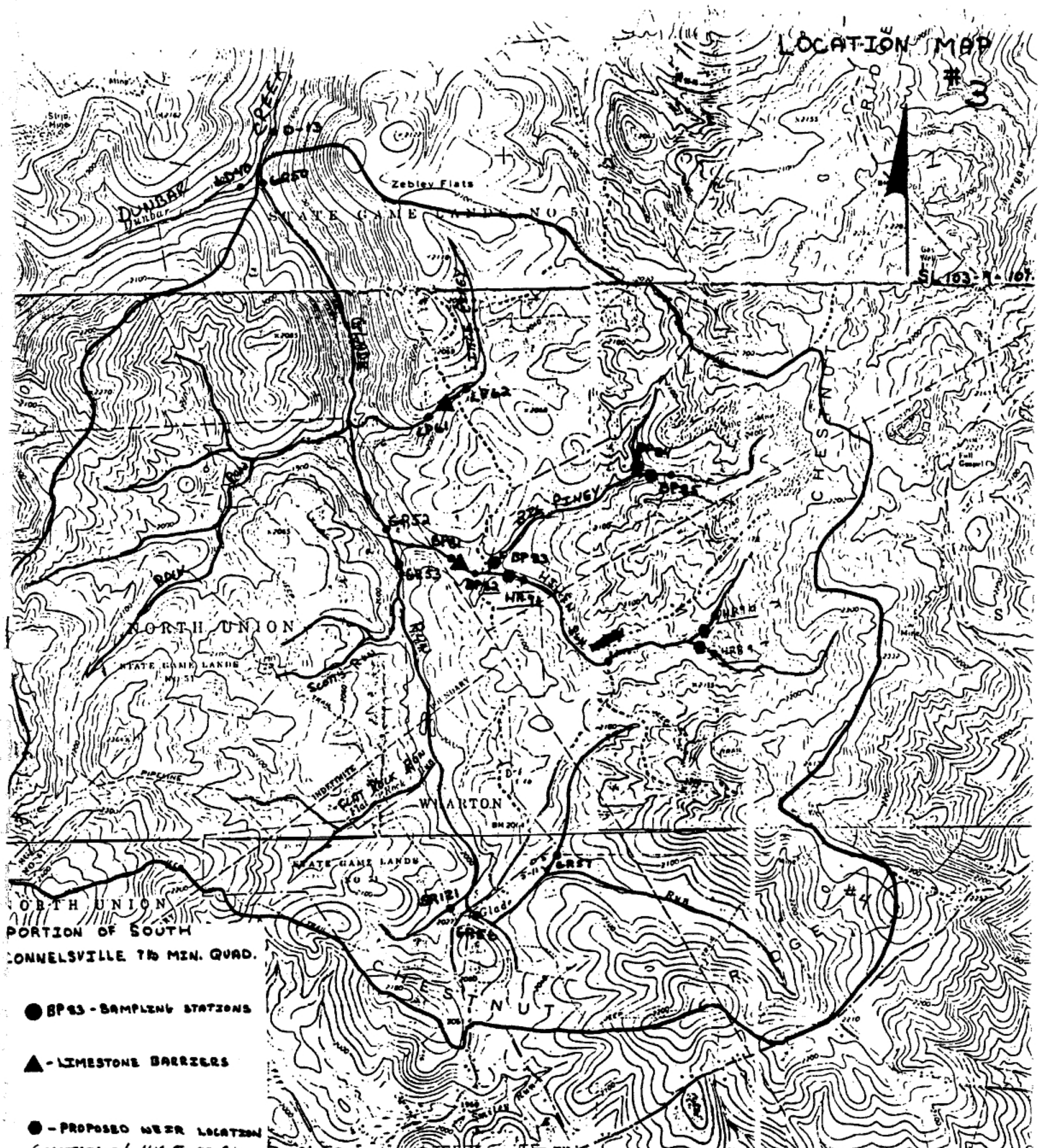
Mashuda Coal Company, Dunbar, Pa. Strip Mine

ame and addresses of observers or witnesses: **Richard Miller, Connellsville, Pa.**
John Craig, Connellsville, Pa.
Harry Pierce, Connellsville, Pa.
Frank Sullivan, Fairchance, Pa.

(OVER)


NORTH UNION
PORTION OF SOUTH CONNELLSVILLE 7½ MIN. QUAD.
●-FR100 - SAMPLING STATION
▲- LIMESTONE BARRIERS
■- BEAVER DAMS
- BASIN BOUNDARY
STATE GAME LANDS NO 51
Zebley Flats
Dunbar
Glade
NORTH UNION
STATE GAME LANDS
WYARTON
CHESTNUT RIDGE
SL 103-9-101.6
D-13
LP59
GR50
LP64
LP62
LP60
LR57
GR52
RR74
RR70
RR73
RR72
RR71
BP84
BP85
BP80
BP82
SR101
SR100
SR102
HR91
FR111
GR60
GR59
GR58
GR56
GR57
D-1
D-11


LOCATION MAP
Zebley Flats
STATE GAME LANDS NO 51
Dunbar
NORTH UNION
STATE GAME LANDS NO 51
WHARTON
STATE GAME LANDS NO 51
NORTH UNION
PORTION OF SOUTH
CONNELSVILLE 7½ MIN. QUAD
- ABANDONED MINES *
- ACTIVE MINES *
- BASIN BOUNDARY
* NOTE: FOR LOCATION ONLY.


LOCATION MAP
#3
PORTION OF SOUTH
CONNELSVILLE 7½ MIN. QUAD.
BP83 - SAMPLING STATIONS
- LIMESTONE BARRIERS
- PROPOSED WEIR LOCATION
OK ?
Zebley Flats
STATE GAME LANDS NO 51
NORTH UNION
WHARTON
DUNBAR CREEK
PINEY
HELEN RUN
SCOTTS RUN
CHESTNUT
STATE GAME LANDS
BP83
PIPELINE

[redacted]

Mashudda Mine Drainage Abatement Study
Phase I - Data Collection, Field Reconnaissance, Initial Sampling, and Feasibility Study
Program Development
July 1982

Mashudda Mine Drainage Abatement Study

Phase I - Data Collection, Field Reconnaissance, Initial Sampling, and Feasibility Study Program Development

Operations Scarlift Project No. SL 103-9-101.6

For

Pennsylvania Department of Environmental Resources Division of Abandoned Mine Reclamation

By

R. E. Wright Associates, Inc.

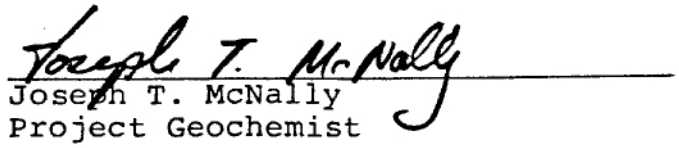
3240 Schoolhouse Road

Middletown, Pennsylvania

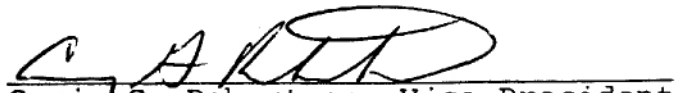
July 1982

Respectfully Submitted:

Michael D. Haufler
Staff Geologist



Joseph T. McNally
Project Geochemist



Craig G. Robertson, Vice President
Project Manager

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PLATES

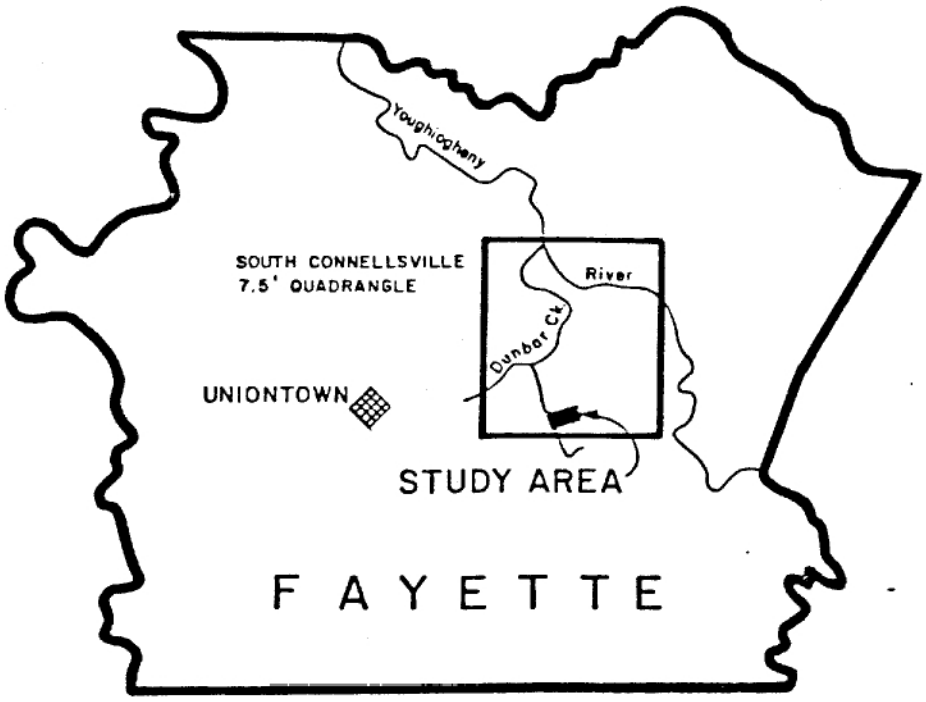
MASHUDDA MINE DRAINAGE ABATEMENT STUDY
PHASE I - DATA COLLECTION, FIELD RECONNAISSANCE, INITIAL SAMPLING, AND FEASIBILITY STUDY PROGRAM DEVELOPMENT

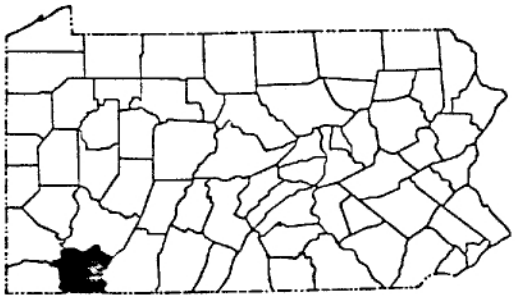
INTRODUCTION

The purpose of this report is to present the results of the Phase I field data collection at the Mashudda Strip Mine. The objectives of this initial field work were to characterize surface water quality, delineate the geologic and mining framework, and develop an exploration program to determine the sources and cause of acid mine drainage emanating from the Mashudda Strip Mine.

The Mashudda Strip Mine is located on the boundaries of Stewart and Dunbar Townships in Fayette County, Pennsylvania (Figure 1). The principal stream draining Mashudda is Big Piney Creek. Hillen Run, a tributary to Big Piney, drains the adjacent basin to the south. Big Piney flows west into Glade Run which eventually empties into Dunbar Creek (Plate 1).

This report is based on both existing data from previous reports and field reconnaissance to characterize the current surface water quality, geology, and extent of mining. A discussion of the existing data and reports is presented below. The methods and results of the field reconnaissance which included the collection of stream water samples, measurement of stream flow, and mapping of geologic features, are discussed in greater detail in subsequent sections.





COUNTY LOCATION

Figure 1 - Location Map of the Mashudda Strip Mine Study Area.

REVIEW OF EXISTING DATA AND REPORTS

A search to determine the extent of old deep mining in the area was conducted through inquiries to the U.S. Bureau of Mines, Mine Map Repository, in Pittsburgh, Pennsylvania and the Pennsylvania DER Division of Mine Subsidence in McMurray, PA. In addition, old permit applications in the Pennsylvania DER files were reviewed.

The results of this search indicate that deep mining in the immediate vicinity of the Mashudda strip was limited to approximately a 3 acre site located upgradient and to the east of the Mashudda highwall. This mine is known as the Old Morrison Strip Mine (Plate 1). Because of the near horizontal attitude of the coal beds and limited extent of this mine, it does not appear likely that a large mine is present at this location (Plate 2). During 12 reinspection reports at this mine, flow was usually not present from the mine opening and when it was, it flowed to the northeast away from the drainage basin of Big Piney Creek.

Previous studies of the surface water quality of Big Piney have been conducted intermittantly since 1949 when the stripping operation was halted because of an illegal acid discharge. In a 1950 reinspection report, the acidic effect of the drainage from Big Piney to Glade Run was determined. At that time, Big Piney was contributing 163 pounds of acid per day, and the pH of the stream water was measured at 3.95. At the same time, Glade Run had a pH of 4.85 with a net acidity of 2 parts per million.

A subsequent study (second reinspection report; 1951) identified 12 points of drainage, 4 of which were contributing close to 98 percent of the acidity within the Mashudda strip. During this later survey, these four discharges were contributing approximately 31 pounds of acid per day which represented a five-fold reduction of the acid load measured one year earlier. The pH of Big Piney near location BP-83 (Plate 3) was 4.1 with

18 mg/l net acidity. The pH measured in Glade Run above the mouth of Big Piney was 4.85 with 0 net acidity. Approximately 2 miles below the confluence with Big Piney the pH of Glade Run was measured at 4.75 with 2 mg/l net acidity.

Between June 1974 and October, 1977 sixteen stream water samples were collected irregularly at location BP-83. These results show that the surface water quality ranged in pH from 3.4 to 5.7 with a median value of 4.4. Similarly the net acidity ranged from 2 to 22 mg/l with a median value of 9 mg/l.

A more recent report by the Pennsylvania DER, was prepared based upon a field investigation conducted in October, 1980. In this investigation, it was suggested that "slugs" of acidity from the Mashudda strip occurred after heavy rainfall causing deterioration of Big Piney and in turn Glade Run. Four discharges were sampled from the Mashudda strip highwall and found to contain between 10 and 30 mg/l of acidity with a pH between 4.19 and 4.63.

The results of these previous investigations indicate that the water quality emanating from the Mashudda strip into Big Piney has improved only minimally since the strip was abandoned in 1949. In addition, the range in water quality may be related more to short term changes in the hydrologic conditions than to long term improvement in the water quality.

This report which represents the most recent study to date of the Mashudda strip, is based upon a field investigation conducted by R.E. Wright Associates, Inc. between April 27 and April 30, 1982. The results of this investigation address the geology, existing stream water quality, and potential sources of acid mine drainage. In addition, recommendations for further investigation to determine the source and the cause of acid mine drainage emanating from the Mashudda strip mine are included.

GEOLOGY AND MINING

Regional Stratigraphy and Structure

Fayette County is located in the Allegheny Plateau Province of Pennsylvania. Rocks here range in age from Devonian to Permian, and are entirely sedimentary, predominantly deltaic sequences. They are not perfectly horizontal as the plateau term implies, but have been folded into a series of gentle anticlines and synclines which strike roughly north-northeast to southsouthwest.

The rocks underlying central Fayette County, where Glade Run watershed is found, are a cyclic series of sandstone, shale, claystone, limestone, and coals of the Pennsylvanian Age Pottsville, Allegheny, and Conemaugh groups. The most prominent structure in central Fayette County is the Chestnut Ridge anticline (which creates the physiographic feature known as Chestnut Ridge). This is a portion of a large anticlinal structure which can be traced northeast from West Virginia into New York State, and is reported to have a structural closure of over 400 feet in areas just to the northeast of the Glade Run watershed (Shaffner, 1963). Though no faulting is mapped in published reports on the geology of the area, seismic data indicates that some quite significant faults occur in the Chestnut Ridge subsurface (Schaffner, 1963).

The Chestnut Ridge anticline has greatly influenced the overlying stratigraphy. This structure was active during the deposition of the major formations in the area, and created highly transitional conditions in an already transitional deltaic depositional environment. As a result, correlation of most lithologies along Chestnut Ridge is very difficult and tenuous at best, even across relatively short distances.

Local Stratigraphy and Mapping

Stratigraphic interpretations and naming of formations is very difficult in this area due to the aforementioned transitional depositional environments and to lack of detailed well logs and accurate geologic mapping in the region. Two shallow exploratory drill holes were drilled on the Mashudda property in 1957. Logs of these wells along with those from a few gas wells in the surrounding areas are the only subsurface data available. Unfortunately, no published geologic mapping exists of the region on a scale larger than 1:62,500 (1938 vintage Fayette County map). Open file mapping done by the Pennsylvania Geologic Survey for the compilation of the 1981 Pennsylvania State Geologic Map is not accurate in this particular area.

In addition, U.S. Geological Survey and Pennsylvania Geological Survey personnel who have worked or are working in this region have conveyed the impression, through personal communication, that naming of formations in this region is futile. However, some naming of formations as a basis for geologic mapping is necessary. As part of the U.S. Coal Resource Evaluation Program, Pennsylvania Geological Survey personnel have compiled data from numerous gas wells in the region. These logs, coupled with what is known of the structural geology in the area, show that strata at least as old as the lowermost Allegheny group, should outcrop in the study area.

Plate 1 shows the results of REWAI field mapping. A pervasive sandstone unit apparently underlies the majority of Big Piney Creek Valley and is found in Hillen Creek at least as far south as the southern access road. This is generally a very hard, medium to light buff colored siliceous sandstone, with fine to medium grained sandstone interbedded in thin to medium thick beds, with more massive beds of very coarse to conglomeratic sandstone. Graded bedding and cross-bedding are evident in well exposed outcrops. Jointing is moderately well developed, generally widely spaced, and often shows yellow-orange iron

staining on joint faces. This unit is interpreted to be the top of the Pottsville group, or the Homewood Sandstone.

Overlying the Pottsville group are the sandstones, shales, claystones, and coals of the Allegheny group. Only the more resistant sandstones are exposed naturally in the study area. These are generally light buff to white colored siliceous sandstone, which are finer grained and thinner bedded than the Homewood Sandstone. Development of jointing varies from very good to very poor.

Two and possibly three distinct units of this sandstone are identifiable in the Mashudda Mine area, where they commonly cap the hills of the region (Plates 1 and 2.) The lowermost sandstone is moderately well exposed in the northern strip pit (not backfilled), where it is characterized by abundant siderite nodules. Well logs to the south and east show that this sandstone pinches out in that direction.

A fairly persistent bed of sandstone occurs 20 to 30 feet above this one, and outcrops at the top of the highwall in most of the Mashudda mine. These sandstones are separated by gray shales, light and dark gray clay and claystone, and coal seams (see below). This lower section of the Allegheny group is exposed in an active strip mine to the northeast, and reportedly in an active strip mine to the south.

A higher section in this formation, approximately 140 feet stratigraphically above this sandstone, is exposed at Rice's Landing and the Old Morrison Strip Mine. These sections correlate fairly well, and consist of a major coal seam overlain by light gray siliceous fine to very fine grained sandstone in thin beds and laminations, with carbonaceous films common. This sandstone is replaced along strike locally by a dark fossiliferous, carbonaceous, silty claystone. Above this sandstone there is a discontinuous coal bed and carbonaceous shale, which are in turn overlain by another sandstone unit. The intervening 140 feet of

stratigraphic section between the exposures in the Mashudda Mine area and those at Rices Landing and the Morrison Mine is known only to contain one or more sandstone beds. Gas well logs in the area show this interval probably contains much sandstone, siltstone, and claystone, along with other coal beds, and possibly a limestone bed near the upper part of the section. Plate 2 shows the known stratigraphy of the study area, based on field mapping and existing well logs.

Structure

The study area is located in a portion of Fayette County where the Chestnut Ridge anticline and Ligonier syncline to the east form an en echelon series of folds. The northeastern extension of the Chestnut Ridge anticline plunges gently and disappears to the south in the area. Adjacent to this, on the west, is the northern terminus of the southwest portion of the Ligonier synclinal axis, which may be coincident with a portion of Glade Run. This fold also plunges gently to the south. The Chestnut Ridge anticline apparently continues south-southeast from an are# on the west side of Glade Run. The Mashudda strip mine is located on the western limb of the Chestnut Ridge anticline at the point where the Ligonier syncline begins. Two minor folds occur between the anticline and syncline, with fold axes which probably strike in the same direction as the major folds, i.e., to the south. Plate 1 shows the likely location of fold axes, based on REWAI field mapping and published and unpublished data.

Because of its location relative to these folds, bedding at the Mashudda strip mine is horizontal or nearly horizontal, with a gentle overall dip of a few degrees to the west across most of the study area. As is shown in Plates 1 and 2, dip of bedding rarely exceeds 10 degrees, and is in most areas horizontal or nearly so.

Three, and possibly four, joint sets are evident in the study area. The two most well developed sets are strike joints, parallel to the strike of bedding, and dip joints, parrallel to the dip of bedding. A less well developed conjugate system of joints is also present, with strikes at various acute angles to the strike of the fold axes. All jointing is vertical to nearly vertical, as would be expected in flat-lying rocks. Together bedding orientation and joint sets help to define the fold axes shown on Plate 1. A few of the more well defined photogeologic fracture traces in the immediate Mashudda strip mine area are shown on Plate 4. These are interpreted as the surface manifestations of deeper fracture zones. It is interesting that a number of these coincide moderately well with joint directions.

Coal Seams

The main coal seam at the Mashudda mine is from 36 to 47 inches thick, based on two drill logs on the site. This seam occurs from 15 to 30 feet above the Homewood Sandstone, at an elevation of approximately 2120 feet (Plate 2). A rider seam 6 to 8 inches thick occurs about 25 feet above the main seam. A 10-inch seam occurs about 10 to 20 feet below the main seam, just above the Homewood Sandstone. Based on published descriptions and reports and on gas well log interpretations, the main coal is probably the Brookville/Clarion coal. This marks the base of the Allegheny group.

This main seam was mined throughout the Mashudda strip and it is presently being mined in an active strip to the. northeast of the study area. The rider seam has been taken out with the overburden, and may have been locally minable along the southern highwall. Inferred premining outcrops of both seams are shown on Plate 1. The lower, 10-inch seam was probably never mined. Its

inferred outcrop is also shown in Plate 1. The Brookville/Clarion coal is pyritic in nearby areas, and is probably so in the Mashudda strip. Nowhere in the Mashudda strip mine area are the coals and associated shale, clay, and claystone naturally exposed.

The coal mined at Rices Landing, across the southern access road, is 40 inches plus in thickness and occurs approximately 170 to 180 feet stratigraphically above the Brookville/Clarion horizon. A zero to 24-inch rider seam of shaly coal occurs 15 to 20 feet above this main seam. The stratigraphy below the coal is unknown. The trace of this coal is shown in Plate 1.

Coal mined at the Morrison mine is reported to be fairly thick, in excess of 36 inches, although none is presently exposed. A slightly thinner seam may underlie the main seam. A rider seam of shaly coal less than 12 inches thick underlain by carbonaceous shale occurs 15 to 20 feet above the inferred stratigraphic elevation of the main seam. Based on exposed stratigraphy, elevations, and structural interpretations, this coal is probably the same coal horizon as at Rices Landing. The inferred trace of this coal is shown on Plate 1.

Although the intervening stratigraphy between the Mashudda coals and the Rices Landing - Morrison coals is unknown, measured sections in other areas of Chestnut Ridge consistently show one or two, and possibly three, coal horizons within 180 feet of the Brookville/Clarion coal. Based on interpretations of other sections, the Rices Landing - Morrison coal may be equivalent to middle to upper Kittanning or even lower Freeport coal. The significance of the identification of this coal is that the upper Kittanning coal in this area is known to be directly underlain by an argillaceous limestone, as shown in the log of a gas well located to the south. Limestone cobbles were found in the immediate vicinity of the Morrison mine; however, they were obviously products of quarrying, and whether they were

transported long distances is unknown. The cross-sections shown in Plate 2 show tentative correlations made from existing data.

The stratigraphic and structural interpretations presented here are complicated by gas well log interpretations just to the east and north of the study area. These show the Brookville/Clarion coal horizon to occur at elevations as high as 2265 feet as opposed to 2120 feet at Mashudda. This necessitates one of three possibilities.

1. Very steeply dipping beds on the western limb of the Chestnut Ridge anticline,

2. A fault between these wells and the study area, necessarily a thrust fault with the upthrown side to the east, or

3. New stratigraphic interpretations of the coal horizons.

As no bedding dips of greater than 10 degrees were found in the study area or surrounding outcrops, one of the latter two modifications is favored. More complete borehole information may resolve this problem.

Mining Operations

The Mashudda mine (Application No. 8716-IW) was strip mined during the 1940's. As the main coal seam is nearly horizontal in this area, its exposure follows topographic contours, as did the mining operations. Apparently, strip mining of the main seam continued into the slopes around Big Piney Creek until the first major sandstone was encountered in the highwall. Its occasionally massive nature and toughness probably precluded further mining operations. At no time was the highwall likely more than 25 feet high. There is no evidence of augering or deep mining in the area. A telephone interview with Melvin Sproul (property owner) who was on site during mining operations

confirmed the fact that no augering or deep mining took place on the Mashudda site.

During the early 1960's, most of the Mashudda mine highwall was backfilled to approximately to original contour in many areas. Only the eroded portion of the highwall is presently exposed in the northwesternmost Mashudda site. Two large piles of unreclaimed spoil remain on the Mashudda site, as shown on Plate 1.

The Old Morrison mine (Application No. 12112-MD) was originally operated as a strip mine priorto the late 1940's. The main coal was exposed at the base of a knoll, and was stripped around its perimeter inward until overburden thickness made mining uneconomical. In the late 1940's, the main seam under the hill was deep mined in a pick-and-shovel operation until most of it was removed and the roof became unstable. The seam just below the main seam is reported to be untouched (Melvin Sproul, personal communication). Stratigraphic and structural interpretations and interviews establish concretely that this mining operation did not extend beyond the immediate 3-acre site..

Spoil from the strip and deep mine operations were dumped in the immediate vicinity of the mine, and presently form elongate piles surrounding the natural hilltop, as shown on Plate 1.

The Rices Landing mine (Permit No. 33755M43) is presently inactive, although it has been operated in recent years. The main coal occurs at approximately 2300 foot elevation. It has been mined back from its northernmost outcrop, to where it is presently exposed at the base of the highwall (Plate 1). The disturbed area is as shown on Plate 1.

Two deep mine shaft and slope symbols are shown on the South Connellsville quad. One is a mine shaft symbol located to the northeast of the Mashudda site at an elevation of 2120 feet. This shaft probably intersected the Mashudda coal seam, but has since been removed due to subsequent strip mining. The other is

since been removed due to subsequent strip mining. The other is a slope symbol located to the southeast of the study area at elevation 2240. It is uncertain which coal seam was mined here, but it is most likely the Rices Landing - Morrison seam, or one just below it. Only a small tipple pile is present at this site. It is likely that neither of these mines was very deep or extensive.

SURFACE WATER QUALITY

Field Methods

During this field investigation, 24 water samples from both streams and seeps were collected. Measurements of pH, temperature, specific conductance, total suspended iron, and dissolved oxygen were recorded in the field. Samples collected for metal analyses were filtered through a 0.45 micron cellulose membrane and acidified with concentrated nitrate acid. Streamflow was measured at each site sampled using either existing weirs, a flow velocity meter or field estimates of surface velocity.

Accuracy of the flow measurements was limited because of leaking weirs and the inherent error in measuring surface water velocity. Because of these limitations, the net acid loads calculated for sample locations BP-85 and BP-82 (Plate 3) form the primary basis for the discussion of acid loading in Big Piney Creek. These two locations are considered more reliable than others because the flow at BP-85 was measured before any leaks had developed in the weir, and the flow at BP-82 was measured using a flow velocity meter. Other locations are less reliable because either the existing weirs were leaking or a field estimate of flow was made.

Flow measurements at sample location BP-83 and HR-91 are each considered to be nearly l/2 the total measured flow downstream of their confluence at BP-82 (Plate 3). This estimate is based upon a one to one flow ratio which was recently determined at these two sites by the PA DER using flow velocity meter measurements.

Presentation of Results

Surface Streams

The analytical results presented in Table 1 should be reviewed with reference to the surface water sampling locations shown on Plate 3. these data indicate that net acidity (acidity minus alkalinity) ranges from a low of 3 mg/l to a high of 23 mg/l in samples taken from the three streams. Dissolved iron was less than 1 mg/l indicating that iron loading is of secondary concern to the problem of acid loading. Sulfate was generally less than 40 mg/l in Big Piney with the exception of samples BP-86 and BP-88 where sulfate was 249 mg/l and 111 mg/l respectively.

The net acid load in Big Piney at BP-85 was calculated to be 50 pounds per day. An estimate of the net acid load at BP-84 is 5 pounds per day for a total of 55 pounds per day of net acid load present in Big Piney Creek directly below the Mashudda Strip Mine.

Moving downstream to the next location where reliable flow data is available, the net acid load in Big Piney Creek below Hillen Run at station BP-82 was calculated to be 115 lbs/day. The increase in net acid load between BP-82 and BP-85 is due in part to the contribution of close to 30 pounds of acid to Big Piney by Hillen Run. However, it also indicates that an additional 30 lbs plus or minus were added to Big Piney Creek from sources below the Masudda strip and above its confluence with Hillen Run. Two possible sources for this acid load are the natural groundwater which supplies baseflow to this stream and underflow

TABLE 1

SUMMARY OF SURFACE WATER PARAMETERS
MASHUDDA STRIP MINE
APRIL 27 - 30, 1982

Sample Location	Date Collected	Flow (gpm)	Field pH (su)	Lab pH (su)	Temp. (°C)	Specific Conductance (umhos/cm)	Dissolved Oxygen (mg/l)	Acidity (mg/l as $CaCO_3$)	Alkalinity (mg/l as $CaCO_3$)	Net Acidity (mg/l as $CaCO_3$)	Fe Total (mg/l)	Fe^{+2} (mg/l)	Al (mg/l)	Sulfate (mg/l)
GR-52-A	4/27	NM	4.35	4.42	10.8	115	9	19	0	19	0.2	0.1	NA	32
GR-53	4/27	NM	4.05	4.30	11.5	140	9	20	0	20	0.6	0.2	NA	37
BP-80	4/27	NM	4.30	4.67	10.5	65	10	14	2	12	0	0	NA	27
BP-82	4/27	675	4.15	4.65	10.8	75	9	16	2	14	0.1	0.1	0.469	29
BP-83	4/26	350	4.10	4.47	13.0	55	8	12	0	12	0.5	0.2	0.58	27
HR-91	4/26	325	4.32	4.70	11.0	70	10	10	3	7	0	0	0.39	32
BP-84	4/29	90	3.65	4.48	6.8	30	10	9	5	4	0	0	0.309	20
BP-85	4/28	300	3.50	4.55	6.3	75	10	15	1	14	0.1	0	0.669	39
BP-86	4/28	50	3.65	4.86	10.0	75	9	9	6	3	0	0	NA	249
BP-87	4/29	250	3.70	4.51	8.5	75	10	15	1	14	0.1	0	NA	29
BP-88	4/29	15	3.60	4.49	11.3	60	8	16	0	16	0.1	0	NA	111
BP-89	4/29	225	3.65	4.46	11.9	85	9	17	0	17	0.4	0.1	NA	35
BP-90	4/29	50	3.90	4.70	11.1	80	9	10	3	7	0	0	0.436	31
BP-91	4/29	100	3.85	4.48	9.8	75	9	14	0	14	0	0	0.628	28
BP-92	4/29	100	3.45	3.97	15.0	165	8	23	0	23	0.4	0.2	0.972	55
S-1	4/29	5	5.05	5.65	NA	30	NA	4	6	0	0	0	NA	16
S-8	4/29	10	3.70	3.90	17.0	190	8	25	0	25	0.5	0.4	NA	59
S-12	4/29	5	3.85	4.03	17.5	135	6	20	0	20	1.1	0.3	NA	40
S-13	4/29	25	4.20	4.80	17.8	55	10	10	4	6	0.5	0.2	NA	20
S-14	4/29	15	3.60	3.94	15.2	145	8	18	0	18	0	0	NA	40
S-15	4/30	12	3.95	4.95	7.2	35	10	10	4	6	0	0	NA	10
S-24	4/30	32	4.35	5.01	8.5	75	11	7	5	2	0	0	NA	26
S-29	4/30	10	3.55	3.99	12.5	160	NA	31	0	31	0.5	0.2	NA	48
S-31	4/30	20	4.15	4.46	11.0	115	9	16	0	16	0.2	0.2	NA	47

NA - Not analyzed

NM - Not Measured

in the sandy streambed which may originate in the strip area but enter the channel farther downstream. However, until more precise flow measurements are available, any meaningful discussion of specific acid sources and loadings is not possible.

In terms of water quality, however, the relationship between the various streams can generally be characterized by a review of field pH data. This parameter shows that the quality of Big Piney Creek above Hillen run (pH = 4.10, BP-83) is improved slightly by the addition of Hillen Run (pH = 4.32, HR-91) such that the downstream pH of Big Piney is 4.15 (BP-82).

Similarly, the quality of Glade Run above its confluence with Big Piney Creek (pH = 4.05, GR-53) is improved by the addition of Big Piney Creek to a pH of 4.35. Therefore, under the conditions that existed at the time this initial survey was conducted, the apparent quality of Glade Run is not reduced by Big Piney Creek. Rather, it is somewhat improved.

Seeps and Springs

Throughout the study area, a total of 35 seeps were identified. The majority of these seeps were wet areas with standing water and minimal surface flow (0 to 5 gpm). Twelve of these seeps did however have noticeable flow (between 5 and 10 gpm) and are identified as such on Plate 1. Samples of nine of these 35 seeps were selected for chemical analysis, the results of which are reported in Table 1. Surface water samples collected near the old highwall of the Mashudda Strip Mine are generally composites of more than one seep and therefore help to characterize the acid production potential of various areas of the highwall. ,

In general, the results of these sample analyses indicate water quality in the mine area not significantly different from that measured in the streams. However, at least one sample collected beyond the limits of the strip (S-1) showed a pH over 5.0, net

alkalinity of 2 mg/l, no iron and low sulfates (16 mg/l). As such, this sample may represent natural background conditions corresponding to the maximum water quality improvement possible in Big Piney Creek.

Areas of particularly high acid generation were identified as follows:

Area l, located on the north flank of the Mashudda Strip in the area drained above BP-92 and specifically near seeps S-7 and S-8 (Plate 3).

Area 2, located in the northeast corner of the Mashudda Strip Mine where approximately 9 separate seeps were identified.

Area 3, located on the southern flank of the Mashudda Strip Mine in the vicinity of station S-29. This area contained the highest acidity measured although the flow was not significant.

Potential Sources of Mine Drainage

The possibility of a deep mine pool in the Old Morrison Mine providing mine drainage to the Mashudda Strip Mine appears unlikely based upon the known location and extent of this operation. In the absence of known deep mining in the seam stripped at Mashudda two sources of acid loading appear to remain.

The first possible source is the backfilled spoil pile itself. Percolation of rain water through this material normally leads to acid production because of the increased surface area of iron sulfides commonly found in overburden and the availability of water and oxygen to break them down.

A second source is the unmined coal and related pyritic strata which outcrop along the old highwall beneath the spoil pile. These coal seams which are now covered by the spoil, may act as a preferred horizontal conduit for groundwater flow due to their natural secondary permeability. Where these strata occur at a relatively shallow depth, the availability of both water and oxygen to break down the pyrites could result in significant acid
production potential. These conditions would be most prevalent close to the highwall.

In addition to these two probable sources, groundwater originating as recharge in the Old Morrison and Rices Landing strips may influence the quality of groundwater flowing into the Mashudda strip. Plate 3 shows generalized groundwater flow arrows and the potential for this upgradient groundwater degradation to effect the quality of water entering the Mashudda strip.

RECOMMENDED SITE INVESTIGATION PROGRAM

Purpose and Objectives

The purpose of the site investigation program recommended below is to identify those sources of acid mine drainage that impact the water quality of the surface streams in this study area and to access the effectiveness of various remedial measures which can be taken to abate this impact. With this purpose in mind, the work plan outlined below has certain objectives associated with this data collection. These objectives are to:

1) Define the groundwater flow system upgradient of, within, and downgradient from the Mashudda Strip Mine, including the determination of specific aquifer horizons within which preferred groundwater movement occurs and also the role of low permeability strata in retarding vertical groundwater flow.

2) Characterize the groundwater quality in affected and unaffected areas within the study area and determine the relationship between this groundwater quality and the quality of surface streams.

3) Characterize the acid production potential of spoil materials within the mined area and undisturbed strata beyond the limits of the mine.

4) Determine the impact of the Old Morrison and Rice's Landing Strip Mines on the groundwater quality upgradient from the Mashudda Mine.

5) Evaluate the affects of variable hydrologic conditions on both quantity and quality of surface water flow.

6) Assess the impact of the Big Piney Creek water quality on the quality of Glade Run and conversely assess the
potential improvement to Glade Run water quality associated with various levels of abatement in Big Piney Creek watershed.

With these objectives in mind, the following work plan has been organized to provide the maximum amount of data collection within a reasonable time and budgetary framework.

Work plan

Site Exploration and Monitoring Well Construction

Air Rotary Drilling - At thirteen locations shown on Plate 4 and listed in Table 2, air rotary borings will be drilled to a total depth which corresponds to the upper portion of the Homewood Sandstone. Each of these borings will be drilled at an 8-inch diameter to at least five feet into solid rock before setting 6-inch diameter casing. The remainder of each boring will then be completed utilizing 6-inch drilling to the total

TABLE 2

MASHUDDA STRIP MINE
PROPOSED TEST BORINGS

Test * Boring	Location	Elevation	Anticipated Depth	Purpose
B1	between Morrison and Mashudda Mines	2265	170'	Stratigraphic and structural control, identify 1 or 2 major coal seams. Establish background water quality. Determine natural water table elevation and recharge/discharge areas.
B2	on access road to northern stripping	2150	50'	Same as above.
B3	on large spoil pile adjacent to swale	2122	50'	Stratigraphic control. Determine spoil thickness and character, identify minor coal seam. Determine spoil material water quality. Determine spoil pile water table elevation. Collect samples of spoil material.
B4	on access road from north	2210	110'	Stratigraphic control, identify major coal seam. Establish background water quality. Determine natural water table elevation and recharge/discharge areas.

* Air rotary drill test hole

Test Boring	Location	Elevation	Anticipated Depth	Purpose
B5	on spoil on pile adjacent to swale	2155	55'	Stratigraphic control. Determine spoil thickness and character, identify minor coal seam. Determine spoil material water quality. Determine spoil pile water table elevation. Collect samples of spoil material.
B6	below mine area in northeastern corner of strip	2090	50'	Determine water quality downgradient from mine area. Determine water table elevation and recharge/discharge areas.
B7	below mine area on short access road from eastern highwall	2115	50'	Same as above.
B8	on spoil on eastern highwall	2155	55'	Stratigraphic control. Determine spoil thickness and character, identify minor coal seam. Determine spoil material water quality. Determine spoil pile water table elevation. Collect samples of spoil material.
B9	below mine area in southeast corner of strip	2100	50'	Determine water quality downgradient from mine area. Determine water table elevation and recharge/discharge areas.

Test Boring	Location	Elevation	Anticipated Depth	Purpose
B10	on spoil on southern highwall	2120	50'	Stratigraphic control. Determine spoil thickness and character, identify minor coal seam. Determine spoil material water quality. Determine spoil pile water table elevation. Collect samples of spoil material.
B11	below mining along along southern highwall on forest service road	2060	50'	Determine water quality downgradient from mine area. Determine water table elevation and recharge/discharge areas.
B12	in clearing adjacent to southern access road	2180	80'	Stratigraphic control, identify major coal seam. Establish background water quality. Determine natural water table elevation and recharge/discharge areas.
B13	west of strip mine and south of creek along jeep trail.	2120	80'	Same as above.

depth. By completing each boring into the top of the Homewood Sandstone, stratigraphic correlations can be performed with greater confidence. While each boring is being completed, samples of well cuttings returned to the surface will be recovered for every five foot interval and for every change in the lithology of the rock being drilled. At all times a qualified hydrogeologist will supervise the drilling and log the well cuttings returned to the surface.

Following completion of each boring the static water level will be measured and SP/resistivity and gamma ray logs will be run to the total depth. Also during the course of drilling specific zones in the borehole which produce measureable increases in the volume of water being blown from the well will be noted and a field pH, specific conductance, acidity and alkalinity determination will be made. Well cuttings recovered from the drilling will be retained and selectively used for overburden analyses.

Backhoe Pit Excavations- At the 8 locations shown on Plate 4. and listed in Table 3 backhoe pit excavations will be completed into the mine spoil. The purpose of these excavations will be to recover samples at various levels of the spoil and to note any stratification associated with the placement of these materials during the mining operation. Samples of the spoil material will be recovered for selective use in overburden analyses.

Monitoring Well Construction- In each of the backhoe pits in which the water table is encountered a minimum 2-inch diameter PVC well point will be installed with PVC riser pipe. This slotted well point will be sand-packed to prevent fine grained material from entering the monitoring well after which the backhoe pit will be closed up.

TABLE 3

MASHUDDA STRIP MINE
PROPOSED BACKHOE PITS

Test Pit	Location	Elevation	Purpose
P1	north facing highwall, northern area of strip	2125	Collect samples of spoil material for overburden analysis. Determine presense of shallow water table, install well point.
P2	west end of south facing highwall	2120	Same as above.
P3	in swale in large spoil pile near large seep	2115	Same as above.
P4	north end of eastern highwall	2160	Same as above.
P5	mid-section of eastern highwall near small seep	2150	Same as above.
P6	open area of spoil pit in southwest corner of strip	2135	Same as above.
P7	southern highwall in pines	2125	Same as above.
P8	west end of southern highwall at edge of trees	2110	Same as above.

backhoe pit, 10'-15' depth.

In addition to these shallow monitoring wells in the spoil area, additional monitoring wells will be installed in the 6-inch borings where it is desirable to monitor various water-bearing horizons penetrated at different depths. As many as 2 such monitoring wells may be placed inside one 6-inch diameter well with each of the screen intervals separated by a bentonite seal.

Water Quality Sampling and Testing

The remaining 75 samples in the overall contract will be divided among the stream stations, seeps and springs, monitoring wells and any domestic wells which can be utilized for water quality monitoring at useful locations. These 75 samples will be analyzed for those specific constituents shown on Table I. However, in addition to the 75 analyses to be performed by DER's own laboratories, REWAI field personnel will routinely perform pH, specific conductance, acidity and alkalinity utilizing field apparatus. In this way rapid and timely determinations of water quality can be used to guide the progress of the exploration program and aid in the selection of sampling sites to be included in the 75 sample program.

Aquifer Testing

Two different types of aquifer tests will be performed at selected locations which are identified during the course of the site exploration work. The first of these is the performance of a "slug test". This involves withdrawing a small quantity of water from a monitoring well or inserting an object of known volume into the well and monitoring the recovery of the water level with extreme accuracy utilizing a pressure transducer water level recorder. The second of these methods is the standard pumping out test which will be performed should any one of the wells yield a sufficient quantity of water that significant areal drawdown affects can be realized in a controlled pumping test.

In this case, both drawdown in the pumping well and nearby observation wells will be recorded.

The data from both of these aquifer testing procedures would be utilized to calculate transmissivity, storage coefficient, leakage rates, and permeabilities associated with the natural strata and also the mine spoil.

Estimated Costs

Costs associated with drilling supervision, overburden analyses, water sampling and testing and aquifer testing are included in REWAI's current contract. Additional costs for contractor's work have been estimated as follows:

Air Rotary Drilling

Mobilization	$ 500
150' of 8" drilling @ $10/ft.	1,500
750' of 6" drilling @ $7/ft.	5,250
175' of 6" casing @ $7/ft.	1,225
Standby: 25 hrs @ $100/hr	2,500
Subtotal	$10,975

Backhoe Pit Excavation

Mobilization	$ 200
30 hrs. at $60	1,800
Subtotal	$2,000

Downhole Geophysical Logging

3 days @ $500/day	$1,500

Monitoring Well Construction Materials	
Pipe, screen, sand, and bentonite	$10,000
Total Estimated Costs	$24,475