

JOHNSON RUN SUB-BASIN

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JOHNSON RUN SUB-BASIN

Discussion of Sub-Basin

Johnson Run has a drainage area of approximately 5,321 acres. There are ten significant sources of acid mine drainage pollution within or partly within the sub-basin, Johnson Run is the second most polluted stream in the East Branch Clarion River Watershed, and on the basis of water quality tests performed over a one year period, it is estimated that these sources contribute an average daily acid discharge of over 2,000 lbs. per day. Most of the acid discharges originate at sources that are in the headwaters of several tributaries that enter the main branch of Johnson Run from the east.

Water Quality Sampling Stations

Fifteen sampling stations were established in the Johnson Run Sub-Basin to determine the sources of acid mine drainage and the relative pollutional effect of each source on Johnson Run. Seven of the water quality sampling stations were established at points where the tributaries flow through culverts under Township Road 363 (Pumpkin Hill Road). This road has been constructed partly of mine waste material and is capable of producing a large slug of acid during periods of rainfall.

The location, drainage area, summary of water quality test results, and sources of pollution for each of the sampling stations are:

Station 5901 was located at the headwaters of the main branch of Johnson Run at a point about 10 feet upstream of a culvert under Legislative Route 24011. The drainage area is approximately 373 acres and the station received drainage from about 1,800 feet of Pumpkin Hill Road (Area 24) and about half of a small strip-mine (Area 18). Station 5901 was sampled 27 times between November 20, 1968 and December 18, 1969 and the maximum acid load was 425 lbs. per day on April 2, 1969. Only eight of the water quality tests showed acid loads greater than 100 lbs. per day and 13 of the tests showed that the acid load was under 40 lbs. per day. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.40	4.35
Total Acidity (mg/l)	18.0	58.0
Free Acidity (mg/l)	1.0	35.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	41.	107.
Total Iron (mg/l)	0.23	4.98
Manganese (mg/l)	0.5	1.6
Flow (cfs)	0.02	2.54

Station 5980 was downstream of a culvert under Township Road 367 (West) and in the headwaters of the first tributary that enters the main branch of Johnson Run from the east. The drainage area is approximately 37 acres and the sampling station received drainage from part of a small strip-mine (Area 18) and an old limestone quarry (Area 19). Station 5980 was sampled four times in the period between March 7, 1969 and October 24, 1969. Two of the water quality tests indicated no acid discharge, one test showed an acid load of 1 lb. per day, and a fourth test showed the acid load was 14 lbs. per day on July 24, 1969. The water quality tests indicated the following minimum and maximum values.

Station 5902 was located at the downstream end of a culvert under Township Road 363 and in the headwaters of an east branch of the first

	<u>Minimum</u>	<u>Maximum</u>
pH	3.10	5.00
Total Acidity (mg/l)	19.0	257.0
Free Acidity (mg/l)	0.0	172.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	82.	353.
Total Iron (mg/l)	0.29	3.95
Flow (Cfs)	0.005	0.02

tributary that enters the main branch of Johnson Run from the east. The drainage area is approximately 12.6 acres and almost all the drainage area is within the Area 8 strip-mine. Station 5902 was sampled 26 times between November 20, 1968 and November 19, 1969 and the maximum acid load was 614 lbs. per day on April 2, 1969. Ten of the water quality tests showed the acid load was 100 lbs. per day or greater and another 11 tests showed the acid load was less than 45 lbs. per day. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.00	3.70
Total Acidity (mg/l)	89.0	780.0
Free Acidity (mg/l)	32.0	300.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	425.	2,664.
Total Iron (mg/l)	1.17	35.72
Manganese (mg/l)	39.0	83.0
Flow (cfs)	0.00	0.18

Station 5903 was located just downstream of a culvert under Township Road 363 and on the second tributary entering the main branch of Johnson Run from the east. The drainage area at this point is approximately 180 acres and there are a number of sources of acid mine drainage pollution within the area.

The mining history within this small drainage area is very complicated. The strip-mine operations were in the Lower and Middle Kittanning Coals and it appears the deep mine workings were confined to the Lower Kittanning Coal which were later partially stripped. At least one mine seal was destroyed and all the headings have been obliterated. Part of the Bucktail Mine workings, which were in the Lower Kittanning Coal, underlie an area that was stripped for the Middle Kittanning Coal.

The sources of acid mine drainage pollution within this drainage area are: Area 10, more than half of a Middle Kittanning strip-mine which is stratigraphically above the Bucktail Mine workings; Area 11, part of a Lower Kittanning strip-mine in which some Middle Kittanning Coal was also stripped where it outcropped near the top of the hill; Area 21, the probable location of the main headings of the Bucktail Mines; Area 22, most of a small strip-mined area in the Lower Kittanning Coal which stripped the working face of an old deep mine which may be part of the Bucktail Mine Complex; Area 23, a coal mine refuse bank adjacent to the Area 22 strip -mine- Area 24, about 2,000 feet of Pumpkin Hill Road (Township Road 363) which has been constructed partly of mine waste material; and Area 30, part of a haul road from the Area 11 strip-mine to Pumpkin Hill Road.

The evaluation of sources of acid mine drainage pollution has been complicated by the fact some of the acid ground water seepage within the drainage area may originate from strip-mine sources outside the "surface" drainage area. The opposite can also be true in that some of the infiltration of surface water into strip-mines within the area may appear as ground water seepage outside the "surface" drainage area. The ground water movement below a strip-mine is controlled to a certain extent by the strike and dip of the coal seam mined.

It is estimated at Station 5903, the average daily acid discharge was 1, 300 lbs. per day in 1969. This station was sampled 28 times between November 20, 1968 and December 18, 1969 and the maximum acid load was 5, 754 lbs. per day on April 2, 1969. Eight of the water quality tests showed that the acid load was over 2, 000 lbs. per day and for 15 of the tests the acid load was over 1, 100 lbs. per day. In all but eight of the water quality test results, the acid load exceeded 500 lbs, per day. The water quality tests indicated the following minimum and maximum values.

	<u>Mini mum</u>	<u>Maximum</u>
pH	3.00	3.35
Total Acidity (mg/l)	265.0	655.0
Free Acidity (mg/l)	90.0	270.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	739.	2,650.
Total Iron (mg/l)	10.62	43.24
Manganese (mg/l)	19.0	68.0
Flow, (cfs)	0.03	3.28

Station 5965 was in the vicinity of where it is believed the main headings of the Bucktail Mine are located. The mine seal shown on the Pennsylvania Department of Health's sketch map of deep mines and strip-mines in the East Branch Clarion River is probably in this area. Samples for water quality tests were collected from seepage that emanates from the base of the slope. Station 5965 was sampled 10 times between April 19, 1969 and November 19, 1969 and the average daily acid discharge at this point was estimated to be about 150 lbs. per day in 1969. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.20	3.60
Total Acidity (mg/l)	385.0	906.0
Free Acidity (mg/l)	165.0	355.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	1,140.	1,590.
Total Iron (mg/l)	1.93	5.50
Manganese (mg/l)	45.0	57.0
Flow (cfs)	0.04	0.04

Station 5904 was on the south branch of the second tributary entering the main branch of Johnson Run from the east. The station was just downstream of a culvert under Township Road 363 and it received drainage from part of the Area 11 stripmine, Area 30 haul road, and about 700 feet of Pumpkin Hill Road. The total drainage area is approximately 22 acres and about 70 percent of the area is in the Area 11 strip-mine. Station 5904 was sampled 18 times between February 4, 1969 and November 19, 1969 and the maximum acid load was 231 lbs. per day on March 21, 1969. The water quality test results showed that the acid load was 85 lbs. per day or greater for only six of the tests and 25 lbs. per day or less for eight of the tests. The water quality tests indicated the following minimum and maximum values.

Station 5905 was located on the north branch of the third tributary entering the main branch of Johnson Run from the east. It is at a point just downstream of a culvert under Township Road 363 and received drainage

	<u>Minimum</u>	<u>Maximum</u>
pH	2.95	3.35
Total Acidity (mg/l)	80.0	320.0
Free Acidity (mg/l)	50.0	195.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	593.	1,461.
Total Iron (mg/l)	1.20	51.70
Manganese (mg/l)	8.5	32.0
Flow (cfs)	0.00	0.40

from parts of the Area 11 and Area 12 strip-mines. The drainage area is approximately 79 acres. Station 5905 was sampled 17 times between February 12, 1969 and November 19, 1969 and the maximum acid load was 450 lbs. per day on March 21, 1969.

Seven of the water quality test results indicated the acid load to be greater than 110 lbs. per day and an equal number of tests indicated acid loads of 45 lbs. per day or less. The water quality tests indicated the following minimum and maximum values.

Station 5906 was located on the third tributary entering Johnson Run from the east and downstream of a culvert under Township Road

	<u>Minimum</u>	<u>Maximum</u>
pH	3.30	4.05
Total Acidity (mg/l)	48.0	135.0
Free Acidity (mg/l)	12.0	68.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	241.	731.
Total Iron (mg/l)	0.61	6.67
Manganese (mg/l)	2.3	27.0
Flow (cfs)	0.01	1.44

363. The drainage area is approximately 27 acres and there are no visible sources of acid mine drainage within the drainage area other than about 950 feet of Pumpkin Hill Road which is considered to be a very minor source of pollution. Station 5906 was sampled 24 times between November 20, 1968 and November 19, 1969 and the water quality test results indicated acid loads of 32 lbs. per day or less for 15 of the tests. The acid load exceeded 100 lbs. per day twice;,- on April 2, 1969 it was 116 lbs. per day and on April 19, 1969 it was 110 lbs. per day. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.15	3.65
Total Acidity (mg/l)	38.0	280.0
Free Acidity (mg/l)	16.0	85.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	249.	774.
Total Iron (mg/l)	1.22	7.61
Manganese (mg/l)	6.5	37.0
Flow (cfs)	0.01	0.53

Station 5907 was located on the north branch of the fourth tributary entering Johnson Run from the east and at a point just upstream of a culvert under Township Road 363. The drainage area is approximately 93 acres which included about one-third of the Area 12 strip-mine. This station also measures an acid discharge from the Area 25 deep mine. Station 5907 was sampled 26 times between November 20, 1968 and December 18, 1969. The maximum acid load was 1,065 lbs. per day on March 21, 1969. Eleven of the water quality tests indicated the acid load to be greater than 300 lbs. per day and all but six of the tests indicated acid loads exceeding 130 PPD. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.20	3.75
Total Acidity (mg/l)	94.0	375.0
Free Acidity (mg/l)	24.0	220.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	541.	2,200.
Total Iron (mg/l)	1.55	6.30
Manganese (mg/l)	2.1	52.0
Flow (cfs)	0.02	1.70

Station 5966 sampled the flow from the mine seal outlet of the Neshadka No. 2 Mine. Station 5966 was sampled 10 times in the period between May 29, 1969 and December 18, 1969 and the maximum acid load was 37 lbs. per day on November 19, 1969. The average daily acid discharge during this period of testing was about 31 lbs. per day. It is estimated that the average daily acid discharge for the full year would not be greater than 40 PPD. The free acidity was relatively very low; the average free acidity was 14.6 mg/l whereas the average total acidity was 289.0. The iron is mostly in the ferrous state as it leaves the mine and it is then rapidly transformed from ferrous to ferric iron. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	4.90	5.65
Total Acidity (mg/l)	135.0	340.0
Free Acidity (mg/l)	0.0	85.0
Alkalinity (mg/l)	0.0	2.0
Sulfate (mg/l)	1,290.0	2,060.
Total Iron (mg/l)	108.00	164.00
Flow (cfs)	0.02	0.02

Station 5967 was located upstream from Station 5907 and Station 5966, and has a drainage area of approximately 60 acres, about half of which is in the Area 12 strip-mine. Station 5967 was sampled 10 times between May 29, 1969 and December 18, 1969 and the maximum acid load was 378 lbs. per day on November 19, 1969. A second water quality test on December 18, 1969 showed an acid load of 259 lbs. per day. The other eight tests indicated the acid load was less than 100 lbs. per day, and for five of these tests, it ranged from 16 to 30 lbs. per day. A comparison of the water quality test results for Station 5907 with those for Station 5967 show there is a fair correlation for the period that both stations were sampled on the same days which for the most part was during the period of lower flows. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.30	3.65
Total Acidity (mg/l)	108.0	315.0
Free Acidity (mg/l)	29.0	140.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	1,109.	2,321.
Total Iron (mg/l)	1.64	13.63
Flow (cfs)	0.01	0.51

Station 5908 was located on the south branch of the fourth tributary entering Johnson Run from the east and at a point just upstream of a culvert under Township Road 363. The drainage area is approximately 288 acres and the station received drainage from a small part of the Area 12 stripmine. Station 5908 was sampled 24 times between November 20, 1968 and November 19, 1969 and the maximum acid load was 466 lbs. per day on April 2, 1969. The water quality tests indicated the acid load was greater than 100 PPD for 10 of the tests and 10 lbs. per day or less for seven of the tests. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	4.10	4.55
Total Acidity (mg/l)	7.0	29.0
Free Acidity (mg/l)	1.0	8.5
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	17.	142.
Total Iron (mg/l)	0.02	0.23
Manganese (mg/l)	1.6	2.7
Flow (cfs)	0.04	4.56

Station 5909 was located about 150 feet upstream of the main branch of Johnson Run and on the fourth tributary entering from the east. The drainage area is approximately 462 acres and includes the combined drainage of Station 5907 and

Station 5908. The only additional source of acid mine drainage pollution would be about 2, 300 feet of Pumpkin Hill Road (Township Road 363) and this is considered to be a very minor source of pollution at this point. Station 5909 was sampled 25 times between November 20, 1968 and December 18, 1969 and the maximum acid load was 977 lbs. per day on February 4, 1969. The water quality tests indicate the acid load was 500 lbs. per day or greater for eight of the tests and exceeded 300 lbs, per day for 14 of the tests. The acid load exceeded 150 lbs. per day for all but four of the tests. It is estimated the average daily acid discharge at this point for the year 1969 was 342 lbs. per day. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.25	4.25
Total Acidity (mg/l)	25.0	187.0
Free Acidity (mg/l)	4.2	70.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	146.	988.
Total Iron (mg/l)	0.41	4.75
Manganese (mg/l)	3.5	20.0
Flow (cfs)	0.05	5.62

Station 5910 was on the main branch of Johnson Run and located at a point about 50 feet upstream of where the fourth tributary enters the main branch. The drainage area is approximately 2, 387 acres and includes all of the major sources of acid mine drainage pollution in the Johnson Run sub-basin with the exception of about 60 acres of the Area 12 strip-mine and the discharge from the Area 25 deep mine. Station 5910 was sampled 25 times between November 28, 1968 and December 18, 1969 and the water quality tests indicated the acid load exceeded 500 lbs. per day for all but five of the tests. The acid load was over 1, 700 lbs. per day for 12 of the tests. The maximum acid load was 5, 051 lbs.

per day on March 21, 1969 and on April 2, 1969, the acid load was 4, 790 lbs. per day. The average daily acid discharge at this point for the year 1969 was estimated to be 1, 579 lbs. per day. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.30	3.95
Total Acidity (mg/l)	32.0	145.0
Free Acidity (mg/l)	12.0	65.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	135.	572.
Total Iron (mg/l)	0.39	6.11
Manganese (mg/l)	5.2	12.0
Flow (cfs)	0.25	26.14

Station 5911 was near the mouth of Johnson Run and located at a point just upstream of the wooden bridge spanning Township Road 365. The drainage area is approximately 5, 319 acres which is all but about two acres of the total drainage area of the Johnson Run sub-basin. Station 5911 was sampled five times in the period between January 24, 1969 and December 19, 1969. Water quality tests indicated the following acid loads: 4, 501 lbs. per day on January 24, 675. lbs. per day on March 7, 622 lbs. per day on June 13, 802 lbs. per day on September 6, and 6, 152 lbs. per day on November 19, 1969. Based on a comparison of the test results from this station with the test results from Station 5909 and Station 5910, it is estimated that the average daily acid discharge at this point for the year 1969 was about 2, 000 PPD. The water quality tests indicated the following minimum and maximum values.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.60	4.05
Total Acidity (mg/l)	25.0	65.0
Free Acidity (mg/l)	6.5	29.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	112.	301.
Total Iron (mg/l)	0.57	2.02
Flow (cfs)	1.77	33.40

Water Quality Prior to Strip-Mining

The earliest records of water quality for the Johnson Run sub-basin made by the Pennsylvania Department of Health are dated July, 1948. At that time, strip-mining had begun in the sub-basin and the mine seals installed at the Bucktail Mine openings probably were destroyed by stripping along the crop line. An analysis of the water quality data indicates Johnson Run may have been a polluted stream prior to the start of strip-mining, but it appears the acid mine drainage pollution was minor. Ketner Dam, on Johnson Run, was constructed by the Baltimore and Ohio Railroad and the water from the reservoir was used in locomotive boilers before the area was stripped. It is doubtful that the water could have been used for this purpose if Johnson Run was polluted to any extent by acid mine drainage.

The Pennsylvania Department of Health records for the main branch of Johnson Run at Legislative Route 24013 and at Township Road 365 give the best indication of stream conditions prior to strip-mining. The earlier records for the second tributary entering Johnson Run from the east shows the tributary to be heavily polluted with acid mine drainage; this is where strip-mine operations were in progress and the Bucktail Mines are located in this area. The records for the Bucktail Mines and the Nashedka No. 2 Mine are not very reliable because the water quality samples were taken at several different points and would include drainage from strip- mine operations.

If all the pollution sources were cleaned up, Johnson Run could very well have a pH between 6 and 7 and the stream would be alkaline.

The Pennsylvania Department of Health's water quality test results are as follows:

1) Johnson Run at L. R. 24013 - Same Location as Station 5910

<u>Date</u>	<u>pH</u>	<u>Total Acidity</u>	<u>Sulfates</u>	<u>Total Iron</u>
7/08/48	4.5	20.0		
4/11/51	4.11	44.0		
7/23/53	2.81	290.0	400.	65.
5/19/54	3.4	140.0	460.	
2/17/55	3.34	120.0	350.	
4/02/59	3.63	60.0		
9/05/59	3.0	250.0	1000.	
9/11/59	2.86	320.0	1125.	

2) Johnson Run at Township Road 365 - Same Location as Station 5911

<u>Date</u>	<u>pH</u>	<u>Total Acidity</u>	<u>Sulfates</u>	<u>Total Iron</u>
7/08/48	6.2	2.0		
4/11/51	4.6	16.0		
3/11/53	3.63	50.0	130.	
7/23/53	3.2	140.0	310.	6.2
5/19/54	3.58	70.0	160.	
2/17/55	3.56	48.0	170.	
6/26/57	3.4	130.0	360.	
4/02/59	3.9	32.0		
9/05/59	3.25	190.0	860.	
9/11/59	3.3	190.0	590.	

3) Second Tributary that Enters Johnson Run from the East-Same location as Station 5903

<u>Date</u>	<u>pH</u>	<u>Total Acidity</u>	<u>Sulfates</u>	<u>Total Iron</u>
7/08/48	2.7	370.0	795.	35.84
2/25/49	4.0	192.0		
12/29/49	3.4	260.0		
6/13/50	3.18	134.0		
4/11/51	3.2	280.0		
7/23/53	2.6	1600.0	2200.	278.00
9/11/59	2.9	390.0	1390.	

4) Attributed to the Bucktail Mines - Samples taken at various locations in the vicinity of the mine headings.

<u>Date</u>	<u>pH</u>	<u>Total Acidity</u>	<u>Sulfates</u>	<u>Total Iron</u>	<u>Acid PPD</u>
7/08/48	2.88	1374.0			151.
7/08/48	3.04	346.0			129.
7/08/48	3.05	170.0			11.
4/11/51	2.9	340.0	360.	62.0	45.
4/11/51	3.18	370.0	1400.	20.0	*175.
7/23/53	2.55	2700.0	3800.	748.0	*1346.
7/19/56	3.31	380.0	1350.	22.0	189.
8/15/56	3.30	380.0	1200.	41.0	723.
9/08/59	2.5	1560.0	2440.	291.2	84.
9/08/59	2.8	380.0	1475.	50.0	*141.

*Combined Discharge of Three Openings.

5) Nasheka No. 2 Mine - Same Location as Station 5966

<u>Date</u>	<u>pH</u>	<u>Total Acidity</u>	<u>Sulfates</u>	<u>Total Iron</u>	<u>Acid PPD</u>
4/11/51	6.25	2.0	50.	6.70	0.
*8/15/56	3.34	510.0	2100.	52.00	*940.
9/08/59	2.75	540.0	2440.	26.88	26.

*The location where this sample was taken and the flow measured would include a large runoff from the Area 12 strip-mine during a period of above normal flow. The sample was taken about 600 feet southwest of our Station 5907 on Pumpkin Hill Road,

Construction of Mine Drainage Treatment Plant

Johnson Run is the second most polluted stream in the East Branch Clarion River Watershed and it is estimated that the average daily acid discharge at the mouth of this stream is about 2000 lbs. per day. There are a large number of acid mine drainage pollution sources in the Johnson Run sub-basin and it will probably take several years to abate this pollution. Construction of a temporary mine drainage treatment plant should be considered. If a mine drainage treatment plant was constructed, it is possible that Ketner Dam could be used as a settling basin for the precipitates formed during mine drainage treatment. Ketner Dam is now the property of the Texas Gulf Sulphur Company, Armstrong Forest Division, Johnsonburg, Pennsylvania. The embankment appears to be in good condition, but the gate was destroyed by the present owners because they did not want to be liable for accidents that might occur in the reservoir.

Sources of Pollution

AREA 10

Area 10 is a 38 acre strip-mine that was stripped for the Middle Kittanning Coal by the Wabash Ridge Corporation. A cut in the northeast end was not backfilled and there is very little vegetation growing on the spoil material. The spoil material is fine to medium coarse and there are traces of acid material at the surface. There is no evidence of soil formation.

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 215 lbs. per day or about 4 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed,

It is recommended that the cut be backfilled and some contour grading be done where there are steep slopes. The strip-mine should be seeded to grass and legumes. The reclamation requirements are as follows:

Reclamation Requirements

Earthwork

Backfilling and grading (Estimate 50, 000 C. Y.) Soil

Treatment

Standard Ground Limestone
(Total application to contain a minimum
of 240 lbs. magnesium per Ac.)

7 Tons per Ac,

50-200-200 in lbs. N-P₂O₅= K₂O

per Ac.

Planting

Creeping red fescue
Penngift crownvetch

30 lbs. per Ac.

10 lbs. per Ac.

Mulching

Hay

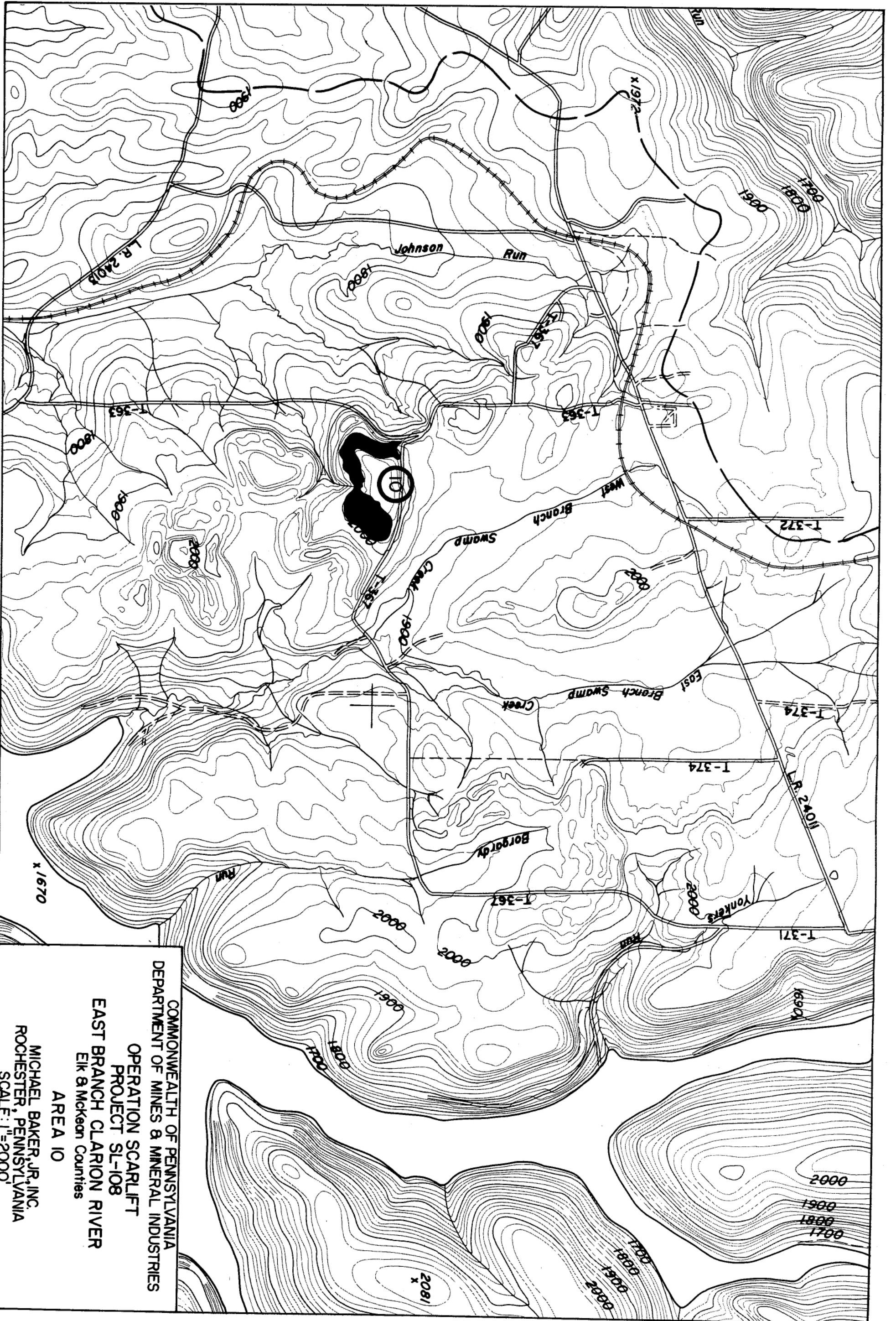
2 Tons per Ac.

Special Requirements

In the fall, one half of the limestone requirement shall be spread and incorporated into the soil to a minimum depth of 4 inches. In the spring, the other half of the limestone and the fertilizer requirement, in separate applications, shall be spread and incorporated into the soil to a minimum depth of 4 inches. Seed shall be applied by disc drill or comparable method.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
<u>AREA 10</u>		
Contour grading, improve drainage, soil treatment and planting	65%	\$184,000



COMMONWEALTH OF PENNSYLVANIA
 DEPARTMENT OF MINES & MINERAL INDUSTRIES
 OPERATION SCARLIFT
 PROJECT SL-108
 EAST BRANCH CLARION RIVER
 Elk & Mckeon Counties
 AREA 10
 MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Source of Pollution

AREA 11

This is the third largest strip-mined area in the East Branch Clarion River Watershed. The total area is approximately 132 acres and about 40 percent is in the Swamp Creek Sub-Basin. The area was stripped for the Lower Kittanning Coal by the Wabash Ridge Corporation, but a small area of about three acres, near the top of the hill, was stripped for the Middle Kittanning Coal,

The strip-mined area was not backfilled or graded and the highwall is up to 40 feet in height. Area 11 is a major source of acid mine drainage pollution in the Johnson Run Sub-Basin.

Even though the area was not backfilled, trees were planted by the strip-mine operator. The tree survival and growth rate is poor to fair depending on the location within the strip-mine. There is very little ground cover except for poverty grass, weeds and berry. The spoil material ranges from fine to coarse and there is little evidence of soil formation. In many areas acid material is exposed at the surface..

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 740 lbs. per day or about 13 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed.

It is recommended that extensive grading be done in all of the strip-mined area with the exception of the steeper slopes along the perimeter. The grading should be closely supervised to insure the prompt burial and cover of acid producing material. Tree seedlings, grass and legumes should be planted on the graded area. The steeper slopes along the perimeter should be seeded to grass_ and legumes.

For the purpose of making reclamation recommendations the Area 11 strip-mine is divided into 1) a Terrace Area which is the area to be graded, and 2) a Slope Area which is the steep slopes along the perimeter of the strip-mine. The reclamation requirements are as follows:

Reclamation Requirements

Earthwork

Terrace Area Backfilling and grading including
affected area above highwall
(Estimate 700,000 C. Y.)

Slope Area None

Soil Treatment

Terrace Area and Slope Area

Standard Ground Limestone 7 Tons per Ac.
(Total application to contain a
minimum of 240 lbs. magnesium
per Ac.)

50-200-200 in lbs. N-P₂O₅-K₂O per Ac.

Planting

Terrace Area Black locust 900 per Ac.
 Creeping red fescue 20 lbs. per Ac.
 Weeping lovegrass 3 lbs. per Ac.

Slope Area Creeping red fescue 30 lbs. per Ac.
 Penngift crownvetch 10 lbs. per Ac.

Mulching

Terrace Area Hay 2 Tons per Ac.

Slope Area Wood cellulose fiber 1200 lbs. per Ac.

Special Requirements

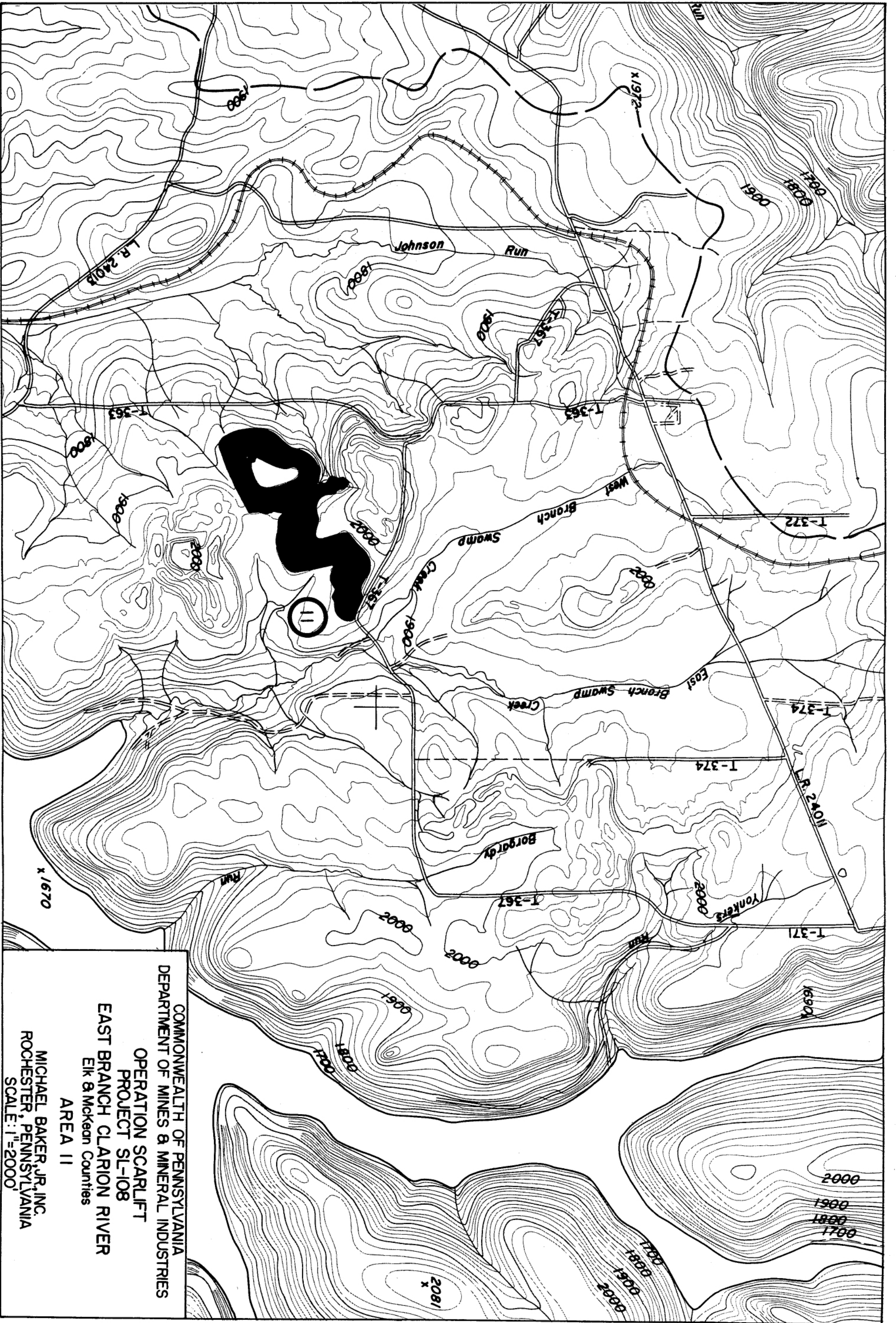
Terrace Area Limestone and fertilizer in separate
applications shall be spread and incorporated
into the soil to a minimum depth of 4 inches.
Seed shall be applied by disc drill or comparable
method. Tree planting shall be done with a
minimum disturbance to the seed bed.

Slope Area

1) limestone shall be applied using a blowing method or by hand, 2) Seed and 25-100-100 lbs. of N-P₂O₅-K₂O per Ac. shall be hydroseeded in one application in the Spring, 3) The remainder of the fertilizer, 25-100-100 lbs. per Ac. , shall be applied in the fall after the seeding has become established.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
<u>AREA 11</u>		
Backfilling and grading to improve drainage, soil treatment and planting	80%	\$487,000



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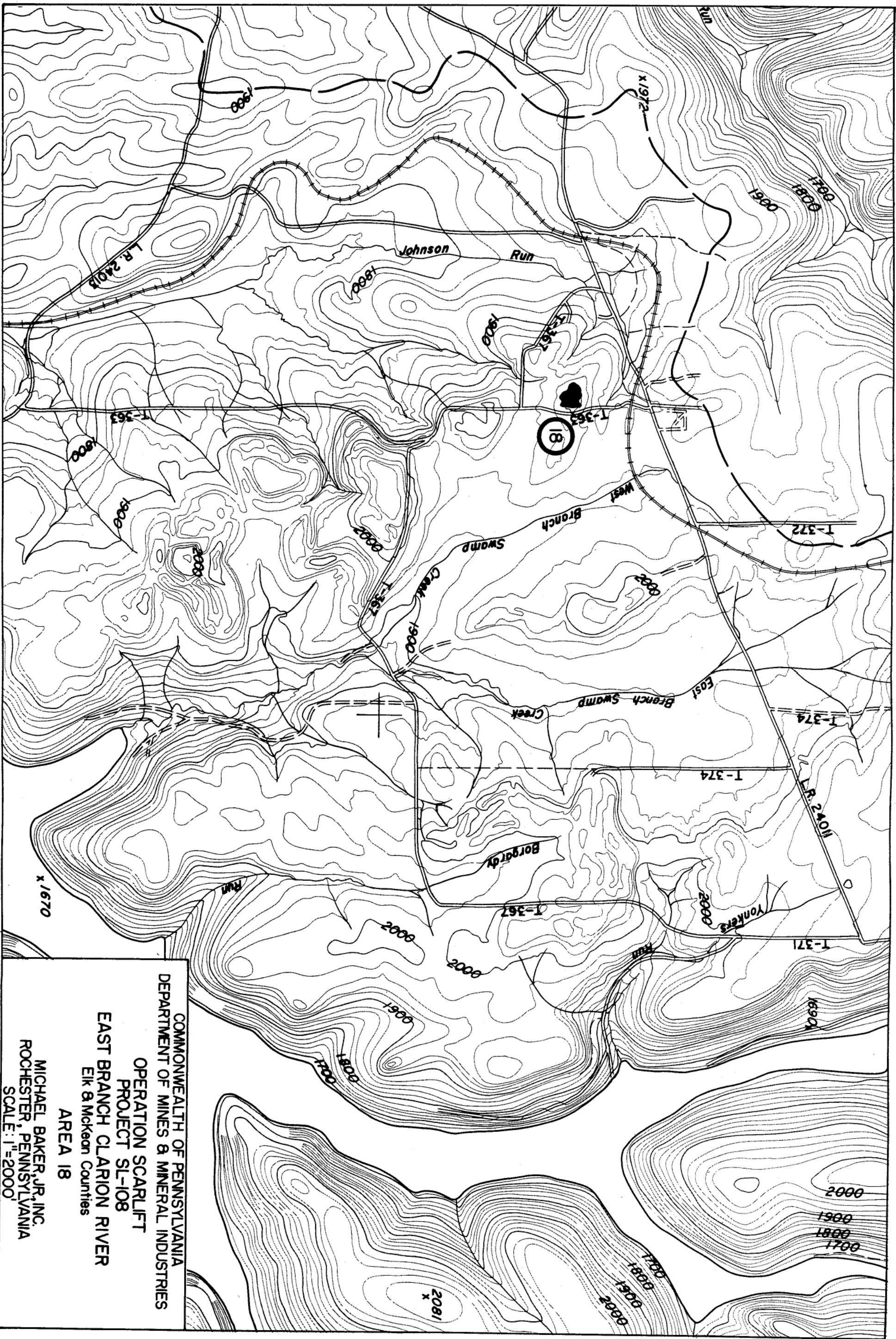
AREA II
 MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Source of Pollution

AREA 18

Area 18 is a small strip-mined area just west of Township Road 363 and about 2, 000 feet south of Legislative Route 24011. About 4. 8 acres were stripped for what is believed to be the Lower Kittanning Coal. This is an old strip-mine and it has a thin grass cover.

Recommended Abatement Measures - There, does not appear to be any measurable pollution from this source, therefore, no reclamation recommendations are herein presented.



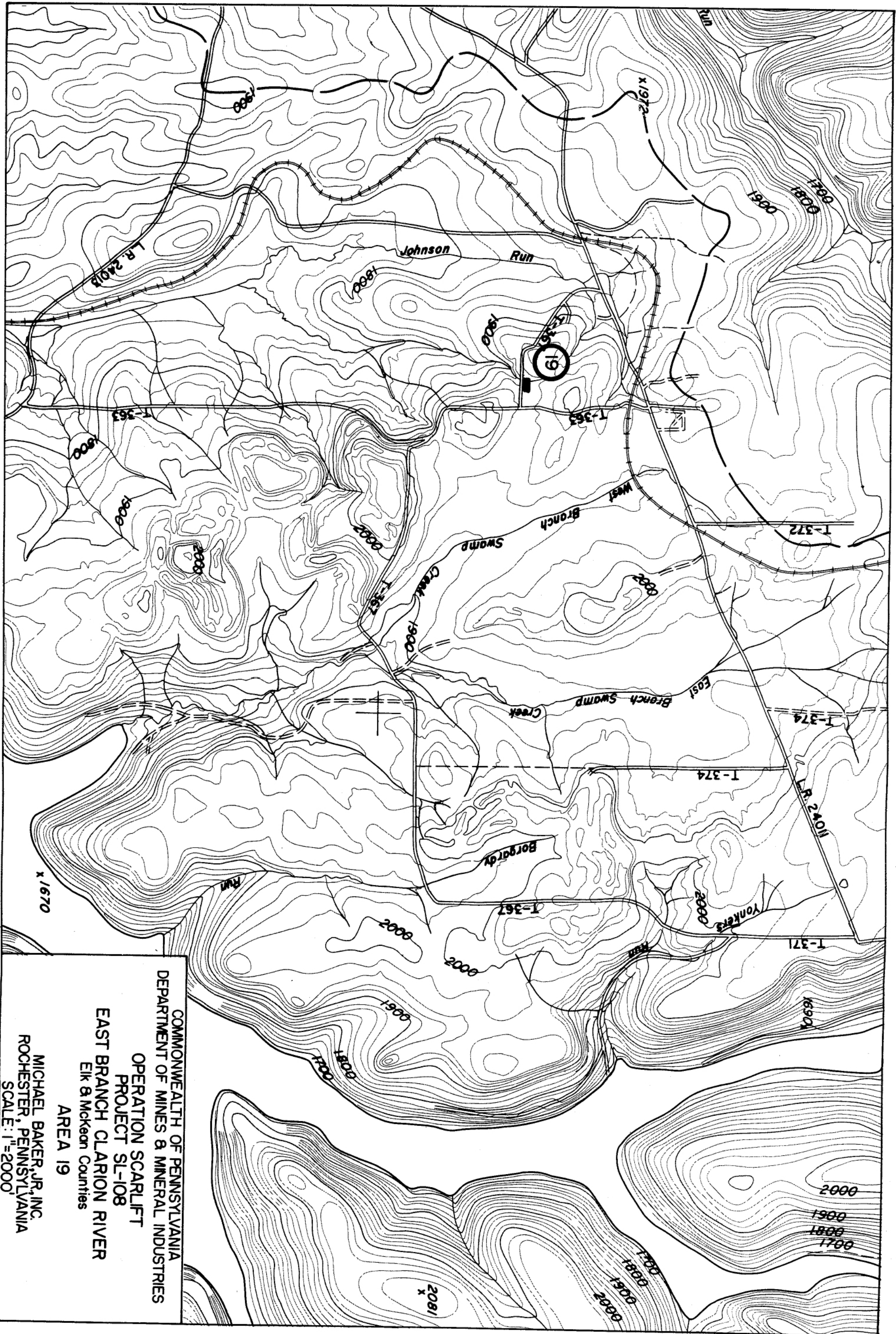
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 PROJECT SL-108
 EAST BRANCH CLARION RIVER
 Elk & Mckean Counties
 AREA 18
 MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Source of Pollution

AREA 19

Area 19 is probably the site of an old limestone quarry which was referred to as "General Kane's Quarry" in the report "The Township Geology of Elk and Forest Counties" by C. A. Ashburner, Report RR, Second Geological Survey of Pennsylvania, 1885. According to the Geological Survey Report, the greatest development of limestone which has been exposed anywhere in Elk County was at this quarry. A thin coal seam was reported to be at the base of the limestone.

Recommended Abatement Measures There is no evidence of pollution from Area 19, therefore, no recommendations are included herein.



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AREA 19
MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA
SCALE: 1"=2000'

Source of Pollution

AREA 20

A coal loading area was constructed just southwest of a point where the Baltimore and Ohio Railroad crosses Legislative Route 24011 west of Johnson Run. According to local residents, it was constructed by the Juliette Coal Company but never placed in operation. The investigation indicates coal was probably loaded on railroad cars at this site. There is also evidence that prior to construction of the loading facilities, the area was stripped, probably for the Clarion Coal. An area of about 3 acres is covered with scattered deposits of mine waste material. The remains of the loading ramp is about 10 feet in height and it is constructed of mine waste material. The concrete foundation for the scales is in an area overgrown with vegetation.

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 20 lbs. per day or about 0.4 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed,

It is recommended that the mine waste material be removed and the area receive minimum soil treatment and planting. The reclamation requirements are as follows:

Reclamation Requirements

Earthwork

Removal of coal waste material
(Estimate 4,000 C. Y.)

Soil Treatment

Standard Ground Limestone
50-50-50 in lbs. N-P₂O₅-K₂O

3 Tons per Ac.
per Ac.

Planting

Kentucky 31 tall fescue
Weeping lovegrass

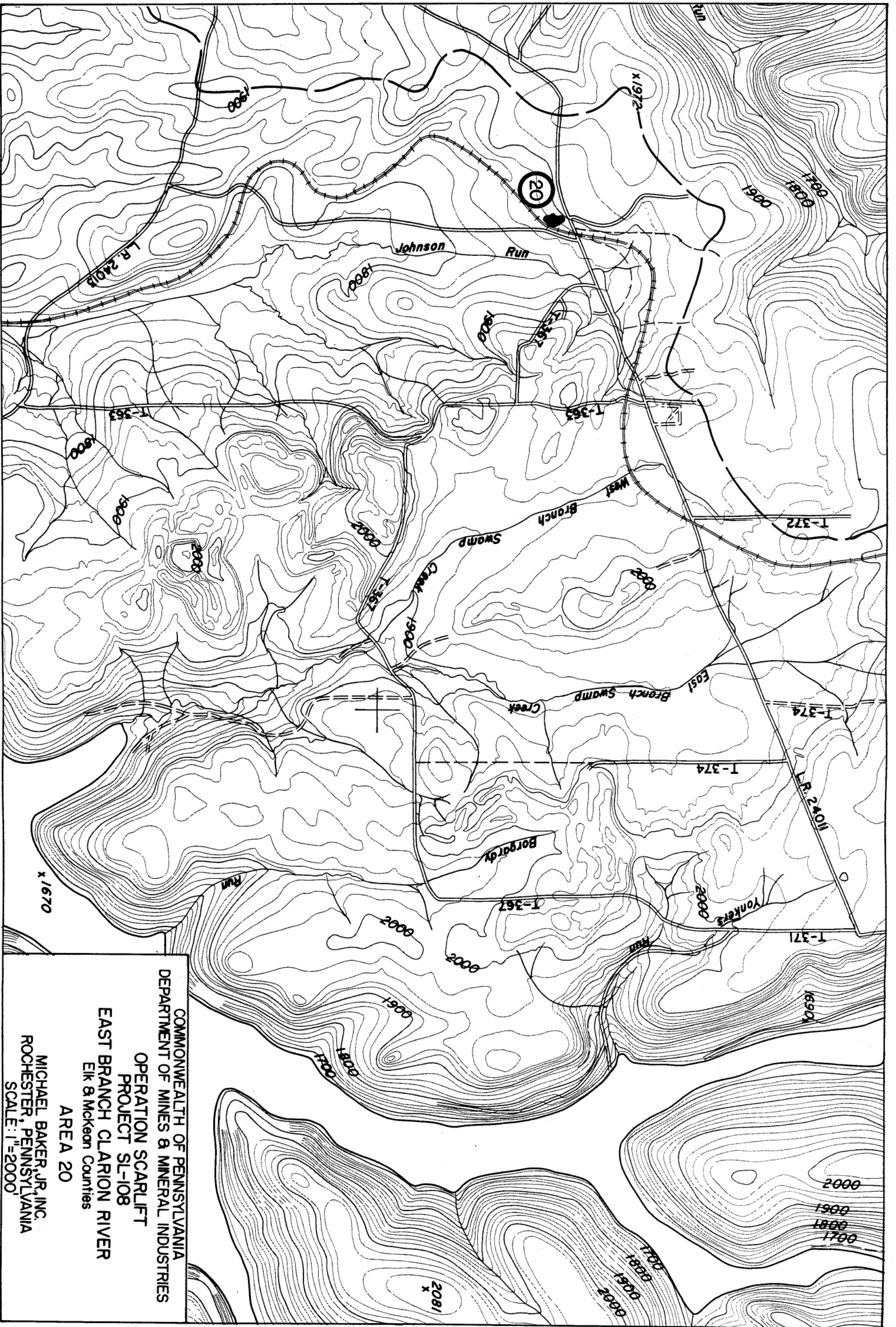
15 lbs. per Ac.
3 lbs. per Ac.

Special Requirements

The coal waste material shall be dumped into the pit in the northeastern part of the Area 11 Strip-Mine.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
<u>AREA 20</u>		
Remove coal waste material, improve drainage, soil treatment and Planting	100%	\$15,000



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 AREA 20
 MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Source of Pollution

AREA 21

The headings of the Bucktail Mines are located in this area, but mine openings have been covered by spoil from the Area 11 strip-mine operation. According to the records of the Pennsylvania Department of Health, there are three separate mine headings located approximately 2,000 feet east of a point on Township Road 363 which is 0.45 miles south of the junction of Township Road 363 and Township Road 367 (East). The mine openings were sealed at one time, but later strip-mining along the crop line destroyed the seals and probably exposed the mine workings.

Report RR of the Second Geological Survey of Pennsylvania has a description of the stratigraphic sequence being mined in 1883 and states that the Lower Kittanning Coal seam at the Bucktail Mines is highly sulfurous. The description of the stratigraphic sequence is as follows:

4'-0"	Slate, gray, soft
0'-10"	Top Bench - Coal, quite sulfurous, hard to mine
0'-10"	Middle Bench - Coal, generally free of sulfur, best coal
1'-3"	Bottom Bench - Coal, sulfurous, but less than top bench
2'	Bottom Bench - Coal, sulfurous, but less than top bench
+	Fire Clay

The bottom bench was reported by miners to sweat after a rainstorm and water filtering through it dissolved considerable iron and sometimes made the coal quite rusty. The sulfur in both the top and bottom benches is generally "lime" or "ball" sulfur occurring in lenticular masses, except for the lower 4 inches of the bottom bench where the sulfur is in the form of flakes. This lower portion of the bottom bench is frequently slaty and too poor to be mined.

Sampling Station 5965 was located in the vicinity of the probable location of the main headings of the Bucktail Mines. This area is covered by spoil from the Area 11 strip-mine operations. The seepage measured at this point is believed to be derived from the deep mine workings and the average daily acid discharge for the year 1969 was estimated to be about 150 lbs. per day.

Station 5903 was located at a point below the Bucktail Mines and had a drainage area of about 180 acres of which about 80 acres was strip mined land (Area 11 and Area 22 strip-mines).

How much of the acid discharge at Station 5903 can be attributed to the Bucktail Mines is difficult to determine, but acid discharges from the deep mines could flow through the stripmine spoil and emerge as seepage quite a distance from the mine workings. It is possible the Bucktail Mines are directly responsible for more than half of the average daily acid discharge of 1,300 lbs. per day at Station 5903, but because the Area 11 strip-mine is a major source of pollution, and because there is no definite evidence that the mine workings have been stripped, the average daily acid discharge being attributed to the Bucktail Mines is 450 lbs. per day.

Coal Production

The only coal production records available for the Bucktail Mines cover a period between 1921 and 1924 and the total production was 46,460 tons. The coal production for each year was:

1921	11,050 tons	1922	
	15,200 tons	1923	19,210 tons
		1924	1,000 tons

Since the coal production for year 1924 only amounted to 1,000 tons, it could be assumed this was the last year the mines were in operation.

According to Report RR of the Second Geological Survey of Pennsylvania, the mines were originally opened by the Northwestern Mining and Exchange Company prior to August 1883. This Company was fairly active in Elk County at the time and they owned the Dagus Mines in Fox Township. A map of the Dagus Mines showing the extent of mining up to September, 1884 shows the mining operation was well planned and was being done by a company well versed in mining technology. Even though there are no coal production records for the Bucktail Mines for the period prior to the year 1921, it should be assumed that the Northwestern Mining and Exchange Company did actively mine the area for at least a few years, but part of their production probably came from a mine opening that was about 650 feet east of Township Road 363 which is called Area 23 in this report.

If the average thickness of the Lower Kittanning Coal seam is assumed to be 3 feet, each acre of land would contain 5,500 tons of coal before mining. Further assuming 60 percent of the coal underlying each acre is extracted during mining, then the total production

of 46, 460 tons for the period 1921-24 would come from about 14 acres. Since there are no coal production records for the years between 1883 and 1920, it can only be conjectured that the production was at least equivalent to the 1921-24 period. Therefore, it is assumed for the purpose of planning effective acid mine drainage abatement measures, that about 30 acres underlying the hill have been mined and only a small part of this acreage was later stripped.

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 450 lbs. per day or about 8 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed.

Exploratory borings are needed to determine how much of the workings of the Bucktail Mines have been stripped.

Pollution abatement of the Bucktail Mines should be done in connection with the Area 11 strip-mine reclamation. The most positive approach would be to excavate a trench along the contact between the highwall and the Area 11 spoil to the elevation of the mine workings. The total quantity of excavation could amount to 75, 000 cu. yd. The excavation of a trench should begin in the area of Station 5965 since this is where it is believed the main headings of the Bucktail Mines are located. Pollution abatement recommendations would be based on what is observed in the trench and it may be possible to install double bulkhead grout seals at the main headings. Based on what is exposed as the trench is excavated in a southeast direction from Station 5965, it may be possible to stop excavation of the trench and grout the spoil along the highwall. If excavation of the trench shows that the mine workings are exposed, the best approach would be to backfill the trench with impervious material to an elevation of about 15 feet above the roof of the mine workings.

Firm recommendations for the abatement of acid mine drainage pollution from the Bucktail Mines cannot be made at this time, but for the purpose of estimating the cost of abatement, the following work items are listed:

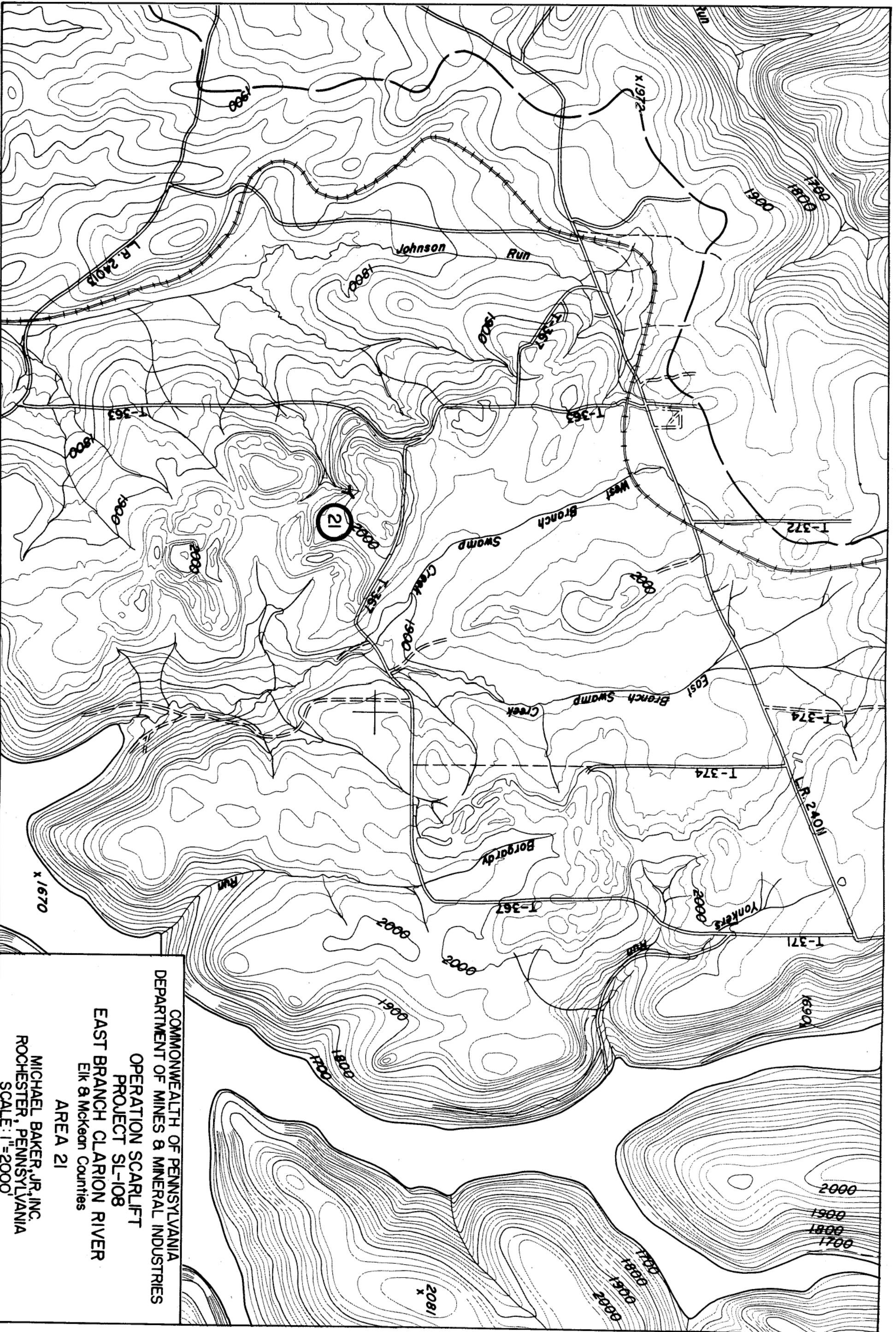
- | | |
|---------------------------|---------------|
| 1. 10 Exploratory Borings | 650 L. F. |
| 2. Excavation | 75, 000 C. Y. |
| 3. Impervious Borrow | 25, 000 C. Y. |

Cost of Abatement Methods

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
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AREA 21

Excavate trench along highwall to elevation of mine workings and backfill with impervious material	90%	\$390,000
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 Elk & McKean Counties
 AREA 21
 MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Source of Pollution

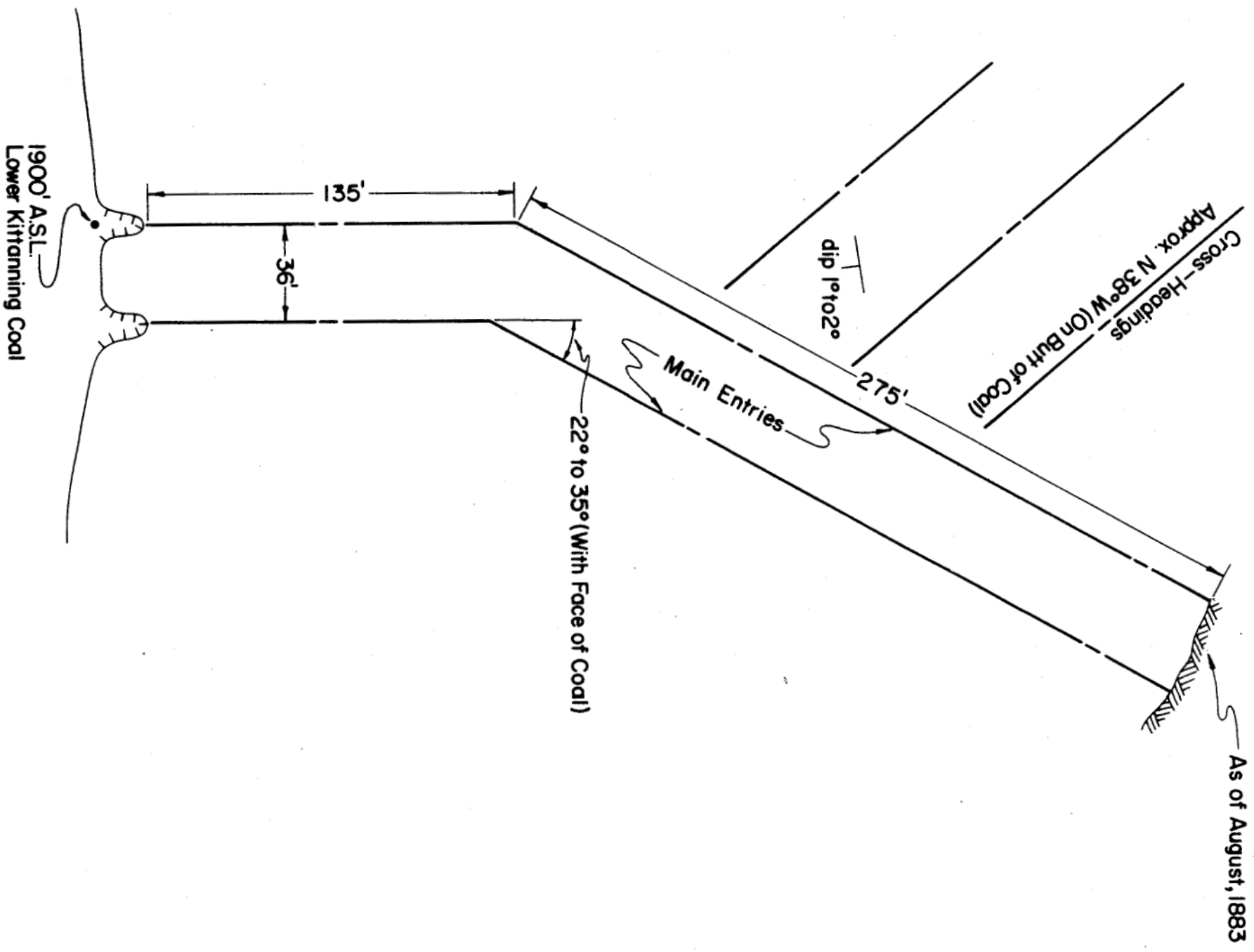
AREA 22

Area 22, covering about 9.5 acres, is just east of Township Road 363 and was stripped for the Lower Kittanning Coal. The deep mine that was in this area may be the Bucktail Mine described in Report RR of the Second Geological Survey of Pennsylvania and reported to be at an elevation of 1900 feet. The main entries of the mine up to August 1883 were driven a distance of 310 feet in a northeast direction. The mine entries ran with the face of the coal and the cross-headings were driven northwest on the butt of the coal. (See sketch map Of a Bucktail Mine). Based on the width of the strip-mine, it appears the mine workings were not completely stripped out if the mine was in operation for any length of time after August 1883.

No seepage was observed coming from the strip-mine that could be attributed to flow from deep mine workings.- There was seepage from the strip-mine after heavy rainfall, but this was widespread and probably the result of surface water infiltration and not ground water flow from deep mine workings.

Since there is no evidence of a flow from deep mine workings, it is recommended that acid mine drainage abatement be limited to reclamation of the strip-mined area. The strip-mine is a significant source of acid mine drainage pollution. There is very little vegetation growing on the spoil material. The spoil material is fine to medium coarse and there are traces of acid producing material at the surface. There is no evidence of soil formation.

FIG. 13



Probably Area 23—Sketch Map
Based on the Description Given in
Report RR, Second Geological Survey
of Pennsylvania, 1885. Mine Operated
by Northwestern Mining and Exchange
Company

Scale: 1" = 50'

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ROCHESTER, PENNSYLVANIA
SKETCH MAP OF A BUCKTAIL MINE—AUGUST 1883

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 90 lbs, per day or about 1. 6 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River, Water shed,

Reclamation of this strip-mine should be done at the same time as the Area 10 strip-mine. The reclamation recommendations are the same for both areas and consist of backfilling, some contour grading, and seeding with grass and legumes, The reclamation requirements are as follows:

In the fall, one half of the limestone requirement shall be spread and incorporated into the soil to a minimum depth of 4 inches. In the spring, the other half of the limestone and the fertilizer requirement, in

Reclamation Requirements

Earthwork

Backfilling and grading (Estimate 25, 000 C. Y.)

Soil Treatment

Standard Ground Limestone (Total Application to Contain a Minimum of 240 lbs. magnesium per Ac.)	7 Tons per Ac.
50-200-200 in lbs. N-P ₂ O ₅ -K ₂ O	per Ac.

Planting

Creeping red fescue	30 lbs. per Ac.
Penngift crownvetch	10 lbs. per Ac.

Mulching

Hay	2 Tons per Ac.
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Special Requirements

separate applications, shall be spread and incorporated into the soil to a minimum depth of 4 inches. Seed shall be applied by disc drill or comparable method.

Cost of Abatement Methods

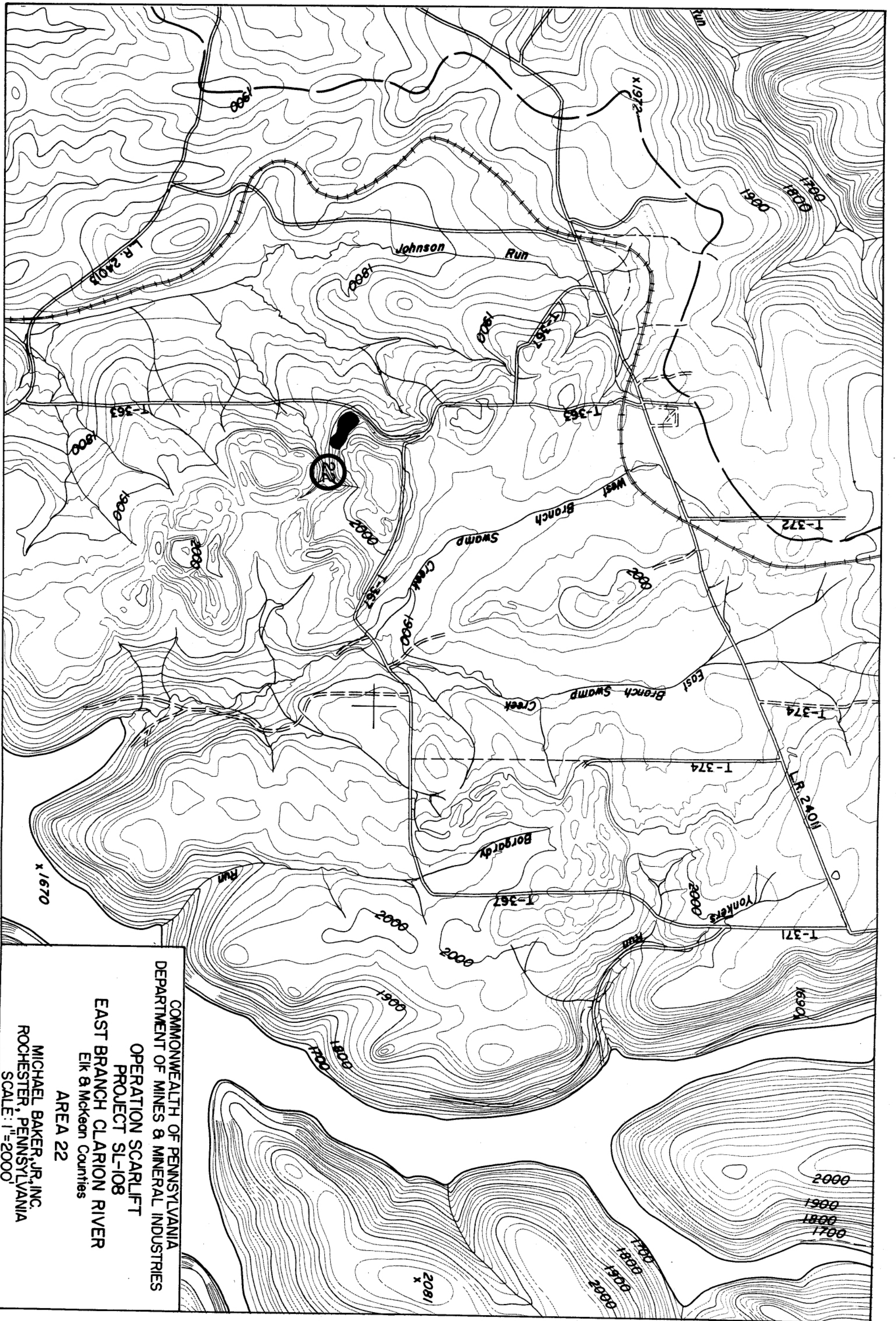
<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
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AREA 22

Backfilling, contour
grading, soil treatment
and planting

65%

\$88,000



Source of Pollution

AREA 23

This is the location of a coal mine waste bank. The mine waste probably came from the Bucktail Mine described in Report RR of the Second Geological Survey of Pennsylvania and discussed under Area 22. The volume of mine waste material is estimated to be 7, 000 cu. yds. , but this may not be the total volume of mine waste removed from the mine. Pumpkin Hill Road, which is constructed partly of mine waste, is 650 feet west of the mine location, and it is possible that some of the mine waste from this mine was used in construction of the road. The mine waste bank is in a wooded area and is a minor source of acid mine drainage pollution.

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 10 lbs. per day or 0. 2 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed.

Since the Lower Kittanning Coal seam is known to be highly sulfurous, it is recommended that the mine waste material be removed and a minimum amount of soil treatment and planting be done to encourage natural revegetation. The reclamation requirements are as follows:

Reclamation Requirements

Earthwork

Removal of coal mine waste
(Estimate 7, 000 C. Y.)

Soil Treatment

Standard Ground Limestone 3 Tons

Planting

Weeping lovegrass 2 lbs.

Special Requirements

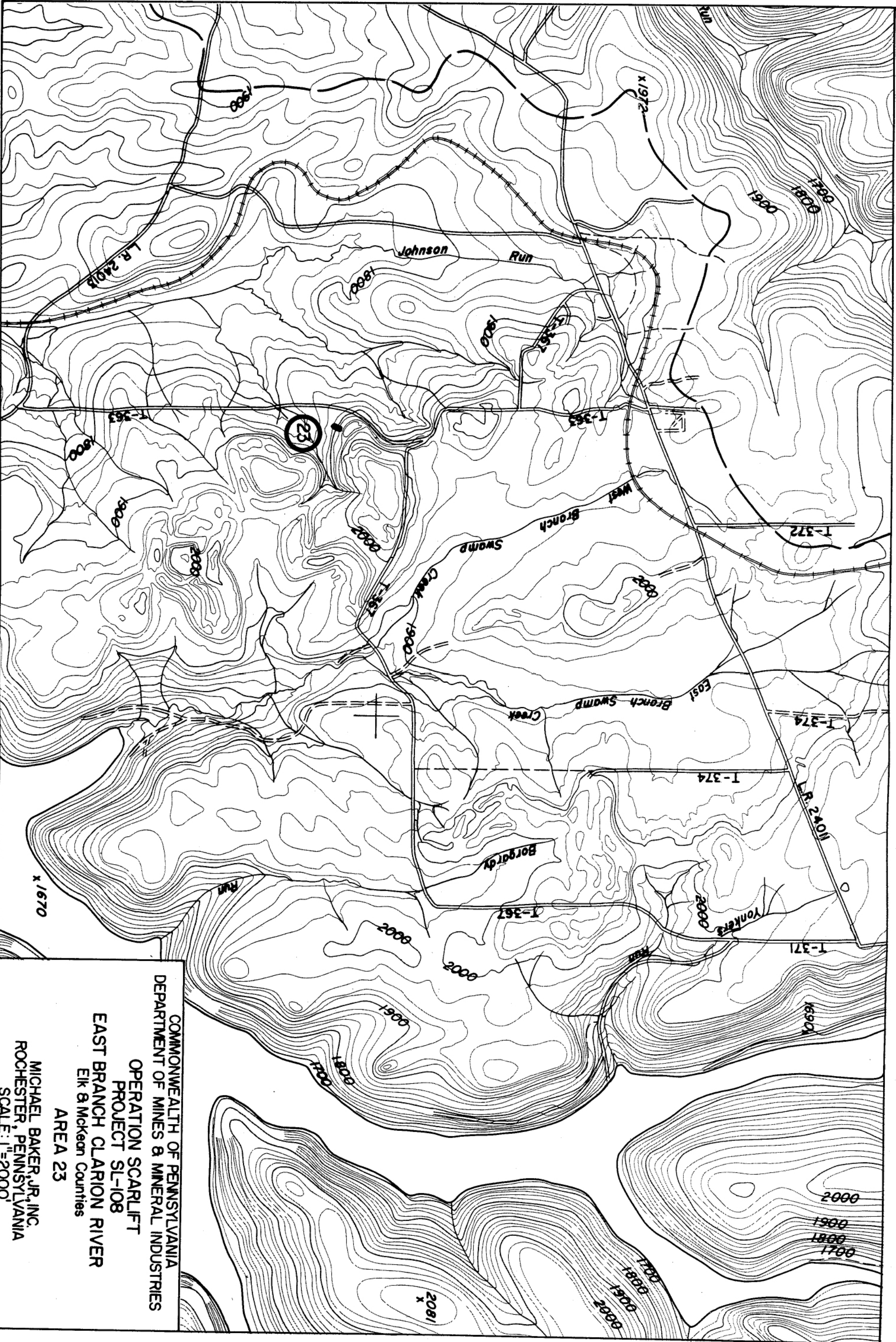
Spread limestone and broadcast seed.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
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AREA 23

Removal of mine waste material, soil treatment and planting	100%	\$24,000
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 EAST BRANCH CLARION RIVER
 Elk & Mckean Counties
 AREA 23
 MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
<u>AREA 24</u>		
Roadway - Place crushed limestone and bituminous surface treatment Improve drainage		\$38,000
Adjacent Areas - Remove mine waste material, soil treatment and planting		<u>82,000</u>
TOTAL	90%	\$120,000

Source of Pollution

AREA 24

Area 24 is Pumpkin Hill Road (Township Road 363) which begins at Legislative Route 24011 and terminates at Legislative Route 24013. The road is approximately 15,150 feet (2.87 miles) in length and the general alignment of the road is in a north to south direction. The road is entirely within the Johnson Run subbasin and strip-mines are to the east of the road for most of the length. Mine waste material has been used in constructing part of the road and at various times it has been used in repairing sections of the road. Most of the acid drainage discharged from along this road comes from the first 10,280 feet. The pollution comes not only from mine waste used in construction of the road, but also from acid producing material along the sides of the road that has washed into low lying areas from the strip-mines. In some areas, there are no mine waste deposits along the sides of the road, but the soil has been affected by the acid discharges from the road and adjacent strip-mines.

For the purpose of describing more fully the polluttional effects of Pumpkin Hill Road on Johnson Run, the road has been divided into 15 sections. Each section is based on the description and quantity of objectionable acid producing material found on the road and off to the sides of the road.

The following is a description of Pumpkin Hill Road beginning at Legislative Route 24011:

<u>Section</u>	<u>Length</u>	<u>Mileage</u>	<u>Description</u>
1	1120'	0.00-0.21	Moderate amount of mine waste material on road and off to west side of road. Soil affected by acid discharge in an area west of road and just south of railroad tracks.

<u>Section</u>	<u>Length</u>	<u>Mileage</u>	<u>Description</u>
2	730'	0.21-0.35	Large amount of mine waste containing coal and pyrite on road and off to west side of road. During dry weather the road becomes whitish with the efflorescence of ferrous salts from pyrite oxidation.
3	360'	0.35-0.42	Moderate amount of mine waste material on road and off to the sides of road.
4	470'	0.42-0.51	Moderate amount of mine waste material on road, but a large amount of highly objectionable acid producing material on sides of road.
5	420'	0.51-0.59	Only a trace of mine waste material on road, but after a rainstorm the pools of water that form on road surface become red in color. This water is highly acid. It appears that the mine waste is covered by a thin clay layer. There is a large amount of acid producing material along the sides of the road. At the intersection with Township Road 367 (West) the road surface is constructed of "red dog".
6	540'	0.59-0.69	Large amount of mine waste containing coal and pyrite on road surface, but does not extend much beyond the roadway width. The soil has been affected by acid drainage in an area on the east side of the road.

<u>Section</u>	<u>Length</u>	<u>Mileage</u>	<u>Description</u>
7	170'	0.69-0.72	Minor amount of acid producing material on road and off to west side of road.
8	210'	0.72-0.76	Moderate amount of mine waste on road - Large amount of acid producing pyritic material off to sides of road.
9	160'	0.76-0.79	Minor amount of mine waste on road, but a considerable amount of acid producing material off to west side of road.
10	170'	0.79-0.82	Moderate amount of mine waste on road - Large amount of acid producing material off to sides of road.
11	2790'	0.82-1.35	Minor to moderate amounts of mine waste on road - Considerable amount of acid producing material off to sides of road - Soils affected by acid drainage in an area along west side of road.
12	1270'	1.35-1.59	Very minor to moderate amounts of mine waste on road, but a moderate amount of acid producing material off to west side of road - Soils affected by acid drainage in area along west side of road.
13	1870'	1.59-1.95	Large amount of mine waste material containing coal and pyrite along the road - During dry weather the road becomes whitish with the efflorescence of ferrous salts from pyrite oxidation. An extensive outwash deposit containing some acid producing material is an area on the east side of the road.

<u>Section</u>	<u>Length</u>	<u>Mileage</u>	<u>Description</u>
14	2480'	1.95-2.42	Very minor amount to no mine waste material visible on road surface except in some places where recent road grading has exposed pyritic material.
15	2390'	2.42-2.87	No mine waste material visible on road or off to sides of road- If any mine waste was used in the construction of this section, it has been well covered.

Samples were collected of mine waste material on the road surface to determine the nature of the whitish coating. The samples contained the mineral pyrite (and marcasite?) in the form of small crystals and also in the form of finely disseminated flakes that were not visible to the naked eye. The samples were placed in a moist environment, and after a short time, pale green crystals of the mineral melanterite or ferrous sulfate heptahydrate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) were observed to be growing. Melanterite is a secondary mineral formed by the oxidation of pyrite and marcasite. It is readily soluble in water and it occurs typically as efflorescences on the walls and timbers of mine workings in pyritic ore deposits.

The samples on which the mineral melanterite had grown were then placed in a dry environment. The mineral melanterite was observed to dehydrate to become the mineral siderite or ferrous sulfate pentahydrate ($\text{FeSO}_4 \cdot 5\text{H}_2\text{O}$). Siderite is the mineral that forms the whitish coatings on the road surface and it is an alteration product of melanterite,

On June 27, 1969 it appeared that a rainstorm was about to begin. In order to obtain information on the pollutional effects of acid producing material along Pumpkin Hill Road, water quality samples were taken at three points, in the vicinity of Station 5903, where the second tributary that enters Johnson Run from the east flows through a culvert under Pumpkin Hill Road.

Water quality samples were taken at these points twice during the rainstorm and once after the rain stopped when it appeared the flow had returned to normal.

The total acid discharge for a period of one hour and 15 minutes at Station 5903 was about 73 lbs. of which about 50 lbs. is attributed to the rainfall. The results of the water quality tests and a discussion of the results are in Appendix C of the report.

It is difficult to estimate the acid discharge that can be attributed to acid producing material along the entire length of Pumpkin Hill Road because of the proximity of strip-mines on the east side of the road. It is very possible, though, that this pollution source was responsible for an acid discharge of more than 200 lbs. of acid during the period of one hour and 15 minutes.

Abatement of the pollution caused by acid producing materials on and along the sides of Pumpkin Hill Road is essential if Johnson Run is to become a clean stream, but it does not appear to be advantageous to clean up Pumpkin Hill Road until the strip-mine areas to the east of the road are being reclaimed.

Recommended Abatement Measures The average acid discharge attributed to Pumpkin Hill Road, including the acid producing materials off to the sides of the road, is estimated to be approximately 150 lbs. per day or about 2.7 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed based on the water quality tests performed over a one year period.

Area 24 is considered to be a major source of acid mine drainage pollution because it can produce a large slug of acid in a relatively short time during periods of rainfall.

Most of the acid discharges come from the first 10,280 feet of Pumpkin Hill Road. An area of about 68,750 sq. yds. (about 14.2 acres) contains acid producing material, and the soil in an additional 6,000 sq. yds. (about 1.2 acres) is affected by the acid discharges.

Figuring a roadway length of 10,280 feet and an average width of 20 feet, including ditches, the area of the roadway would be 22,845 sq. yds. (about 4.7 acres). Therefore, two-thirds of the acid producing material is outside the existing road. The legal limit of right-of-way is 33 feet, and this would contain about 30,000 sq. yds. of the acid producing material, but this is still less than half of the material causing pollution.

For the purpose of making reclamation recommendations the roadway and the areas to the sides of the road are discussed separately. The

Roadway

Pumpkin Hill Road is an unimproved road consisting of a surface constructed of soil and aggregate, part of which is mine waste material. The depth and percentage of the mine waste material is not known because it is mixed with soil and aggregate from other sources and in places the mine waste is covered by a thin veneer of material that is not acid producing. It probably would be more economical to reconstruct the first 10, 280 feet of Pumpkin Hill Road by covering the acid producing material. Removal of this material has been considered, but this would entail in addition to the cost of excavation, the cost of burial of the mine waste in a strip-mine pit, and the cost of borrow to replace the material removed. Grading and shaping the roadway and drainage ditches would also be part of the cost.

It, therefore, is recommended that the first 10, 280 feet of Pumpkin Hill Road be reconstructed and the mine waste material covered. The width of the roadway should be increased to 18 feet to insure that the mine waste material near the edges of the existing road is covered. A thickness of 4 inches of crushed limestone aggregate and bituminous surface treatment is recommended. The 2,480 lineal feet of roadway immediately to the south of this section, where recent grading has exposed acid producing material, should receive bituminous surface treatment.

The reclamation requirements for Pumpkin Hill Road are as follows:

Reclamation Requirements

- | | | |
|----|---|-----------------|
| 1. | Grading and shaping roadway and ditches | 10,280 L. F. |
| 2. | Bituminous Surface Treatment | |
| | a) 10,280 L. F. | 20,560 sq. yds. |
| | b) 2,480 L. F. | 4,200 sq. yds. |
| 3. | 4" Crushed Limestone Aggregate | 20,560 sq. yds. |

Areas to the Sides of Pumpkin Hill Road

It is estimated about 25, 000 cu. yds. of mine waste material lies in an area of 48, 190 sq. yds. (about 10 acres).

This material should be removed and buried in the Area 11 stripmine.

Soil treatment and planting should be done in the area of 48, 190 sq. yds. and in the area of 6, 000 sq. yds, where soil has been affected by acid discharges. The reclamation requirements are as follows:

Reclamation Requirements

Earthwork

Removal of mine waste material.
(Estimate 25, 000 C. Y.)

Soil Treatment (11.2 Acres)

Standard Ground Limestone 7 tons per Ac.
(Total application to contain a minimum
of 240 lbs. magnesium per Ac.)

50-50-50 in lbs. N-P₂O₅-K₂O per Ac.

Planting (11.2 Acres)

Creeping red fescue 30 lbs. per Ac.
Sericea lespedeza 10 lbs. per Ac.

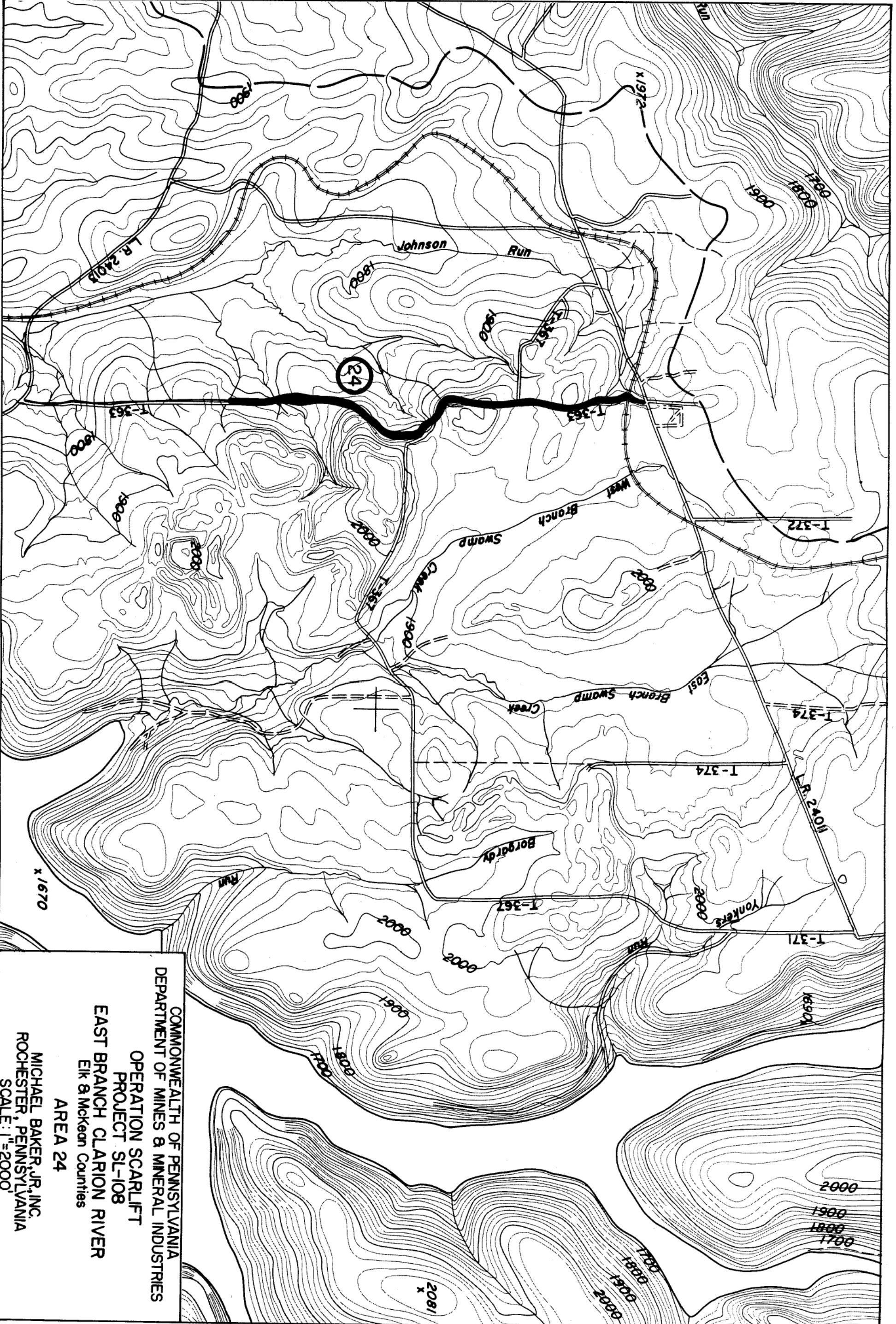
Special Requirements

The coal waste material shall be dumped into the pit in the northeastern part of the Area 11 Strip-Mine.

Limestone and fertilizer shall be spread and the seed broadcast.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
<u>AREA 24</u>		
Roadway - Place crushed limestone and bituminous surface treatment Improve drainage		\$38,000
Adjacent Areas - Remove mine waste material, soil treatment and planting		<u>82,000</u>
TOTAL	90%	\$120,000



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 PROJECT SL-108
 EAST BRANCH CLARION RIVER
 Elk & Mckean Counties
 AREA 24
 MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Source of Pollution

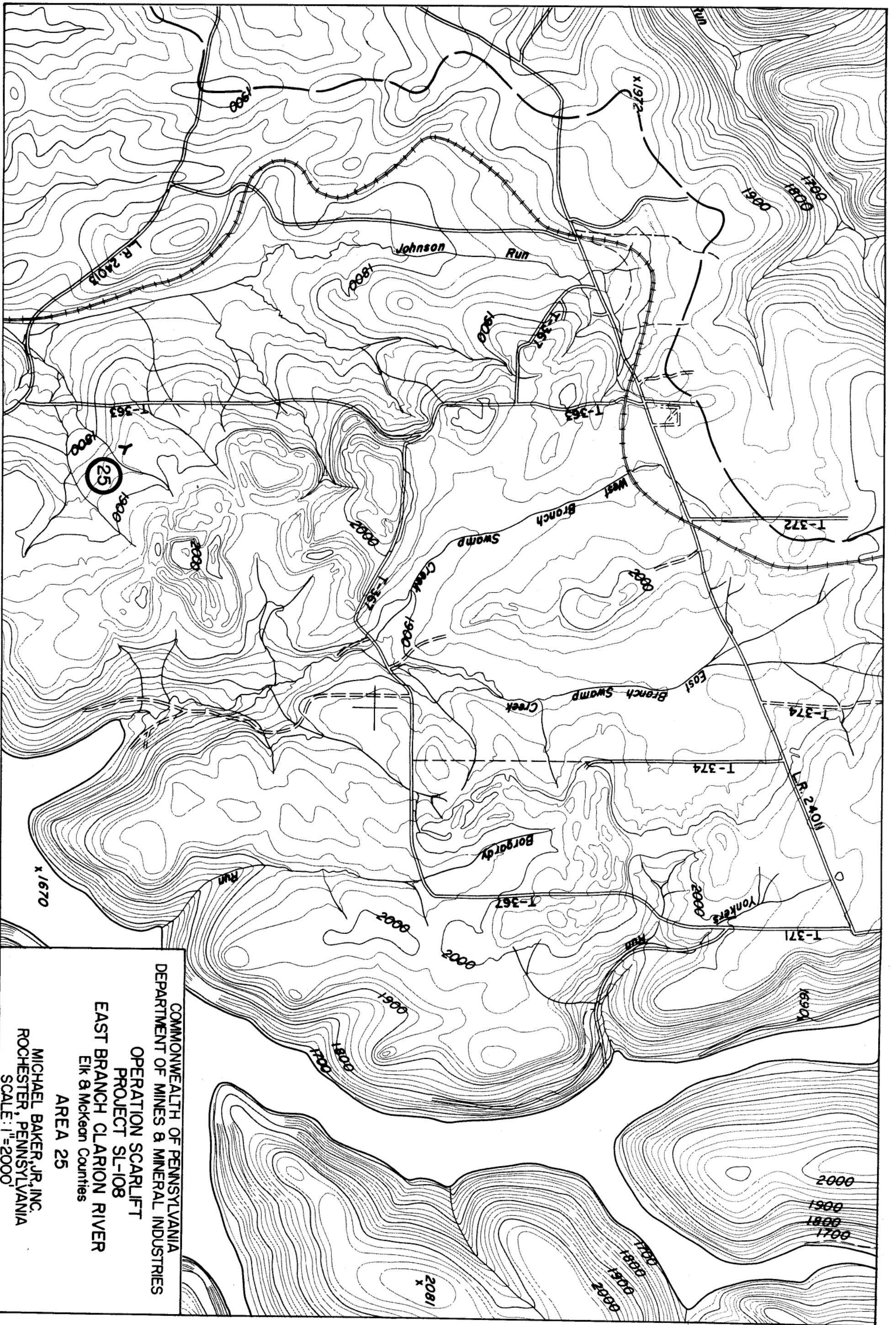
AREA 25

Area 25 is a deep mine which is located about 800 feet east of Township Road 363 (Pumpkin Hill Road) and about 2000 feet north of the junction of Township Road 363 with Legislative Route 24013. It is called the Nashedka No. 2 mine in this Report because it was worked by Mr. Felix Nashedka in the 1930's. The mine would be in the Lower Kittanning Coal seam and it is believed the tonnage mined was small. The mine opening is in a heavily wooded area and the mine refuse bank does not amount to much more than 100 cubic yards of mine waste.

A mine seal was installed at the location of the mine opening, but there is no record of when this work was done, or by what government agency. The flow from the mine seal is small and during the period of testing the average daily acid discharge ranged from 15 to 37 lbs. per day. The iron is in the ferrous state as it leaves the mine seal and it is rapidly transformed from ferrous to ferric iron. A "yellow boy" deposit about 250 feet in length, and 10 to 50 feet in width is located immediately below the mine seal.

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 40 lbs. per day or 0.7 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed,

It is recommended that no further attempt be made at pollution abatement of acid discharges from this source. This is a minor source, and without a detailed subsurface investigation, it would be difficult to determine if it would be possible to completely eliminate acid discharges.



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 AREA 25

MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SCALE: 1"=2000'

Source of Pollution

AREA 30

Area 30 is a haul road beginning at the Area 11 strip-mine and ending at Township Road 363 (Pumpkin Hill Road). It is estimated that about 2,000 cu. yds. of mine waste was used in the construction of the road.

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 10 lbs. per day or 0.2 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed.

Reclamation of this area should be done in connection with the reclamation of Area 24 (Pumpkin Hill Road). The reclamation requirements are as follows;

Reclamation Requirements

Earthwork

Removal of coal mine waste material (Estimate
2,000 C. Y.)

Soil Treatment

Standard Ground Limestone	4 Tons
25-25-25 in lbs. N-P ₂ O ₅ -K ₂ O	

Planting

Creeping red fescue	20 lbs.
Sericea lespedeza	10 lbs.

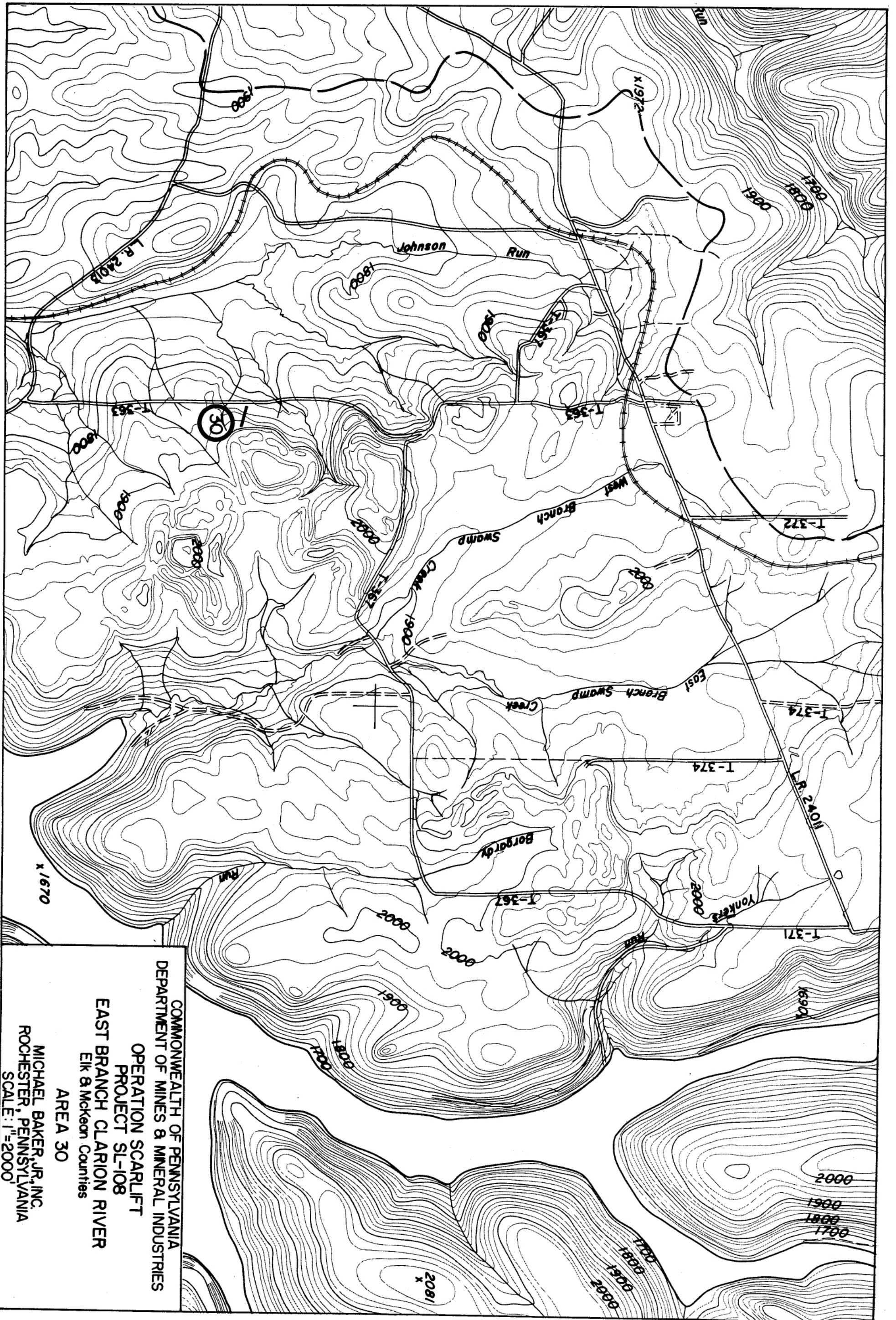
Special Requirements

The coal mine waste shall be dumped into the pit in the northeastern part of the Area 11 strip-mine.

Limestone and fertilizer shall be spread and seed shall be broadcast.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
<u>AREA 30</u>		
Remove coal waste material, soil treatment and planting	100%	\$12,000



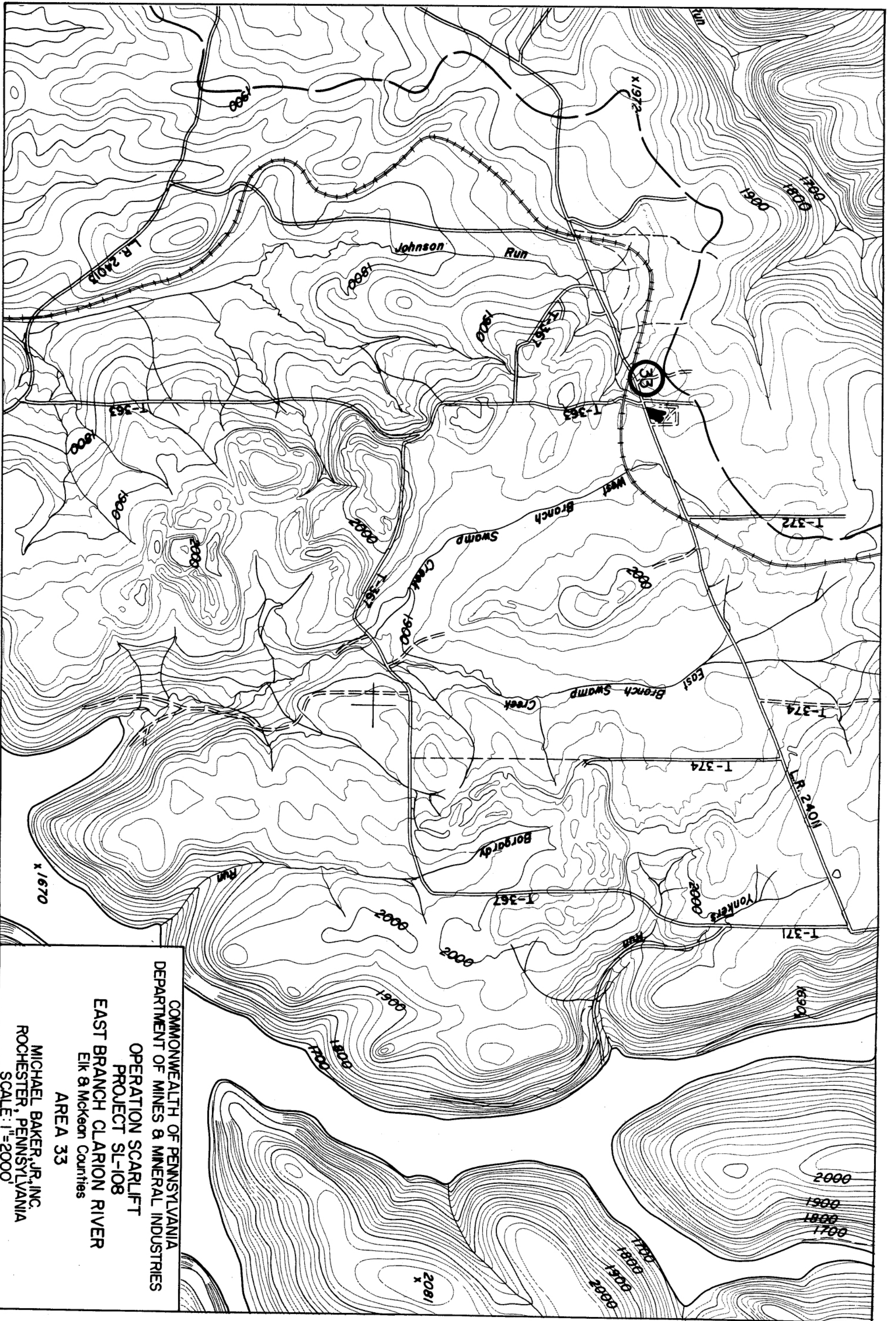
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 AREA 30
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 SCALE: 1"=2000'

Source of Pollution

AREA 33

Area 33 is a stripped area just northeast of the junction of Township Road 363 and Legislative Route 24011. The Catholic Cemetery borders this area on the north. The stripped area is now the property of the Roman Catholic Diocese of Erie and it is understood they plan to use it in the future for a cemetery. This is an old strip and it is believed that it was not stripped for coal but for weathered limestone which was then sold to local farmers as a poor grade of agricultural limestone. It appears the area was seeded to timothy and harvested for a number of years.

Recommended Abatement Measures - There does not appear to be any acid mine drainage pollution from this source even though a thin coal seam is reported to be associated with the limestone of Elk County. Therefore, no reclamation recommendations are included herein.



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 AREA 33
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 SCALE: 1"=2000'

Source of Pollution

AREA 34

Area 34 is an old dirt road off Legislative Route 24011 just west of Rasselas and north of Area 20. The first 2,400 feet of road, up to a picnicking area, has scattered mine waste deposits on the road surface and to the east of the road. Most of the coal mine waste is at places where water courses cross the road and was used to cover pipe culverts. This material has been placed on the road in recent years and is not due to any mining operations.

Recommended Abatement Measures - The average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 10 lbs. per day or less than 0.2 percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed.

This is a minor source of pollution and it would not be feasible to remove all the scattered mine waste, but the bulk of the coal mine waste is at the water courses and in a few piles near the picnicking area. It is recommended that the mine waste at the water courses and in piles be removed.

It is difficult to estimate the volume of material at the water courses and in piles because the mine waste material is at a number of locations and in some areas partly covered by soil, For the purpose of reclamation recommendations it is estimated to be about 500 cu. yds. The reclamation requirements are as follows:

Reclamation Requirements

Earthwork

Remove coal mine waste at water courses
and where in piles (Estimate 500 cu. yds.)

Special Requirements

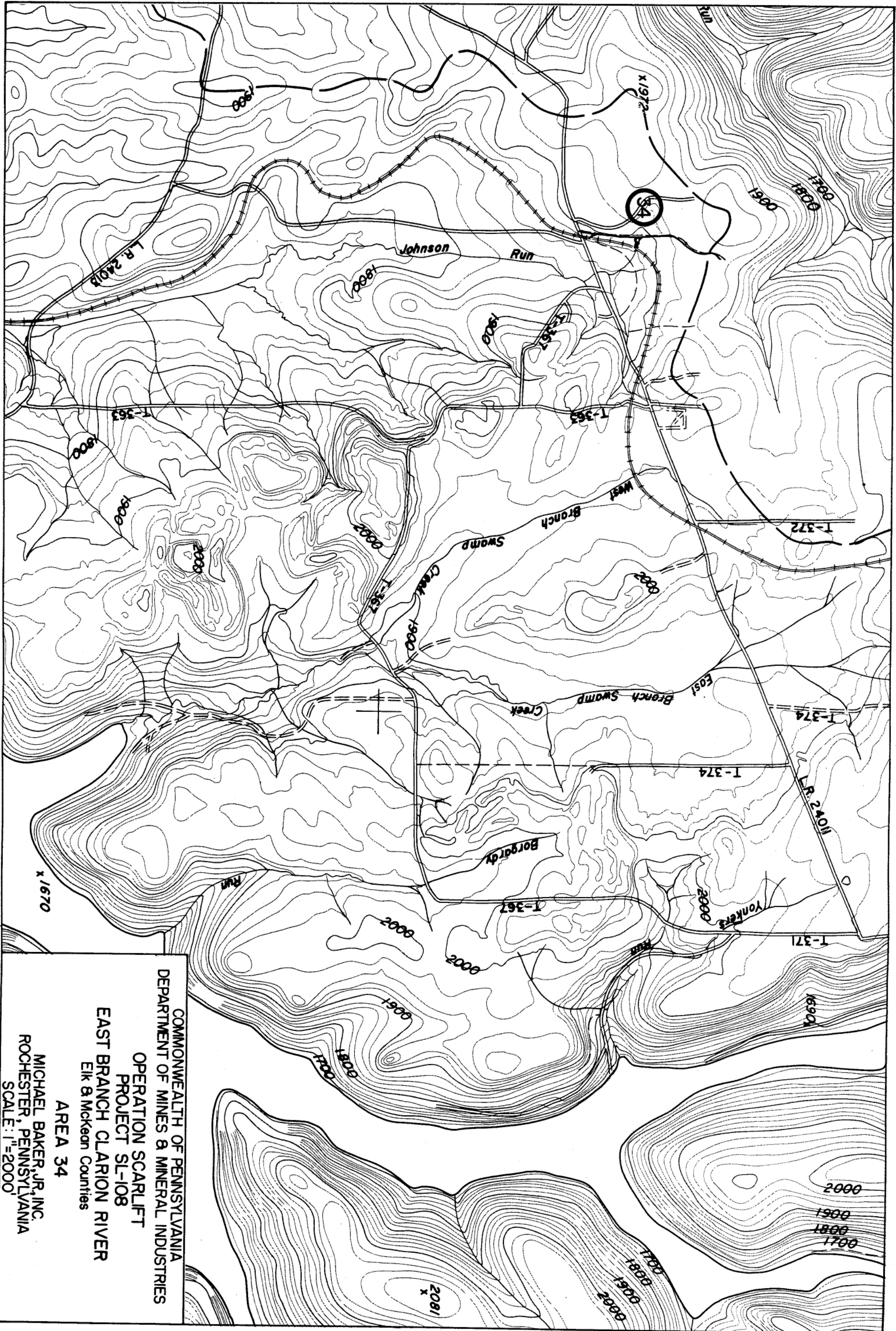
The coal mine waste shall be dumped into the pit in
the northeastern part of the Area 11 strip-mine.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
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AREA 34

Remove coal waste material	100%	\$2,000
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Sources of Pollution

AREAS Discussed in Other Sub-Basins

AREA 8

About 40 percent of the strip-mine is in the Swamp Creek Sub-Basin. Within the Johnson Run Sub-Basin, the average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 80 lbs. per day or almost 90 percent of the total average daily acid load produced by this source. Area 8 is discussed in the Swamp Creek Sub-Basin. section of the report, page A-43.

AREA 9

Most of Area 9 strip-mine is in the Swamp Creek Sub-Basin, Within the Johnson Run Sub-Basin, the average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 30 lbs. per day or 50 percent of the total average daily acid load produced by this source. Area 9 is discussed in the Swamp Creek Sub-Basin section of the report, page A-47.

AREA 12

This is the second largest strip-mine in the East Branch Clarion Watershed and about 55 percent of the area is in the Swamp Creek Sub-Basin. Area 12 is a major source of acid mine drainage pollution. Within the Johnson Run Sub-Basin, the average acid discharge from this source is estimated, on the basis of water quality tests performed over a one year period, to be approximately 400 lbs. per day or about 45 percent of the total average daily acid load produced by this source. Area 12 is discussed in the Swamp Creek Sub-Basin section of the report, Page A-51.