PROPOSED ABATEMENT PLAN

The essential purpose of this mine drainage investigation is to formulate an abatement plan to effectively deal with source pollution from mining sites and related areas. The success of a program proposal is largely measured by the ability to orientate the study to problem solving objectives which identify specific abatement project areas.

The abatement plan for the Toby Creek Watershed consists of 20 project areas that are discharging large quantities of acid mine drainage. Each area has been assigned a. priority number relative to the amount of pollution each area is discharging. The following priority system has been assigned to the watershed: Priority number 1 - average daily acidity discharge greater than 1,000 pounds per day; Priority number 2 - average daily acidity discharge between 400 and 1,000 pounds per day; Priority number 3 - average daily acidity discharge less than 400 pounds per day.

Each project area was analyzed as to the most appropriate abatement measure required for a given site condition or criteria. The following measures were recommended or given consideration: surface mine reclamation, deep mine sealing; surface water management, oil or gas well plugging, impervious barriers, impervious covering and coal refuse disposal and management. Costs were developed for each measure utilizing the recent (1978) bidding of related abatement and/or reclamation work in Pennsylvania. Obligatory contingencies and engineering costs are also included. A percentage determination of the estimated acid load reduction reasonably expected from each area was determined. In addition, a cost/benefit ratio was calculated by relating the total cost of the project to the expected reduction in acidity ($/lb. of acid).

The implementation of this plan will improve the water quality of the Toby Creek Watershed. In addition, many land areas within the watershed will be returned to useful and productive purposes.

The following figures represent the locations of the project areas in the watershed and the legend for various components of the project area maps.

LEGEND FOR PROJECT AREA MAPS

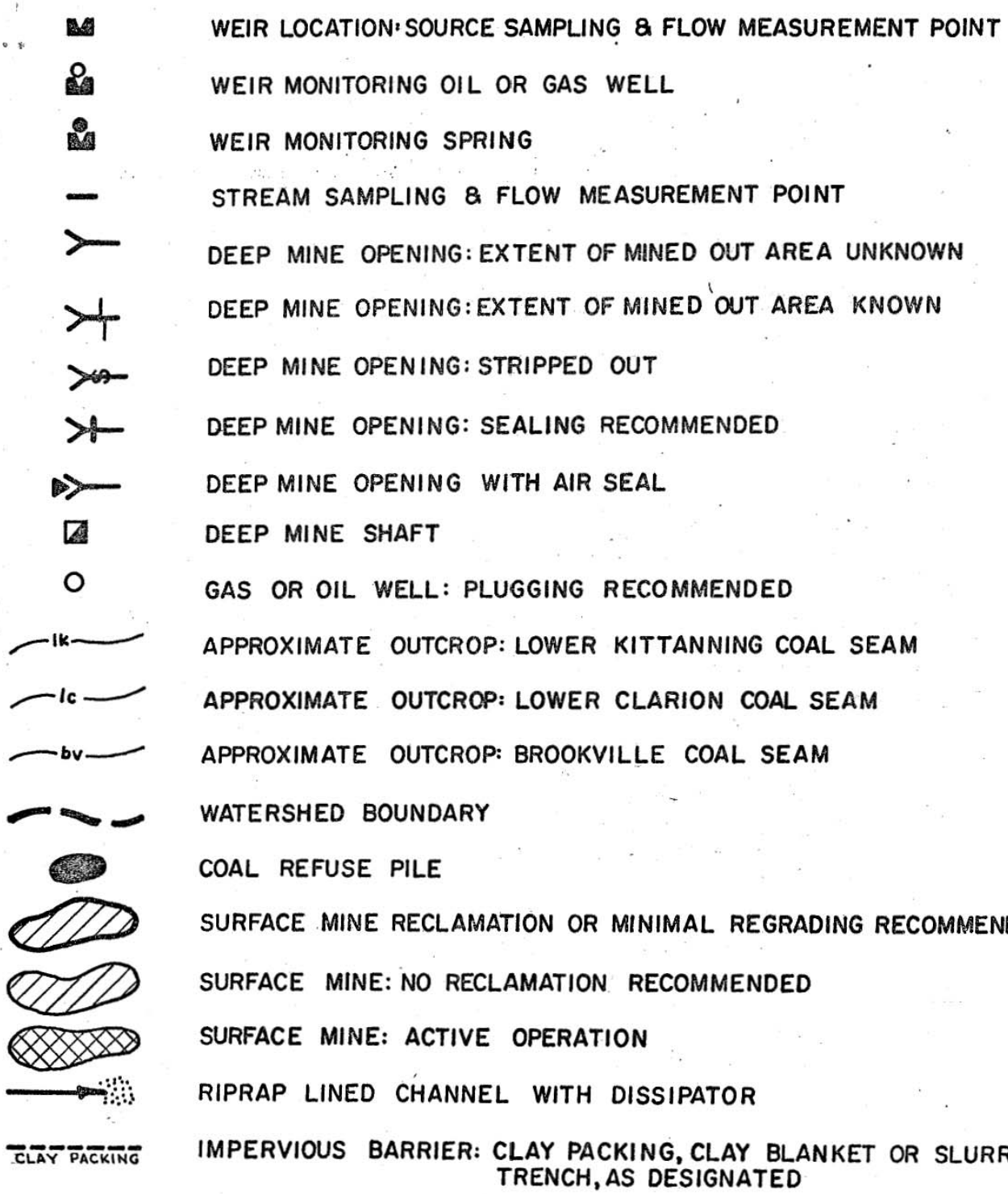


FIG. 5

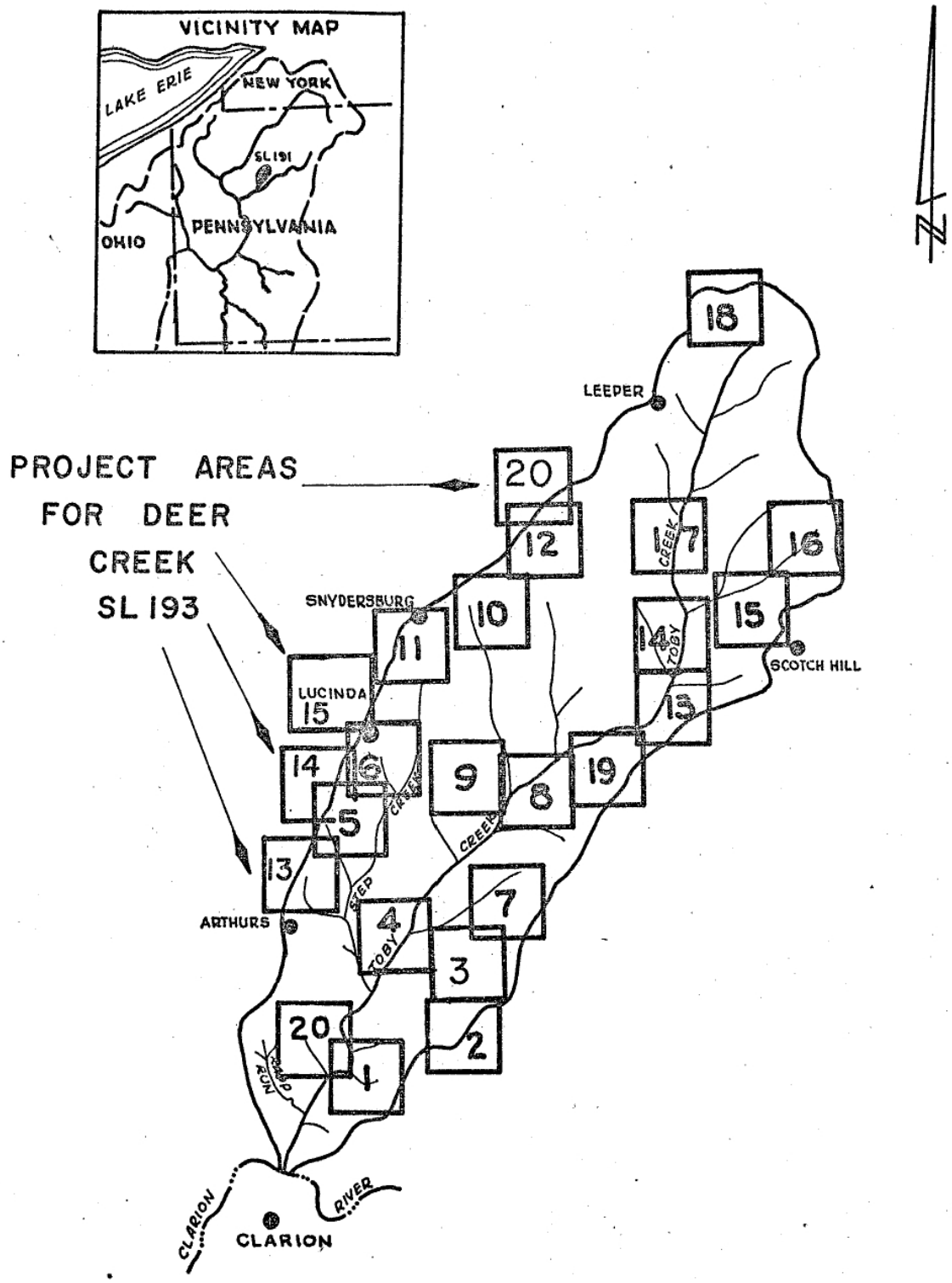
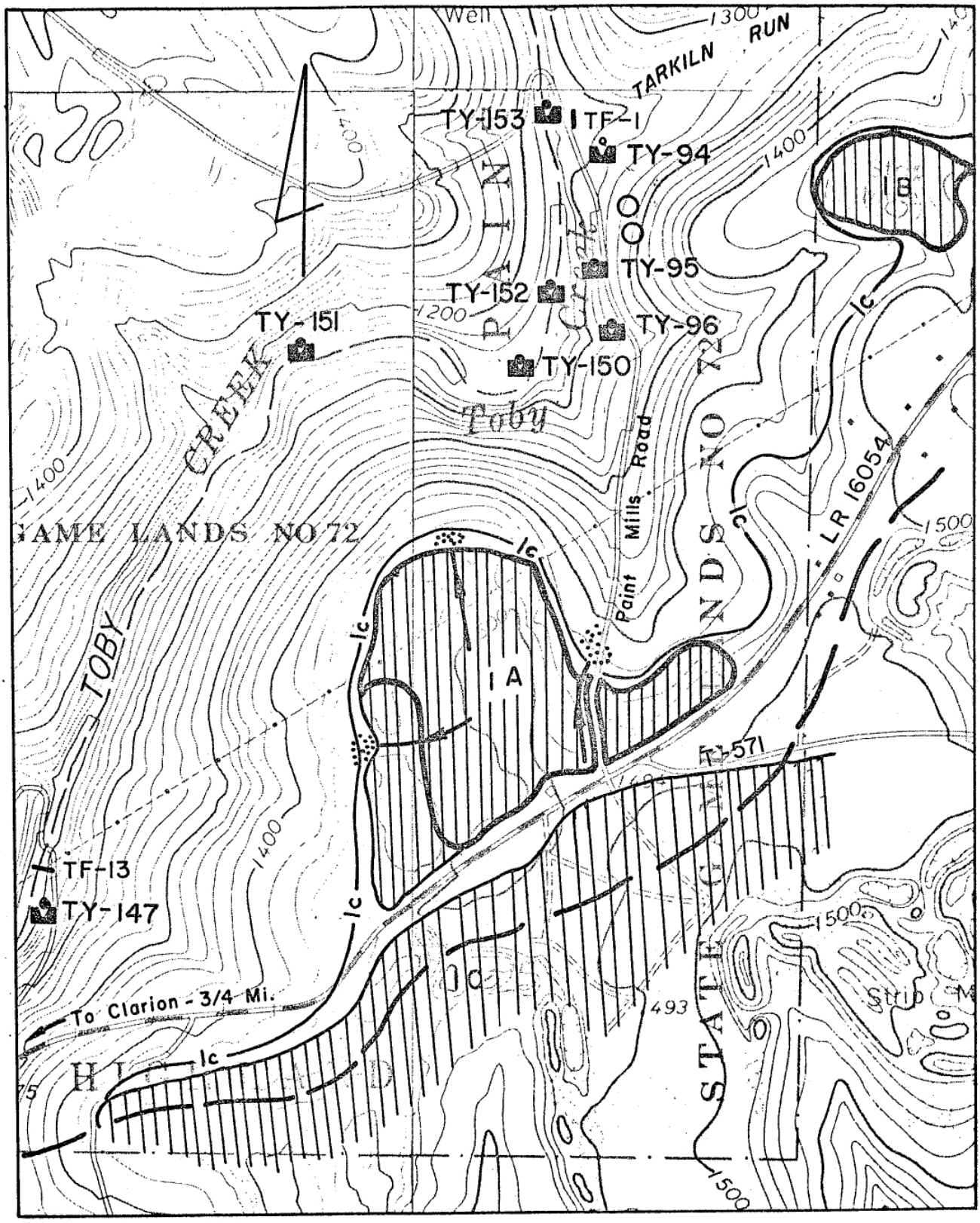


FIG. 6
INDEX TO PROJECT MAPS
TOBY CREEK WATERSHED
CLARION COUNTY



PROJECT MAP NO. 1

SCALE: 1" = 1000'

PROJECT AREA NUMBER 1 Priority No. 2

LOCATION: Approximately 12 miles southwest of Miola, State Game Lands No. 72, Highland Township
This project area consists of 3 strip mines, 2 gas wells and 7 springs.

The area is located on the eastern boundary of the watershed and within the confines of State Game Lands No. 72 (except for strip mine 1B). Acid mine drainage is discharged into Toby Creek approximately 1,000 feet above its confluence with the Clarion River.

The area was monitored by weir numbers TY-94,95,96,147,150,151,152 and 153. The following table represents the water quality recorded by these stations. (The flow is represented as gallons per minute and the iron and acid loads in pounds per day.)

Strip mine 1A has been essentially backfilled but lacks a vegetative cover in many places. The surface of the mine is extremely rocky and permeable. It was determined by the exploratory drilling program that the strip mine serves as the recharge area for the spring monitored by TY-147. The Pennsylvania Game Commission has planted grasses on a portion of the strip mine near L.R. 16054.

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-94	127	274	983	40	97
TY-95	1.4	1.4	3	0.01	0.01
TY-96	38	6.0	27	0.25	1.5
TY-147	130	378	1305	0.46	1.2
TY-150	6.7	1.3	2.9	0.0	0.0
TY-151	2.2	11	36	6.8	20
TY-152	43	60	94	0.9	1.5
TY-153	5.7	3.2	5.8	0.02	0.03
TOTALS	348	732	2451	48.4	121

Strip mine 1B is a small mine located on the northeastern portion of the project area. There are several open drains located along the toe of spoil. The mine, for the most part, lacks a vegetative cover. Strip mine 1C has been completely regraded and planted and discharges no drainage into the watershed.

Weir number TY-94 monitored flows from two abandoned gas wells west of strip mine 1B. Weir numbers TY-95,96,147 and 150 through 153 were located below springs discharging acid mine drainage. These springs may be recharged from the large mine (SL 191-1) north of Toby Creek.

Recommendations for strip mine 1A include minimal regrading with special compaction requirements of the area delineated on the project map. The reclaimed area should receive soil treatment and planting. Water management facilities would include diversion ditches with riprap discharge aprons and clay liners to channel surface runoff over the area. These measures should reduce the flow observed at TY-147.

Strip mine 1-B should receive minimal regrading and soil treatment and planting. No work is recommended for strip mine 1-C.

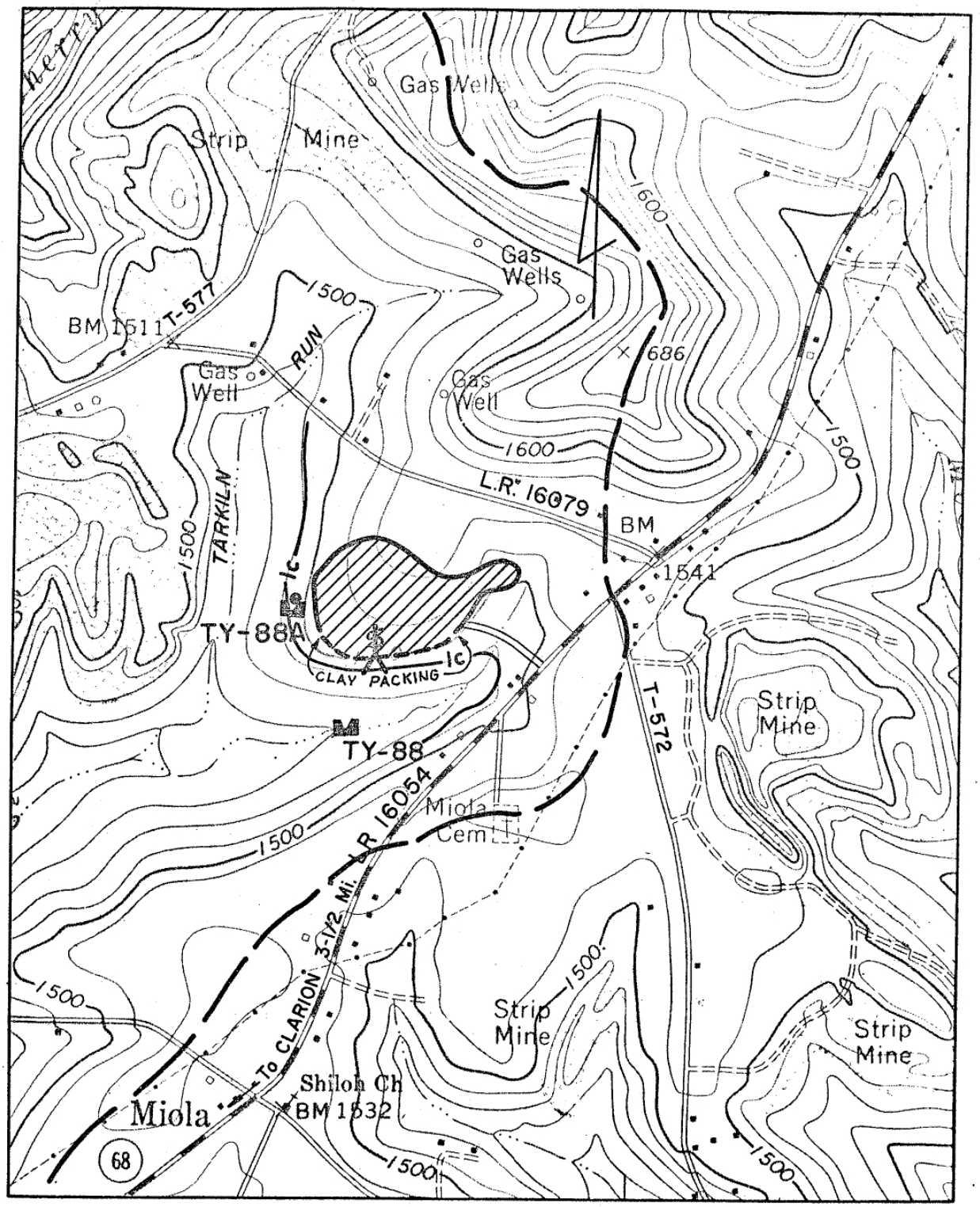
The two gas wells monitored by TY-94 should be plugged. No work is recommended for the springs, but their flows may be reduced upon implementation of reclamation measures on the large strip mine (SL 191-1) north of Toby Creek

ESTIMATED ABATEMENT COSTS

1.	Minimal Regrading	
	Strip Mine 1A	$252,000
	Strip Mine 1B	32,000
2.	Soil Treatment and Planting	
	Strip Mine 1A	72,000
	Strip Mine 1B	16,000
3.	Water Management Facilities	
	Strip Mine 1A	90,000
	Strip Mine 1B	3,000
4.	Gas Well Plugging	30,000
5.	Contingencies	50,000
6.	Engineering	44,000
	TOTAL	$589,000

Estimated Acid Load Abatement - 60%

Cost per pound of acid load abatement - $1,336/lb.



PROJECT MAP NO. 2

SCALE: 1" = 1000'

PROJECT AREA NO. 2 Priority No. 2

LOCATION: Approximately 3/4 mile north of Miola in Highland Township. The project area contains a strip mine and one spring that discharge acid mine drainage into the headwaters of Tarkiln Run.

The area was monitored by weir numbers TY-88 and 88A. The following table represents the water quality produced from these discharges. (The flow is represented as gallons per minute and the iron and acid loads in pounds per day).

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-88	159	407	771	41	77
TY-88A	5.6	0.54	1.2	0.12	0.2
TOTAL	165	408	772	41.1	77.2

The strip mine worked the Upper Clarion coal seam in the early 1970's. The surface is very rocky, permeable and supports very little vegetation. A deep mine opening was removed during the stripping operation. Weir number TY-88 monitored flow in a small stream below the mine.

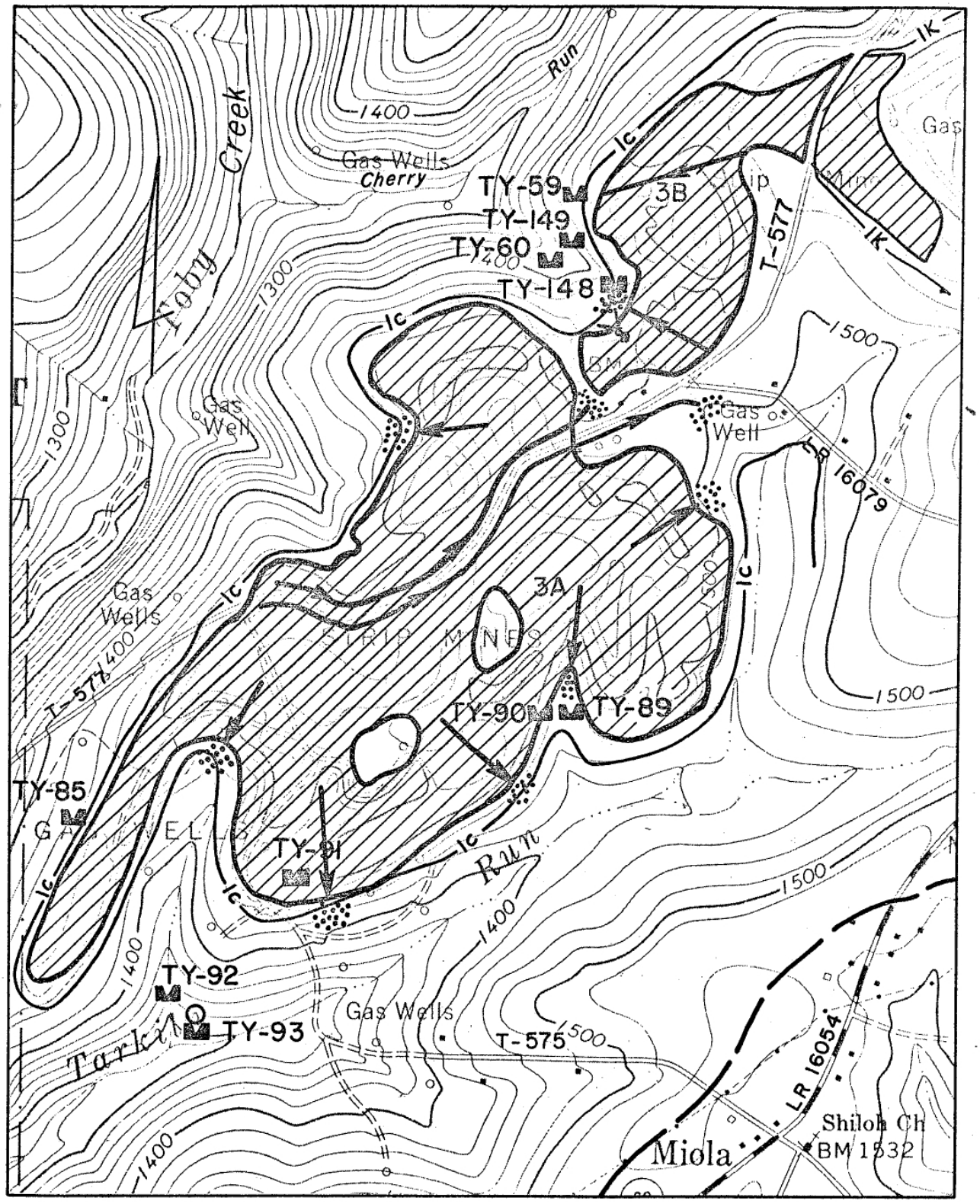
Weir number TY-88A monitored a small spring at the western end of the operation. Recommended abatement measures for this area include clay packing (from under clay) over the toe of the southern end of the strip mine and minimal regrading of the surface with soil treatment and planting. Water management facilities would include a diversion ditch above the area to channel surface water away from the reclaimed area.

ESTIMATED ABATEMENT COSTS

1.	Minimal Regrading	$ 42,000
2.	Soil Treatment and Planting	21,000
3.	Clay Packing	40,000
4.	Water Management Facilities	5,000
5.	Contingencies	11,000
6.	Engineering	12,000
	TOTAL	$131,000

Estimated Acid Load Abatement - 85%

Cost per pound of acid load abatement - $378/lb.



PROJECT MAP NO. 3

SCALE: 1" = 1000'

PROTECT AREA NUMBER 3 Priority No. 1

LOCATION: Approximately one mile northwest of Miola, Highland Township. This project area consists of 2 large strip mines and 1 gas well that discharge acid mine drainage into Tarkiln Run, Cherry Run and Toby Creek.

The area was monitored by weir numbers TY-51, 60, 84, 85, 87, 89 through 93, 148, and 149. The following table represents the water quality produced from these discharges. (The flow is represented as gallons per minute and acid loads in pounds per day.)

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-59	121	1188	8448	62	411
TY-60	51	131	779	0.7	5.5
TY-84	14	432	1728	16	79
TY-85	39	1432	1932	201	386
TY-87	65	9.6	57	0.2	1.4
TY-89	28	1086	2100	115	236
TY-90	8.8	356	619	47	91
TY-91	30	859	1920	73	402
TY-92	36	617	1535	108	229
TY-93	20	413	592	87	139
TY-148	4.6	79	167	4.0	8.3
TY-149	1.3	52	72	2.3	3.4
TOTAL	419	6655	19,950	716	1992

Strip mines, 3A and 3B, operating primarily in the Upper Clarion Coal seam generate tremendous quantities of acid mine drainage. Strip mine 3A is the primary source of pollution to Tarkiln Run. Strip mine 3B adds large amounts of pollutants to Cherry Run. With the exception of Project Area No. 20 (SL 1911), this area is responsible for more pollution than any other site in the Toby Creek Watershed. The area may also serve as the recharge for springs located downslope of the mines along Toby Creek.

Strip mine 3A was operated by the Zacherl Coal Co., Inc. in the late SO's

and early 60's. Mining essentially consisted of the hilltop removal of 30 inches of the Upper Clarion coal seam., The mine has numerous exposed highwalls and depressions, some containing water. The surface is very rocky, pyritic in nature, permeable and virtually barren of vegetation. Acid mine drainage is discharged primarily along the southern periphery of the strip mine into Tarkiln Run and was monitored by weir numbers TY-89, 90, and 92.

Strip mine 3B operated in two coal seams. The western end of 3B was an extension of strip mine 3A in the Upper Clarion coal and was operated by Zacherl Coal Co., Inc. The eastern end of 3B worked the Lower Kittanning coal, though the operator of the mine could not be determined. Drainage seeps through the spoil and emerges at the western end of 3B where it was monitored by weir numbers TY-59, 60, 148, and 149.

A gas well, located to the south of strip mine 3A, was monitored by TY-93.

Recommendation for strip mines 3A and 3B (west of T-577) include strip mine reclamation of the highwalls and adjacent spoil piles and minimal regrading of the entire remaining surface with special surface compaction requirements. Soil treatment and planting along with diversion ditches and riprap channels to divert surface runoff will be needed to complete the reclamation.

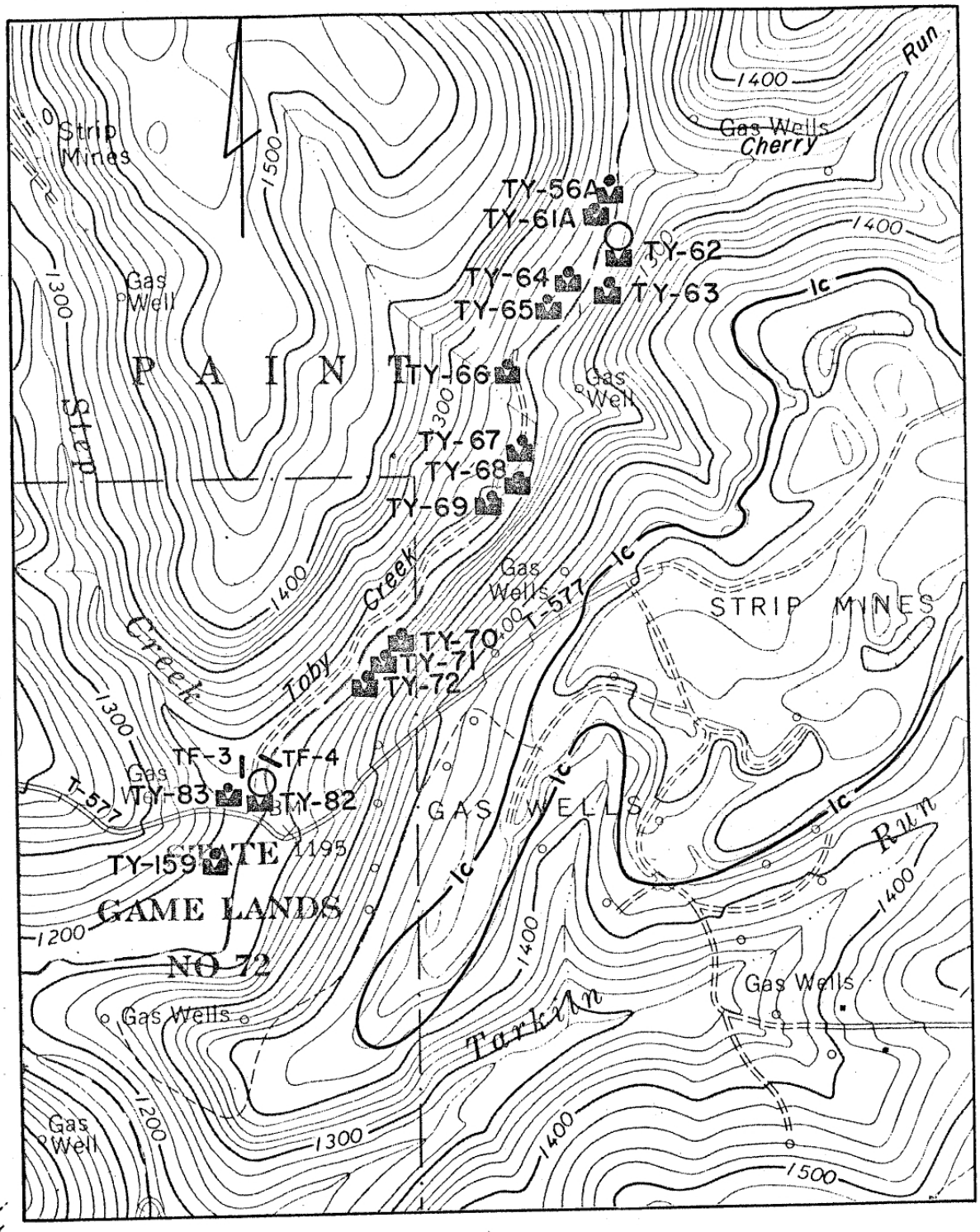
It is also recommended that the gas well at TY-93 be plugged.

ESTIMATED ABATEMENT COSTS

1.	Strip Mine Reclamation	
	Strip Mine 3A	$ 310,000
	Strip Mine 3B	163,000
2.	Minimal Regrading	
	Strip Mine 3A	975,000
	Strip Mine 3B	125,000
3.	Soil Treatment and Planting	
	Strip Mine 3A	203,000
	Strip Mine 3B	50,000
4.	Water Management Facilities	
	Strip Mine 3A	250,000
	Strip Mine 3B	61,000
5.	Gas Well Plugging	15,000
6.	Contingencies	216,000
7.	Engineering	161,000
	TOTAL	$2,529,000

Estimated Acid Load Abatement - 80%

Cost per pound of Acid Load Abatement - $475/lb.



PROJECT MAP NO. 4

SCALE: 1" = 1000'

PROJECT AREA NUMBER 4 Priority No. 1

LOCATION: Approximately 1, miles northwest of Miola, on Toby Creek between Highland and Paint Townships. This project area consists of 2 gas wells and 14 springs that discharge acid mine drainage directly into Toby Creek.

The area was monitored by weir numbers TY-56A, 61A, 62 through 72, 82, 83, and 159. The following table represents the water quality recorded by these stations. (The flow is represented in gallons per minute and the iron and acid loads in pounds per day.)

Two flowing gas wells were monitored by TY-62 and 82. The remainder of the weirs monitored springs. The recharge area for the springs on the west side of Toby Creek is not known. The springs on the east side of Toby Creek may be recharged from the large strip mine of Project Area Number 3.

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-56A	54	170	510	47	199
TY-61A	13	1.1	1.6	0.25	0.5
TY-62	61	187	371	53	161
TY-63	13	48	141	16	54
TY-64	11	31	73	8.4	96
TY-65	17	58	354	23	148
TY-66	48	231	504	108	192
TY-67	8.4	2.6	8.2	1.4	7
TY-68	12	1.9	11	0.6	4.5
TY-69	6.8	11	36	5.1	17
TY-70	3.1	34	74	0.34	0.8
TY-71	4.4	53	94	0.64	1.2
TY-72	4	49	.53	0.55	2.3
TY-82	41	538	1008	258	548
TY-83	9.8	33	145	0.36	1.2
TY-159	9	32	36	0.07	0.1
TOTAL	316	1481	3520	523	1433

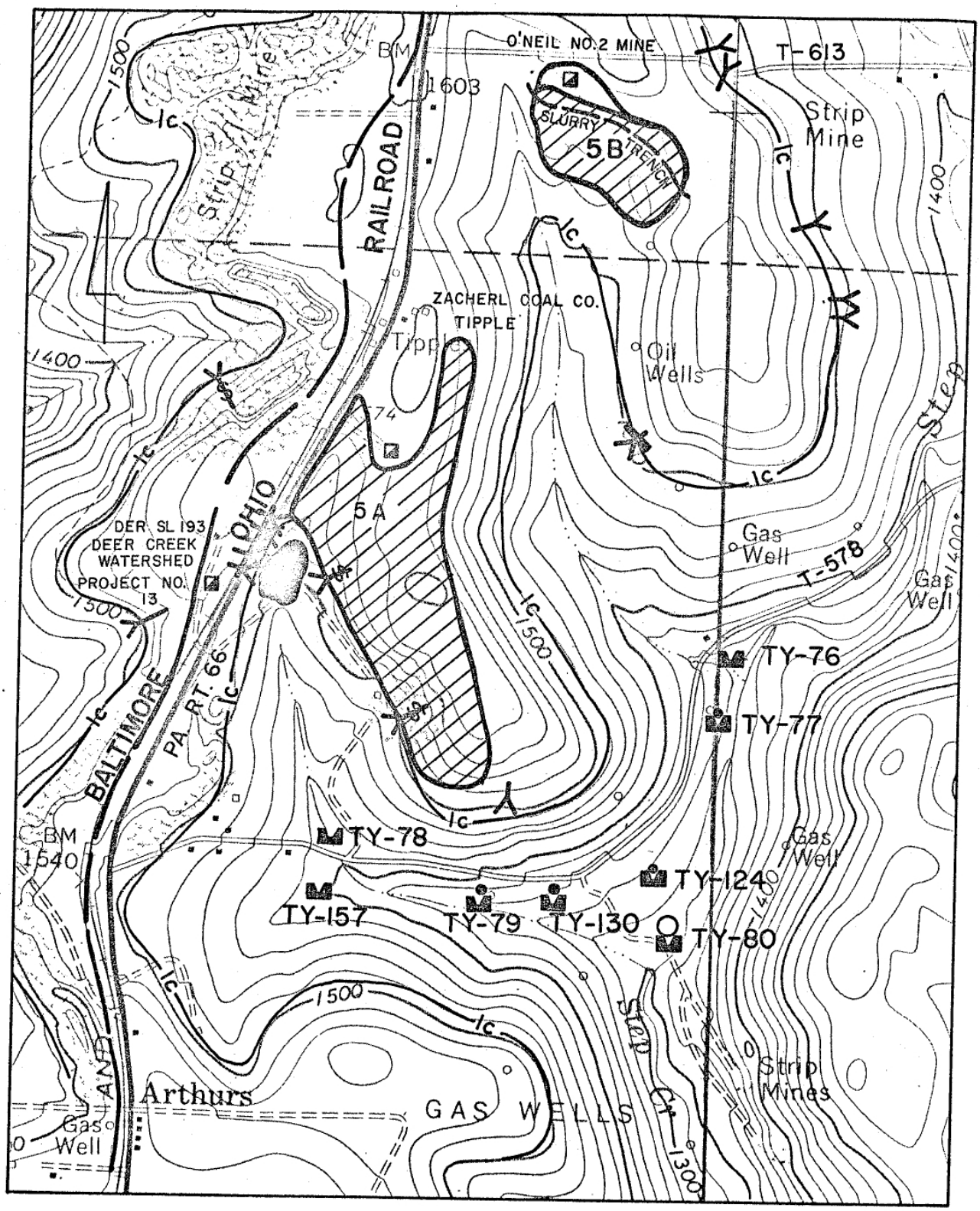
It is recommended that the two gas wells at TY-62 and 82 be plugged. No work is recommended for the springs. It is felt that the flow from the springs on the east side of Toby Creek may be reduced upon implementation of the abatement measures in Project Area Number 3.

ESTIMATED ABATEMENT COSTS

1.	Gas Well Plugging	$30,000
2.	Contingencies	3,000
3.	Engineering	3,300
	TOTAL	$36,300

Estimated Acid Load Abatement - 45%

Cost per pound of acid load abated $55/lb.



PROJECT MAP NO. 5

SCALE: 1" = 1000'

PROTECT AREA NUMBER 5 Priority No. 1

LOCATION: Immediately north of Arthurs in Paint Township. This project area consists of 2 strip mines, several deep mine openings with associated refuse piles, a gas well and an active coal processing facility. Acid mine drainage from this area discharges into Step Creek.

The area was monitored by weir numbers TY-76 through 80, 124, 130, and 157. The following table represents the water quality recorded at these stations. (The flow is shown in gallons per minute and the iron and acid loads in pounds per day.)

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-76	517	1751	5390	165	409
TY-77	4.5	0.35	0.9	0.01	0.04
TY-78	175	1757	5717	119	338
TY-79	4.6	23	98	0.06	0.30
TY-80	48	386	1204	159	231
TY-124	5.6	9.2	17	1.4	4.3
TY-130	9.1	7.4	19	0.25	0.5
TY-157	18	9.6	26	0.1	0.3
TOTALS	782	3944	12 470	449	984

Strip mine 5A has been partially backfilled and is presently being operated as a. gravel pit by Zacherl Coal Company. Two deep mines have been stripped out along the southwestern toe of this strip.

The area around strip mine 5B is a major source of pollution. Water quality in the tributary to Step Creek which flows along the western edge of the strip mine has been affected by the stripping. A fan shaft associated with the O'Neil No. 2 Mine of Project Area No. 6 and Deer Creek Project (SL 193) No. 14 is located above the highwall. An inspection of W.P. A. maps of the deep mine reveal that strip mine 5A intercepted the old works. Flows from this area are monitored by TY-76.

The active coal tipple along Route 66 is operated by the Zacherl Coal Co.

It was determined that the facility contributes significant "slug" acid loads to the watershed after periods of rainfall. Though not sustained acid loads, from four (4) samples collected it was found that the tipple produces an average of 679 pounds per day of acid during rainfall periods. The tipple utilizes a washing operation and has treatment facilities for the wastewater. Sediment

from the ponds are transported to an adjacent strip mine for disposal. The sources of pollution result from surface runoff over coal storage piles, the strip pit containing the coal fines and the waste coal randomly distributed around the tipple site. No facilities (diversion ditches) are present to collect these flows and convey them for treatment and sedimentation. A sandstone quarry with mill is also located adjacent to the tipple.

A deep mine complex is located under Route 66 between Arthurs and the tipple. Large coal refuse piles are associated with this complex. Discharges from this area are monitored by TY-78. In addition, a large holding pond is present at this site and discharges water to TY-78.

It is recommended that strip mine 5B have a slurry trench installed along the outcrop in conjunction with strip mine reclamation. This work should be done during the same time when work on Project Area No. .6 and Project Area No. 14 (Deer Creek Watershed, SL 193) is taking place.

The deep mine openings under Route 66 should be sealed. The opening on the west side should be sealed at the same time (Project No, 13, Deer Creek Watershed SL.193). The coal refuse should be excavated and transported to an adjacent strip pit for disposition. The gas well monitored by TY-80 should be plugged. No work is recommended for strip mine 5A.

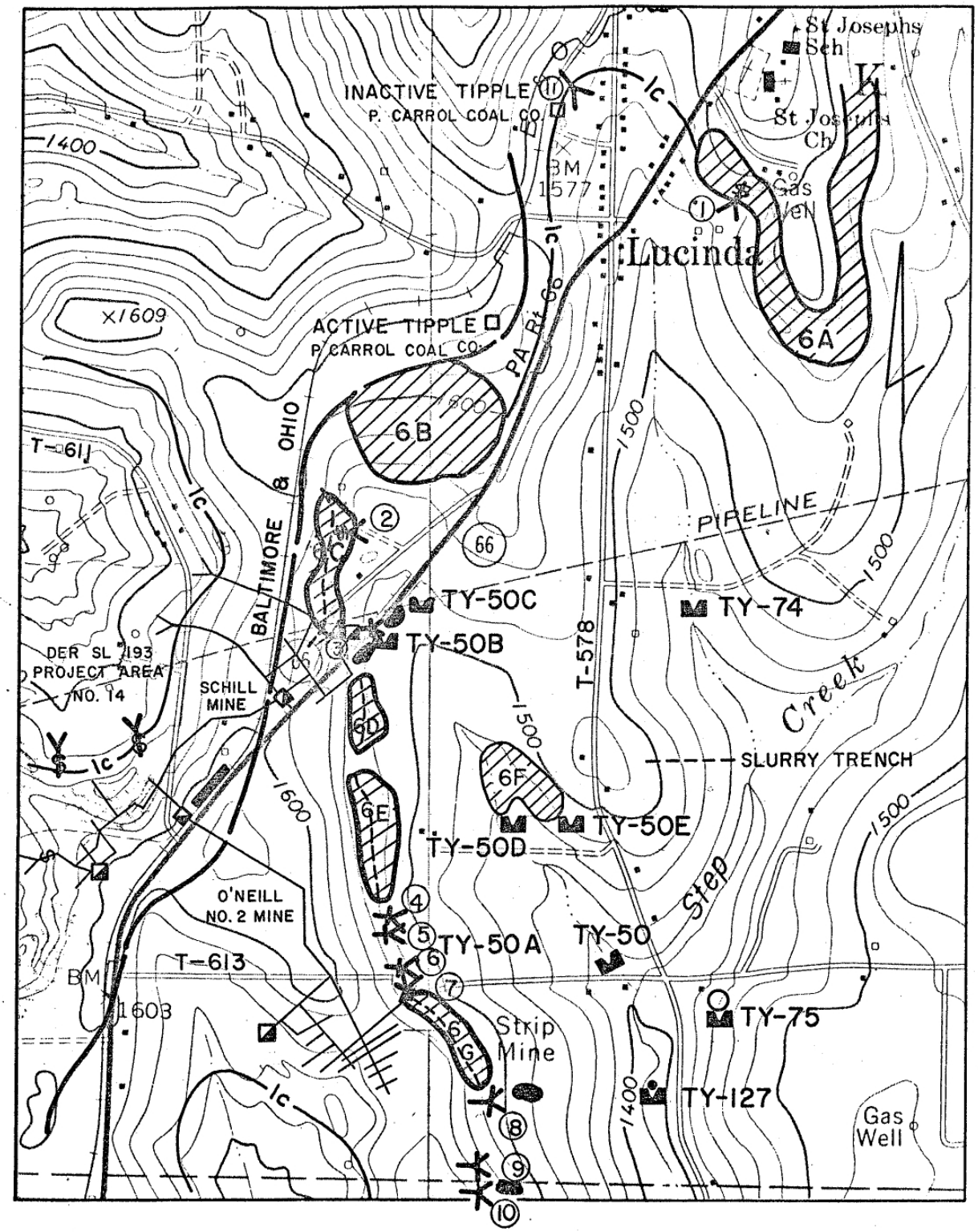
It is recommended that the owners of the active coal tipple be advised by representatives of the Department of Environmental Resources relative to corrective and/or abatement actions that are required at this facility.

ESTIMATED ABATEMENT COSTS

1.	Strip Mine Reclamation	$ 80,000
2.	Slurry Trench Installation	128,000
3.	Soil Treatment and Planting	16,000
4.	Water Management Facilities	6,000
5.	Deep Mine Sealing	125,000
6.	Coal Refuse Disposal	40,000
7.	Gas Well Plugging	15,000
8.	Contingencies	41,000
9.	Engineering	37,000
	TOTAL	$488,000

Estimated Acid Load Reduction - 75%

Cost per pound of acid load reduction - $165/lb.



PROJECT MAP NO. 6

SCALE: 1" = 1000'

PROJECT AREA NO. 6 Priority No. 1

LOCATION: Just southwest of Lucinda, Knox Township. The project area consists of 7 strip mines, several deep mine complexes, 1 inactive coal tipple, 1 flowing gas well and 1 spring. Acid mine drainage is discharged into Step Creek.

The area was monitored by Weir Numbers TY-,50 through 50E, 74, 75, and 127. The following table represents the water quality recorded at these station.

(The flow is shown as gallons per minute and the iron and acid loads in pounds per day.)

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-50	271	571	2626	67	331
TY-50A	12	101	306	19	58
TY-50B	6.5	31	54	3.7	6.6
TY-50C	13	26	41	2.3	3.9
TY-50D	17	14	19	0.27	0.50
TY-50E	6.5	3.8	7.8	0.10	0.20
TY-74	119	73	333	11	56
TY-75	85	339	749	202	397
TY-127	7.3	4.7	12	0.005	0.03
TOTAL	537	1163	4148	305	853

Strip mine 6A has not been completely backfilled or planted although some reclamation work has been performed. The strip is discharging at the site of a stripped out deep mine and the water was monitored as part of the flow of Weir TY-74, which was located in a small stream south of Lucinda. Strip mine 6B has been completely backfilled, graded, and planted and is not discharging any mine drainage.

Strip mines 6C and 6D were operated during the period of the study by Colt Resources, Inc. permit #3774SM16. Both were backfilled and graded during February 1975. In the course of their operation, they stripped the entrance and part of the workings of the Schill deep mine. No evidence of a discharge was observed from this operation.

Strip mines 6E and 6G have not been backfilled although some revegetation has occurred. Water pools occur between the highwall and the spoil piles but neither mine seems to discharge any water on the surface.

Strip mine 6F was a clay-strip operation rather than a coal-strip operation.

A coal seam was exposed at the surface but the pit was approximately 25 feet deep. Weir number TY-50E monitored water coming from the coal seam. Weir number TYSOD monitored the flow from a ventilation pipe of an underground clay mine. It only discharged after periods of heavy rainfall. There is evidence of ground movement due to flooding of this clay mine.

The deep mine complexes in the area include the Schill Mine and O'Neill Number 2 mine. These mines are interconnected and the extent of mining is no doubt greater than what is shown on the map. The outcrops of the deep mining have been frequently intercepted by strip mining and would be difficult to seal. All of the openings are probably interconnected.

The entrance of deep mine 3 was covered over during the construction of Route 66 but a pipe was laid under the road and the flow from it was monitored by TY-50B. A large refuse pile is associated with this opening and probably served as the haulageway for the Schill mine.

Deep mine openings 4 and 5 discharged water only during periods of high rainfall. Deep mine openings 6 and 7 both leaked significant amounts of mine drainage that was monitored by TY-50A. Of these 2 mines, the major discharge was. from opening 6. Mine openings 6 and 7 probably served as water courses for the O'Neill No. 2 Mine.

Deep mine openings 8, 9, and 10 only discharged water during high rainfall periods. There was no consistent flow from any of them. Mine openings 8 and

9 were probably haulageways for the O'Neill Mine as indicated by the large coal refuse piles associated with them. A shaft to the O'Neill mine between Rt. 66 and T-611 also has a large "gob pile" adjacent to it.

A flowing gas well was located above Weir TY-75 and was within the area of the proposed drilling program. It was determined that the small, ups lope strip mine probably was not the source to this well.

An abandoned coal tipple, operated by the P. Carroll Coal Company, is located in Lucinda. Deep mine opening No. 11 was located above the tipple, but was not discharging. Six (6) samples were taken below the site during rainfall periods. Though not sustained acid loadings, an average of 244 pounds. per day of acid were added to the watershed after rainfall periods. The P. Carroll Coal Co. has since moved their coal processing operations to a new site on a hill south of Lucinda in the Deer Creek Watershed.

Recommendations for the mine complexes include deep mine sealing of all

applicable openings, slurry trenches for strip mines 6C, D, E, and 5, and coal refuse disposal where necessary. Exploratory drilling would be a prerequisite before any abatement work could be undertaken. The work would have to be done simultaneously with abatement measures required for Project Area No. 5 and - Project Area No. 14 of DER SL 193, Deer Creek Watershed.

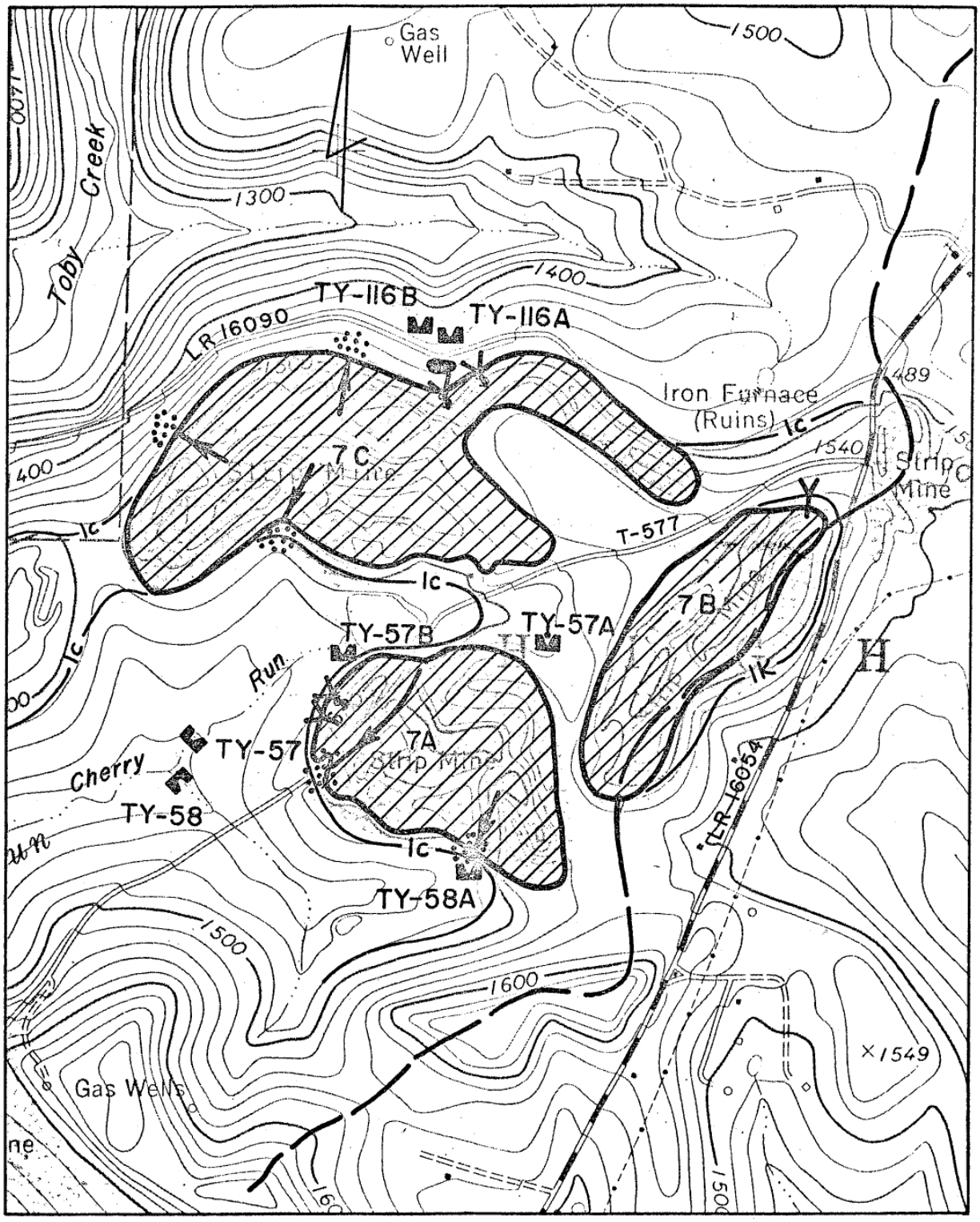
The gas well at TY-75 should be plugged. Corrective actions for the inactive coal tipple are solely the responsibility of the owners. It is felt that the site be thoroughly cleaned up and all waste material properly disposed of.

ESTIMATED ABATEMENT COSTS

1.	Deep Mine Sealing	$200,000
2.	Slurry Trench Installation	360,000
3.	Strip Mine Reclamation	25,000
4.	Soil Treatment and Planting	5,000
5.	Exploration Drilling	50,000
6.	Coal Refuse Disposal	50,000
7.	Gas Well Plugging	15,000
8.	Contingencies	71,000
9.	Engineering	59,000
	TOTAL	$835,000

Estimated Acid Load Reduction - 50%

Cost per pound of acid load reduction - $1,436/lb.



PROJECT MAP NO. 7

SCALE: 1"= 1000'

PROJECT AREA NUMBER 7 Priority No. 2

LOCATION: Approximately one mile southwest of Helen Furnace, Highland Township

This project area consists of 3 strip mines, 4 deep mine openings and 1 spring. Acid mine drainage from the area discharges into Cherry Run and directly into Toby Creek.

The area was monitored by weir numbers TY-57, 57A, 57B, 58, 58A, 116A, and 116B. The following table represents the water quality recorded by these stations. (The flow is shown in gallons per minute and the iron and acid loads in pounds per day.)

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-57	272	306	916	1.9	3.7
TY-57A	3.7	2.8	4.5	0.02	0.04
TY-57B	4.0	14	22	0.06	0.10
TY-58	600	76	193	2.4	5.8
TY-58A	7.5	3	3.7	0.10	0.10
TY-116A	14	23	55	0.12	0.40
TY-116B	16	48	120	0.12	0.20
TOTAL	917	473	1314	4.7	10.3

Strip mine 7A operated in the Lower Clarion coal seam. Seepage along the western toe was monitored by TY-57B. Two small deep mines have been also stripped out in this area. An open cut in the spoil in the southern end of the mine was monitored by TY-58A. The remainder of the mine was poorly backfilled but revegetation has been extensive.

Strip mine 7B,located above the iron furnace ruins, worked the Lower Kittanning coal seam. The mine was not backfilled, but was not found to be discharging acid mine drainage.

Strip mine 7C was discharging at several places along the northern edge of the mine. Weir number TY-116A monitored flow from two stripped out deep mines. A large gob pile is associated with these openings. Weir number TY-116B monitored water that flowed from a clay pipe along L.R. 16090 having its origin from strip mine 7C. Reclamation of this mine was poor, leaving several highwalls, surface depressions, and many areas barren of vegetation. One highwall section of this mine revealed the presence of the Vanport limestone. The limestone and its iron ore was mined for use in making iron at the furnace adjacent to 7C in the 1800's.

Weir number TY-57A monitored the flow from a spring located between the strip mines.

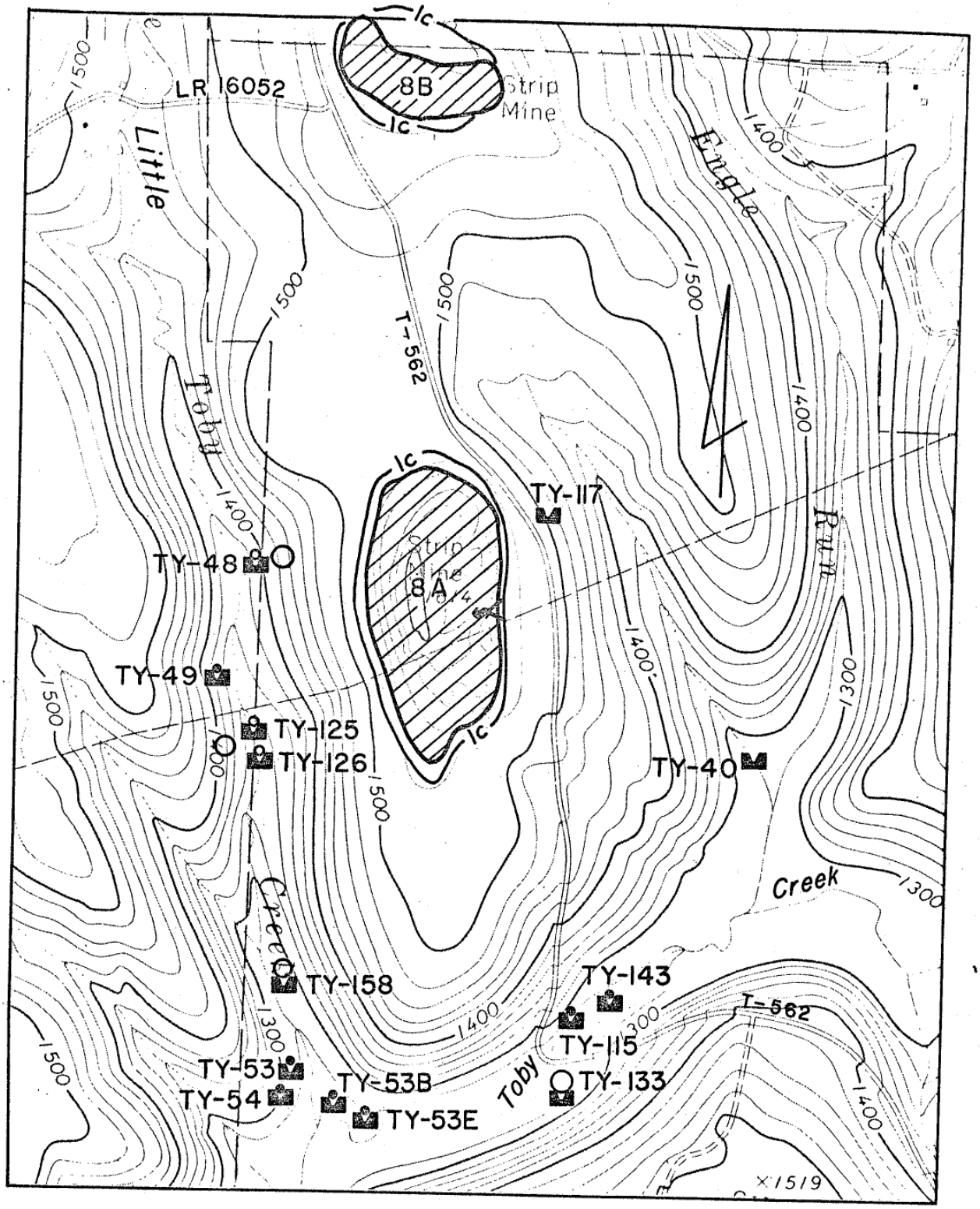
Recommendations for strip mine 7A include strip mine reclamation, soil treatment and planting and riprap channels with diversion ditches. Strip mine 7C requires the same reclamation procedures as 7A, but the burial of the coal refuse in spoil is also needed. No work is recommended for strip mine 7B.

ESTIMATED ABATEMENT COSTS

1.	Strip Mine Reclamation	
	Strip Mine 7A	$ 255,000
	Strip Mine 7C	500,000
2.	Soil Treatment and Planting	
	Strip Mine 7A	51,000
	Strip Mine 7C	100,000
3.	Water Management Facilities	
	Strip Mine 7A	81,000
	Strip Mine 7C	74,000
4.	Coal Refuse Burial	
	Strip Mine 7C	20,000
5.	Contingencies	108,000
6.	Engineering	87,000
	TOTAL	$1,276,000

Estimated Acid Load Abatement - 75%

Cost per pound of acid load abated - $3,600/lb.



PROJECT MAP NO. 8

SCALE: 1"=1000'

PROJECT AREA NUMBER 8 Priority No. 2

LOCATION: Approximately 1, miles east of Lucinda, Knox and Highland Townships

This project area consists of 2 strip mines, 1 deep mine opening, 5 gas wells and 7 springs. Acid mine drainage is conduced primarily into Engle Run, Little Toby Creek and directly into Toby Creek.

The area was monitored by weir numbers TY-40, 48, 49, 53, 53B, 53E, 54, 115, 117, 125, 126, 133, 143, and 158. The following table represents the water quality recorded by these stations. (The flow is shown in gallons per minute and the acid and iron loads in pounds per day.)

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-40	334	172	400	9.5	24
TY-48	5.1	20	43	12	35
TY-49	11	3.8	8.4	4.2	30
TY-53	27	15	52	18	3.2
TY-53B	15	1.4	2.4	0.2	0.08
TY-53E	27	0.2	0.5	8.6	37
TY-54	67	23	95	0.92	42
TY-115	34	8.9	24	0.09	0.30
TY-117	3.8	30	58	1.2	2.1
TY-125	42	160	252	71	150
TY-126	11	39	98	7	29
TY-133	2.8	0.31	1.1	0.46	1.0
TY-143	1	0.15	0.20	0.003	0.005
TY-158	4	22	36	7.4	9.4
TOTAL	585	496	1071	124	363

Strip mine 8A was discharging at several places along the toe and was monitored by TY-117. A small deep mine was stripped out south of TY-117. Some backfilling was done on the mine but many spoil piles and surface depressions remain. Some revegetation has taken place but many barren areas remain.

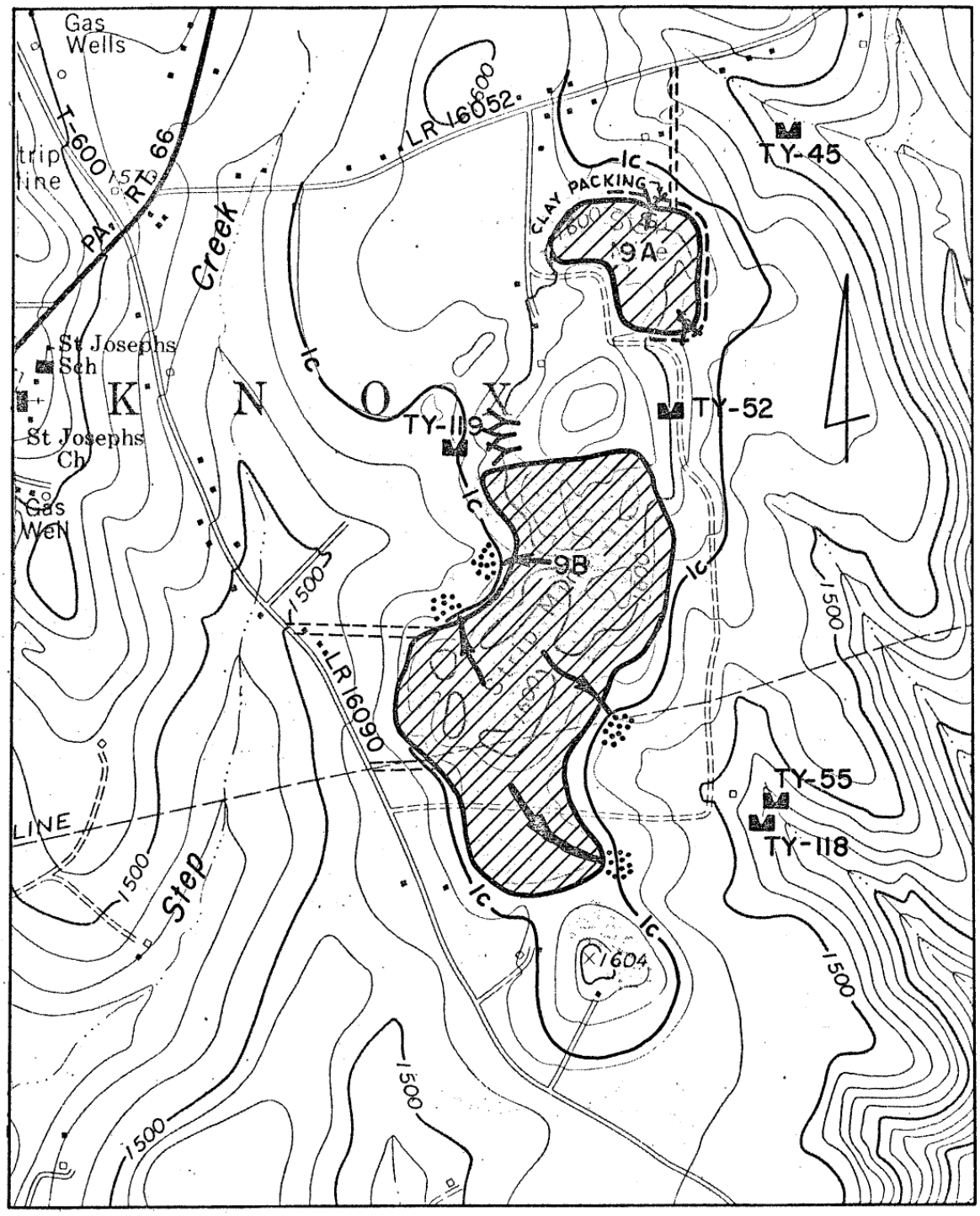
Strip mine 8B was not backfilled, leaving a highwall along its entire length. Water pools between the highwall and the spoil where it drains at the southeast corner and was monitored by TY-40.

Flowing gas wells were monitored by TY-48, 125, 126, 133, and 158. Water flowing from springs was monitored by TY-49,,53, 53B, 53E, 54, 115, and 143.

Recommendations for strip mines 8A and 8B include strip mine reclamation and soil treatment and planting. Gas wells at TY-48, 125, 126, and 158 should be plugged. The springs below the strip mines may improve upon the implementation of the abatement measures at those sites.

ESTIMATED ABATEMENT COSTS

1.	Strip Mine Reclamation	
	Strip Mine 8A	$230,000
	Strip Mine 8B	70,000
2.	Soil Treatment and Planting	
	Strip Mine 8A	45,000
	Strip Mine 8B	14,000
3.	Water Management Facilities	
	Strip Mine 8B	5,000
4.	Gas Well Plugging	60,000
5.	Contingencies	43,000
6.	Engineering	38,000
	TOTALS	$505,000
	Estimated Acid Load Abatement - 70%	
	Cost/lb. of Acid Load Abated $1454/lb.	



PROJECT MAP NO. 9

SCALE : 1"= 1000'

PROJECT AREA NUMBER 9 Priority No. 3

LOCATION: Approximately one mile east of Lucinda, Knox Township

This project area consists of 2 strip mines and 5 deep mine openings. The area discharges acid mine drainage into Step Creek.

The area was monitored by weir numbers TY-45, 52, 55, 118, and 119. The following table represents the water quality recorded by these stations. (The flow is shown in gallons per minute and the acid and iron loads in pounds per day.)

Weir Number	Avg. Flow	Avg. Acid	Max. Acid	Avg. Iron	Max. Iron
TY-45	13	23	64	0.25	0.70
TY-52	9.2	39	143	4.7	9.7
TY-55	34	69	213	1.6	4.8
TY-118	1	4.5	4.5	0.1	0.1
TY-119	1.7	10	26	0.93	2.3
TOTALS	59	146	451	7.6	17.6

Strip mine 9A has been partially backfilled and planted; however, many depressions and unvegetated areas exist. Deep mine openings on the northern and southern perimeter of the mine have been stripped out. The openings were probably associated with the three portals monitored by TY-119. The northern opening was monitored by TY-45 while TY-52 recorded the flow at the south opening.

Strip mine 9B lacks a vegetative cover and has been poorly backfilled and graded. Roadways leading to the strip mine are covered with coal refuse. Flows from 9B are monitored by TY-118 and 55. Recommendations for 9A include strip mine reclamation and clay: packing of the outcrop of the mine. Diversion ditches and soil treatment and planting will be needed to complete the reclamation. The coal refuse covering on the roads should be transported to the reclamation site for burial.

Strip mine 9B should receive strip mine reclamation soil treatment and planting and diversion ditches with riprap channels. The coal refuse from the roads and the mines should be transported to the reclamation site for burial.

ESTIMATED ABATEMENT COSTS

1.	Strip Mine Reclamation	
	Strip Mine 9A	$440,000
	Strip Mine 9B	70,000
2.	Soil Treatment and Planting	
	Strip Mine 9A	14,000
	Strip Mine 9B	85,000
3.	Water Management Facilities	
	Strip Mine 9A	80,000
	Strip Mine 9B	4,000
4.	Coal Refuse Burial	10,000
5.	Clay Packing	80,000
6.	Contingencies	78,000
7.	Engineering	66,000
	TOTAL	$927,000

Estimated Acid Load Abatement - 80%

Cost per pound of acid load abated - $7,936/lb.