VI THE ABATEMENT PLAN

THE ABATEMENT PLAN

1.0 General

1.1 Method Discussion

Three possible solutions to an acid deep mine discharge are (1) control the discharge at its source, (2) diversion to another location, and (3) treatment.

Ideally, controlling the discharge at its source can be accomplished in several ways, (1) by completely flooding the mine, (2) by preventing ground water and runoff from entering the mine, and (3) by filling the mine with grout or clay.

Within the study area, controlling the discharge at its source is not feasible through complete flooding using mine seals. The ideal conditions: sound barriers, no subsidence or roof fracturing, and good thick barriers near the outcrop, are not present. Filling the mines with grout or clay would be economically impractical because of the large areal extent.

Because roof fractures and subsidence are present, it is felt that reclaiming the outcrop, by regrading and by stripping beyond the subsidence zone, where possible, will substantially reduce the amount of ground water and runoff that can enter the mine, thus significantly reducing the amount of discharge.

Mine seals would not flood the mines completely and are used here as a method of diverting the mine water to another section of the pool. The purpose of diverting the AMD is to move the highly acid water from the southwestern sector of the mine pool near the outcrop into contact with less acidic to alkaline waters in the central and northeastern sectors of the pool.

This mixing (from preliminary testing) indicates that some portion of the iron will be deposited within the mine, improving the quality of the AMD before it flows from the mine and lessening the amount of treatment needed.

The treatment phase includes settling ponds and lime addition, if necessary, to bring the AMD within acceptable water standards.

The addition of certain caustic wastes into the mine pool should also be considered to improve the quality of the AMD before it flows from the mine.

The abatement plan for the Southern Latrobe Syncline Mine Pool was formulated using the following considerations as guidelines.

<u>GUIDELINES FOR DEVELOPMENT OF ABATEMENT PLAN</u>

1. The most economically feasible alternative should be selected.
2. Maintainence requirements and costs should be minimized.
3. Disturbance of natural and revegetated cover should be minimal as possible.
4. Recoverable natural resources should be completely exhausted prior to reclamation.
5. The abatement should be as close as feasible to the source.
6. Modifications of the present flow regimes of surface streams should be minimal.
7. The abatement method selected should be aesthetically compatable with its environment.

1.2 Abatement Scheme

The proposed approach to abating the AMD from the Southern Latrobe Syncline includes surface mine reclamation, deep mine seals, mine drainage diversion, and construction of settling ponds. The general scheme includes a recommended time schedule of construction

(See figures VI-1 and VI-2). This time schedule should be followed as closely as possible. This will allow evaluation of each major phase of the abatement plan and could serve to modify the proposed implementation of succeeding phases.

The Monitor I, II and III Phase designations (See Figure VI-1) are proposed mainly for convenience. The initial monitoring required will be flow measurements on discharges M101, M102, M103, M63, M62A, M62B, and M62C. The results of this monitoring will be utilized to evaluate the effectiveness of the outcrop reclamation and determine the size of flume required to divert these discharges to Buffalo Run. After construction of the flume, this phase will continue at M05 and M104 to develop criteria for sizing the pipe required to divert these flows to 1206 on Wilson Run. Phase II monitoring will consist of quantity and quality measurements at Discharges M06 (plus others) M07, M08, M08A, M09, M10, M11, and M12. This information will be used to develop design criteria for settling ponds 1, 2 and 3. Phase III monitoring of quantity and quality of the effluent from ponds 1, 2 and 3 can begin as soon as one of the ponds is complete. Data gathered during this phase will determine the need for any lime addition and the best location to introduce the lime. If Phase VI, Caustic Waste Addition, is implemented, the Phase III monitoring will provide information on its effectiveness.

As indicated on the proposed abatement plan time schedule the initial phase of the abatement plan includes reclamation of approximately 1050 acres of abandoned surface mines along the outcrop of the Pittsburgh seam. Included in the reclamation is the construction of clay seals in deep mine openings prior to backfilling and regrading of the surface mines. In areas of low cover, it may be

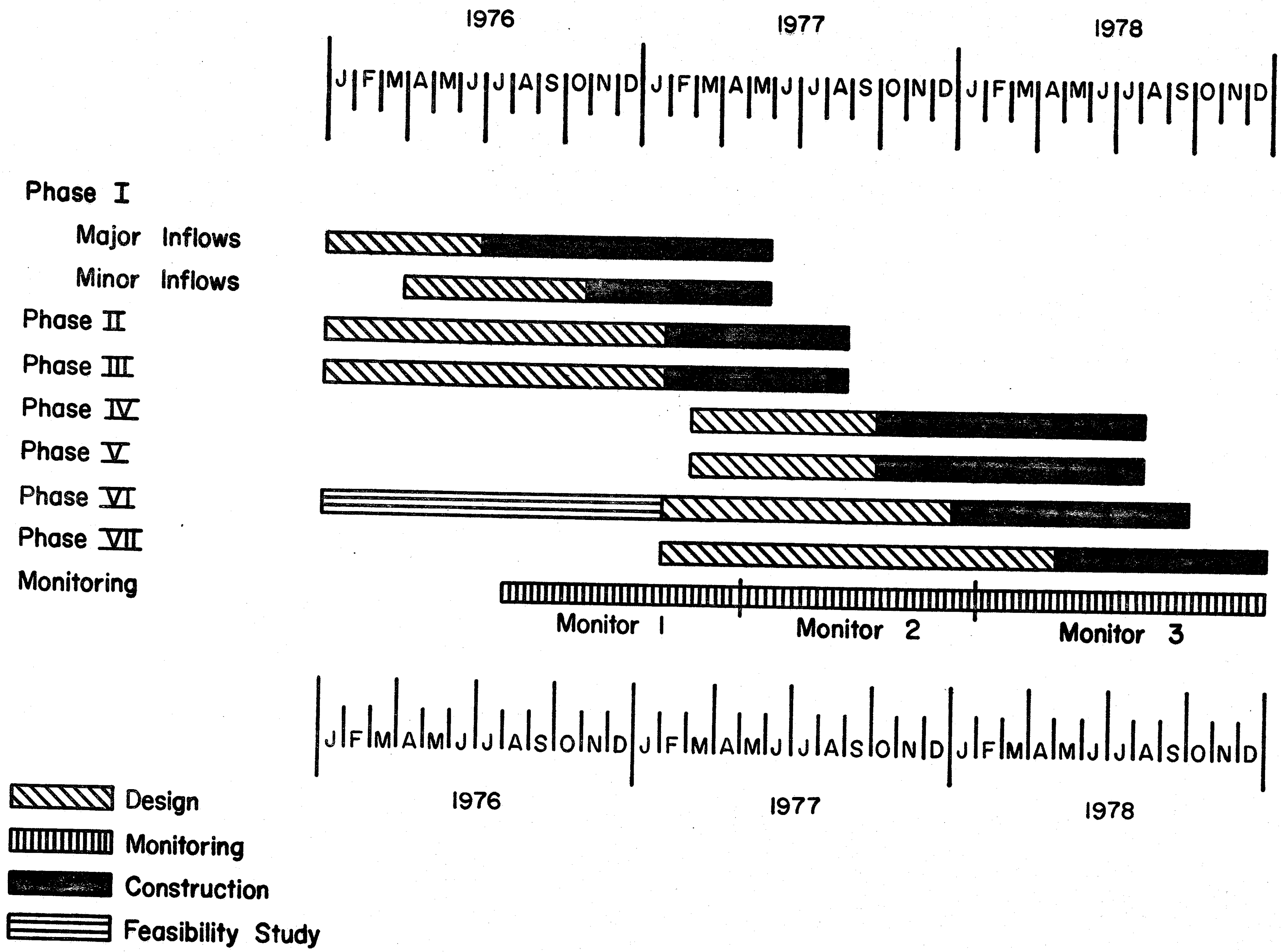


Figure VI-1. Proposed Abatement Plan Time Schedule

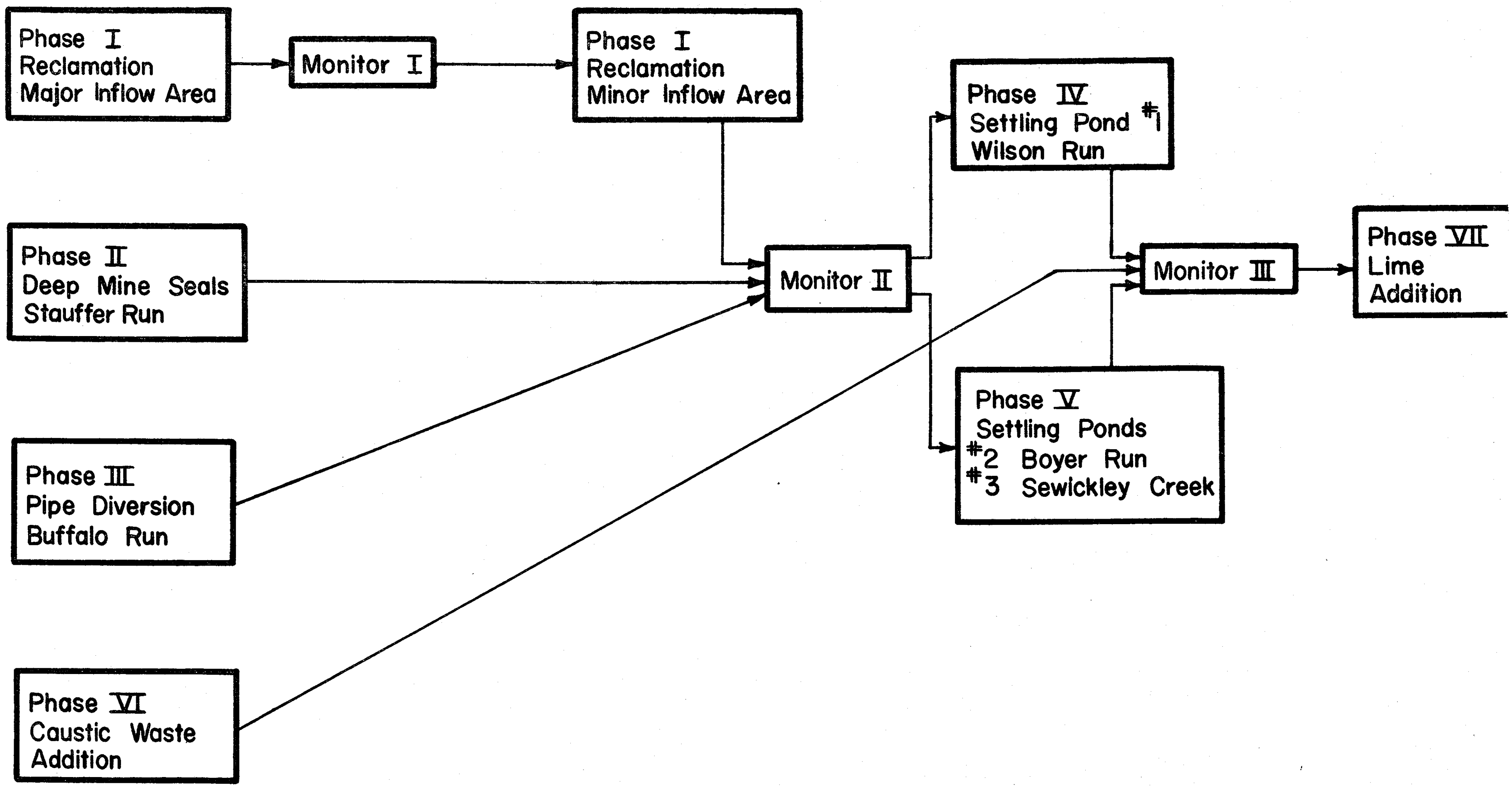


Figure VI-2 Abatement Plan Flow Diagram

necessary to remove an additional cut from the highwall to provide more substantial cover, remove subsidence holes from above the existing highwall, and provide less weathered abutments for the clay seals. The cost benefit analyses were determined based on the known or mapped openings. It is not within the scope of this report to determine the total number of openings in each area. However, based on conditions observed in the field and published information reviewed, it would be conservative to assume at least one unknown opening exists for every known one. For purposes of establishing cost benefit analyses on estimated inflow reduction and estimated acid load reduction, it was assumed that 100% of the Surface Water Remaining (Run off) for the drainage area above each proposed reclamation area and that on the disturbed area enters the outcrop. Surface Water Remaining was calculated from annual rainfall figures of the Derry and Donegal Stations and the Method Evapotranspiration (Chow, 1964). The estimated acid reduction was calculated from the nearest reasonable discharge following implementation of Phases II, III and IV.

The surface mine reclamation and clay seals in the major and minor inflow areas (See Tables VI-3 and VI-5) could reduce inflow to the mine pool by an estimated 4,750,000 gallons per day. This inflow reduction could lower the mine pool and may change the quantity and quality of AMD from the pool. Reclamation of the outcrop areas may reduce the inflow to the pool sufficiently to eliminate the need for enlarging any of the existing discharge openings. This reduction of inflow under average precipitation conditions will act as a safety factor during extremely heavy precipitation events, i.e. Tropical Storm Agnes. The safety factor, in storage capacity, may prevent the rise in pool level and

TABLE VI-1. Major inflow areas along the outcrop of the Pittsburgh coal seam in the Southern Latrobe Syncline. For locations of the below areas see Vol. II, Plate 1 and 2.

AREA NUMBER	ACRES DISTURBED	APPARENT DEEP MINE OPENINGS	CONTRIBUTING DRAINAGE AREA (Acres)
6,6A,7	75	*	98
12,13,14,2	33	2	110
24,25,26,27,28	166	3-4(?)	92
29	17	1	106
32	24	**	70
34,35,36	54	10	380
40,42,43,44	44	*	320
88	32	10(?)	148
95,96	61	2-3	731
98,99	30	3	104
102,103	123	3	125
109,110,111	80	5-6(?)	200

* None Apparent

** Main Slope of Southwest No. 3 Mine, pipe diversion (Page VI-71)

TABLE VI-2. Minor inflow areas along the outcrop of the Pittsburgh coal seam in the Southern Latrobe Syncline. For location of the below areas see Volume II, Plates 1 and 2.

AREA NUMBER	ACRES DISTURBED	APPARENT DEEP MINE OPENINGS	CONTRIBUTING DRAINAGE AREA (Acre)
38	12	1 - 2(?)	18
51,52	46	*	212
54, 55	68	*	51
71	22	2 (?)	131
82, 83, 84	35	*	195
89	29	*	342
113	8	*	54
118	76	2	804

* None Apparent

subsequent problems that occurred during Tropical Storm Agnes. Because of these possibilities, a monitoring period is recommended prior to the initiation of the second phase. This monitoring should allow any trends developing in the pool regime to be considered prior to implementation of the deep mine sealing and diversion phase.

The second phase of the abatement plan entails the construction of water tight, bulkhead seals at discharges M63 (2), M62C, M62B, M101, M102, and M103 and construction of a flume to carry the discharge of the above plus M62A into the main drain of the Alverton Mine. Prior to construction of these seals that portion of the outcrop between them should be investigated by drilling and pressure testing to insure that it is capable of withstanding the pressure that will be applied to it, with acceptable seepage volumes. This investigation phase should also provide information relative to any additional seals required and their location. This phase should divert the major sources of AMD from the Stauffer Run Watershed to discharge M05 in the Buffalo Run Watershed.

Phase III is the construction of a pipe diversion system to carry the discharge from M05 and M104 to the main drain of the Southwest No. 3 Mine. This flow will then be diverted from the Buffalo Run Watershed to M06 and M07 at Wilson Run.

Phase IV includes the construction of a settling pond(s) at M06 and M07 on Wilson Run, channel relocation and possible enlargement of the existing outlets. The outlets of M06 and M07 may have to be enlarged to handle the increased flow due to the added volume from Phase II and III diversions. The recommended size for the settling basins is also based on this volume of discharge. Monitoring the flow at M06 and M07 is recommended (See Figure VI-2-Abatement Plan Time Schedule and Section VI-1.2) to determine if the volume of AMD is significantly different from that determined during the past monitoring program. The volume of discharge through M06 may not be significantly increased due to the reduction of inflow to the pool anticipated from sealing and reclamation along the outcrop. The length of Wilson Run channel that will have to be relocated is dependent on the final size of the settling basin required.

Phase V of the abatement plan includes the construction of settling basins, possible enlargement of existing outlets and channel relocations. Two series of ponds will be required, one for M08, M08A and M09 (Pond 2) on Boyer Run and one for M10, M11 and M12 (Pond 3) on Sewickley Creek. The need for enlarging any of the existing outlets will have to be evaluated based on the information obtained during the monitoring phases. At M10 (Pond 3) a combination of upward pressure from the pool and minimal cover on the mine have produced a situation where the discharge is self-enlarging.Prior to final design of Pond 3 test borings should be made to determine the maximum limit to which M10 will expand. These borings will also be necessary to insure the stability of the pond embankments. The enlarged M10 may also serve as relief outlet during periods of excessive precipitation preventing the rise of the pool level. The ponds in each area will be constructed so all discharges are within the pond area and streams diverted to flow around the embankments (See Volume II, Plates 22 - 23 for estimated size and approximate location).

Phase VI of the abatement plan is the addition of selected caustic wastes into the mine pool. This phase is recommended as an option which will require evaluations beyond the scope of this project. This alternative is discussed in greater detail on page VI-90. This operation is recommended here as an available alternative to lime addition. Introduction of this type of material into this pool will provide a useful mode of disposal and may prove to be economically beneficial to the Commonwealth and any potential supplier. The waste materials could be introduced into the flume at M62A and/or the pipe diversion at M05. Introduction at these points will insure mixing of the caustic material with the mine pool. At the completion of Phase III a six to twelve month monitoring program should be initiated to determine the quality of effluents from the settling basins and receiving streams. If conditions warrant Phase VII could be implemented.

Phase VII includes the addition of lime to the AMD within the settling basin or M62A flume and M05 pipe diversion if needed. This phase is recommended to be implemented last because of economic considerations. The equipment and lime quantities recommended in this report are based on anticipated water quality and volume determined from the 1973-1974 monitoring program. If it is necessary to implement this phase, it is recommended the lime addition be first considered at the M62A flume and M05 pipe diversion. Addition of the lime at these locations should cause at least a portion of the sludge generated to precipitate in the mine workings, reducing the frequency at which the settling ponds have to be dredged. If the lime addition at these points does not produce sufficient improvement in water quality, especially in ponds 2 and 3, additional lime could be added at the discharges as they enter the settling ponds.

2.0 Phase I: Sealing and Reclamation of Major Inflow Areas

2.1 Method Discussion

The outcrop line of the Southern Latrobe Syncline, as defined for this study, is approximately fifty-five (55) miles long, and forty-one (41) miles of the outcrop were surface mined. Portions of the outcrop were also disturbed during the course of deep mining operations, including coke ovens, ash piles and coal refuse piles. Since the cessation of deep mining, many areas on or near the outcrop have subsided to varying degrees (see Appendix D). Approximately 1500 acres along the outcrop are disturbed by one or more of the above coal mining activities. The disturbed areas containing visible inflows to deep mines, openings with a potential for surface water inflow to deep mines, or surface mines without positive drainage are considered as major inflow areas and are listed in Table VI-1.

The abatement techniques applied to these areas include removal of existing highwall to provide fresh cut, placement of clay seals in mine openings or against the coal crop, filling, regrading and revegetating unreclaimed or poorly reclaimed surface mine pits, backfilling regrading and revegetating pooling areas, and regrading subsidence areas to establish positive drainage.

In all the above areas the feasibility of mining the recoverable coal was evaluated. The potential cost or profit from the coal removal or daylighting operations was based on the assumption that excavation and backfill were being done in a continuous sequence typical of many surface mining methods. It is further assumed the backfill will be placed to predetermined grades and will not require any regrading. The computations are based on removing a maximum of thirty (30) feet of overburden for each one (1) foot of coal. The maximum depth of cut was then determined based on an estimate of coal remaining after previous deep mining within the area. For example if it was estimated 30% of the coal was remaining under an area, the maximum highwall height would be estimated as, 6 ft. coal x 30% remaining x 30 ft. overburden/ft. coal = 54 ft. of overburden. The amount of adjustment was evaluated for each individual area but generally 60%-70% of the original amount of coal present was estimated to be removed. A conservative six (6) foot seam thickness was used throughout. This procedure is assumed to provide a conservative estimate of recoverable coal. The volume of coal recovered was then converted to tons using a conversion factor of 0.877 yd^3 = 1 ton (Moore, 1940). The coal was valued at $20.00 per ton at the site. This is considered to be a conservative estimate at this time and with current trends in energy and the economy the price is not anticipated to fall below this level in the future.

Determination of possible inflow reduction was based on theoretical computations of average rainfall over the outcrop area. The average rainfall was adjusted for evapotranspiration. An assumption was made that the surface water remaining after evapotranspiration was intercepted by the stripped and subsided outcrop areas and transported into the abandoned deep mines. This assumption was formulated by the geologic bowl shape of the Latrobe Syncline, and the comparative analysis, within the same time frame, between gaged readings from mine discharges and streams versus gaged rainfall. The assumption was further encouraged by field investigations of the outcrop areas which revealed surface water flowing directly into slope openings, pooling areas without positive drainage, and the tendency for streams to be rather small relative to their drainage areas. The drainage assumption was used to develop a consistent basis that will be used throughout the analytical computations. Estimates of flow reduction prepared on this basis are considered conservative; the actual cost per gallon for reclamation may be lower than is shown.

2.2 Area Description and Recommended Abatement

2.2.1 General

The area descriptions that follow are located on Plates I and II, Vol. II. These sheets were used for location and drainage area determinations. The disturbed areas were measured on 1"=570' aerial photographs. The number of deep mine openings in an area were determined from the field investigation phase and also from available mine maps for the areas.

The quantities used to determine the estimated reclamation costs were also estimated based on field inspection and are presented here for the purpose of arriving at a total estimated abatement cost.

Many of the open drifts and subsidence holes located during this study create safety hazards. This is especially true in subsided areas near groups of houses where children are apt to be playing. No attempt was made to place a dollar value on the elimination of these hazards.

The unit prices for the various work elements were derived from either Pennsylvania Department of Environmental Resources figures, bids on recent PennDOT projects, or from E.P.A. estimates.

The source which had the higher unit cost was utilized. These prices should closely approximate unit price bids on these projects if the bids are requested within a reasonable time frame.

2.2.2 Area 6,6A,7

A. Description

This area consists of nearly 75 acres disturbed by surface and deep mining activities with a contributing drainage area of 98 acres. Area 6, the area above the surface mine highwall contains many subsidence holes, spacing of which suggest that most of the runoff is directed into the holes. Area 6A, the northerly section of the valley contains many subsidence holes in the tree section. This area does not appear to have been surface mined. Area 7 is the valley bottom, containing indiscriminate piles of surface mine spoil forming many pooling areas with no positive drainage in the valley.

The coal option, used to remove the subsidence holes and provide a fresh cut face for clay blanket and backfilling, was based on a conservative estimate of thirty (30) percent coal remaining.

Essential work elements necessary in this combined area include clearing and grubbing, backfilling, regrading the entire area to establish positive drainage in the valley bottom and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	50 Ac	$ 800.00/Acre	$ 40,000.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	726,000 cy	$ 0.50/cy	$ 363,000.00
C. Soil Cover	119,800	$ 1.00/cy	$ 119,800.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 4,000.00
4. Seeding and Mulching	363,000 sy	$0.15/sy	$ 54,450.00
TOTAL ABATEMENT COST			$ 581,250.00
5. Coal Option			
A. Excavation & Backfill	324,900 cy	$ 1.00/cy	$ 324,900.00
B. Coal Recovery	19,000 t.	$ 20.00/Ton	-$ 380,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$526,150.00

2.2.3 Area 12, 13, 14, 2

A. Description

This area consists of nearly 33 acres disturbed by surface and deep mining activities with a contributing drainage area of 110 acres. Area 2 contains pooling areas from a poorly reclaimed surface mine and a collapsed drift opening. Area 12 contains a collapsed drift and also many large subsidence holes above the highwall. Area 13 contains surface mine spoil piled indiscriminately and producing many pooling areas and water pools. The valley has no positive drainage. The upper end of the valley has become a dumping area for worn out tire casings and some garbage. Area 14 has many subsidence holes in the tree line.

The coal option, used to remove the subsidence holes and provide a fresh cut surface for clay blanket installation, was based on a conservative estimate of forty percent coal remaining.

Essential work elements include clearing and grubbing, two clay seals, backfilling and regrading the entire area, established positive drainage in the valley bottom and revegetation. Installation of the clay seals and removal of the subsidence holes in areas 2 and 12 with compacted backfilling may provide an added benefit. This compacting should decrease the amount of oxygen (air) that enters the mine workings and, so, slow the rate of movement of the mine fire present in area 1. This mine fire is a hazard and should be extinguished, possibly in conjunction with this reclamation. It was beyond the scope of work of this project to determine methods and procedures to accomplish this end.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	33 Ac	$800.00/Acre	$ 26,400.00
2. Earthwork			
A. Clay Seals	440 cy	$ 4.00/cy	$ 1,760.00
B. Regrading	319,400 cy	$ 0.50/cy	$159,700.00
C. Soil Cover	52,700 cy	$ 1.00/cy	$ 52,700.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 2,000.00
4. Seeding and Mulching	159,700 sy	$ 0.15/sy	$ 23,955.00
	TOTAL ABATEMENT COST		$266,515.00
5. Coal Option			
A. Excavation & Backfill	684,000 cy	$ 1.00/cy	$684,000.00
B. Coal Recovery	53,300 t.	$ 20.00/Ton	-$1,066,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			-$ 115,485.00

2.2.4 Area 24, 25, 26, 27, 28

A. Description

The location of these areas may be found in Volume II Plate 1. From a reclamation standpoint, all these areas should be considered as one. A total of 166 acres were disturbed by surface and deep mining activities. Major items of reclamation include three (3) and possibly four (4) deep mine openings, a poorly graded surface mine with ponding areas, many subsidence holes in the trees and also above the surface mine highwall.

Two of the deep mine openings were found in Area 28, possibly the main heading of the Empire mine. A collapsed drift opening was located in Area 25. Common mining practice indicates another opening should be found in the same area.

The coal option, used to remove the subsidence holes and provide a fresh cut face for clay blanket and backfilling, was based on a conservative estimate of forty (40) percent coal remaining.

The work elements proposed for this area include clearing and grubbing, construction of three (3) and possibly four (4) clay seals, backfilling of drift openings, backfilling the surface mine cut, regrading and revegetation of the area.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	90 Ac	$800.00/Acre	$ 72,000.00
2. Earthwork			
A. Clay Seals	880 cy	$ 4.00/cy	$ 3,520.00
B. Regrading	656,500 cy	$ 0.50/cy	$ 328,250.00
C. Soil Cover	265,100 cy	$ 1.00/cy	$ 265,100.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 6,000.00
4. Seeding and Mulching	803,400 sy	$ 0.15/sy	$ 120,510.00
	TOTAL ABATEMENT COST		$ 795,380.00
5. Coal Option			
A. Excavation & Backfill	2,080,000	$ 1.00/cy	$2,080,000.00
B. Coal Recovery	121,600 t.	$ 20.00/T.	-$2,432,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 443,380.00

2.2.5 Area 29

A. Description

This area covers approximately 17 acres with about 106 acres contributing runoff. This area contains at least one open drift, unreclaimed surface mine cut, large areas of subsidence and deep mine refuse piles. There are numerous fresh subsidence holes and older ones acting as pooling areas.

The existing vegetation ranges from thick tree cover to grass. The trees will have to be removed to properly regrade the area.

The coal option, used to remove the subsidence holes and provide a fresh cut surface for clay blanket and backfilling was based on a conservative estimate of forty (40) percent coal remaining from previous deep mining activities.

Major items of reclamation are clearing and grubbing, a clay seal, backfilling, regrading and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	17 Ac	$ 800.00/Acre	$ 13,600.00
2. Earthwork			
A. Clay Seals	220 cy	$ 4.00/cy	$ 880.00
B. Regrading	109,600 cy	$ 0.50/cy	$ 54,800.00
C. Soil Cover	27,200 cy	$ 1.00/cy	$ 27,200.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 1,000.00
4. Seeding and Mulching	82,300 sy	$ 0.15/sy	$ 12,345.00
	TOTAL ABATEMENT COST		$ 109,825.00
5. Coal Option			
A. Excavation & Backfill	320.00 cy	$ 1.00/cy	$ 320,000.00
B. Coal Recovery	18,700 t.	$ 20.00/Ton	-$ 374,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 55,825.00

2.2.6 Area 32

A. Description

This area contains approximately 24 acres disturbed by surface and deep mining activities with a contributory drainage area of approximately 70 acres. This area also contains the main slope heading of the Southwest No. 3 mine. This heading is intended to carry the pipe discharge of M05 and M104 into the mine. Reclamation activities in this area should be made in conjunction with the pipe construction.

The coal option, used to remove the subsidence holes and provide a fresh cut surface for clay blanket and backfilling was based on a conservative estimate of forty (40) percent coal remaining.

Major elements of reclamation include clearing and grubbing, taking an additional cut along the outcrop, exposing the slope heading for pipe installation, backfilling the slope heading after the pipe is emplaced, general backfilling, regrading and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	24 Ac	$ 800.00/Acre	$ 19,200.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	235,000 cy	$ 0.50/cy	$ 117,500.00
C. Soil Cover	38,300 cy	$ 1.00/cy	$ 38,300.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 2,000.00
4. Seeding and Mulching	116,200 sy	$ 0.15/sy	$ 17,430.00
	TOTAL ABATEMENT COST		$ 194,430.00
5. Coal Option			
A. Excavation & Backfil	886,400 cy	$ 1.00/cy	$ 866,400.00
B. Coal Recovery	50,700 t.	$ 20.00/TON	-$1,014,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 46,830.00

2.2.7 Areas 34, 35, 36

A. Description

This area consists of approximately 54 disturbed areas with a contributing drainage area of approximately 380 acres. Area 34 is currently being surface mined by an individual for house coal. The extraction method employed here created large areas for water to pool against the outcrop of the coal seam. Area 35 can be subdivided into two areas, one representing approximately 1000 feet of outcrop that was stripped and reclaimed and the other representing about 3000 feet of outcrop that was the site of the Central Mine Slope.

The large central area (area 36) is also the site of numerous coke ovens. The abandoned buildings, ovens, ashes, deep mine refuse and miscellaneous debris from the mining and coking operations constitute an eyesore and health hazard. This area has subsidence holes throughout. During the field reconnaissance a fresh subsidence pit measuring about 20' x 20' estimated at 30' deep was observed. The pits are used by local residents for trash disposal and represent a significant safety hazard, as well as an entrapment area for surface runoff which then percolates to the mine pool. On the Mt. Pleasant U.S.G.S. 7.5 minute Topographic Quadrangle two ponds are indicated in this area. These ponds are formed by large depressions in the coke oven ashes and coal refuse which cover the entire area. These ponds have no apparent surface outlets, indicating the water is seeping into the mine through this very permeable material and may also be reacting with the material to cause the water to be higher in iron and acid content when it reaches the mine pool.

Field investigation of this area revealed the location of one of the slope entries (backfilled) and one ventilation shaft (from house still standing). Detailed (1”= 100') mine maps are available for this area (see Volume II, Plate 8). The maps indicate the possibility of 6 deep entries in the area. For estimating purposes 10 clay seals were used in the cost computations.

The coal option, used to remove the subsidence holes and provide fresh cut face for clay blanket and backfilling, was based on a conservative estimate of thirty (30) percent coal remaining.

Major elements of reclamation include (1) in Area 34 and a portion of Area 35, the removal of the coal, which in some places is covered by 2-4 feet of soil only, backfilling, regrading and revegetation; (2) in the rest of Area 35 and Area 36, clearing and grubbing, clay seals, backfilling, regrading and revegetation. Some of the abandoned coke ovens and a portion of the abandoned railroad will be removed during the regrading phase.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	54 Ac	$ 800.00/Acre	$ 43,200.00
2. Earthwork			
A. Clay Seals	2,200 cy	$ 4.00/cy	$ 8,800.00
B. Regrading	366,400 cy	$ 0.50/cy	$ 183,200.00
C. Soil Cover	86,200 cy	$ 1.00/cy	$ 86,200.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 4,000.00
4. Seeding and Mulching	261,400 sy	$ 0.15/sy	$ 39,210.00
	TOTAL ABATEMENT COST		$ 364,610.00
5. Coal Option			
A. Excavation & Backfill	1,000,000 cy	$ 1.00/cy	$1,000,000.00
B. Coal Recovery	58,500 t.	$ 20.00/T.	-$1,170,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 194,610.00

2.2.8 Area 40, 42, 43, 44

A. Description

These areas should be considered as one for reclamation purposes. Approximately 44 acres have been disturbed by surface or deep mining activities. Area 40 contains large numbers of subsidence holes in the wooded area. Area 42 contains a surface mine with subsidence above the highwall, also pools and pooling areas. Area 43 contains many closely spaced subsidence holes and, in part, a surface mine highwall with subsidence above. Area 44 is a poorly reclaimed surface mine with subsidence above the highwall and pooling areas.

The coal option used to remove the subsidence holes and provide a fresh cut face for clay blanket and backfilling, was based on a conservative estimate of thirty (30) percent coal remaining after deep mining activities.

Major elements of reclamation will include regrading (Areas 40, 42) backfilling and outcrop sealing (East-West portion of Area 43) and daylighting knob in Area 43-44 with revegetation.*

*Field trips made near the completion of this report, discovered road-building (U.S. 119) activities are in progress through a portion of Areas 40, and 42. The C & A Coal Company is surface mining (Reclamation Project 111) in Areas 43 and 44. The cost estimate was made before these activities were noted and is expected to be very high. After completion of these activities this area should be re-evaluated.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	44 Ac	$ 800.00/Acre	$ 35,200.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	276,800 cy	$ 0.50/cy	$ 138,400.00
C. Soil Cover	70,300 cy	$ 1.00/cy	$ 70,300.00
D. Daylight Excavation			
1. Excavation & Backfill	2,419,500cy	$ 1.50/cy	$ 3,629,250.00
2. Coal Recovery	123,200 t.	$ 20.00/Ton	-$2,464,000.00
3. Anti-Pollution	L/S	L/S	$ 2,800.00
4. Seeding and Mulching	213,000sy	$ 0.15/sy	$ 31,950.00
	TOTAL ABATEMENT COST		$1,443,900.00
5. Coal Option			
A. Excavation & Backfill	1,308,000cy	$ 1.00/cy	$ 1,308,000.00
B. Coal Recovery	76,500 t.	$ 20.00/T.	-$ 1,530,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$1,221,900.00

2.2.9 Area 88

A. Description

This area consists of approximately 32 acres disturbed by mining activities with approximately 148 acres of contributing drainage area. No field evidence of deep mine entries was seen, however, the WPA mine maps for this area indicate ten or more may be present. The presence of deep mine refuse within this area is another indication of deep mine entries. These possible entries were not included in the cost estimate because they could not be verified in the field.

Major items of reclamation for this area include draining a large (200' x 300') pond, clearing and grubbing, regrading the large area of deep mine refuse, soil cover and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	32 Ac	$ 800.00/Acre	$ 25,600.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	214,600	$ 0.50/cy	$ 107,300.00
C. Soil Cover	51,100 cy	$ 1.00/cy	$ 51,100.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 2,000.00
4. Seeding and Mulching	154,900 sy	$ 0.15/sy	$ 23,235.00
	TOTAL ABATEMENT COST		$ 209,235.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

2.2.10 Areas 95, 96

A. Description

Location of these areas may be found on Plate 1 in Volume 2. These areas should be worked as one from a reclamation standpoint. Approximately 61 acres were disturbed by surface and deep mining activities. The combined area contains (1) two drift mine openings (area 95) allowing direct flow of runoff to enter the mine, (2) two large refuse piles (area 96) and (3) three ponds (area 96), two on the Redstone coal seam and one on the Pittsburgh seam in poorly reclaimed surface mines.

The coal option used to remove the subsidence holes and provide a fresh cut face for placement of clay seals, clay blanket and backfilling was based on a conservative estimate of forty (40) percent coal remaining after deep mining activities.

Major elements of reclamation include clay seals for the deep mine entries, backfilling using the coal refuse piles, soil cover and revegetation. The remainder of the refuse piles is to be used to backfill the poorly reclaimed surface mines, followed by soil cover and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	61 Ac	$ 800.00/Acre	$ 48,800.00
2. Earthwork			
A. Clay Seals	660 cy	$ 4.00/cy	$ 2,640.00
B. Regrading	451,100 cy	$ 0.50/cy	$ 225,550.00
C. Soil Cover	111,000 cy	$ 1.00/cy	$ 111,000.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 4,000.00
4. Seeding and Mulching	336,500 sy	$ 0.15/sy	$ 50,475.00
	TOTAL ABATEMENT COST		$ 442,465.00
5. Coal Option			
A. Excavation & Backfill	3,733,300 cy	$ 1.00/cy	$ 3,733,300.00
B. Coal Recovery	218,300 t.	$ 20.00/T.	-$ 4,366,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			-$ 190,235.00

2.2.11 Areas 98, 99

A. Description

This area consists of approximately 30 acres disturbed by mining activities including surface and deep mining. Within area 98 there is an open drift with a thirty to forty foot highwall area with a small refuse pile. Area 99 contains at least two drifts, a fifty to sixty foot surface mine cut in the Pittsburgh seam and a surface mine in the Redstone seam, also piles of deep mine refuse and surface mine spoil. The northern portion of area 99 was regraded and planted with pine trees. Although the vegetation cover is not the most suitable, it is well established and should not be disturbed.

The drainage area contributing surface runoff to area 98 and 99 totals approximately 104 acres. The majority of this has the potential to enter the mine pool. This is especially true for area 99 where the regraded surface mine spoil is very permeable and the open surface mine cut portion will essentially trap all surface runoff. The southern portion of area 98 has not been disturbed or has been sufficiently reclaimed to be developed into a pasture, and should pass most of the runoff.

The coal option used to remove the subsidence holes and provide a fresh cut face for clay blanket and backfilling, was based on a conservative estimate of forty (40) percent coal remaining after deep mining activities.

The essential work elements proposed for the disturbed portions of areas 98 and 99 include construction of three (3) clay seals, backfilling drift entries, backfilling the surface mine cut, regrading and revegetating the area.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	30 Ac	$ 800.00/Acre	$ 24,000.00
2. Earthwork			
A. Clay Seals	660 cy	$ 4.00/cy	$ 2,640.00
B. Regrading	196,800 cy	$ 0.50/cy	$ 98,400.00
C. Soil Cover	47,900 cy	$ 1.00/cy	$ 47,900.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 2,000.00
4. Seeding and Mulching	145,200 sy	$ 0.15/sy	$ 21,780.00
	TOTAL ABATEMENT COST		$ 196,720.00
5. Coal Option			
A. Excavation & Backfill	480,000 cy	$ 1.00/cy	$ 480,000.00
B. Coal Recovery	28,100 t.	$ 20.00/Ton	-$ 562,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 114,720.00

2.2.12 Areas 102, 103

A. Description

This area consists of approximately 123 disturbed acres with approximately 125 acres contributing drainage area. This area was extensively disturbed by mining activities on both the Pittsburgh and Redstone seams. Almost the total area is composed of unreclaimed surface mines. The major portion of the drainage flows into a pond located on an abandoned surface mine bench. This pond has no apparent outlet on the surface. This indicates the majority of the runoff is entering the mine pool by percolation through the highwall.

Some pine trees were planted on the unregraded surface mine spoil and some volunteer growth has also become established. The vegetation should be cleared prior to regrading. Although, there was no visible evidence of openings in the field the available mine maps (See Volume II, Plate 15), indicate the main slope of the Mammoth Mine and two other entries are in this area.

Above the highwall, there are numerous subsidence holes which local residents are using as waste disposal areas. The spacing of the subsidence holes practically precludes runoff from passing through the subsidence area.

The daylighting section, used to remove the subsidence holes and provide a fresh cut face for clay blanket installation and backfilling was based on a conservative estimate of thirty (30) percent coal remaining after deep mining activities.

The essential work elements for this area would include clearing and grubbing, daylighting at least certain portions of the deep mine workings, construction of a clay blanket, backfilling, regrading and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	70 Ac	$ 800.00/Ac	$ 56,000.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	315,200 cy	$ 0.50/cy	$ 157,600.00
C. Soil Cover	196,500 cy	$ 1.00/cy	$ 196,500.00
D. Daylight Excavation			
1. Excavation & Backfill	1,300,000 cy	$ 1.50/cy	$1,950,000.00
2. Coal Recovery	76,000 t.	$ 20.00/T.	-$1,520,000.00
3. Anti-Pollution	L/S	L/S	$ 5,000.00
4. Seeding and Mulching	595,300 sy	$ 0.15/sy	$ 89,295.00
	TOTAL ABATEMENT COST		$ 934,395.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

2.2.13 Areas 109, 110, 111

Description

This area consists of approximately 80 acres disturbed by past mining activities with a contributing drainage area of approximately 200 acres. Area 109 contains one open drift and multiple unreclaimed open surface mine cuts. Some volunteer vegetation has become established and will have to be removed for the regrading. The northern portion of area 110 contains four openings, one a drift, a small deep mine refuse pile and an unreclaimed surface mine cut. The volunteer vegetation on this area is somewhat more developed than in area 109 but will also have to be removed. No work is required in the remainder of Area 110. Area 111 contains deep mine refuse piles and partially reclaimed surface mines. The disturbed area is relatively continuous and the majority of the runoff apparently has easy access to the coal seam and hence the mine pool.

The coal option, used to remove the subsidence holes and provide a fresh cut face for clay blanket, clay seals installation and backfilling, was based on a conservative estimate of thirty (30) percent coal remaining after deep mining.

The recommended abatement measures for this area include installation of clay seals in the drifts, burial of the refuse piles in the surface mine cuts, clearing and grubbing of the area, regrading and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	80 Ac	$800.00/Ac	$ 64,000.00
2. Earthwork			
A. Clay Seals	1,320 cy	$ 4.00/cy	$ 5,280.00
B. Regrading	519,400 cy	$ 0.50/cy	$ 259,700.00
C. Soil Cover	127,800 cy	$ 1.00/cy	$ 127,800.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 5,000.00
4. Seeding and Mulching	387,200 sy	$ 0.15/sy	$ 58,080.00
	TOTAL ABATEMENT COST		$ 519,860.00
5. Coal Option			
A. Excavation & Backfill	2,800,000 cy	$ 1.00/cy	$ 2,800,000.00
C. Coal Recovery	143,200 t.	$ 20.00/T.	-$2,864,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 455,860.00

2.3 Cost Effectiveness Analysis

Implementation of recommended reclamation of the major inflow areas could reduce direct inflow of water to the mine pool by approximately 3MGD at an estimated cost of $6,058,585 without the coal option or $3,897,185 with the coal option. Table VI-3 provides a cost effectiveness analysis for each reclamation area individually.

As previously noted (Section VI, 1.2), the inflow reduction is based on the assumption that one hundred (100) percent of the Surface Water Remaining (Runoff) will enter the mine pool. A more precise estimate of water entering the pool through each area was beyond the scope of work.

The estimated acid load reduction column was derived at the direction of Pennsylvania Department of Environmental Resources personnel. This column is based on the following assumptions:

1. 100% Surface Water Remaining (SWR) directly enters mine before reclamation,
2. Reclamation will be 100% effective on SWR providing diversion to surface drainage ways,
3. Phases II, III, IV, V have been implemented, providing three combined discharges,
4. Areas 51, 52, 95, 96, 98, 99 affect Boyer Run (Discharge E) only,
5. Areas 54, 55, 71, 102, 103, 109, 110, 111, 113, 118 affect Sewickley Creek (Discharge D) only,
6. All other reclamation areas affect Wilson Run (Discharge C) only, and,
7. Decreased flows will not affect water quality parameters.

TABLE VI-3

COST EFFECTIVENESS ANALYSIS

MAJOR INFLOW AREAS

AREA	Estimated Reclamation Cost		Cost/Gallon/Day		Cost/1000 gal./15 yrs.		Estimated Number Of Gal./Day Decreased	Estimated Acid Load Reduction Pounds/Day
	Without Coal Option	W/Coal Option	Without	With	Without	With		
6,7	$581,250	$526,150	3.76	3.41	0.69	0.62	154,500	150.8
2,12,13,14	266,515	*-115,485	2.10		0.38		127,200	124.2
24,25,26, 27,28	795,380	443,380	4.16	2.32	0.76	0.42	191,300	186.8
29	109,825	55,825	1.00	0.51	0.18	0.09	109,800	107.2
32	194,430	46,830	2.33	0.56	0.43	0.10	83,600	81.6
34,35,36	364,610	194,610	0.94	0.50	0.17	0.09	388,000	378.8
40,42,43, 44	1,443,900	1,221,900	4.44	3.75	0.81	0.68	325,500	317.8
88	209,235	** -------	1.30	----	0.24	----	160,900	157.1
95,96	442,465	*-190,235	0.52		0.10		848,300	906.1
98.99	196,720	114,720	1.65	0.96	0.30	0.18	119,000	127.1
102,103	934,395	** -------	4.23	----	0.78	----	220,900	366.3
109,110, 111	519,860	455,860	2.08	1.83	0.38	0.33	249,600	408.3
TOTAL	$6,058,585	$3,897,185	2.03	1.31	0.37	0.24	2,978,600	3307.1

*Minus sign indicates a net profit through exercising the coal option.

**The coal option is not feasible for these areas.

2.4 Priority Assignment

The following factors were utilized in assigning a priority to each of the major inflows. The factors were considered in the order presented.

Priority Assignment Factors

1. Hydraulic connection to Mine Pool; open drifts, surface mine highwall, subsidence
2. Economics - cost per gallon
3. Public Safety - eliminate hazards
4. Social and Aesthetic Impact

Based on the above, reclamation of the major inflow areas should proceed according to the following table. This priority should also represent the funding priority if sufficient funding is not available for the entire project.

TABLE VI - 4 RECLAMATION PRIORITY, MAJOR INFLOW AREAS

Priority	Area
1	95,96
2	34,35,36
3	102,103
4	88
5	98,99
6	109,110,111
7	29
8	6,7
9	32
10	12,13,14,2
11	24,25,26,27,28
12	40,42,43,44

3.0 Phase I: Reclamation of Minor Inflow Areas

3.1 Method Discussion

Minor inflow areas are distinguished from major inflow areas on the basis of disturbed area, size of contributory drainage area and degree of hydraulic connection with the underground mine workings. Essentially the difference between major and minor inflow areas is the amount of surface runoff that could enter the mine pool. Generally these are small areas of subsidence or partially reclaimed surface mines with small contributing drainage areas. There is generally some vegetation present on these sites, in some cases volunteer and in others thin growths of pine from previous reclamation efforts. A number of these sites are used by local residents as unregulated solid waste disposal areas.

The major work elements required for this phase include, clearing and grubbing, extraction of recoverable coal, placing clay seals, backfilling, regrading and revegetation. Not all elements will be required at all sites. The individual areas and work elements required are discussed below.

3.2 Area Description and Recommended Abatement

3.2.1 General

The area descriptions that follow are located on Plates 1 and 2, Vol. II. These sheets were used for location and drainage area determinations. The disturbed areas were measured on 1"=570’ aerial photographs. The number of surface mine cuts and subsidence holes in an area were determined from the field investigation phase and also from available mine maps for the areas.

The quantities used to determine the estimated reclamation costs were also estimated based on field inspection and are presented here for the purpose of arriving at a total estimated abatement cost.

Many of the surface cuts and subsidence holes located during this study create safety hazards. This is especially true in subsided areas near groups of houses where children are apt to be playing. No attempt was made to place a dollar value on the elimination of these hazards.

The unit prices for the various work elements were derived from either Pennsylvania Department of Environmental Resources figures, bids on recent PennDOT projects, or from E.P.A. estimates.

The source which had the higher unit cost was utilized. These prices should closely approximate unit price bids on these projects if the bids are requested within a reasonable time frame.

3.2.2 Area 38

A. Description

This area consists of approximately 12 acres of disturbed land with a contributing drainage area of 18 acres. This area is mainly affected by deep mine subsidence with the total area being marked by subsidence holes averaging 4 to 8 feet in depth. The density of subsidence practically precludes any runoff from passing through the area. The area is densely covered be trees averaging 6" - 8" in diameter.

There is one caved drift and the mine maps indicate the presence of others. Because of minimal cover and density of workings in this area; daylighting the entire area, placing a clay blanket against the exposed coal seam, regrading and revegetation appears the most practical abatement methodology for this area.

A conservative estimate of thirty (30) percent coal remaining after previous mining was used to determine the amount of coal recoverable with daylight extraction.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	7 Ac	$ 800.00/Acre	$ 5,600.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	N/A	N/A	N/A
C. Soil Cover	19,200	$ 1.00/cy	$ 19,200.00
D. Daylight Excavation			
1. Excavation & Backfill	600,000 cy	$ 1.50/cy	$ 900,000.00
2. Coal Recovery	39,300 t.	$ 20.00/Ton	-$786,000.00
3. Anti-Pollution	L/S	L/S	$ 500.00
4. Seeding and Mulching	58,100 sy	$ 0.15/sy	$ 8,715.00
	TOTAL ABATEMENT COST		$148,015.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

3.2.3 Areas 51, 52

A. Description

The area consists of approximately 46 acres of disturbed area with a contributing drainage area of 212 acres. Area 51 contains approximately 4200 feet of outcrop area that is disturbed mainly by deep mine subsidence with minor areas of surface mining (less than 1000 feet). Area 52 was affected by deep mining, surface mining and coking operations. The available mine maps (See Vol. II Plates 11, 12 and 14), indicate extensive deep mine workings.

The major work elements involve possible outcrop sealing and regrading along that total disturbed portion of the outcrop in area 51. This would be best accomplished by taking an additional cut along the existing highwall and continuing through the subsided areas prior to placing the clay blanket against the outcrop and regrading. The coal option used to remove the subsidence holes and provide a fresh cut face for clay blanket and backfilling was based on a conservative estimate of forty (40) percent coal remaining after deep mining.

The major work elements required in area 52 would be essentially limited to clearing, grubbing, regrading, and revegetation. Because of the horizontal and vertical relation of this area to discharges M08, M08A, and M09 (within 2000 feet horizontal and 30 feet vertical) it is not deemed advisable to cut into the deep mine workings to construct clay seals.

B. Cost Estimate

Reclamation	Quantity	Unti Cost	Estimated Cost
1. Clearing and Grubbing	46 Ac	$ 800.00/Acre	$ 36,800.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	93,400 cy	$ 0.50/cy	$ 46,700.00
C. Soil Cover	73,500 cy	$ 1.00/cy	$ 73,500.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 3,000.00
4. Seeding and Mulching	222,600 sy	$ 0.15/sy	$ 33,390.00
	TOTAL ABATEMENT COST		$ 193,390.00
5. Coal Option			
A. Excavation & Backfill	416,000 cy	$ 1.00/cy	$ 416,000.00
B. Coal Recovery	24,300 t.	$ 20.00/Ton	-$ 486,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 123,390.00

3.2.4 Areas 54, 55

A. Description

This area contains 68 acres disturbed primarily by surface mining with a contributing drainage area of 51 acres. The surface mines are not regraded forming pooling areas that catch most of the runoff from the 51 acres upgradient. The surface mines are in Redstone and Sewickley Coal seams. The Redstone seam was deep mined in this area (Rath Mine).

Reclamation will consist of clearing and grubbing the surface mine spoil piles, compacting the spoil against the highwall, regrading to provide positive drainage and revegetation.

Removal of additional coal prior to outcrop sealing does not seem feasible because of the Redstone deep mine and lack of detailed mine maps.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	68 Ac.	$ 800.00/Acre	$ 54,400.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	521,500 cy	$ 0.50/cy	$ 260,750.00
C. Soil Cover	108,600 cy	$ 1.00/cy	$ 108,600.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 4,500.00
4. Seeding and Mulching	329,100 sy	$ 0.15/sy	$ 49,365.00
	TOTAL ABATEMENT COST		$ 477,615.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

3.2.5 Area 71

A. Description

This area, approximately 22 acres, with a contributing drainage area of 131 acres, was disturbed by surface mining. Many subsidence holes are present above the highwall effectively receiving the runoff from the approximately 131 acres upgradient and transmitting the water to the coal seam.

Reclamation will consist of clearing and grubbing the surface mine spoil and the area above the highwall, compacted backfilling the subsidence holes, backfilling and regrading the surface mine pit for positive drainage and revegetation. Removal of coal prior to reclamation could not be calculated due to insufficient mine maps.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	22 Ac	$ 800.00/Acre	$ 17,600.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	138,400 cy	$ 0.50/cy	$ 69,200.00
C. Soil Cover	31,900 cy	$ 1.00/cy	$ 31,900.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 1,500.00
4. Seeding and Mulching	106,500 sy	$ 0.15/sy	$ 15,975.00
	TOTAL ABATEMENT COST		$ 136,175.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

3.2.6 Areas 82, 83, 84

A. Description

An area of approximately 35 acres has been disturbed by surface, deep mining and coke making (West Overton) activities. The northern portion of area 82 contains indiscriminately piled surface mine spoil and several pools. The tree covered portion of area 82 contains many subsidence holes. A deep mine fire is present in area 83. This area has been strip mined and no regrading was done. Several partly collapsed deep mine openings are in the exposed highwall. These openings are probably providing oxygen to the fire as well as providing direct paths to the mine for runoff. Two deep mine entries are located at the extreme southern part of area 83. Area 84 contains subsidence holes in the tree covered northern portion.

The cost estimate was based on total reclamation for these areas, including regrading, revegetation and providing positive drainage for the valley.*

*Field trips made near the completion of this report discovered that remedial measures were being put into effect in the mine fire (area 83) area under Operation Scarlift Project SL 333. The cost estimate was made before this activity was noted and is expected to be very high. After completion of SL 333 this area should be re-evaluated.

No coal option or daylighting costs were calculated because of the mine fire and also because the reclamation without a coal option was considered adequate for these areas.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	5 Ac.	$ 800.00/Acre	$ 4,000.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	64,900 cy	$ 0.50/cy	$ 32,450.00
C. Soil Cover	55,900 cy	$ 1.00/cy	$ 55,900.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 1,000.00
4. Seeding and Mulching	217,800 sy	$ 0.15/sy	$ 32,670.00
	TOTAL ABATEMENT COST		$ 126,020.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

3.2.7 Area 89

A. Description

This area contains approximately 29 acres of land disturbed by deep mine activities. Mine subsidence is present on the hillside, the remainder of the area contains broken coke ovens, coal refuse piles and flat pooling areas.

Reclamation items include clearing and grubbing the hillside, compacted backfilling of subsidence holes, regrading to provide positive drainage in the valley bottom and revegetation.

The coal option was not considered feasible in this area because of its proximity to homes and roads.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	17 Ac.	$ 800.00/Acre	$ 13,600.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	107,000 cy	$ 0.50/cy	$ 53,500.00
C. Soil Cover	46,300 cy	$ 1.00/cy	$ 46,300.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 1,000.00
4. Seeding and Mulching	140,400 sy	$ 0.15/sy	$ 21,060.00
	TOTAL ABATEMENT COST		$ 135,460.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

3.2.8 Area 113

A. Description

This area consists of approximately 8 disturbed acres with a contributing drainage area of 54 acres. This area is affected mainly be deep mine subsidence. The density of subsidence practically precludes any runoff from passing through the area.

The most practical abatement for this area involves excavating the subsidence area and construction of a clay blanket along the total length of the outcrop exposed. After construction of the blanket this area should be regraded and revegetated.

Approximately 1700 feet of the outcrop is being strip mined (3/19/74) in Area 114. The operator is stripping the abandoned deep mine workings and extracting the stumps and pillars. Based on a brief inspection and discussion with William Sray, District Mine Conservation Inspector, the reclamation of this area should significantly reduce the inflow to the mine pool in this area. The surface mining of area 113 should be seriously considered.

The coal option used to remove the subsidence holes and provide a fresh cut face for clay blanket and backfilling, was based on a conservative estimate of thirty (30) percent coal remaining after deep mining.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	8 Ac.	$ 800.00/Acre	$ 6,400.00
2. Earthwork			
A. Clay Seals	N/A	N/A	N/A
B. Regrading	38,700 cy	$ 0.50/cy	$ 19,350.00
C. Soil Cover	38,700 cy	$ 1.00/cy	$ 38,700.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 1,000.00
4. Seeding and Mulching	38,700 sy	$ 0.15/sy	$ 5,805.00
	TOTAL ABATEMENT COST		$ 71,255.00
5. Coal Option			
A. Excavation & Backfill	210,000 cy	$ 1.00/cy	$ 210,000.00
B. Coal Recovery	12,300 t.	$ 20.00/T.	-$ 246,000.00
TOTAL ABATEMENT COST WITH COAL OPTION			$ 35,255.00

3.2.9 Area 118

A. Description

This area contains 76 acres of disturbed land with a contributing drainage area of 804 acres. This area contains old coke ovens, large bony piles, one deep mine opening and one air shaft (both in depressed areas). There is also a working tipple for loading coal which is trucked onto the site. Insufficient data prevents an evaluation of coal reserves in this area.

Reclamation for this area should consist of sealing the two mine openings with clay seals, regrading of the entire site to promote positive drainage in the valley and revegetation.

B. Cost Estimate

Reclamation	Quantity	Unit Cost	Estimated Cost
1. Clearing and Grubbing	76 Ac.	$ 800.00/Acre	$ 60,800.00
2. Earthwork			
A. Clay Seals	440 cy	$ 4.00/cy	$ 1,760.00
B. Regrading	483,500 cy	$ 0.50/cy	$ 241,750.00
C. Soil Cover	121,400 cy	$ 1.00/cy	$ 121,400.00
D. Daylight Excavation			
1. Excavation & Backfill	N/A	N/A	N/A
2. Coal Recovery	N/A	N/A	N/A
3. Anti-Pollution	L/S	L/S	$ 5,000.00
4. Seeding and Mulching	367,800 sy	$ 0.15/sy	$ 55,170.00
	TOTAL ABATEMENT COST		$ 485,880.00
5. Coal Option			
A. Excavation & Backfill	N/A	N/A	N/A
B. Coal Recovery	N/A	N/A	N/A
TOTAL ABATEMENT COST WITH COAL OPTION			$ N/A

3.3 Cost Effectiveness Analysis

Implementation of recommended reclamation of the minor inflow areas could reduce direct inflow of water to the mine pool by approximately 1.8 MGD at an estimated cost of $1,773,810 without the coal option or $1,667,810 with the coal option. Table VI-5 provides a cost effectiveness analysis for each reclamation area individually.

As previously noted (Section VI, 1.2), the inflow reduction is based on the assumption that one hundred (100) percent of the Surface Water Remaining (Runoff) will enter the mine pool. A more precise estimate of water entering the pool through each area was beyond the scope of work.

The estimated acid load reduction column was derived at the direction of Pennsylvania Department of Environmental Resources personnel. This column is based on the following assumptions:

1. 100% Surface Water Remaining (SWR) directly enters mine before reclamation,
2. Reclamation will be 100% effective on SWR providing diversion to surface drainage ways,
3. Phases II, III, IV, V have been implemented, providing three combined discharges,
4. Areas 51, 52, 95, 96, 98, 99 affect Boyer Run (Discharge E) only,
5. Areas 54, 55, 71, 102, 103, 109, 110, 111, 113, 118 affect Sewickley Creek (Discharge D) only,
6. All other reclamation areas affect Wilson Run (Discharge C) only, and,
7. Decreased flows will not affect water quality parameters.

3.4 Priority Assignment

Priority was assigned using the same criteria as for the major inflows (See Section VI, 2.4). The following table lists the priority for minor inflow areas:

TABLE VI - 6 RECLAMATION PRIORITY, MINOR INFLOW AREAS

Priority	Area
13	118
14	89
15	51,52
16	71
17	113
18	54,55
19	38
20	82,83,84

Although these are the priorities within the minor inflow areas, funding should not be expended on these until all major inflow areas are funded.

4.0 Phase II: Mine Sealing for Water Diversion at M62A M62B, M62C, M63, M101, M102 and M103

4.1 Method Discussion

Three AMD discharges M62A, M62B, and M62C make up the majority of the flow in the headwaters of Stauffer Run, while M63, M101, M102, and M103 make up the majority of the flow in the headwaters of small unnamed tributaries entering Stauffer Run near its headwaters. Diversion of these discharges from the Stauffer Run watershed will reduce the mean flow in Stauffer Run by approximately 0.2 MGD and approximately 1496 lbs. of acid, 190 lbs. of iron, and 1890 lbs. of sulfate per day will be eliminated (Table B-2). This will significantly reduce the AMD pollution in Stauffer Run from its headwaters to its confluence with Jacobs Creek, a distance of 3.23 stream miles.

The abatement plan for this area includes the installation of watertight seals on discharges M101, M102, M103, M62B, M62C, M63 (2 pipe discharges) and other entries encountered during the construction. Available mine maps of this area indicate the possibility of at least 5 additional seals being required (See Vol. II Plate 5). These seals may be required to supplement the proposed grout curtain because mining in this area was continued to a close proximity of the outcrop under very low cover. The cost estimate for this area was based on installation of 10 seals, using the more costly remote placing technique if during the design phase test drilling indicates surface seals or seals constructed within the mine are feasible this cost would be significantly reduced.

Information generated for this study suggests that approximately 9500 feet of grout curtain would be required to insure complete diversion and preclude the formation of new discharges. Prior to final design this area should be drilled and pressure tested to determine the actual length of grout curtain required and its design criteria.

This barrier and seals should be capable of withstanding the head needed to divert all the water into the M62A discharge at about elevation 1140±. The elevation and head requirements will have to be determined after the source of M62A is excavated and its exact elevation determined. If the grout barrier and seals are constructed a small pool may build up before the water flows into M62A, but if either the daylighting or trench barrier are constructed (see below), they should be designed to prevent the formation of a pool.

Implementation of the above plan should essentially divert all the known AMD discharges to the source of M62A. An open cut flume could then be constructed from M62A approximately 400 feet to intercept the main drain of the Alverton No. 1 Mine. The discharge should then flow through the Southwest No. 3 workings and be discharged through M05.

An open cut flume was used in the cost estimate because it offered the most economical solution that would function adequately. Depending on the actual depth of the proposed flume, safety and economic considerations may justify the use of a covered structure at this location also. This will have to be evaluated by test drilling and excavation to verify the information contained on the mine maps.

Two alternative methods for diverting the AMD to M62A were considered but based on the preliminary cost estimates the mine seals and grout curtain appears to offer the most cost effective solution. Alternative I for this area consists of daylighting the mine workings to approximately the alternative barrier indicated in Vol. II Plate 5. After daylighting a clay barrier will be constructed along approximately 1750 feet of the exposed coal crop, backfilled and seeded. The estimated cost for this alternative is $4,450,000 (without coal option) and $2,600,000 (with coal option). Alternative 2 for this area consists of excavating a 20 foot bottom width trench with 1 1/2:1 side slopes along the line of the alternative barrier shown on Vol. II Plate 5. After excavation a 20 foot wide by 10 foot high compacted clay barrier would be placed against the exposed workings. The trench would then be backfilled, graded and seeded. The preliminary estimated cost for this alternative is $1,400,000.

This area requires a more in-depth study, including test drilling to determine which of the above proposals would be most feasible and economically sound.

4.2 Area Description and Cost Estimate

A. Description

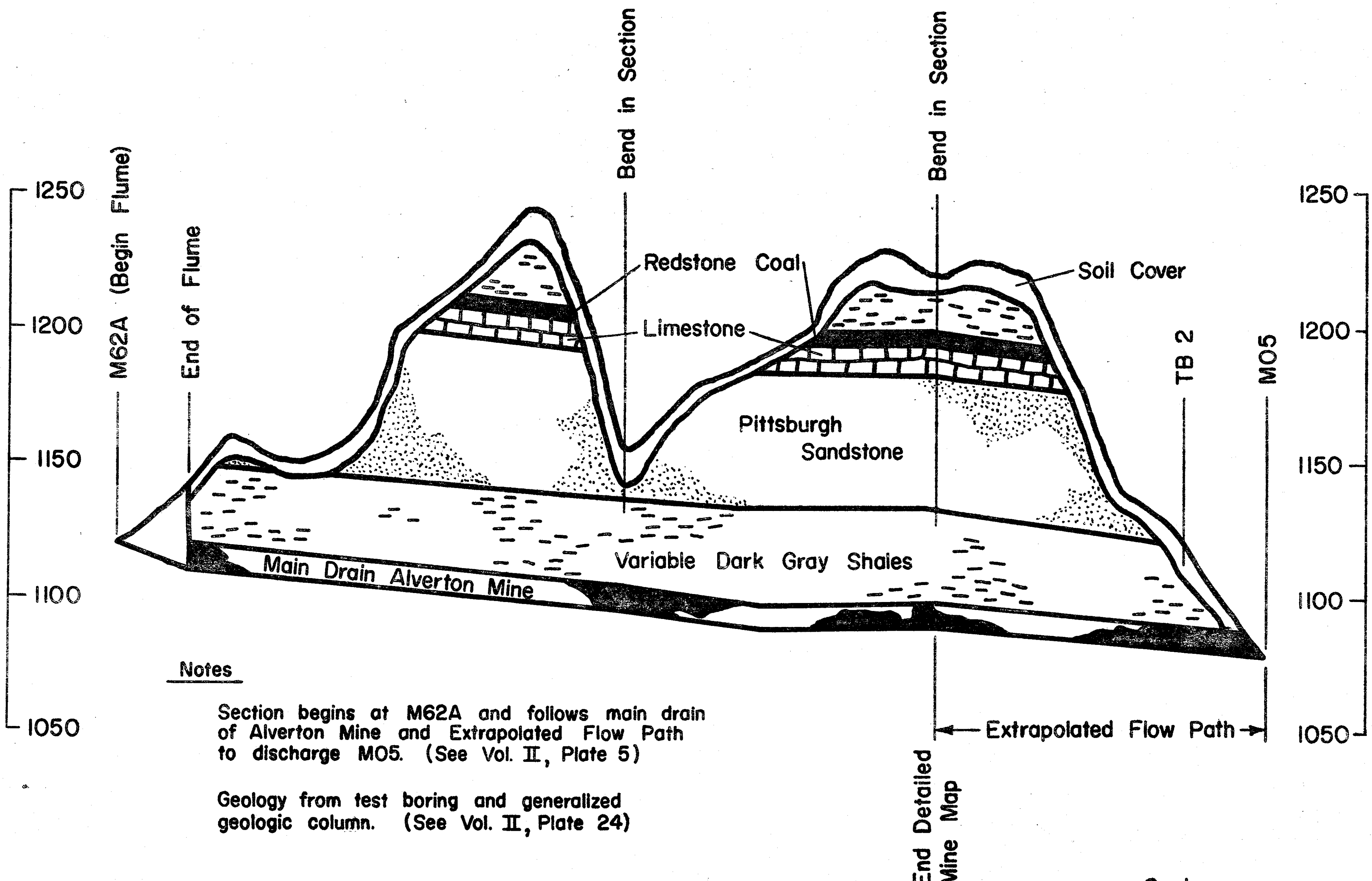
Source M62A is located at the headwaters of Stauffer Run and discharges from a stone and concrete flume from the Alverton Mine. M62B is similar in appearance and construction to M62A as is M62C.

These discharges were piped to outlet close to Stauffer Run and excavation will be necessary to determine the location and elevation of their sources. All three of the structures are in need of repair.

Source M63 is discharging from the Alverton mine while M101, M102 and M103 are discharging from either the Mahoning or Peerless mines. All these discharges drain into small unnamed tributaries to Stauffer Run. An active surface mine operation on the Redstone Seam is located on the hill between these sources. There is evidence of mine subsidence around these discharges as well as mine openings sealed or partially caved. Surface water is entering the seam through extensive subsidence areas. Also near these discharges are abandoned coke ovens and approximately 1400 feet downstream is an active coking operation. The banks of Stauffer Run are composed primarily of mine refuse, boney and waste material from the coking operations.

The entire area has been deep mined and surface mined and although small portions are cultivated, most of the area is forested with second growth and underbrush and appears to have little commercial value.

The flow path for the proposed diversion of M62A to M05 is sketched in Figure VI-3. This path is based in part on detailed mine maps, discussions with local residents and former mine employees and also experience with past local mine drainage handling techniques (See Section IV).



Notes

Section begins at M62A and follows main drain of Alverton Mine and Extrapolated Flow Path to discharge MO5. (See Vol. II, Plate 5)

Geology from test boring and generalized geologic column. (See Vol. II, Plate 24)

Figure VI - 3 Flow Path, M62A to MO5

Scale
Horz.: 1" = 800'
Vert.: 1" = 50'

B. Cost Estimate

10 Double bulkhead seals remotely placed @ $15,000 ea.	$150,000.00
9500 ft. of grout curtain @ $50.00/L.F.	$475,000.00
Open cut flume excavation 22,300 yd^3 @ $2.00/$Yd^3$	$ 44,600.00
Anti-Pollution	$ 2,000.00
1000 ft. of chain link fencing @ $7.00/L.F.	$ 7,000.00
Seeding and mulching, 5000 yd^2 @ $0.15/$yd^2$	$ 750.00
PHASE II ESTIMATED COST	$ 679,350.00

4.3 Cost Effectiveness Analysis

Implementation of Phase II will essentially remove the effects of AMD on 3.23 miles of Stauffer Run. The cost per mile of stream would be $210,325.07 for Stauffer Run. Based on pollution load the cost ratio is:

PARAMETER	REMOVED LBS/DAY	INITIAL COST/LB/DAY	COST/LB/15 YRS
Acid	1,496	$ 454.11	0.08
Iron	190	$ 3,575.52	0.65
Sulfate	1,890	$ 359.44	0.07
Total	3,576	$ 189.97	0.03

The cost per pound of the total parameter would more closely reflect the actual benefits from implementation of this phase than the cost per individual parameter because all pollutants would be removed from the watershed.

5.0 Phase III: Pipe Diversion of M05 and M104

5.1 Method Discussion

The two AMD discharges, M05 and M104 (See Volume II, Plates 5 and 8) make up the majority of the flow in the headwaters of Buffalo Run. Diversion of these discharges from the Buffalo Run Watershed will reduce the flow in Buffalo Run by approximately 1.0 MGD and with this approximately 3813 lbs. of acid, 334 lbs. of iron and 7365 lbs. of sulfate a day will be eliminated (Table B-2). This will significantly reduce the AMD pollution in Buffalo Run, from its headwaters to its confluence with Null Run, a stream distance of approximately 3.2 miles. Null Run reportedly (Gibbs & Hill, 1972, P. V-19) receives water from Eastern Associated Coal Corporation's Delmont Mine (Active) which is to be treated prior to discharge.

The diversion of M62A, etc. from the Stauffer Run Watershed to the Buffalo Run Watershed will lead to additional AMD contributed to Buffalo Run, which will, in turn, be diverted to Wilson Run.

An approximation of the flow and quality of the combined discharge to Buffalo Run prior to diversion to Wilson Run was produced by combining sample portions of these discharges according to their mean flows. The results of this combined discharge follow as "Discharge A".

DISCHARGE A

Flow	1.154 (MGD)
pH	3.0
Acidity	376 mg/l
Alkalinity	0 mg/l
Ferrous Iron	26 mg/l
Total Iron	56.6 mg/l
Sulfate	960 mg/l

These results indicated that the discharge at M05 will still contain large amounts of AMD, however, it will be necessary to monitor this discharge to determine its actual characteristics.

The essential elements in the abatement plan for this area include: exposing the Southwest No. 3 main slope heading, installation of two (2) pipes to convey discharges M05 and M104 to the slope, headwalls on the pipes and backfilling of the slope opening. The combined discharges will then flow down the Southwest No. 3 main slope heading, and to the Main Drain of the Central Mine (See Volume II, Plate 8). This flow will then be outlet through the present M06 discharge. Based on monitoring during the period of this study the flow at M06 could be expected to increase by approximately 1.2 MGD (See Table V-2). However, it is anticipated that the actual increase will be somewhat less because of the decreased inflow to the pool due to the reclamation of the outcrop. This combined flow could then be more efficiently neutralized in conjunction with M06 & M07.

The source of M05 appears to be from Southwest No. 3 and also possibly the Alverton Mine. Due to the lack of detailed mine maps in this area it is not possible to say the above with absolute certainty. However, detailed mine maps (Volume II, Plate 5) of the Alverton Mine indicate the Southwest Connellsville Coke Company Donnelly Heading Main Drain and the Alverton Main Drain meet as shown.

As Volume II, Plate 8 indicates, there is extensive development of the Central Mine that transitions abruptly to apparently less developed areas of the Southwest No. 3 Mine. Based on a review of available literature and comparison of the W.P.A. mine maps for areas where detailed maps are available, we feel it is valid to assume this area of Southwest No. 3 was more extensively developed than the W.P.A. map indicates. The flow path outlined (Vol. II - Plates 8 & 11) follows main headings through these sections and should be the best supported and developed areas. The probability of these headings remaining at least partially open should be good. The water would also have alternate paths open through other headings that may be partially caved but should retain sufficient permeability, considering the large cross-sectional area, to transmit the anticipated volume of water.

By previous combination of M101, M102, M103, M62A, M62B, M62C and M63 the increased flow into the Southwest No. 3 and Alverton Mines may cause a rise in elevation of the mine pool thus reducing the number of active acid producing sites and reducing the AMD load from M05 and M104. Further reductions may be realized by the addition of alkaline material to the inflow (Phase VI).

Combination of the resulting discharge from M05 and M104 with M06 and M07 will result in one discharge that is easier to treat than three separate discharges, and because of the alkalinity present in M06 and M07 less expensive to treat to achieve the desired water quality. The anticipated quality for discharges to Wilson Run (Discharges B and C) is presented on Page VI-78 and 79.

5.2 Area Description and Cost Estimate

A. Description

Discharge M05 is an artesian flow from a drain of the Southwest No. 3 Mine. Although detailed information is lacking, it appears that discharges M05 and M104 are also draining the Southwest No. 2 Mine, and portions of the Alverton Mine. Discharge M05 is located at the bottom of a valley on the property of John Love approximately 1 mile south of Tarrs and 0.6 miles southeast of West Bethany. Discharge M104 is located approximately 300 feet downstream of M05.

Discharge M104 is an air seal almost completely submerged by Buffalo Run due to the silting up of the Buffalo Run Channel and a partial blockage existing approximately 1 1/2 miles downstream from M104.

The area surrounding the discharges was deep mined and surface mined. There is some subsidence downstream from M05 and ponding is evident in the subsidence. The outcrop of the Pittsburgh coal seam is present in the valley and in the refuse areas.

The cost estimate was calculated in two ways, one in conjunction with the reclamation of Area 32 and, two without Area 32 reclamation.

B. Cost Estimate

	With Reclamation	Without Reclamation
Reclamation of Area 32	$ 46,830.00	$ ---
Ditch Excavation 345 cy @ $1.50/cy	$ 517.50	$ 517.50
Expose and Backfill Slope Heading 25300 cy @ $1.50/cy	---	$37,432.50
Pipe - Epoxy Line Transite		
4" - 600 ft. @ $4.00/L.F.(M104)	$ 2,400.00	$ 2,400.00
15" - 1150 ft. @ $9.20/L.F.	$10,580.00	$10,580.00
Concrete Pipe Placement		
1 - Junction Box @ $350.00/Box	$ 350.00	$ 350.00
1 - Junction Box @ $300.00/Box	$ 300.00	$ 300.00
1 - Endwall @ $600.00/Each	$ 600.00	$ 600.00
TOTAL ABATEMENT COST	$ 61,577.50	$ 52,180.00

5.3 Cost Effectiveness Analysis

Implementation of Phase III will essentially remove AMD from 3.2 stream miles of Buffalo Run. The cost per stream mile will be $19,242.97 with reclamation or $16,306.25 without reclamation for Buffalo Run. It should be pointed out that the reclamation of this area is expected to prevent an estimated 83,600 gallons per day from entering the mine. These 83,600 gallons, should enter Buffalo Run providing fresh water for dilution.

Based on pollution load, the cost ratio is:

Parameter	Removed Lbs/Day	Initial Cost/Lb/Day		Cost/Lb/Day/15 Years (Cost in Mills)	
		With	Without	With	Without
Acid	3,800	$ 16.20	$ 13.73	3.0	2.5
Iron	330	$186.60	$158.12	34.1	28.9
Sulfate	7,400	$ 8.32	$ 7.05	1.5	1.3
Total	11,530	$ 5.34	$ 4.53	1.0	0.8

The cost per pound of the total parameter more closely reflects the actual benefits from implementation of this phase, because all pollutants would be removed from the watershed.

6.0 Phase IV: Settling Pond at M06 and M07 on Wilson Run

6.1 Method Discussion

The two sources, M06 and M07 (Located in Volume II, Plates 1 and 11) have a combined flow of approximately 4.8 MGD which carries approximately 3440 lbs/day of acid, 1640 lbs/day of iron and 23,340 lbs/day of sulfate to Wilson Run, a tributary of Sewickley Creek. Wilson Run is essentially non-polluted by AMD upstream of M06 and M07 which enter the stream approximately 300 feet apart. Below the discharge Wilson Run is severely polluted by iron and sulfate for a distance of 4.17 stream miles to its junction with Sewickley Creek (Gibbs & Hill, 1972). Immediately downstream from M06 and M07 the channel of Wilson Run is coated with deposits of yellowboy.

The essential elements of the abatement plan recommended for this area include construction of a settling pond system, possible relocation of a portion of the channel of Wilson Run and, if needed, enlargement of the opening of M07 due to its alkaline nature and installation of a continuous liming unit. The design criteria for sizing the pond system, the amount of enlargement of M07 and the need for a liming unit should be determined during the Monitoring II and III phases (See Figure VI-2). The following discussion is based on data generated during this study. The quantity of flow estimated for Discharge B of 3.53 MGD at M06 is expected to be higher than what will actually be discharged. The actual amount of volume reduction depends on how much the inflow is reduced through outcrop reclamation. The most feasible method to determine the quantity of discharge is monitoring after completion of the abatement projects directly affecting this area. These projects include:

1. Reclamation of major and minor inflow areas;
2. Placing of seals at discharge M63, M62B, M62C, M101, M102, and M103 to divert flow to M62A;
3. Diversion of the resultant flow at M62A through the Alverton Mine and the Southwest No. 3 Mine to M05;
4. Diversion of the resulting M05 and M104 discharges through the Southwest No. 3 main slope heading to the main drain of the Central Mine to outlet at M06 as discharge "B" and;
5. Diversion of discharge "B" to mix with M07 as discharge "C".

The abatement scheme proposed for this area may increase the flow in Wilson Run by approximately 1.2 MGD (25%) based on monitoring during this study. The estimated settling pond size was based on the maximum flows of M06, M07, and the combined maximum flows of the diverted discharges. This anticipated increase in flow does not consider any reduction of the discharges due to sealing of the major and minor inflow areas. Estimates of the direct inflow reductions were made in Section VI, Subsections 2.3 and 3.3, however these were not considered when estimating the approximate pond size. It is recommended that discharges M06 and M07 be monitored after the completion of the pipe diversion for a minimum of 6 months with flow readings taken at weekly intervals and water samples collected for analysis every other week. The weekly intervals may be expanded if a stabilized flow is established prior to the end of the monitoring period.

In an attempt to substantiate these findings, a sample of the anticipated discharge at M06 was made by combining the component discharges (M62A, M62B, M62C, M63, M05, M06, M101, M102, M103 and M104) on the basis of mean flow. The resulting sample was analyzed and the results are as follows:

DISCHARGE "B"

Flow	3.526 MGD
pH	6.1
Acidity	159 mg/l
Alkalinity	14 mg/l
Ferrous Iron	36.5 mg/l
Total Iron	53.3 mg/l
Sulfate	804 mg/l

The combined discharge is poorer in quality than the mean values of M06 (Page II-4). However, the elimination of discharges M62A, M62B, M62C, M63, M101, M102, M103, M104, M05 from their respective streams appears to more than compensate for this slightly poorer quality of discharge B.

Further improvement may be expected following construction of the settling ponds. Discharge M07 flows from an excavated trench (approximately 14 feet wide) into a natural settling pond before flowing into Wilson Run. Based on one sample collection a comparison of two samples, one taken before entering the pond and one from the discharge to Wilson Run, indicates an improvement in quality. This improvement may be due to one or a combination of several factors including dilution, mixing, possible biological activity, retention time, and availability of oxygen for the large surface area as opposed to the depth. Sample analysis results follow:

Parameter	Sample 1 Before Entering Pond	Sample 2 Discharge into Wilson Run
pH	5.8	6.1
Acidity	168.0 mg/l	40.0 mg/l
Alkalinity	1720 mg/l	164.0 mg/l
Ferrous Iron	33.6 mg/l	19.0 mg/l
Total Iron	36.7 mg/l	19.6 mg/l
Sulfate	700.0 mg/l	700.0 mg/l

A composite sample was prepared by mixing Discharge B with the M07 discharge in proportion to their mean flow. This final anticipated discharge combination (Discharge C) entering the settling pond on Wilson Run had the following characteristics, from the one sample collection.

DISCHARGE "C"

Flow	5.994 MGD
pH	6.1
Acidity	117 mg/l
Alkalinity	78 mg/l
Ferrous Iron	30 mg/l
Total Iron	46.9 mg/l
Sulfate	720 mg/l

6.2 Area Description and Cost Estimate

A. Description

Discharges M06 and M07 are located in relatively flat pasture land approximately 500 feet southwest of the crossing of the Pennsylvania turnpike by Rt. 819. (See Volume II, Plate 1). The two discharges are located approximately 300 feet apart with M06 being downstream of M07. There are at least 4 visible deep mine entrances in the immediate area. Water was not observed discharging from any of these openings at any time during the study period although it is presumed that the mines are flooded.

Discharge M06 is a flume discharge entering directly into Wilson Run. Discharge M07 is an artesian flow located approximately 300 feet from Route 819 between Route 819 and Wilson Run. It flows into a pond before discharging into Wilson Run. The immediate area around these discharges is used as pasture.

To arrive at an estimated construction cost for the settling pond it was sized to handle the maximum flows as monitored for this study. Implementation of Phase I, Reclamation of Major and Minor Inflow Areas, may reduce the size of the pond required.

The ponds were visualized as being constructed with a minimum embankment height using material excavated from the pond area to construct the embankment. With this type of construction sequence, the Excavation and embankment construction can be considered as one pay item. Excess excavation material would be used for access road construction, or transported as cover or construction material for sludge disposal. The excavation yardage was increased by a half to allow for miscellaneous construction and special construction techniques as necessary.

Sludge would be pumped to the nearest suitable site, such as an abandoned surface mine, for disposal in large settling impoundments or alternately by air drying or possible porous drying beds. For estimating pump costs it was assumed, that a suitable disposal location would be found within 2000 feet, 100 feet higher in elevation than the ponds. .

The pond system was sized at maximum flow to provide two days retention time with sufficient sludge storage (iron precipitate only) capacity to operate for thirty days without cleaning. This storage capacity is provided for pump repairs, electrical failures, on pipeline breakage repairs. At this preliminary estimation stage, the cost of relocating approximately 700 feet of Wilson Run is included in the pond excavation costs. The preliminary estimate is based on an eight (8) foot bottom trapezoidal channel with 2:1 side slopes. The need for a ditch lining was not investigated.

The exact location of the disposal area will be determined in the design stage.

B. Cost Estimate

I. If Phases II and III are not implemented the following is an estimate of costs for Phase IV.

Pond Excavation 163,400 cy @ $1.50/cy		$ 245,100.00
Diversion Ditch Excavation 1,100 cy @ $1.50/cy		$ 1,650.00
Service Road 4,600 ft. @ $2000/L.F.		$ 92,000.00
Concrete pipe placement, 1-Junction Box @ $390.00/Box (for M06)		$ 390.00
Transite Epoxy coated 20" diameter pipe, 200 ft. @ $14.50/L.F. (for M06) Installed		$ 3,005.00
Sludge Pump and Piping Installed		$ 25,500.00
Chain Link Fence 3,000 ft. @ $7.00/L.F.		$ 21,000.00
Seeding and Mulching 32,000 sy @ $0.15/sy		$ 4,800.00
	Estimated Construction Cost	$ 393,445.00
	Maintenance @ $5,300.00 per Year for 15 Years	$ 79,500.00
	TOTAL ESTIMATED COST	$ 472,945.00

II. If Phases II and III are implemented the following cost estimates are applicable.

Pond Excavation 200,800 cy @ $1.50/cy		$ 301,200.00
Diversion Ditch Excavation 1,100 cy @ $1.50/cy		$ 1,650.00
Service Road 4,600 ft. @ $20.00/L.F.		$ 92,000.00
Transite Epoxy coated 20" diameter pipe, 200 ft. @ $14.50/L.F. (for M06) Installed		$ 3,005.00
Concrete pipe placement 1 - Junction Box @ $390.00/Box (for M06)		$ 390.00
Sludge Pump and Piping Installed		$ 31,000.00
Chain Link Fence 3,500 ft. @ $7.00/L.F.		24,500.00
Seeding and Mulching 32,000 sy @ $0.15/sy		4,800.00
	Estimated Construction Cost	$ 458,545.00
	Maintenance @ $6,600.00 per Year for 15 Years	$ 99,000.00
	TOTAL ESTIMATED COST	$ 557,545.00

6.3 Cost Effectiveness

To provide a cost effectiveness analysis several assumptions had to be made. They included (1) samples 1 and 2 are valid and representative, (2) the pond is in a steady state with inflow equal to outflow, (3) retention time for the proposed pond is similar to that of the existing pond and (4) the same decreases in acidity and total iron will apply to the mixed discharges. On these assumptions the cost effectiveness benefit is determined below, for both implementation of Phase II and III, and with non-implementation of Phases II and III, based on the twelve month mean analyses and flows of the discharges.

Parameter	Abate (lb/day) Without Phase II&III	Abate (lb/day) With Phase II&III	Initial Cost/LB. Without	Initial Cost/LB. With	Cost/lb/15Years Without	Cost/lb/15Years With
Acid	5425	9459	$ 87.18	58.94	0.02	0.01
Iron	1033	1279	$ 457.84	435.92	0.08	0.08
TOTAL	6458	10738	$ 73.23	51.92	0.01	0.01

A loss of 47% was calculated for the total iron decrease from Samples 1 and 2. The closeness of ferrous and total iron values indicates dissolved oxygen may be the limiting factor for the reaction causing ferric iron precipitation. The use of baffles or some other method of aeration as the discharges enter the settling pond should increase the percentage of iron precipitated. The method of aeration should be determined during the development feasibility stage.

The decrease in acidity, calculated from Samples 1 and 2, was 76 %.

7.0 Phase V: Settling Pond Construction for M08, M08A, and M09 on Boyer Run.

7.1 Method Discussion

The three AMD discharges, M08, M08A, and M09 supply approximately 1260 lbs. of acid and 290 lbs. of iron per day to Boyer Run which is essentially non-polluted by AMD upstream of M08, M08A, and M09. These AMD discharges enter the stream approximately 500 feet apart. Below the discharges, Boyer Run is severely polluted by iron and sulfate for a distance of 1.01 miles to its junction with Sewickley Creek (Gibbs and Hill, 1972). Immediately downstream from M08 and M08A, and M09 the channel of Boyer Run is heavily coated with deposits of yellowboy. The analysis of the combined discharge (Discharge E) from these sources is as follows:

DISCHARGE "E"

Flow	1.219 MGD
pH	6.3
Acidity	128 mg/l
Alkalinity	172 mg/l
Ferrous Iron	32.0 mg/l
Total Iron	37.3 mg/l
Sulfate	576 mg/l

The essential elements of the abatement plan recommended for this area include construction of a settling pond system, relocating approximately 600 feet of Boyer Run and installation of a continuous liming unit if necessary. The location of the pond was chosen to minimize construction costs, disruption of existing structures and utilities and containment of all three discharges within the pond. The design criteria for sizing the pond system, the amount of diversion of Boyer Run, and the need for a liming unit should be refined during the Monitoring II and III phases. The quantity of flow estimated (1.2 MGD) for the settling pond is anticipated to be higher than what will actually be discharged. The actual flow will depend on the reduction of the inflow by reclamation of the outcrop. The most feasible method of determining the quantity of the combined discharge is to monitor it after completion of outcrop reclamation.

7.2 Area Description and Cost Estimate

A. Description

Discharges M08, M08A, and M09 are located approximately 1.25 miles southwest of Brinkerton and 1.3 miles northwest of the crossing of the Pennsylvania Turnpike by Route 819. (See Volume II, Plate 1). All three discharges are artesian flows located near Boyer Run. There is extensive subsidence in the area with many pooling areas and evidence of caved deep mine openings, abandoned coke ovens, and railroad grades present in the area as well as a refuse pile located near M09. There is also evidence of a small active mine, probably providing house coal to homes located in the area. Some of the pooling areas are used as refuse dumps by local residents and there is evidence of septic tank discharge into other subsidence areas.

The below cost estimate was derived using the same procedure and assumptions as Pond No. 1 at M06 and M07 (Page VI-80).

B. Cost Estimate

Pond Excavation 52,600 cy @ $1.50/cy		$ 78,900.00
Diversion Ditch Excavation 1,200 cy @ $1.50/cy		1,800.00
Service Road 4,400 ft. @ $20.00/L.F.		88,000.00
Chain Link Fence 1,700 ft. @ $7.00/ft.		11,900.00
Seeding & Mulching 22,500 sy @ $0.15/sy		3,375.00
Boyer Run Relocation 8,900 cy @ $1.50/cy		13,350.00
Sludge Pump and Piping Installed		18,500.00
	ESTIMATED CONSTRUCTION COST	$ 215,825.00
	MAINTENANCE @ $2,800.00 PER YEAR FOR 15 YEARS	$ 42,000.00
	TOTAL ESTIMATED COST	$ 257,825.00

7.3 Cost Effectiveness Analysis

The cost effectiveness analysis was based on the twelve month mean analyses and flows of discharges M08, M08A and M09, using the same percent reduction as calculated for Pond 1. (Page VI-83). The amount of iron precipitated is expected to be higher than shown below due to additional aeration.

Parameter	Abate LBS/Day	Initial Cost/Lb.	Cost/Lb./15 Years
Acid	958	$ 269.13	$0.05
Iron	136	$ 1,895.77	$0.35
TOTAL	1094	$ 235.67	$0.04

The cost per pound of the total parameter more closely reflects the actual benefits from implementation of this phase.

8.0 Phase V: Settling pond construction for M10, M11 and M12 on Sewickley Creek.

8.1 Method Discussion

The three AMD sources M10, M11, and M12 have a combined mean flow of 8.0 MGD and contribute approximately 14600 lbs. of acid and 4590 lbs of iron to Sewickley Creek per day. Sewickley Creek is relatively non-polluted by AMD above M10, M11, and M12, while below it is severely polluted by AMD.

The essential elements of the abatement plan for this area include construction of a settling pond system, diversion of approximately 4200 feet of Sewickley Creek, and the installation of a continuous liming unit if necessary. The design criteria for each element should be determined during the Monitor Phases II and III due to possible changes in quantity and quality of the discharges which should occur as a result of the outcrop reclamation.

Mean chemical parameters for M10, M11 and M12 are listed on page II-2. The combined discharge made by mixing the three discharges in proportion to their respective flows was analysed as Discharge "D". The results follow:

DISCHARGE "D"

Flow	7.994 MGD
pH	6.1
Acidity	196 mg/l
Alkalinity	112 mg/l
Ferrous Iron	56.0 mg/l
Total Iron	63.1 mg/l
Sulfate	848 mg/l

8.2 Area Description and Cost Estimate

A. Description

The discharges M10, M11, and M12 are located in the Brinkerton Overflow Area approximately 0.5 miles southwest of Brinkerton and 0.7 miles west of United (See Volume II, Plates 1 and 14).

Discharge M10 is located in the valley and flows from a series of ponds created by subsidence of an abandoned deep mine, probably Hecla #1. Throughout the study period new ponds appeared which eventually joined the main discharge through further subsidence. The area is heavily mined and extensive subsidence is visible in the vicinity of M10 as well as on the nearby hillside.

Discharge M11 is a large swampy area formed by several seepages from the outcrop. This discharge is apparently draining the Brinkerton Mine. The entire swamp is heavily laden with yellow boy and its size varies throughout the year as the discharge varies. No evidence of a single point discharge was found in the swamp, it is apparently formed by seepage. The swamp outlets at one main point under the abandoned railroad tracks although in periods of heavy flow it outlets at several other points.

Discharge M12 is an artesian flow and appears to be the "main drain" of the Brinkerton Mine. This discharge point appears to have been constructed in an effort to avoid "breakouts" which were common in the field between M11 and M12.

The area surrounding all three discharges shows a large amount of subsidence. Abandoned coke ovens from the Hester Mine are between M11 and Sewickley Creek; a double row of abandoned coke ovens from the Brinkerton Mine along with coal refuse and coke waste surround and hide the source(s) of M11.

The settling pond system should be located approximately as shown in Volume II, Plate 22, because of the thinness of cover over the mine pool, as evidenced by old and fresh subsidence around M10, and for economic construction. Before construction at this location, subsurface information should be obtained to insure that the embankments are located for maximum support and where possibility of subsidence is minimal. An ancilliary benefit that may be derived from construction at this location is the deposition of some of the sludge into the abandoned mine workings under the pond.

For cost estimating purposes, costs for removing the abandoned railroad tracks, ties and coke ovens are included in the Pond and Relocation Excavation costs. The same procedures and assumptions were used as outlined for Pond 1 (Page VI-80), except excavation cubic yardage was doubled to provide for special construction techniques.

B. Cost Estimate

Pond Excavation 507,600 cy @ $1.50 cy	$ 761,400.00
Sewickley Creek Relocation 380,800 cy @ $1.50 cy	571,200.00
Diversion Ditch Excavation 7,200 cy @ $1.50 cy	10,800.00
Chain Link Fence 3,500 ft. @ $7.00/L.F.	24,500.00
Service Road 9,700 ft. @ $20.00/L.F.	194,000.00
Epoxy Lined Transite Pipe, Installed	
400 ft. 24" diameter @ $20.00/ft. (M11) 400 ft. 18" diameter @ $12.50/ft. (M12) 450 ft. 18" diameter @ $12.50/ft. (M11A)	19,300.00
Sludge pump and Piping Installed	32,500.00
Seeding and Mulching 58,000 sy @ $0.15/sy	8,700.00
ESTIMATED CONSTRUCTION COST	$1,622,400.00
MAINTENANCE COSTS @ $ 7,750.00 PER YEAR FOR 15 YEARS	$ 116,250.00
TOTAL ESTIMATED COST	$1,738,650.00

8.3 Cost Effectiveness Analysis

The cost effectiveness analysis was based on the twelve month mean analyses and flows of discharges M10, M11 and M12, using the percent reduction as calculated for Pond 1. (Page VI-83.) The amount of iron precipitate is expected to be higher due to additional aeration.

Parameter	Abate Lbs/Day	Initial Cost/Lb.	Cost/Lb./15 Years
Acid	11100	$ 156.64	0.03
Iron	2155	$ 806.80	0.15
TOTAL	13255	$ 131.17	0.02

The cost per pound of the total parameter more closely reflects the actual benefits from implementation of this phase.

9.0 Phase VI: Introduction of Alkaline Materials into the Mine Pool through Existing Conduits.

9.1 Method Discussion

Addition of alkaline material to the mine pools through existing conduits offers the advantages of a "quick and easy" method of AMD treatment as well as a method of disposing of these caustic wastes without treatment.

Introduction of caustic wastes at the flume at M62A will insure complete mixing with the mine pool, possible reduction of acidity and iron in the discharge M05 and settling of some of the yellowboy produced in the mine itself eventually "silting up" part of the mine. Based on data obtained during the monitoring and sampling phase of this study the discharge at M62A will contain approximately 1496 lbs/day of acid 190 lbs/day of iron and 1,890 lbs/day of sulfate. Addition of approximately 1,686 lbs/day of alkaline material will result in a discharge approaching zero acidity.

Introduction of caustic wastes at the pipe diversion of M05 will also insure complete mixing with the mine pool, possible reduction of acidity and iron in the discharge at M06 and settling of some of the yellow boy produced in the mine itself eventually "silting up" part of the mine. The twelve month monitoring data indicates the discharge at M05 following implementation of Phase I and Phase II will contain approximately 5260 lbs/day of acidity, 523 lbs/day of iron and 9,080 lbs/day of sulfate. Addition of approximately 6,072 lbs/day of alkaline material will result in a discharge approaching zero acidity, (See Page VI-93).

Regarding the alkaline waste material itself, it is recommended that the material be obtained from a source which is currently required to treat its discharge to comply with existing water quality standards. This will insure that extremely large quantities will not be required to achieve a benefit, and the costs of transportation and addition will be lowered because of the elimination of the need for continuous liming units. It is also recommended that the alkaline waste be analyzed to insure that objectional quantities of other material (cyanides, heavy metals, etc.) will not be present in the final discharge.

Preliminary investigation has revealed that the Eidemiller Quarry operating in Unity Township has a waste material consisting of washings from the quarry. The Eidemiller Quarry operates primarily in the Loyalhanna limestone which is approximately 25% calcium oxide (CaO). The washings should contain the same percentage of CaO. Mr. Robert Snyder of Bidemiller Quarry has quoted a price (1-8-75) of $7.00/ton including transportation. Current prices for CaO are quoted at $36.00/ton not including transportation.

It is recommended that independent analysis be performed on the Eidemiller alkaline waste to confirm these assumptions and that further investigation be done to determine quality, quantity, cost, and location of additional alkaline waste sources. This should be done during the initial sealing and diversion phases so that addition of alkaline wastes may begin before the Monitoring II and III phases. This would allow an evaluation to be made of the method as well as provide data for any additional treatment which may be necessary.

10.0 Phase VII: Installation of Continuous Liming Units

10.1 General

Continuous liming units are an effective but expensive means of AMD treatment. Because of this, continuous liming units should be used only where absolutely necessary and should be placed in a manner so as to produce the greatest amount of treatment per dollar. Five possible locations for continuous liming units in the study area were explored. They include (1) unit at M62A following Phase II completion; (2) unit at M05 following Phase III completion; (3) unit at Pond 1 (M06 and M07) following Phase IV; (4) unit at Pond 2 (M08, M08A, M09) following Phase V; and (5) unit at Pond 3 (M10, M11, M12) following Phase V.

The Acid and Iron loads are based on mean values from the monitoring phase of this study. The effects of Phase I, sealing and reclamation, were not considered in the calculations. Costs are based on prices quoted by the Shirley Machine Company, manufacturer of the MIXMETER systems. The cost estimate and effectiveness were based on the following:

(1) Information contained in the "Information Manual" by the Shirley Machine Company, indicated that the amount of calcium oxide needed to approach zero acidity and iron content was approximately equal to the sum of the acid and iron load in pounds per day plus five percent. This estimate was used for determining costs,

(2) All treatment was continued to result in 0.0 pounds per day of acidity and total iron.

(3) It was assumed that after fifteen (15) years the cost of

repairs to the Mixmeter unit would approach the cost of a new unit. Repair and other miscellaneous costs were estimated at $1,000.00 per year.

(4) Loading in pounds per day was taken from Table B-3, Mean Analysis, All Discharges.

10.2 Continuous Liming Unit at Discharge M62A

Discharge M62A will be the only AMD source on Stauffer Run following completion of Phases I and II. This discharge will be channeled into the Alverton Mine with the resulting discharge outletting at M05. The discharge at M62A will be a combination of M101, M102, M103, M62A, M62B, M62C, and M63. The expected water quality will have an acidity of 978 mg/l and a total iron concentration of 123 mg/l. This represents an average load of 1496 pounds/day of acid and 190 pounds/day of iron being removed from Stauffer Run and added to the Alverton Mine. A continuous liming unit would require approximately 1770 pounds/day of CaO (100% reactive) to reduce the acidity and iron concentrations to zero. This resulting effluent to the Alverton Mine should, through dilution, reduce the AMD load of M05 by approximately 16%. The estimated cost of a liming unit is as follows:

Mixmeter and Monitoring Equipment Installed	$ 50,000.00
323 Tons/Year of CaO @ $36.00/Ton for 15 Years	$ 174,420,00
Maintenance Costs for 15 Years @ $1,000.00/Year	$ 15,000.00
TOTAL ABATEMENT COST	$ 239,420.00

Computed on the basis of pollution load:

PARAMETER	TREAT LBS/DAY	INITIAL COST/LB/DAY	COST/LB/15 YEARS
Acid	1496	$ 160.04	0.03
Iron	190	$ 1,260.11	0.23
Total	1686	$ 142.00	0.03

Total cost per pound is more representative of the cost effectiveness to be realized.

10.3 Continuous Liming Unit at M05

Discharges M05 and M104 flow from the Southwest No. 3 Mine into Buffalo Run. Following completion of Phases I and II, M05 will also be discharging the combined discharge of M62A. Phase III will collect this expanded M05 flow, add the M104 discharge and pipe them into the main slope of the Southwest No. 3 Mine for eventual discharge at M06.

A continuous liming unit installed at the pipe would be required to treat water with approximately 542 mg/l acidity and 54.5 mg/l total iron (assuming subsection 10.2 is not used). This represents an approximate loading of 5308 pounds per day of acidity and 524 pounds per day of total iron. A continuous liming unit would require approximately 6124 pounds per day of CaO (100% reactive) to reduce the acidity and iron concentrations near zero. The resulting effluent to M06 should, through dilution, reduce the AMD load of M06 by 34%. The estimated cost of a liming unit is as follows:

Mixmeter and Monitoring Equipment

Installed	$ 50,000.00
1118 Tons/Year of CaO @ $36.00 per Ton for 15 Years	$ 603,720.00
Maintenance Cost for 15 Years @ $1,000.00/Year	$ 15,000.00
TOTAL ABATEMENT COST	$ 668,720.00

Computed on the basis of pollution load:

PARAMETER	TREAT LBS/DAY	INITIAL COST/LB	COST/LB/15 YEARS
Acid	5308	$ 125.98	0.02
Iron	524	$ 1,276.18	0.23
Total	5832	$ 114.66	0.02

The total cost per pound more closely represents the cost effectiveness to be realized.

10.4 Continuous Liming Unit at Wilson Run

The combined discharge at Wilson Run, following implementation of Phases I, II, III and IV will include all of the AMD from M101, M102, M103, M104, M05, M06, M07, M62A, M62B, M62C, and M63. This combined discharge should have an approximate load of 8747 pounds of acid and 2162 pounds of total iron per day. A continuous liming unit will require approximately 11455 pounds of CaO (100% reactive) per day to reduce the acidity and total iron loading near zero. The resulting effluent is to be discharged directly into Wilson Run and will have no effect on other discharges.

The estimated cost of a liming unit is as follows:

Mixmeter and Monitoring Equipment Installed	$ 50,000.00
2090 Tons/Year of CaO @ $36.00 per Ton for 15 Years	$1,128,600.00
Maintenance Costs for 15 Years @ $1,000.00/Year	$ 15,000.00
TOTAL ABATEMENT COST	$1,193,600.00

Based on pollution loads, the costs are:

PARAMETER	TREAT LBS/DAY	INITIAL COST/LB	COST/LB/15 YEARS
Acid	8747	$ 136.46	0.02
Iron	2162	$ 552.08	0.10
Total	10909	$ 109.41	0.02

10.5 A Continuous Liming Unit At M08, M08A, M09

Discharges M08, M08A, and M09 into Boyer Run have a combined mean flow of 1.2 MGD, an approximate load of 1260 pounds/day of acid, and a load of 289 pounds/day of total iron. A continuous liming unit would require approximately 1626 pounds/day of CaO (100% reactive) to reduce the acidity and total iron loading near zero. The effluent from the combined sources would be discharged directly into Boyer Run and have no influence on other sources. Estimated costs are as follows:

Mixmeter and Monitoring Equipment Installed	$ 50,000.00
297 tons/year of CaO @ $36.00 per ton for 15 years	$ 160,380.00
Maintenance for 15 Years @ $1000.00/Year	$ 15,000.00
TOTAL ABATEMENT COST	$ 225,380.00

Based on pollution loads, the costs are:

PARAMETER	TREAT LBS/DAY	INITIAL COST/LB	COST/LB/15 YEARS
Acid	1260	$ 178.87	0.03
Iron	289	$ 779.86	0.14
Total	1549	$ 145.50	0.03

The total cost per pound more closely represents the cost effectiveness to be realized.

10.6 Continuous Liming Unit at M10, M11, and M12

Discharges M10, M11, and M12 on Sewickley Creek are to be combined into one discharge with approximately 14605 pounds of acid and 4586 pounds of iron per day. A continuous liming unit will require approximately 20151 pounds per day of CaO (100% reactive) to eliminate the acidity and iron. The resulting effluent is to be discharged into Sewickley Creek and will have no effect on the other AMD sources. Estimated costs of a continuous liming unit are as follows:

Mixmeter Monitoring Equipment

Installed	$ 50,000.00
3678 tons/year of CaO @ $36.00 per Ton for 15 Years	$ 1,986,120.00
Maintenance for 15 Years @ $1000.00/Year	$ 15,000.00
TOTAL ABATEMENT COST	$ 2,051,120.00

Based on pollution loads, the costs are:

PARAMETER	TREAT LBS/DAY	INITIAL COST/LB	COST/LB/15 YEARS
Acid	14,605	$ 140.44	0.03
Iron	4,586	$ 447.26	0.08
Total	19,191	$ 106.88	0.02

The total cost per pound is more representative of the cost effectiveness to be realized.

11.0 Minor Source Abatement

11.1 Method Discussion

The abatement plan formulated for the Southern Latrobe Syncline includes all known discharges except M100, M105, M106, M107, M108 M109, M110, and M111. These discharges are generally small seeps draining coal outliers or minor areas of the main syncline (See Vol. II, Plate 1 and 2). These discharges were not included in the proposed abatement plan for the reasons discussed below.

Discharge M100 is a small seep located along Bridge St. in Bridgeport. This discharge is believed to be draining a small area of abandoned workings to the southeast. The crop in this area was stripped and there is much subsidence behind the highwall. The area surrounding this discharge is residential with closely spaced houses. One means available to abate this discharge would be to divert the flow to the main syncline pool. This alternative is not recommended because of the anticipated high costs that would be incurred for construction of seals and grout curtain that would be needed. Because this discharge contributes relatively minor pollution load, does not constitute a major health or safety problem and is not dependent on the main pool the do nothing alternative appears to be the most feasible in this case.

Discharges M105, M106, M107, M108 and M109 are draining two outliers of the Pittsburgh coal seam. M105, M106 and M107 are draining the southern most of the two outliers and M108 and M109 the northern most. Both of these areas were deep mined and the discharges are all on the downdip side of the mines. Mine seals alone would not be effective at these sites because the outcrop was stripped in many areas and the sealing of the existing discharges would probably lead to breakouts along other sections of the crop line. A preliminary cost estimate is presented below in Table VI-7. The measures anticipated for the 3 outliers include mine seals at the discharges and other possible headings and a continuous grout curtain around the outcrop. This construction would cost approximately 1.6 million dollars for the three outliers. Expenditure of this amount of money does not appear warranted at this time when the quality of Brinker Run is taken into consideration. Data supplied by PennD.E.R., Bureau of Water Quality Management indicate that Brinker Run maintains a pH above 6.0 and Total Iron generally less than 7 ppm.

TABLE VI-7 PRELIMINARY COST ESTIMATE TO ABATE DISCHARGES M105-M111

Outlier 1 (M105, M106, M107)	
Deep Mine Seals, Est. 6 @ $15,000 ea,	$ 90,000.00
Grout Curtain, Est. 9,500 L.F. @ $50.00/L.F.	475,000.00
	$ 565,000.00
Outlier 2 (M108, M109)	
Deep Mine Seals, Est. 4 @ $15,000 ea.	$ 60,000.00
Grout Curtain, Est. 8,000 L.F. @ $50.00/L.P.	400,000.00
	$ 460,000.00
Outlier 3 (M110, M111)	
Deep Mine Seals, Est. 4 @ $15,000 ea.	$ 60,000.00
Grout Curtain, Est. 9,000 L.F. @ $50.00/L.F.	450,000.00
	$ 510,000.00

Because of their relatively small size and independence from the main syncline the sites would provide good demonstration sites to study various reclamation techniques. The data collected for this study could be used as background data. As previously noted, the area around M105 is presently being surface mined. The operator is removing pillars from the exposed mine workings. A reevaluation of this area after completion of mining would be necessary for a better cost estimate.

Discharges M110 and M111 are seeps draining to an unnamed tributary of Sewickley Creek. As can be seen on Plate 2 (Vol. II), these discharges are also apparently draining a small mined out outlier of the main syncline. This area was deep and surface mined. These seeps represent the drainage from these mine workings. These discharges were differentiated from the other outliers because the main dip in this area is to the northeast not towards the main southern portion of the pool. The reason for selecting the do nothing alternative for these discharges is similar to that for M105-M109 above.