

ABSTRACT

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The specific objective of this study is to recommend an abatement plan that will significantly reduce the acid mine drainage pollution in the Moshannon and Clearfield Creek Watersheds at a reasonable cost to the Commonwealth. The study itself is a pilot program designed to significantly reduce the costs normally required of studies to achieve the above stated objective. The study was accelerated by means of a new feasibility study approach which involved the systematic elimination of developed watershed modules which would have a low benefit/cost ratio resulting from mine drainage abatement. The study was performed within a framework of a logical series of phases or steps.

Step I - Use Existing Data to Establish Reconnaissance Program

This study was initiated with an exhaustive data collection and compilation effort performed prior to the initiation of field studies to prevent duplication of existing work and to provide a sound foundation for the remaining study.

Step II - Subdivide Basins Into Modules Perform Reconnaissance

Based in part on the information obtained in Step I, both watersheds were divided into many smaller subwatershed units or modules. Sampling and measuring points were designated in each module and the initial sampling and measuring, using a pre-determined sampling technique, began. Water quality analysis results enabled preliminary classification of all modules as hot, cold or marginal.

Step III - Intensify Study on Reduced Scope Areas

This step involved the expansion of the sampling efforts within the hot modules that were discovered during the first two steps of the study. Sample crews walked streams, sampled and measured all pollution sources and located the sampling points and all mining-related features on topographic maps. Most of these pollution sources were sampled only once during the study, resulting in tremendous time savings. Measured flows were adjusted to arrive at water quality values indicative of a normal hydrologic year.

Step IV - Preliminary Evaluation

Preliminary evaluations of the feasibility of abating each of the pollution sources defined in Step III were made after all available, pertinent information had been collected, collated, and plotted on Mine Development

Drawings. Areas where preliminary evaluation indicated that abatement would be feasible were subjected to more intensive field work in Step V.

Step V - Final Feasibility Determination

This step involved the final determination of abatement feasibility in each abatement area. A specific abatement plan that detailed the techniques to be used to abate acid mine drainage was formulated for each area utilizing the latest available abatement techniques. Plans were finalized for each area emphasizing the concept of the greatest amount of abatement for the lowest cost.

Step VI - Final Report

All findings and recommendations were incorporated in this report. Charts, tables and mapping for the abatement areas are presented where helpful. Mapping outside of the twenty-five abatement areas, as well as all water quality data, has been submitted separately to the Department as backup data for this report.

Conclusions

The modular sampling approach combined with the grab sampling method proved to be simple, time-saving, effective and adaptable to other areas. Sampling revealed that the majority of acid production within the

study area is concentrated in only two coal seams (the Clarion-Brookville and Lower Kittanning coals) and is further concentrated within one geologic structure (the Houtzdale-Snow Shoe Syncline).

Moshannon Creek is grossly polluted by acid mine drainage throughout most of its length. The Clearfield Creek Watershed, on the other hand, can be divided into two distinct water quality regimes. Clearfield Creek's southern regime (south of Madera) is not severely polluted by mine acid, but it is degraded by several pollution sources located within a few polluted modules. The northern one-third of Clearfield Creek (the northern regime upstream from the Shoff Mine) is severely polluted by two large deep mine discharges and several smaller pollution sources. The two large deep mine (Brookwood and Middle Pen #4) discharges have to be abated before any significant water quality improvements can be realized in this northern portion of Clearfield Creek.

Abatement plans could not be formulated for large portions of both watersheds due to the complexity of the active mine permits within these areas. The continually changing permit structure as well as the complexity of the current filing system utilized by the Bureau of Surface Mine Reclamation prohibits the assembly of complete permit information for large areas such as the one studied. Abatement plans could not be set forth for any areas within active mine drainage permits.

Twenty-one abatement projects and four additional study projects are recommended in this report. The seventeen project areas within the Clearfield Creek Watershed account for an at-source acid load of 123,385 (adjusted) lbs/day. The recommended abatement work in this watershed for which costs have been presented will eliminate an estimated 40% of that acid load, or 33,500 lbs/day. This can be accomplished at a total cost of \$7.3 million, with a cost effectiveness of \$215 per lb/day acid abated. Three additional projects in the Clearfield Creek Watershed involve further study or coordination, for which no costs were presented. These projects could eliminate an additional 44,000 lbs/day acid if the recommended abatement is performed.

The eight abatement areas within the Moshannon Creek Watershed account for an at-source acid load of 188,530 (adjusted) lbs/day. The seven recommended projects for which costs were presented in this watershed should abate an estimated 45,285 lbs/day or 50% of this acid load at a total cost of \$10.4 million. These abatement projects show a cost effectiveness of \$229 per lb/day acid abated. Further study and coordination is recommended for the remaining abatement project in this watershed. It is estimated that an additional 32,000 lbs/day acid could be abated within this last abatement area.

In summary, the abatement recommendations resulting from this pilot program should abate roughly 79,400 lbs/day acid at a total cost of

\$17.7 million. This abatement work will have a cost effectiveness of \$216 per lb/day acid abated. The four projects for which no costs were presented could account for an additional 56,000 lbs/day acid abated (assuming 40 percent of at-source acid abated), at a presently unknown additional cost. This total amount of acid mine drainage abatement could return the entire length of Clearfield Creek to an excellent recreation and sport fishing area, and significantly improve the water quality of Moshannon Creek and downstream reaches of the West Branch. The recommended abatement would also have far reaching effects outside of the study area. Significant water quality improvement would occur in the West Branch of the Susquehanna River. Many miles of the West Branch upstream from Lock Haven would be improved to the extent that a sports fisheries could be re-established.

Recommendations

It is recommended that the engineering design of the abatement plans be implemented immediately to prevent undue delay in initiating construction at the high priority pollution sources.

Several other recommendations to the Department of Environmental Resources are also made. Maximum coordination between the Department and active strip operators can enable pre-planning of future mining, possible shifting the major activities from acid to non-acid producing coal seams and areas. A \$100 to \$200 per acre bounty payable to operators

who restrip abandoned, unreclaimed strip mines would encourage miners to do so and provide much needed strip mine reclamation at nominal cost to the State. Finally, an active mine permit indexing and mapping system would allow rapid location of the latest mine permit information.

The charts on the following pages are a summary tabulation of the individual abatement plans for the entire study area. The first twenty-one areas are arranged in order of decreasing priority. The remaining four areas have been listed separately because they require further study to determine the feasibility of the abatement techniques suggested. These four abatement plans are very important, but since costs could not be developed, they were not included in the priority tabulations.

SUMMARY ABATEMENT TABULATION

PRIORITY NUMBER	ABATEMENT AREA	ESTIMATED ACID ABATED lbs. / day	MINE DESCRIPTION	RECOMMENDED ABATEMENT MEASURES	ESTIMATED CONSTRUCTION COST
1	B	2,620	Brubaker-Little Laurel Run	Strip mine reclamation	\$1,235,000
2	C	2,240	Powell Run	Strip mine reclamation	1,050,000
3	Y	5,150	Black Moshannon Creek	Strip mine reclamation	1,620,000
4	E	2,700	Swank's Mine	Deep mine sealing, Strip mine reclamation	293,000
5	S	24,000	Hill south of Osceola Mills, Quick Start No. 1	Strip mine reclamation	4,792,000
6	J	2,060	Mascot Area-Upper Morgan Run	Strip mine reclamation, Bony area reclamation	273,000
7	L	9,360	Lost Run, Quick Start No. 2	Strip mine reclamation	710,500
8	R	10,000	Bear Run-Mountain Branch	Strip mine reclamation	1,270,000
9	F	4,200	Shoff Mine	Deep mine sealing, Strip mine reclamation	516,000
10	K	2,000	North of Upper Morgan Run	Strip mine reclamation	156,000
11	G	582	Pine Run	Strip mine reclamation	161,000
12	Q	3,580	Roaring Run	Strip mine reclamation	972,000
13	V	1,967	Big Run	Strip mine reclamation	1,045,000
14	H	Unknown 300	Japling Run headwaters	Stream channel, Diversion ditch construction	141,300
15	M	700	North of Lost Run	Strip mine reclamation	226,000
16	N	1,100	Potts Run	Strip mine reclamation	532,000

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PRIORITY NUMBER	ABATEMENT AREA	ESTIMATED ACID ABATED lbs. / day	MINE DESCRIPTION	RECOMMENDED ABATEMENT MEASURES	ESTIMATED CONSTRUCTION COST
17	W	3,150	Little Laurel Run	Strip mine reclamation	\$1,004,000
18	U	680	Coal Run	Strip mine reclamation	243,000
19	D	100	Coalport bony area	Construct stream channel, minor regrading	15,000
20	P	1,000	Krebs-Long Runs	Strip mine reclamation	694,000
21	X	1,360	Hawk, Sulphur, Grassflat Run areas	Bony regrading, revegetation	375,000
TOTAL		79,400			\$17,323,800
	I	38,200	Mid Penn No. 4 Mine	Feasibility study for selected deep mine sealing and lime neutralization	Call: \$17,400,000 Unknown
	A	5,800	Trapp Run	Feasibility study for deep mine sealing	Unknown
	T	32,000+	Little Beaver-Coal Run, Rush Twp. from Trout Run to sample station 61	DER-strip mines cooperation, bounty to restrip unreclaimed cuts	Unknown
	O	590	Passmore Mine	Minor surface reclamation, feasibility study for daylighting or sealing deep mine	406,000 (for surface work)