CHAPTER II (b)

RECOMMENDATIONS

SUMMARY OF RECOMMENDATIONS

1. Utilize the upper West Branch (30-mile reach above Bower Station) as a natural neutralization system.

2. Initiate projects to effect major reductions in the operating costs of the Duman treatment plant. Typical projects would be designed to achieve:

    a. Improvements in equipment and methods of operation at the Duman plant (See Quick Start Project No. 1 in Chapter X).

    b. Control of Lancashire No. 15 pool operating levels to decrease required pumping volumes and increase water quality (See Quick Start Project No. 2 in Chapter X).

    c. Diversion of B-seam water into the Moss Creek complex for natural neutralization (± 1 MGD) (See Quick Start Project No. 2).

3. Provide facilities for abating major acid sources above Spangler. Three suggested projects in this category are:

    a. Diversion of Sterling No. 7 Discharge to Lancashire No. 15 pool via a gravity flow pipeline (See Quick Start Project No. 3 in Chapter X).

    b. Sealing and/or diversion of the surface discharges of the Victor Mine complex and pumping of the total discharge to a 6 MGD treatment plant near Watkins (See Quick Start Project No. 4 in Chapter X).

    c. Diversion of 3 to 6 MGD of acid West Branch stream water through the Delta Mine complex for natural neutralization and ultimate discharge into Beaver Run (See Quick Start Project No. 5 in Chapter X).

4. Explore the economic potential of combined mine drainage sewage treatment facilities for the Barnesboro Area (See Quick Start Project No. 6 in Chapter X).

5. Convert the Moss Creek watershed into a fishing and recreational area (See Quick Start Projects No. 2 and No. 7-11R in Chapter X).

6. Sample the major refuse piles to determine economic feasibility of combined coal recovery and secondary refuse relocation (See Quick Start Projects 7-1R to 7-12R).

The individual recommendations listed above are discussed generally in the following section and in full detail in Chapter X.

SUGGESTED ACTION

Since the most pressing need in the study area is to reduce the high operating costs at the Duman plant (about $900,000 per year), it is suggested that Quick Start Projects No. 1 and No. 2 be given immediate consideration. The successful completion of these projects could result in very significant reductions in mine water abatement costs within the next two years. These quick-start projects are presented in detail in Chapter 10.

BASIS FOR SELECTION

The recommendations for ways and means for controlling mine drainage pollution in the study area are based upon these several key observations made during this survey:

1. Under base flow conditions, 78% of the mine drainage acidity originates above Spangler, conventional treatment of which would require facilities for handling the full flow of the West Branch near Spangler, (6 to 140 cfs). Complete abatement facilities to meet Clean Streams Standards could cost $10 to $20 million and would restore 32 miles of stream at a 95% abatement reliability level.

2. Under high flow conditions, (greater than 2000 cfs), the effects of any abatement treatment above Spangler are completely swamped out by the large acid slug (slugging index = 10) generated within the West Branch below Spangler. (Slugging index is the ratio of maximum to average acid loading).

3. An abatement plant to control this acid slug would have to be located at Stifflertown where capacity to handle maximum full stream flows of up to 500 cfs (320 MGD) would be required. Conventional full treatment abatement plants of this capacity range from $15 to $30 million and would restore 22 miles of stream at an abatement reliability level of perhaps 99%.

4. Since 1968 (with the exception of the breakout period) the 30-mile reach of the West Branch between Garmantown and Bower Station has performed as an adequate, self-regulating natural neutralizing plant. Thus, by sacrificing 22 miles of stream (maximum recoverable length), a reliable, no-cost, full neutralization treatment of all headwaters pollution is attained. Five year records show that precipitated solids have no discernible effect on fish life in Curwensville Reservoir.

5. Natural pollution control in the West Branch is attainable only if the Duman and Lancashire #20 treatment plants are kept in constant operation at a present operating cost of more than $1.2 million per year.

6. There are promising indications that further study of the hydrology and interflows of the deep mine pools could lead to control of underground water flow to permit diversion (and natural neutralization) of ± 1 MGD from the Duman plant.

7. Revision of treatment procedures and reassessment of effluent quality requirements at the Duman plant could result in significant savings in operating costs.

8. There is a strong civilian desire in the headwaters area for a good fishing stream, which need could be met by instituting pollution abatement measures and flow augmentation techniques on several of the West Branch alkaline tributaries.

9. Any partial abatement treatment applied above Spangler would produce a negligible effect on the year round water quality in the 30-mile reach below Spangler, but might result in a slightly higher water quality in Curwensville Reservoir.

10. According to FWPCA figures of 1968, annual pollution control costs for the headwaters area do not appear justifiable if they greatly exceed the assigned abatement benefit value of $27,000 per year.

11. Water quality criteria for effluent from the Duman plant should be much less stringent because of the extremely poor quality of the high flow stream (Elk Creek) into which it discharges.

It can be concluded from the conditions cited above that a pollution control program for the upper West Branch should have four basic objectives:

1. Provide for the constant protection of the recreational waters in the Curwensville Reservoir.

2. Reduce the continuing pollution control operating costs at the Duman treatment plant to the greatest degree possible.

3. Take advantage of all natural sources of alkalinity in the area, particularly the self-regulating, high capacity alkalinity of the West Branch system and the neutralizing potential of the limestone reserves in the D-seam.

4. Provide water-use benefits to the study area by improving one or more West Branch alkaline tributaries.

The recommendations that follow are based upon these objectives.

GENERAL RECOMMENDATIONS

1. Retain the Upper West Branch as a Natural Neutralization System.

This study indicates conclusively that the most logical means for controlling mine drainage contamination of the Curwensville Reservoir is to permit the 30-mile reach of the West Branch above Bower Station to continue to function as an efficient, self-regulating, natural treatment plant, the facility-equivalent value of which is at least $15 million and the daily operating cost equivalent is at least $1,000 per day ($365,000 per year). This is in contrast with a stream annual recreational value of $27,000 per year.

Emergency control could be provided by in-stream neutralization with lime added at the old Lancashire No. 20 treatment plant which could be maintained in stand by condition

2. Initiate Projects to Effect Major Reductions in the 0perating Costs of the Duman Treatment Plant.

The types of projects which this study has indicated would be most effective are:

a. provision of engineering management at the Duman plant to implement improvements in equipment and methods of operation which could result in major operating cost reductions. Typical cost savings which might be attained are the following:

Proposed Improvement	Annual Potential Cost Saving
Conversion from lime to limestone	$150,000
Densifying of precipitated solids	90,000
Improved sludge handling	30,000

Details of ways and means for making these and other improvements are contained in Quick Start Proposal No. I in Chapter X.

b. initiation of an engineering flow control program to determine the most economic operating level for the Lancashire No. 15 pool. There are promising indications from this study that a change in pool operating level from 1440 to between 1480 and 1500 feet could result in:

(1) a decrease in required pumping rate at the Duman plant of at least 1 MGD (a potential saving of $90,000 per year).

(2) a possible gravity flow diversion of ± 1 MGD of B-seam water into D-seam for natural neutralization in Pardee No. 61 Mine (a possible saving of ± $90,000 per year).

(3) a possible diversion of ± 1 MGD of B-seam water into the Moss Creek mines complex with removal of the naturally neutralized flow by borehole pumping into Moss Creek (a potential saving of $75,000 per year).

The first two objectives could be accomplished without involving any construction or equipment installation costs. They would consist of engineering management and monitoring of the underground pool complex and its surface discharges over a period of at least one year. This pool study would be a necessary preliminary requirement for establishing the feasibility of a D-seam borehole pumping project. A management project of this type is proposed as a sub-division of Quick Start Project No. 2 (see details in Chapter X).

Cost of Engineering Management Phase of Quick Start Project No. 2 - $42,000

Cost of Borehole Drilling and Pump Installation Phase - $84,000

3. Provide Facilities for Abating Major Acid Sources Above North Barnesboro

The discharges from Sterling No. 7 and the Victor Mines complex constitute the largest deep mine pollutant sources still entering the West Branch. The acidity loadings these two sources contribute are as follows:

Source	Flows - GPM		Acid Loading - PPD	
	Average -	Maximum	Average -	Maximum
Sterling No. 7 Portal	700	2,100	6,000	20,600
Victor Mines Complex	1,604	4,757	7,381	20,619

Under base flow conditions, these two sources constitute 68% of the deep mine acidity and about 17% of the total acid loading from all known sources. The elimination of these loadings from the upper West Branch would not result in the insured restoration of any appreciable section of the West Branch above Bower Station as a fishing stream. However, the removal of this loading might result in a slightly higher alkalinity in the waters of Curwensville Reservoir which could encourage the propagation of the higher game fish such as the rainbow trout.

The elimination of these sources would involve two separate projects:

Project No. 3. The diversion of Sterling No. 7 discharge to Lancashire No. 15 pool via gravity flow through 1200 feet of 12" pipe to Lancashire No. 15 portal. Ultimate treatment of the water would occur at the Duman plant. Details for this project are contained in Quick Start Proposal No. 3 (see Chapter X).

Cost of Quick Start Project No. 3 - $30,000

Project No. 4. The sealing and/or diversion of several mine discharges to transport underground mine waters into one or more optimum collection points. The combined waters would be pumped to a 6 MGD treatment plant near Watkins for lime neutralization and sludge separation. The treated water could be used locally as industrial water or discharged directly into the West Branch. The sludge would be returned underground. Details for this project are contained in Quick Start Project No. 4 (see Chapter X).

Cost of Quick Start Project No. 4 - $600,000

Another abatement measure which would be partially effective during base flow conditions would be to divert 3 to 6 MGD of the West Branch flow at Barnesboro into the abandoned Delta Mine Complex northeast of Barnesboro which produces an alkaline discharge. This diversion was successfully piloted by Barnes and Tucker in a special project conducted from September 1966 through June 1967 which demonstrated that 3 MGD could be naturally neutralized in the old workings and emerge as neutral water in the Beaver Run headwater. A diversion of 6 MGD from the West Branch at this point would result in the removal of 5,000 ppd of acidity (about 33% of the total stream loading under base flow conditions of 20 cfs at North Barnesboro).

A project of this type would require the construction of pumping facilities and an 18" pipeline 6,000 feet long. With proper planning, these facilities could become a demonstration plant to show the feasibility of several types of abatement measures:

1. It can be used to gradually determine the ultimate maximum flow which can be diverted into the Delta complex for natural neutralization. Hopefully, diversions could eventually be increased to near the base flow capacity of the stream.

2. With additional equipment, it can be used to pilot the combined treatment of acid stream water and sewage from the local communities (this possibility is discussed more fully in a subsequent section).

3. The diverted neutralized flow of 5 to 9 cfs which emerges near a recreational area in the Beaver Run headwater could be utilized to enhance the recreational value of that area. This diversion would also create an additional flow of 5 to 9 cfs of alkaline water into the West Branch at a lower point via Beaver Run.

A major project of this broad scope should logically be subdivided into sequential phases. A proposal for the basic diversion project is presented in detail in Quick Start Project No. 5. A second project, involving more sophisticated technology and equipment for treating sewage is described in Quick Start Project No. 6 (see Chapter X).

Construction Cost for Quick Start Project No. 5 - $180,000

Construction Cost for Quick Start Project No. 6 - $552,000

4. Explore the Economic Potential of Combined Mine Drainage - Sewage Treatment Facilities for the Barnesboro Area.

Sewage is presently a major contaminant throughout the length of the West Branch, and seriously degrades several small alkaline tributaries such as Porter Run and Walnut Run near Barnesboro. The communities in this area will be forced to install new sewage facilities sometime in the near future, hence this is an opportune time to consider the possibility of integrating mine water and sewage treatment utilizing technology which has already been pilot plant tested at Pennsylvania State University and other locations. A combined treatment plant could perform several abatement functions and the project might be structured such that appreciable savings in sewage facilities costs could be made for these small communities which, in general, are decreasing in population.

A proposal to explore this potential is presented in Quick Start Project No. 6. The basic technical objective of this project would be to determine the feasibility of mixing primary (chlorinated) sewage effluent with acidic West Branch water, and diverting the mixture underground into the abandoned 2000 acre alkaline pool, where the interaction of the three waters should result in the equivalent of tertiary sewage treatment.

Construction Cost of Quick Start Project No. 6 - $552,000

The basic concept could actually be pre-tested on a pilot plant scale at the Pennsylvania State University mine drainage treatment pilot plant at Hollywood, Pennsylvania. Dr. Lovell, the director of that facility, has indicated an interest in participating in such an undertaking.

The data obtained from a project of this type would be extremely valuable, since this is the type of abatement method that could be used by many small communities throughout the Commonwealth.

5. Convert Moss Creek Watershed to a Recreational Area.

To satisfy the need for a good fishing stream in the study area, Moss Creek appears to be a good demonstration tributary. This 5 mile stream is naturally alkaline and has a good fish population in its upper reaches. It has a small base flow (2 cfs) however, and its lower 2 miles are contaminated with pollutants from the large refuse pile located at Marsteller. To convert this stream into a full length fishing facility, a multi-purpose project is proposed (Quick Start Project No. 2) which would require the following engineering and construction:

(1) Preliminary drilling program to determine optimum borehole location.
(Construction Cost - $10,000)

(2) Drilling and installation of an 18" dia. borehole (280 ft. deep) and pumping facilities for a maximum 3 MGD flow.
(Construction Cost - $74,000)

(3) Construction of an impoundment dam at the headwater (600 ft. long by 60 ft. high) to produce a 24 acre reservoir and fishing pond.
(Construction Cost - $575,000)

(4) Reshaping of the Moss Creek refuse pile and channeling of a small acid leaching stream (Quick Start Project No. 7-11R).
(Construction Cost - $80,000 - $100,000)

This project would be designed to obtain the following objectives

(1) Divert ± 1 MGD for natural neutralization from the Duman plant (an annual savings of $90,000).

(2) Increase the base flow in Moss Creek to 3 to 4 cfs, which is the volume required to attract the interest and possible support of the State Fish Commission.

(3) Provide a high quality water storage reservoir (480 acre feet) for low flow release and for recreation and fishing in the headwaters area.

(4) Convert the full length of the stream into a good fishing area by increasing flow and removing refuse pile contamination which presently makes the lower two miles of Moss Creek a barren stream.

The success of this diversion project would depend entirely upon the feasibility of controlling operating levels in the Lancashire No. 15 deep mine pool. Hence, a necessary preliminary adjunct to this project would be the engineering management of pool operating conditions discussed under Recommendation No. 2B.

The full details of the Moss Creek beneficiation program are presented in Quick-Start Project No. 2 (Chapter X).

6. Sample the Major Refuse Piles.

The details and benefits to be derived from a preliminary sampling program to determine recoverable coal values from each refuse area and discussed in full detail in Chapter X.