

## CONCLUSIONS

### 1. LOCATION OF POLLUTION SOURCES

Major Acid Mine Drainage (AMD) pollution of the study area streams is caused by the discharges from the Askam borehole into the Nanticoke Creek, the discharges from the three South Wilkes-Barre boreholes and the discharges from the Buttonwood Tunnel into the Solomon Creek.

### 2. ORIGIN OF AMD DISCHARGES

The aforementioned AMD discharges emanate from the mine pools that underlie the study area. These mine pools are interconnected with other mine pools in the Wyoming Valley that are located outside the study area. The mine pools in the Wyoming Valley are grouped into the North-West Mine Pool Complex and the South-East Mine Pool Complex. In addition to the above major mine pool complexes, some isolated mine pools were located and reported in previous studies. Losses of surface water into the deep mines is the major source of mine pool recharge. These losses consist mainly of streambed losses and losses of surface runoff trapped by strip mine operations. In addition to surface water losses, the mine pools are being recharged by groundwater flow from the areas adjacent to the coal measures. The surface water in the streams, as well as the groundwater outside the coal measures, is of good quality. When this water reaches the coal measures and the deep mine workings, it becomes contaminated by contact with the acid producing rock minerals and the acid water in the mine pools. The longer the path of water travel through the deep trines and the longer the detention period within the mine pools, the greater is the acid, iron and sulfate concentration of the AMD discharges from the mine pools. Surface water losses within the study area recharge the South-East Mine Pool Complex. However, the AMD discharges from the study area are related to both mine pool complexes that have recharge source areas outside of the study area limits.

### 3. EFFECT OF MINE POOLS ON THE STUDY AREA

When the inflow into the mine pools is equal to the

outflow from the mine pools, the mine pool levels are virtually unchanged. However, during periods of high surface runoff, resulting from precipitation over the area, water losses into the deep mines are high and the inflow exceeds the outflow from the mine pools. The high mine pool levels are frequently associated with basement flooding and subsidence in the residential and other sections of the communities in the Wyoming Valley.

4. CAUSE OF THE PRESENT AMD DISCHARGES

To prevent flooding of basements by rising mine pool water and to reduce subsidence hazards, the remedial measures taken to date consisted of limiting the fluctuations in mine pools. These measures included drilling of the Askam borehole, the three South Wilkes-Barre boreholes and construction of the Buttonwood Tunnel outlet. Although these remedial measures achieved their desired purpose, it was accomplished at the expense of degrading the water quality in the Nanticoke and Solomon Creeks. Prior to the completion of the boreholes and the tunnel, the outflow from the mine pools was distributed along both banks of the Susquehanna River as well as the lower reaches of the tributary streams. Presently these mine pool outflows are concentrated as point discharges in the Nanticoke and the Solomon Creeks.

5. MAGNITUDE OF POLLUTION

The magnitude of major AMD discharges in the study area is as follows:

DESCRIPTION	ASKAM BOREHOLE	S. WILKES-BARRE BOREHOLES	BUTTONWOOD TUNNEL	TOTAL
<b>DISCHARGE:</b>				
IN MILLION GALLONS PER DAY	5.51	22.21	14.60	42.32
IN GALLONS PER MINUTE	3,830	15,425	10,140	29,395
% OF TOTAL	13.0%	52.5%	34.5%	100%
<b>LOAD IN LBS PER DAY:</b>				
ACID LBS/DAY	29,100	104,370	36,500	169,970
% OF TOTAL	17.1%	61.4%	21.5%	100%
TOTAL IRON LBS/DAY	17,660	70,150	18,250	106,060
% OF TOTAL	16.7%	66.1%	17.2%	100%
SULFATE LBS/DAY	88,975	340,500	188,600	618,075
% OF TOTAL	14.4%	55.1%	30.5%	100%

Approximately 30 percent (28.8%) of the mean daily AMD discharges are attributed to water recharge of mine pools within the study area. Of these discharges, only the Askam borehole outflow is the result of surface water losses and groundwater recharge that is entirely with the Nanticoke and Warrior Watersheds. Therefore 70 percent of the AMD discharges, in the study area are attributed to water recharge sources located outside the study area.

In addition to the discharges from the boreholes and the Tunnel into the lower stretches of the Nanticoke and Solomon Creeks, there are other pollution sources within the study area. These pollution sources consist of raw sewage discharges, accidental spills of "wash" water from Blue Coal Company silt sump basin and direct discharges into the deep mines. The diversion of "clean" Solomon Creek water by the Blue Coal Company, through the Huber Colliery operation into the upper mine pools in the Warrior Creek Watershed, is a significant contribution to the Askam Borehole AMD discharges.

The Warrior Creek is generally an alkaline stream. The alkalinity is attributed to raw sewage discharges into both branches of this creek from the unsewered communities, as well as from broken sewers resulting from stripping operations and from land subsidence in sewer communities.

The magnitude of AMD discharges attributed to these latter pollution sources is as follows:

DESCRIPTION	NANTICOKE & WARRIOR WATERSHEDS		SOLOMON CR WATERSHED	TOTAL
	BLUE COAL COMPANY WATER DIVERSION INTO WARRIOR CR.	RAW SEWAGE	RAW SEWAGE	
<b>DISCHARGE:</b>				
IN MILLION GALLONS PER DAY	0.62	0.14	0.23	0.99
IN GALLONS PER MINUTE	430	100	160	690
% OF TOTAL	62.3%	14.5%	23.2%	100%
<b>LOAD IN LBS PER DAY:</b>				
ACID	3,270	760	1,080	5,110
TOTAL IRON	1,980	460	730	3,170
SULFATES	9,980	2,320	3,530	15,830

Comparison between the latter water losses and the total AMD discharges from the boreholes indicates that the water diversion by the Blue Coal Company and the raw sewage losses into the deep mines amount to 13.8 percent of the total AMD discharges from the Askam Borehole.

6. WATER QUALITY IN THE STUDY AREA STREAMS

Both the Solomon Creek and the Nanticoke Creek originate upstream of the coal measures. The "base flow" of these streams provides a continuous (uninterrupted) inflow of pollution free water into the coal basin. Due to streambed losses within the coal basin, this unpolluted water recharges the underlying mine pools and the flow of the streams diminishes. The limits of major streambed losses are between the entrance of these streams into the coal basin and the "Middle Road" crossing of these streams. Along these stretches of the streams, the entire flow is lost into the deep mines during low flow periods. During high flow periods, the flow in excess of the losses does reach "Middle Road". The intermittent flow within these stream stretches, severely limits the capabilities of these streams to sustain aquatic life.

If streambed losses were eliminated, the flow of these streams would continuously be maintained. The quality of the stream water that enters the coal basin can also be maintained, provided that accidental spills from the Blue Coal Company Washery operation and the present discharges of raw sewage into the streams are eliminated. The removal of coal silt from the banks and the bed of the streams and the prevention of seepage from waste banks into the streams would also be necessary to maintain the quality of water in these streams.

Downstream of the "Middle Road", the groundwater table is at or above the streambeds and therefore, the streams regain "base flow" through groundwater recharge. Although this recharge does not contain a high concentration of AMD, only Warrior Creek meets the presently proposed water quality standards for these streams.

The groundwater recharge and the "base flow" of the Nanticoke Creek below Middle Road has a total iron concentration of over 5 parts per million (ppm) which is above the 1.5 ppm limits presently proposed for all the streams in the Commonwealth. The natural concentration of total iron in the Nanticoke Creek, upstream of the coal measures, is less than 1.5 ppm. The prevention of water losses from the streambed in the Nanticoke Creek. would enable this low iron water to reach Middle Road where it could then dilute the iron concentration in the "base flow" below Middle Road. Nevertheless, the effect of such dilution would not be sufficient to reduce the concentration of iron below the presently proposed water quality criteria of 1.5 ppm.

The average concentration of alkalinity in the groundwater recharge and "base flow" of the Solomon Creek (below Middle Road) is 7.5 ppm. The present water quality standards for the Commonwealth streams is to maintain the alkalinity level at a concentration equal to or higher than 20 ppm. Therefore, the water quality in the Solomon Creek below Middle Road will not meet the presently proposed water quality criteria.

Similar conditions related to the concentration of alkalinity exist In the natural unpolluted stretches of the Solomon and the Nanticoke Creeks, upstream of the coal measures.

The lower reaches of the Nanticoke and the Solomon Creeks are the recipient of the major AMD discharges from the mine pools. The Buttonwood Tunnel and the three South Wilkes-Barre Boreholes discharge AMD Into the Solomon Creek, near its confluence with the Susquehanna River. The Askam Borehole discharges AMD into Nanticoke Creek, downstream of Middle Road. Below these discharges, the concentration of AMD in the streams is detrimental to aquatic life and prohibits the existence of any fish species in the Solomon and the Nanticoke Creeks.

Implementation of the proposed abatement measures in

the study area and the prevention of surface water losses into the deep mines in adjacent watersheds are expected to reduce or eliminate the high AMD discharges into the study area streams. This should enable the restoration of aquatic life in these streams, from "source to mouth" Consequently, if the present stream water quality criteria is not revised to reflect the natural water quality conditions in these streams, the elimination of AMD discharges would restore aquatic life but would not meet the present water quality criteria established by the Department for Nanticoke and Solomon Creeks. If revision of the water quality criteria for these streams is to be given consideration by the Water Quality Branch of the Department, the priorities for the projected water uses in these streams should also be reevaluated. The present water uses prescribed for the study area streams include boating and cold water fish as additional requirements to the standard water uses for the Commonwealth streams. The study area streams are not presently Included in the Pennsylvania Fish Commission's list of the Luzerne County Fishing Streams. The present Intermittent flow in these streams makes boating rather difficult and very limited. Consequently, consideration should be given to protect the .type of water uses that are most important to the local people and more compatible with the existing and projected land uses in the study area.

7. EFFECT OF AMD DISCHARGES ON THE SUSQUEHANNA RIVER

In contrast to the study area streams, the North Branch of the Susquehanna River is included in the Pennsylvania Fish Commission's list of the Luzerne County Fishing Streams. Therefore, the present AMD discharges from the study area do not affect the quality of the River as much as they affect the quality of the individual study area streams, which are tributaries of the River. Despite the AMD discharges into the River between its confluence with the Lackawanna River and the mouth of Newport Creek; the quality of the Susquehanna River meets most of the presently proposed water

quality standards for the River. The present concentrations of iron and manganese in the River water are the only conditions that exceed the concentration limits of the presently proposed water quality criteria.

Prior to construction of the Buttonwood Tunnel and the boreholes to lower the mine pools in the study area, mine pool discharges were more evenly distributed along the banks of the River and streams in the Wyoming Valley. Assuming that the concentration of acid, iron and sulfates in the mine pools remains unchanged, the daily load of AMD discharges into the main stem of the River, prior to the construction of the Tunnel and the boreholes, was similar to the present discharge load. Therefore, although the point discharges from the tunnel and the boreholes into the Solomon and Nanticoke Creeks have a significant effect on the quality of these streams, these discharges did not materially alter the main stem River quality that existed prior to the construction of the tunnel and the boreholes.

During periods of extreme low flow in the Susquehanna, AMD discharges from the Lackawanna River have a significant effect on the quality of the Susquehanna River water. The history of recorded fish kills in the Susquehanna River indicates that out of thirteen reported fish kills, only five were attributed to AMD discharges. All five of these latter fish kills occurred between 1949 and 1966, when the Buttonwood Tunnel and the borehole discharges were not in existence. Out of the five reported fish kills, only one was attributed to AMD discharges from the study area. The other four fish kills resulted from the Lackawanna River and the AMD outfalls at the mouth of the Lackawanna River. All four fish kills attributed to the Lackawanna discharges occurred at times when the flow ratio between the Lackawanna and Susquehanna Rivers was high. The latter conditions renders further support to the pronounced effect of the Lackawanna discharges on the quality of the Susquehanna River during periods of extreme low flow. Analysis of available records indicates

that the total AMD load of the Lackawanna River is equivalent to the combined AMD load of the Buttonwood Tunnel and the borehole discharges from the study area.

Analysis of the fluctuation in the levels of the NorthWest Mine Pool Complex, outside the study area, and correlation between these fluctuations and the flow of the River indicates the possible existence of additional AMD discharges into the River that were previously unknown and unrecorded.

The magnitude of such discharges, derived by analytical methods, is 170 cubic feet per second (110 million gallons per day). If the existence of such discharges from the North-West Mine Pool Complex is verified, the average daily AMD load that is being discharged into the River is 275,000 lbs of acid, 138,000 lbs of iron and 1,422,000 lbs of sulfates. These loads are as large as the combined AMD loads from the study area and the Lackawanna River. Based on these results, the AMD loads from the study area constitute only 25 percent of the total AMD load presently discharging into the River in the Wyoming Valley. Complete abatement of the present discharges from the Buttonwood Tunnel and the boreholes would significantly improve the water quality in the Solomon and Nanticoke Creeks. However, the complete abatement of the AMD discharges from the study area would, at best, reduce the AMD load in the main stem of the River by 25 percent. Therefore, if it is desired to insure that the iron and manganese concentration in the River will not surpass the presently proposed water quality standards, the abatement of the AMD discharges from the study area alone, would not be sufficient to achieve such a goal.

Upgrading the water quality in the Susquehanna River should be predicated on the desired water uses for the River, both within the valley and downstream of the coal measures. Furthermore, the effect of present AMD discharges on the quality of the River, downstream of the coal measures, should be determined prior to establishing water quality criteria for the River. Such criteria for the River stretch within



the Wyoming Valley may differ from criteria for the River, downstream of the Valley.

The present "on-going" study of water quality management (COWAMP), which is part of the Comprehensive State Water Plan, can provide the data required for the determination of the existing quality of the River, including the tolerable quality standards that would be compatible with the projected water uses. After the completion of the aforementioned "ongoing" study, a comprehensive management plan for the River can then be formulated. Consequently, the primary objective of AMD abatement within the study area should be to improve the quality of the Solomon and Nanticoke Creeks. Such abatement is desirable even if the present AMD discharges do not significantly affect the quality of the Susquehanna River.

8. PROPOSED ABATEMENT PLAN

An ideal abatement plan should meet the following objectives:

- a. Eliminate present discharges of AMD into the study area streams and restore clean streams.
- b. Avoid causing or contributing to basement flooding, subsidence, mine fires and air pollution.
- c. Stimulate "higher and better use" for the scarred land, presently consisting of abandoned strippings and waste banks.
- d. Provide for, account for and not interfere with future mining activities in the area.

Warrior and Nanticoke Creek Watersheds: The proposed plan for AMD abatement in these watersheds is believed to achieve most of the aforementioned goals. In addition to the complete abatement-of the Askam Borehole discharges, the proposed plan is expected to achieve the following benefits:

- a. Lower mine pool levels below the present range of water fluctuation; thus reduce the property flooding and subsidence hazards in the Nanticoke and Askam areas.
- b. Provide new stream channels and line the streambeds in

the water loss areas of these watersheds. The restored clean streams should stimulate future land restoration projects by local interests which, in turn, will provide additional AMD abatement benefits.

- c. Reduce the present water losses and groundwater flow into the deep mines. This would facilitate future deep mining in the area at no additional cost to the Commonwealth or to the local people.

The economic benefits that would be provided to future deep mining in the area by minimizing such water losses are as follows:

- a. Reduction in rate of pumping that would be necessary to dewater the deep mines.
- b. Reduction in the cost of AMD treatment that would be required of the future operators to meet environmental regulations.

The estimated total cost of the proposed AMD abatement in the Warrior and Nanticoke Creek watersheds is \$10,153,000. The benefits from the abatement of Askam borehole discharges alone are equivalent to the removal of 29,000 lbs of acid per day. Therefore, the minimum benefits to be derived from the plan is the removal of the present acid load at the estimated cost of \$350/lb/day.

Solomon Creek Watershed: A comprehensive AMD abatement plan for this watershed cannot be formulated within the present scope of this study. The present AMD discharges into the creek from the Buttonwood Tunnel and from the South WilkesBarre boreholes, originate in recharge areas that are located outside of the present study area. Therefore, although the cost of neutralizing these discharges by treatment plants were readily determined, alternative abatement methods cannot be formulated within the scope of this study. Analysis indicates that the cost of abating the Buttonwood and South Wilkes-Barre AMD discharges by constructing and operating treatment plants is equivalent to an expenditure of 74,000,000 for alternative methods of abatement. Applying this upper limit of construction cost to the average daily acid load,

emanating from the Buttonwood Tunnel (36,500 lbs/day) and the three Sdiith Wilkes-Barre boreholes (104,400 lbs/day), results in an equivalent cost distribution of \$525.2/lb/day of acid removal.

The Solomon Creek watershed is the only watershed within the present study area that directly contributes to the AMD discharges from the South Wilkes-Barre boreholes. The proposed abatement projects in this watershed would reduce the present average daily acid load from these boreholes by 27,760 lbs which represents an AMD load reduction of about 27% ( $\frac{27,760}{104,400} \times 100 = 27\%$ ). The total estimated cost of the proposed abatement is \$6,755,000 which is equivalent to \$310/lb/day of acid removal.

Cost comparison between the proposed abatement projects in the Solomon Creek watershed and the equivalent cost of treatment indicates that for the useful life of the proposed projects (40 years), the cost of the proposed projects is 60 percent less than the cost of equivalent abatement by treatment.

The derived cost per lb. of acid for the proposed projects within the study area, coupled with data from the "on going" reconnaissance survey in the Mill Creek watershed, indicates that the cost for total abatement of the Buttonwood and South Wilkes-Barre discharges is expected to be considerably less than the equivalent abatement cost by treatment.

#### 9. COST ANALYSIS OF AMD ABATEMENT METHODS

The proposed AMD abatement plan for the study area consists of preventing surface water losses and reducing groundwater recharge into the deep mines. Neutralization of the present AMD discharges in treatment plants was also considered among the alternative abatement methods studied. Analysis of cost and benefits to be derived from the neutralization of AMD discharges in treatment plants does not compare favorably with the proposed abatement plan for the study area.

Therefore, although treatment of AMD discharges may be a reasonable solution for the abatement of effluent discharges from active mines, it is not an economically feasible solution for the abatement of AMD discharges from the abandoned mines in the study area.

## RECOMMENDATIONS

### I. NANTICOKE AND WARRIOR CREEK WATERSHEDS

Implementation of the proposed abatement plan would eliminate the present AMD discharges in these watersheds. Therefore, it is recommended that this plan be implemented. If the proposed plan meets the Departments approval, the following additional recommendations are offered for further consideration:

- a. Evaluate the suggested multi-purpose projects and abatement concepts related to groundwater interception. Such projects can further enhance the benefits of the proposed plan.
- b. Promote local interests into taking the following actions that would benefit the area and facilitate the Department's abatement efforts:
  1. Control discharges into the deep mines (raw sewage, storm sewers and industrial waste) by local ordinances to alleviate existing pollution problems.
  2. Encourage the Pennsylvania Gas and Water Co. (the major water supplier in the area) to utilize the surface and groundwater resources in the study area for future sources of supply. Such sources would be in lieu of, or in addition to the Susquehanna River water, presently under consideration. Informal discussions with a company official indicate that favorable consideration would be given by the company to a feasible proposal
  3. Encourage the County Planning Commission to implement land use plans within the County Comprehensive Plan that deal with conversion of abandoned strippings and waste banks into higher and better use.
  4. Explore state and federal programs relating to technical and financial assistance available to the County for implementing the recreational and flood control aspects of the County Comprehensive Plan.
  5. Schedule and coordinate locally sponsored projects with the abatement projects undertaken by the Department, to achieve maximum benefits to all parties involved.
- c. Enforce through the Department, or through the local enforcement agencies, the present regulations related

to the discharge of raw sewage and accidental spills of industrial effluent into the Commonwealth waters.

- d. Verify if the present diversion of Solomon Creek water by the Blue Coal Company is in violation of Department of Environmental Resources regulations. This diversion and the subsequent discharge of this water into the deep mines in the Warrior Creek watershed is a significant source of AMD pollution.
- e. If the above diversion is not violating present state regulations, consideration may be given to assist the Blue Coal Company in developing alternative operational solutions that would alleviate the present source of AMD pollution.
- f. Verify the status and applicability of Act 82 (7/07/55), as amended; relative to the availability of matching Federal Funds for the proposed abatement plan.
- g. Review the presently proposed water quality criteria for the Warrior and Nanticoke Creeks. Consideration should be given to the exclusion of boating and cold water fish from the proposed water uses in these streams, since these uses are incompatible with present conditions and local needs. Consideration should also be given to modification of the present Water Quality Criteria for these streams so that the criteria is compatible with the quality of the existing natural unpolluted water in these streams.

## 2. SOLOMON CREEK WATERSHED

The ultimate feasible solution for the abatement of the present AMD discharges into the Solomon Creek, requires the determination and evaluation of pollution sources that are located outside the study area. The presently proposed abatement projects are limited to the prevention of surface water losses and the recharge of mine pools within the Solomon Creek watershed. Consequently, they represent only a partial solution or intermediate phase of the total abatement plan. Therefore, the following recommendations are offered:

- a. Determine the location of AMD pollution sources in all the watersheds that overlie the South-East\* and the North-West Mine Pool Complexes.

*At this writing, the adjacent Mill Creek Watershed study is in progress.*

- b. Continue the monitoring program, presently being conducted by the Department in the Wyoming Valley.

The present program consists of monitoring the fluctuation of mine pools and the AMD discharges from the Buttonwood Tunnel, and from the Askam, South Wilkes-Barre and the Plains boreholes.

Correlation between mine pool fluctuations, AMD discharges, precipitation and stream flow will enable a determination of the relationship between surface water losses into the deep mines and the magnitude of AMD discharges from the mine pools in the Wyoming Valley.

Continuation of the present monitoring program will facilitate the determination of mine pool recharge sources that are located outside the study area. The monitoring program is also required to evaluate the degree of AMD abatement to be achieved by the implementation of selected projects of the ultimate abatement plan.

- c. On the basis of the information to be gathered in the adjacent watersheds, determine water quality standards that are most suited to existing conditions and local needs, as well as to the AMD abatement program.
- d. Evaluate the proposed concept of groundwater interception as it applies to AMD abatement. If the Department concurs with the expected benefits to be derived from such a concept, the following additional recommendations are offered:
1. Verify the magnitude, cost and benefits of this concept by a demonstration project in a selected watershed.
  2. Verify the feasibility of the concept both with, or without the marketability aspect for the intercepted water.
- e. On the basis of recommendations a. thru d. above, prepare a feasible total abatement plan for the present discharges into the Solomon Creek. The results of the AMD study in Mill Creek Watershed\* are essential to achieving the objectives of the total abatement plan.
- f. Inform local agencies that implementation of the presently proposed abatement projects in the Solomon Creek watershed, can only be considered as an intermediate phase of the total abatement plan, yet to be formulated.

\* *At this writing, the adjacent Mill Creek Watershed study is in progress.*

3. IMPROVING THE QUALITY OF THE SUSQUEHANNA RIVER

The quality of the Susquehanna River, opposite the study area, is affected by AMD from the Lackawanna River, as well as the AMD discharges from the Wyoming Valley. Conclusions reached in the present study indicate that the abatement of all the AMD discharges from the study area would remove approximately 25 percent of the total daily acid load, presently being discharged into the River. It was also concluded that the discharges from the North-West Mine Pool Complex through the Buttonwood Tunnel into the Solomon Creek, represent only a small portion of the total AMD discharges from these mine-pools into the River. Therefore, if it is desired to insure that the total plan of abatement would also provide a considerable improvement in the quality of the Susquehanna River; the following is recommended:

- a. The magnitude of the discharges from the North-West Mine Pool Complex into the River should be verified. This verification can be done by means of hydrographic and qualitative surveys, during low flow periods in the River.
- b. The occurrence, location and magnitude of river losses into the deep mines should be verified. This verification can also be made by means of a hydrographic survey.
- c. If the magnitude of the River losses into the deep mines is found to be as large as the losses computed in this study; consideration should be given to the development of a feasible solution to prevent such losses.
- d. Joint federal and state participation should be implemented. The provisions of the "River and Harbor" Act and the Interstate Compact provide certain Federal controls and jurisdiction over the quality in the Susquehanna River. River water lost into the mines becomes contaminated, increases basement flooding and subsidence problems, and is subsequently discharged into the River as AMD. Prevention of such losses would eliminate or minimize such problems and may facilitate future deep mining in the Wyoming Valley. Therefore:
  1. Consideration should be given to the desirability of a joint federal and state effort to implement a feasible solution for the prevention of river losses into the deep mines.



2. If it is possible to obtain federal participation in solving the aforementioned problem, consideration may also be given to include the abatement of the Lackawanna outfalls into a total water quality improvement program for the North Branch of the Susquehanna River.
- e. Consideration should be given to the "AMD Retardation Concept", presented in this report, as one of the proposed methods to improve the quality of the Susquehanna River.
  - f. The present water quality standards in the Susquehanna River, between the confluence with the Lackawanna River and the mouth of Newport Creek, should be reevaluated. Consideration should also be given to:
    1. Verify the effect of present River Quality within the Wyoming Valley on river water quality, downstream of the mouth of Newport Creek.
    2. Determine the optimum levels of iron and manganese that can be tolerated by aquatic life. Such optimum levels should be compatible with a feasible total plan to upgrade the quality of the river within the Wyoming Valley.
  - g. The present program of monitoring river quality between the Wyoming and Nanticoke Bridges should be continued. In addition, consideration should be given to extending the scope of the present program to include:
    1. Monitoring the Lackawanna AMD outfalls (Old Forge and Duryea), the quality at the USGS Gaging Station at Old Forge and the quality of the Susquehanna River, immediately upstream and downstream of the confluence with the Lackawanna River.
    2. Monitoring the quality of the Susquehanna River at three additional locations, between the mouth of Newport Creek and the USGS Gaging Station at Danville.
  - h. The proposed monitoring program should be coordinated, supplemented or incorporated in the present Comprehensive Water Quality Management Program (COWAMP), which is part of the State Water Plan.

