RECOMMENDATIONS

A. ABATEMENT MEASURES

Two methods of abating the pollution seem obvious for this project and both have been considered.

1. Flooding:

(a) Benefits: The flooding of the deep mine workings offers the potential for greatly reducing pollution through the reduction of the quantity of oxygen entering the mine and, under favorable conditions, the stagnation of the water within the confines of the workings. One great advantage of this method is the immediate abatement of pollution from the mine.

(b) Condition and Number of Headings: As previously mentioned, the Elbon Mine has a total of twenty-eight known entrances if both seams are considered. At least half of these entrances are on the low side of the workings and would be subject to heavy pressure if the mine were flooded through both seams. All of these entrances have been caved, and the installation of a hydraulic seal would prove costly. The extent of the caving is not known and a considerable amount of exploratory excavation, or drilling, would be necessary to determine the proper locations for the seals, and the method to be used.

In order to effect the flooding of the upper workings (Middle Kittanning) it will be necessary to seal all of the entrances to the lower workings, even those on the high side of the mine. It is highly probable that the upper and lower workings are connected hydraulically, by virtue of bore holes, caving, etc., and the upper workings could not be inundated unless the lower was completely sealed.

(c) Condition of Perimeter Barriers: From inspection of the topographic maps of the area on which the limits of the mine were established, it can be seen that in a number of areas the deep mine workings and the strip mine workings appear to intersect. Presently, no openings are visible at these locations. Presumably the exposed mine workings were closed by placing fill against the exposed face of the workings.

In other areas the extent of the mine workings was not clear, from the old mine maps, and it is possible that long stretches of the barrier were completely removed. One such area is visible on the drawing of Area No. 2 (Appendix D2). At the northerly end of the area a small valley extends over the mine workings and several old headings were cut into the low workings in the left fork of the valley. Subsequent strip mining appears to have removed most of the barrier in this valley. In order to flood the mine, an impermeable barrier would have to be construction along most of the perimeter of the mine, not only in the Lower Kittanning seam but in the Middle Kittanning seam as well since this area is close to the Shawmut syncline.

(d) Potential Risk: The capability of the barrier, as it now exists, to withstand the pressure created by the flooding of both workings is considered to be non-existent, and such flooding would be extremely hazardous. The loose fill pushed against the highwall cannot be considered as a seal because of the probability of seepage which, under pressure, would lead to piping and finally a rapid failure of the "barrier". One example is in evidence at an old heading at the upper extremity of Area No. 2. A small flow is eminating from the spoil at a point where the old heading was. The strip mining obliterated the heading and loose fill was placed over the coal seam. Because a small portion of the mine drains to that heading, there is enough pressure to force the drainage out into the spoil and then upwards to the surface, where it then flows to Brandy Camp Run. It is estimated that the fill may be approximately five feet deep over the old heading and the pressure head behind the blockage can be no more than six or eight feet. Still, it pushed out and drains the workings.

If the two workings were completely sealed and allowed to fill, the total pressure head working on the lowest seals (and barriers) would be the difference in elevation between the lowest headings in the lower workings, and the highest point in the upper workings. This would exceed 100 feet of head. Even if only the lower workings were flooded, the pressure on the seals would exceed 50 feet and it is highly improbable that the integrity of the barrier could be maintained under these conditions. Furthermore, a partial flooding of the mine would

not guarantee that there would be no circulation through the lower workings, and thus the effort might result in total failure to control pollution.

The risk of failure of a seal or a section of the barrier under fully-flooded conditions also includes the potential damage downstream, both through physical damage and through the shock effect on larger downstream water courses. It is estimated that the two mines could hold as much as 7,000 acre-feet of water. If it were to escape in a short period, the effect would be quite significant.

2. Air Sealing and Flow Diversion

This method of pollution control must be predicated on the assumption that a reduction in flow through the mine will bring about a corresponding reduction in the acid load being discharged. In effect, this means that the concentration of acidity must be relatively constant at all flows.

The implication of this condition is that the controlling mechanism is the process of acid formation is related to flow.

In an earlier section of this report it was noted that there is a strong linear relationship between flow and acid load (lbs/day), and it is with this in mind that we have considered flow diversion as a method of reducing acid load. As mentioned earlier, a large percentage of the drainage flows is believed to enter the mine by way of the strip mines. Because of the lack of topsoil and vegetation this water probably reaches the coal seam with a high level of dissolved oxygen. What little alkalinity it might have acquired is likely exhausted by the time it percolates through the spoil and reaches the coal seam.

Diversion of these waters can thus be considered as a step toward the benefaction of the drainages from the mine.

A factor which must be considered on this particular project is the condition of the vegetation on the strip mine spoil. While there is no topsoil or ground cover, there is a good stand of evergreens over most of the old strippings.

In some areas these evergreens have reached a height of ten to twelve feet and have thickly forested the high ridges of the spoil. There is very little good growth, however, in the low areas adjacent to the high walls. It is here that runoff accumulates in ponds and eventually infiltrates into the deep mines.

In areas where the stripping does not directly overlie the deep mines it is intended that only these low channels and pools will be regraded to remove the pools and provide for quick runoff of surface water with a minimum of percolation into the ground water system. Channels must be cut through the spoil at regular intervals to allow the runoff to descend to the valley floor. This, of course, will destroy some of the trees, but it is intended to keep this to a minimum.

In the McCauley Run Valley it appears that a more complete restoration will be necessary to divert flows away from the mines.

Large areas of the strip mining activity (in the Middle Kittanning Seam) are directly over old deep mine workings in the Lower Kittanning Seam. Recharge of the mine water system is even aided by the activities of a beaver colony which has constructed a dam in the run. The water level in the pond is eleven feet higher than the elevation of a nearby buried heading in the lower mine. The barrier between the old heading and the pond is loose spoil. It is impossible to determine the quantity of flow migrating through the spoil, but there is little doubt that such a flow exists. For this reason the beavers should be "captured" and relocated to an area where their activity will not aid in the creation of acid drainage.

In conjunction with the regrading of the spoil piles it would be advantageous to construct diversion ditches above the high wall of the upper strip mine workings to intercept surface runoff from the overlying hills. Artificial channels will be necessary to carry this runoff to the valley floor without allowing it the opportunity to enter the loose fill.

The effect of flow diversion should be a significant reduction of the quantity of flow discharged by the mines into Brandy Camp Creek.

There also exists the probability that a substantial reduction of the infiltration into the mine through the strip mines will result in a lower concentration of acidity in the remaining discharge. Since the alkalinity reaching the mine has a fixed maximum concentration which cannot be increased, it would appear that the only way left to change the alkalinity/acidity ratio is to reduce the amount of acidity generated and a reduction in the flows from the strip mines will have this effect.

B. DETAILED RECOMMENDATIONS

It is recommended that immediate steps be taken in the McCauley Run Area (Area No. 6) and the Curry Run Area (Area NO. 8) to reduce infiltration into the deep mine on the up-dip side.

Because of the extent of the problems, it will be necessary to perform complete renovation of these areas, including diversion ditches and stream channel liners where the streams pass over the abandoned deep mine.

For the remaining portions of the project the substantial forest cover (mostly evergreens) would be lost by complete renovation. Thus, a partial re-grading of the low areas behind the spoil piles is considered advisable. This re-grading would be intended to effect quick and complete run-off of surface drainages.

A number of hydraulic mine seals are called for in Areas Number 1, Number 2 and Number 3. Those areas Number 2 and Number 3 are intended to flood only the extreme western portions of the Elbon Mine (Lower Kittanning Seam) and divert all the discharges to heading Number E-10 where treatment of the ultimate residual flows could be effected. These seals would be low-head seals and it is not intended to subject the barriers on the low side of the mine to heavy pressures.

No costs have been projected for treatment facilities because of the difficulty of predicting the quality and quantity of the flows remaining after the reclamation work is complete. Further, the research currently being conducted in methods of treatment would likely make such projections obsolete in a very short time.

Costs for the regrading and drainage work called for in Phase II are based upon a cost of $400.00 per acre multiplied by the gross area affected.

A detailed list of recommended abatement measures is as follows:

1. Phase I - Area Number 6

(a) Remove beavers and beaver dams.

(b) Re-contour strip mine workings in Lower Kittanning seam on east side of McCauley Run to terrace type of configuration.

(c) Re-grade and drain two small impoundments in spoil of recent strip mine workings of Middle Kittanning seam on east side of valley.

(d) Re-contour spoil of both seams on west side of McCauley Run and on both sides at the head of the valley. Pull down highwall of Middle Kittanning operation where it still exists.

(e) Construct earth diversion ditches above the Middle Kittanning highwall on both sides of the valley with flumes to carry surface flows to the valley floor.

(f) Construct a bituminous coated corrugated metal channel liner to carry McCauley run across that portion of the strip mine which is underlain by the deep mine.

Phase I - Area Number 8

(a) Re-grade areas not reclaimed by recent mining.

(b) Remove old beaver dam (and any beavers encountered) to facilitate drainage.

(c) Construct a channel liner for Curry Run from the upper end of the strip mined area to a point below the deep mine workings.

2. Phase II - Long Range Corrective Measures

(a) Area No. 1

(1) Improve drainage of spoil piles in stripping south of Williams Mine.
(2) Construct hydraulic seals in Mine Headings W-1, W-2, and W-3 of Williams Mine.

(b) Area No. 2 (Sheet No. 2 of Appendix V)

(1) Improve drainage of spoil piles in stripped areas.
(2) Construct hydraulic seals on Stiles Mine and openings E-1, E-2, E-3, E-4, E-5, E-6, E-7, and E-8 of the Elbon Mine.
(3) Construct diversion ditch above Middle Kittanning highwall.

(c) Area No. 3 (Sheet No. 3 of Appendix V)

(1) Improve drainage of spoil piles.
(2) Grade and cover culm piles with impervious material.
(3) Construct hydraulic seals at Opening E-9.

(d) Area No. 4 (Sheet 4 of Appendix V)

(1) Improve drainage of spoil piles.

(e) Area No. 5 (Sheet No. 5 of Appendix V)

(1) Improve drainage of spoil piles.

(f) Area No. 7 (Sheet No. 7 of Appendix V)

(1) Improve drainage of spoil piles.