

CONCLUSIONS

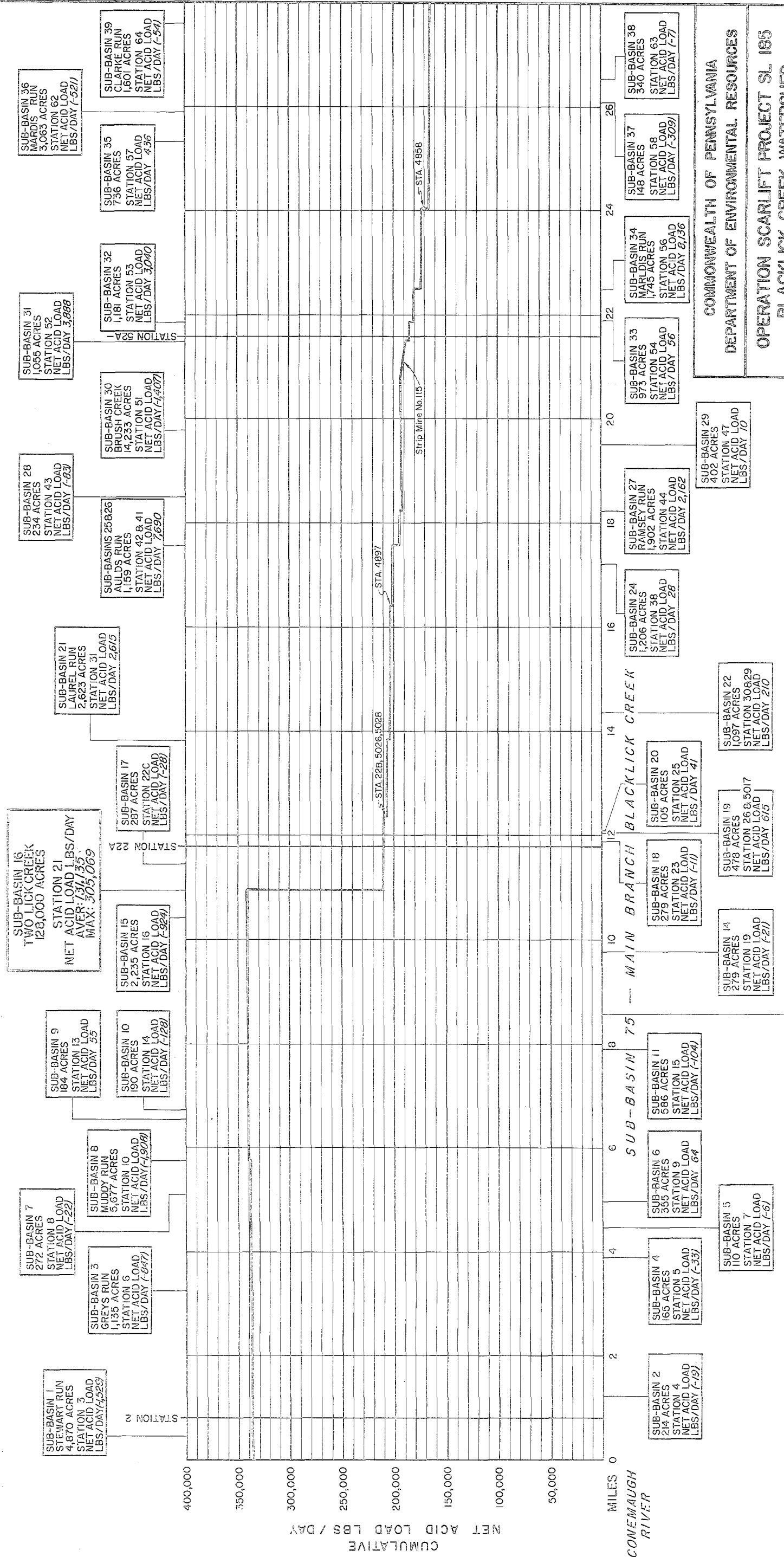
CONCLUSIONS

The Blacklick Creek watershed is seriously polluted by acid mine drainage. Based on stream water quality sampling between October of 1973 to September of 1974, an average net acid load of 335,000 lb./day occurred at the mouth downstream of sampling station #2 and sub-basin 1. This net acid load figure has been computed by adding and subtracting all measured acid and alkaline average contributions from the tributary sub-basins draining to the main branch and any sources of drainage occurring immediately along the main stem. An actual "total" average of 399,000 lb./day of acid is generated in the watershed, which is the total of all the measured acid discharges at the source, but this load is reduced or buffered by 64,000 lb./day of measured unpolluted discharges in the basin resulting in the net load above ($399,000 - 64,000 = 335,000$ lb./day). Approximately 33 percent of the actual total contribution is directly attributed to discharges from the drainage area of Two Lick Creek. Though Two Lick Creek is technically part of the Blacklick Creek watershed, an investigation of this area was not necessary because of a previous study by L. Robert Kimball Consulting Engineers.

Subtracting the acid contribution of Two Lick Creek measured at sampling station #21 from the actual "total" load (399,000-131,000), a total of 268,000 lb./day of acid discharges were generated within the specific study area. Each individual contribution is accounted for in the Sub-Watershed Analysis portion of this report dealing with stream degradation on the sub-basin scale. Figure 8 graphically represents the cumulative acid load along Blacklick Creek based on respective discharges at the sub-basin mouths plus discharges directly into the main stream. The average acid loads at the mouths of North Branch Blacklick Creek (sampling station #76) and South Branch Blacklick Creek (sampling station #106A) were 55,000 and 96,000 lb./day respectively. The load on main branch Blacklick Creek just upstream of the contribution of Two Lick Creek or sub-basin 16 was 210,000 lb./day in contrast to 341,000 lb./day below ($210,000 + 131,000$).

The specific sources of pollution generation within the Blacklick Creek watershed are predominantly deep mine workings or coal mine refuse banks. Approximately 52 deep mine openings, associated with 21 mine complexes, plus 36 miscellaneous openings out of a total of 381 within the watershed discharge acid waters. Of a total of 65 mine waste banks, approximately 36 are pollution sources. Though 113 strip mines lie within the study area limits, these areas are only significant in a few cases where deep mine workings have been intersected and are draining or the strip has been used as a site for coal waste disposal.

Because many of the individual pollution sources were peripheral to much larger sources that spanned several sub-basins, (e.g., many drift mine entries to a large mine complex) sites were organized that segregated all related discharges. These sites also include the whole deep mine extent involved, areas of increased infiltration of surface waters such as at strip mines, plus local coal waste banks



ACRES	SQ. MILES
10,877	17.0
14,820	23.2
6,871	10.7
11,212	17.5
43,781	68.4
100,264	156.7
144,044	225.1

AREAS OF DIRECT RUNOFF NOT INCLUDED
IN TRIBUTARY SUB-BASINS

MAIN BRANCH BLACKLICK CREEK (SUB-BASIN 75)
NORTH BRANCH BLACKLICK CREEK (SUB-BASINS 48 & 48C)
ELK CREEK (SUB-BASINS 48A & 48B)
SOUTH BRANCH BLACKLICK CREEK (SUB-BASINS 76, 64 & 64B)

AREAS OF TRIBUTARY SUB-BASINS (BLOCKS)
EXCLUSIVE OF TWO LICK CREEK

Note
Graph represents the cumulative influences of all known average alkaline and acid loads within the Blacklick Creek Watershed.
Discrepancies between those values actually measured and those calculated for sampling stations 2, 22A, 52A and 106A are attributable to insufficient mixing and problems in correlation.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OPERATION SCARLIFT PROJECT SL 185
BLACKLICK CREEK WATERSHED
Cambria & Indiana Counties
LOWER BLACKLICK CREEK
NET ACID LOAD DISTRIBUTION

that are related in some way. Twenty-seven sites with average acid load discharges ranging from 73,000 to 151 lb./day have been analyzed in detail and account for 90.6 percent of the total acid production within the watershed. Another 8.77 percent of the total load, a discharge into sub-basin 48A, may be related to active acid mine drainage treatment plants in the area. The remaining 0.63 percent is the sum of acid loads associated with 30 insignificant sources whose discharges range from 144 to 5 lb./day. Table 1 presents the average acid loads for each site as well as respective percentages of the total pollution load for the watershed.

Recommended abatement within the study area consists primarily of three techniques: 1) utilization of coal waste material, 2) infiltration control, and 3) deep mine sealing. Utilization is encouraged as a commercial endeavor and may be accomplished through reprocessing for previously discarded coal, use as highway embankment material, or a combination of many uses at no cost to the Commonwealth. Infiltration controls are geared at reducing the water available to flush pollutants from sub-surface mines. Reclamation of strip mines directly overlying or up-dip and along the outcrop of abandoned deep mines is recommended as such a control. In addition, clay sealing, to cover the coal measure of some of these strip mines or cut off up-dip drift openings which allow inflow, is a remedial measure that is also recommended in certain cases. Because of the older mining methods the majority of abandoned sub-surface mines are in such a state that hydraulic mine sealing will be ineffective. Many of the abandoned operations had extended far too close to coal outcrops so that sealing and pressure buildup would inevitably be followed by a blow-out. Similarly, strip mines have in many cases intersected deep mined areas or decreased the coal barrier so much that sealing is impractical. Such conditions usually ruled out flooding before costs could even be considered. Only two underground mine complexes appear to be conducive to hydraulic mine sealing in the watershed.

Over 60 percent of 167,000 lb./day of the acid pollution of the watershed can be abated by usage of coal refuse at minimal or no cost to the State. Infiltration control measures can eliminate a maximum of 10,000 lb./day of acid pollution at an estimated cost of \$3,814,200. This reduction is 3.88 percent of the acid pollution generated within the study area. Hydraulic mine seals can eliminate an estimated 2,000 lb./day of acid pollution at an approximate cost of \$180,000. This is 0.74 percent of the acid pollution generated within the Blacklick Creek watershed. Individual recommendations, costs, and expected pollution load abatement summarized in Table 2.

TABLE 1
 PERCENT OF TOTAL ACID LOAD CONTRIBUTED
 BY INDIVIDUAL POLLUTION SITES

Source	Average Contribution lb./day	Percent of Total Load Produced Within Study Area Alone	Percent of Total Load Including Two Lick Creek Contribution
Two Lick Creek	131,135	--	32.88
Site N	72,743	27.18	18.24
Site K	53,958	20.16	13.53
Site I	19,294	7.21	4.84
Site F	16,701	6.24	4.19
Site M	15,194	5.68	3.81
Site H	13,429	5.02	3.34
Site C	10,145	3.79	2.54
Site J	8,196	3.06	2.06
Site E	6,773	2.53	1.70
Site L	5,380	2.01	1.35
Site R	4,464	1.67	1.12
Site D	3,016	1.13	.76
Site A	2,683	1.00	.67
Site V	2,039	.76	.51
Site B	1,952	.73	.49
Site U	1,180	.44	.30
Site G	1,111	.42	.28
Site O	794	.30	.20
Site X	676	.25	.17
Site AA	551	.21	.14
Site Q	526	.20	.13
Site T	460	.17	.12
Site Y	292	.11	.07
Site Z	279	.10	.07
Site W	239	.09	.06
Site S	210	.08	.05
Site P	151	.06	.04
30 Misc.			
Sources under 150 lb./day	1,751	.63	.45
Sub-basin 48A	23,473	8.77	5.89
	398,000	100.00	100.00