TWO LICK CREEK

MINE DRAINAGE POLLUTION ABATEMENT PROJECT

SL-109

A PART OF OPERATION SCARLIFT

FOR

PENNSYLVANIA DEPARTMENT OF MINES AND MINERAL INDUSTRIES

BY

EARTH SCIENCES DEPARTMENT

L. ROBERT KIMBALL CONSULTING ENGINEERS

EBENSBURG, PENNSYLVANIA

MARCH 1971

<u>Acknowledgments</u>

We gratefully acknowledge the assistance given to this firm during the course of this investigation by the following private companies public agencies, and professional persons:

- 1. Clearfield Bituminous Coal Corporation Ralph Roth, Vice President Jerry Rosenberger, Engineer Jack Davidson, Engineer
- 2. Rochester and Pittsburgh Coal Company James Schaeffer, Chief Engineer Edward Sokol, Chief Draftsman Merle Craig, Draftsman
- 3. Barnes and Tucker Coal Company Hugh Davidson, Engineer
- 4. Moody McGuire, Retired Engineer Clymer, Pennsylvania
- 5. Thomas Howorth, Surveyor Commodore, Pennsylvania
- 6. R. B. Shannon Associates Paul Botsorf, Engineer
- 7. Marion Center Mining Company Deckers Point, Pennsylvania Clair Kinter, Proprietor
- 8. Indiana County Planning Commission
- 9. U. S. Soil Conservation Service U. S. Department of Agriculture Ebensburg, Pennsylvania
- 10. U. S. Weather Bureau Indiana, Pennsylvania

TABLE OF CONTENTS

I. Introduction	1
II. Method of Investigation	2
III. Definition of Terms	4
IV. Basin Description	5
A. Location, Area and Drainage	5
B. Stream Condition	
Plate 1, Two Lick Creek Drainage Basin, Acid Streams	
Plate 2, Two Lick Creek Watershed Acid Load Distribution	
C. Topography	
Plate 3, Topography of Two Lick Creek Drainage Basin	10
D. Geology	11
Plate 4, Surficial Geology of Important Coal Resources,	4.0
in the Two Lick Creek Watershed	
Plate <u>5.</u> Columnar Section Sheet	
E. Climatology Weather Conditions During Study Period	
Plate 6, Two Lick Creek Watershed Precipitation and	
Temperature Relationship	16
G. Coal Mining History and Methods	
H. Water and Sanitary Sewage Collection and Treatment Facilities	
I. Population Distribution	
J. Water Resources and Demand	23
Plate <u>7.</u> Estimated Daily Water Consumption By Source	25
V. Description of Sampling Station	26
VI. Laboratory Analysis Methods	27
A. pH	27
B. Acid (Total)	
C. Alkalinity (Total)	
D. Sulfate (Total)	
E. Iron (Total)	28
VII. Water Quality Criteria	30
VIII. Discussion of pH and Acidity	32
IX. Discussion of Mine Drainage Formation	34
A. Sources of Mine Drainage	34
B. Chemistry	34
X. Abatement Methods and Related Costs	36

A. Associated Deep Mine Abatement Methods Plate 8, Combination Hydraulic/Standard Seal Method	36 37
Plate 9, Hydraulic Seal Method	39
Plate 10. Water Diversion/Flume Discharge Method	42
B. Refuse Pile Reclamation Methods	41
Plate 11, Coal Refuse Burial Method	43
C. Surface Mining Reclamation Methods	44
Plate 12, Contour Backfilling Method	45
Plate 13, Terrace Backfilling	46
D. Revegetation	47
E. Hydrated Lime Treatment Plant Method	49
XI. Mine Sealing in Relation to Stratigraphy	51
A. General	51
B. Diamond Drill Hole Log Evaluations	51
XII. Conclusions	57
A. Pollution Sources	57
B. Priorities	57
XIII. Recommendations	58
A. General	58
B. Priority	58
C. Abatement Plans	59
D. Post Construction Studies	59
XIV. Cost Analysis	61
XV. Analysis of Individual Watersheds	65
A. General	65
B. Cost Benefication	65
C. Non-Polluted Watersheds	67
1. South Branch Watershed	67
Plate 14, South Branch Watershed	69
Plate 15, Relationship Between Stream Flow,	
Pollution Load, and Weather Elements	70
Ramsey Run Watershed	72
Plate <u>16,</u> Ramsey Run Watersheds	74
Plate 17, Relationship Between Stream Flow,	
Pollution Load, and Weather Elements	75
3. Stoney Run Watershed	76
Plate 18, Stoney Run Watershed	78
Plate 19, Relationship Between Stream Flow,	
Pollution Load, and Weather Elements	79

		80
	Plate 20, Little Yellow Creek Watershed	84
	Plate <u>21,</u> Relationship Between Stream Flow,	
	Pollution Load, and Weather Elements	85
D. Polluted	Watersheds	86
	1. North Branch Watershed	88
	Plate 22, North Branch Watershed	89
	Plate $\overline{23}$, Relationship Between Stream Flow,	
	Pollution Load, and Weather Elements	95
	Plate 24, Inventory Map #1, North Branch Watershed	101
	Plate <u>25,</u> Inventory Map #2, North Branch Watershed	102
	Plate <u>26,</u> Inventory Map #3, North Branch Watershed	103
	2. Buck Run Watershed	108
	Plate <u>27,</u> Buck Run Watershed	109
	Plate $\overline{28}$, Relationship Between Stream Flow,	
	Pollution Load, and Weather Elements	113
	Plate 29, Inventory Map #1, Buck Run Watershed	118
	Plate 30, Inventory Map #2, Buck Run Watershed	119
	3. Dixon Run Watershed	124
	Plate 31, Dixon Run Watershed	125
	Plate 32, Relationship Between Stream Flow,	
	Pollution Load, and Weather Elements	129
	Plate 33, Inventory Map #1, Dixon Run Watershed.	135
	Plate 34, Inventory Map #2, Dixon Run Watershed	136
	Plate 35, Inventory Map #3, Dixon Run Watershed	137
	Plate 36, Inventory Map #4, Dixon Run Watershed	138
	4. Penn Run Watershed	144
	Plate 37, Penn Run Watershed	145
	Plate 38, Relationship Between Stream Flow,	
	Pollution Load, and Weather Elements	147
	Plate 39, Inventory Map #1, Penn Run Watershed	151
	Plate 40, Inventory Map #2, Penn Run Watershed	152
	Plate 41, Inventory Map #3, Penn Run Watershed	153
	5. Two Lick Creek Watershed	157
	Plate 42, Flow and Pollution Load – Downstream Pattern.	158
5A. Upper	Portion, Main Stream, Two Lick Creek Watershed	159
	Plate 43, Upper Portion, Main Stream, Two Lick Creek Watershed	160
	Plate 44, Relationship Between Stream Flow,	
	Pollution Load, and Weather Elements .	166
	Plate 45, Inventory Map #1, Upper Portion, Main Stream,	
		171
	Plate 46, Inventory Map #2, Upper Portion, Main Stream,	
	Two Lick Creek Watershed	172
	Plate 47, Inventory Map #3, Upper Portion, Main Stream,	
		173

Plate 48, Inventory Map #4, Upper Portion, Main Stream,	
Two Lick Creek Watershed	174
Plate 49, Inventory Map #5, Upper Portion, Main Stream,	
Two Lick Creek Watershed	175
Plate <u>50,</u> Inventory Map #6, Upper Portion, Main Stream,	
Two Lick Creek Watershed	176
5B. Lower Portion, Main Stream, Two Lick Creek Watershed	181
Plate 51, Lower Portion, Main Stream, Two Lick Creek Watershed	182
Plate 52, Relationship Between Stream Flow,	
Pollution Load, and Weather Elements	186
Plate <u>53,</u> Inventory Map #1,.Lower Portion, Main Stream,	
Two Lick Creek Watershed	190
Plate <u>54,</u> Inventory Map #2, Lower Portion, Main Stream,	
Two Lick Creek Watershed	191
Plate <u>55.</u> Inventory Map #3, Lower Portion, Main Stream,	400
Two Lick Creek Watershed	192
6. Tearing Run Watershed	197
Plate <u>56.</u> Tearing Run Watershed	198
Plate <u>57,</u> Relationship Between Stream Flow, Pollution Load, and Weather Elements	202
Plate <u>58,</u> Inventory Map #1, Tearing Runt Watershed	202
Plate <u>59,</u> Inventory Map #1, Tearing Run Watershed	209
Plate <u>60,</u> Inventory Map #3, Tearing Run Watershed	210
7. Cherry Run Watershed	215
Plate 61, Cherry Run Watershed	216
Plate 62, Relationship Between Stream Flow,	
Pollution Load, and Weather Elements	218
Plate 63, Inventory Map #1, Cherry Run Watershed	221
8. Yellow Creek Watershed	225
Plate 64, Flaw-and Pollution Load – Downstream Pattern	226
8A.UpperPortion, Yellow Creek Watershed	227
Plate 65, Upper Portion, Yellow Creek Watershed.	228
Plate <u>66.</u> Relationship Between Stream Flow,	
Pollution Load, and Weather Elements	233
Plate <u>67,</u> Inventory Map #1, Upper Portion, Yellow	000
Creek Watershed	238
Plate <u>68.</u> Inventory Map #2, Upper Portion, Yellow	220
Creek Watershed	239
Plate <u>69,</u> Inventory Map #3, Upper Portion, Yellow Creek Watershed	240
8B. Lower Portion, Yellow Creek Watershed	2 4 0
Plate 70, Lower Portion, Yellow Creek Watershed	
Plate 71, Relationship Between Stream Flow,	10
Pollution Load, and Weather Elements	252
Plate 72, Inventory Map #1, Lower Portion, Yellow	_0_
Creek Watershed	257
Plate 73, Inventory Map #2, Lower Portion, YellowCreek Watershed	258

	Plate 74, Inventory Map #3, Lower Portion, Yellow Creek Watershed	259
XVI. References		264
Appendix	A (Map Sheets)	