EXHIBIT I

STREAM FLOW (3)

REDSTONE CREEK AT WALTERSBURG

Water Year	Minimum (MGD) (1)	Maximum (MGD)	Yearly Mean (MGD)
1943 (2)	-	1,324.30	82.04
1944	9.69	1,130.50	56.27
1945	10.34	1,582.70	98.84
1946	14.86	1,776.50	76.87
1947	9.69	1,576.24	57.17
1948	10.34	1,434.12	69.12
1949	7.75	1,111.12	65.25
1950	7.11	1,492.26	68.48
1951	9.04	1,576.24	94.96
1952	6.27	1,111.12	71.06
1953	7.75	891.48	54.20
1954	7.11	474.81	28.55
1955	9.69	2,842.20	76.87
1956	9.04	1,989.68	83.98
1957	7.75	646	52.07
1958	8.40	1,059.44	55.23
1959	10.34	2,041.36	55.10
1960	9.04	1,130.50	51.75
1961	3.62	1,808.80	56.85
1962	2.71	704.14	52.33
1963	7.11	2,351.44	48.00
1964	4.01	1,647.30	48.90
1965	6.46	1,169.26	48.58
1966	7.11	1,737.74	37.60
1967	3.62	2,144.72	60.47
1968		1,447.04	

(1) - Million gallons per day

(2) - October 1, 1942 to September 30, 1943

(3) - Taken from U.S. Geological Survey Reports

[1] EXHIBIT II

CHEMICAL & BACTERIOLOGICAL CHARACTERISTICS OF REDSTONE CREEK @ WALTERSBURG

SHEET NO. 1 OF 3

	DATE				FIELD ANALYSIS			LABORATORY ANALYSIS																				BACTERIA
	MONTH	DAY	YEAR	STREAM FLOW (CFS)	TEMPERATURE (DEGREES C)	DISSOLVED OXYGEN	pH (UNITS)	APPEARANCE (NO UNITS)	COLOR (PT-CO STD.)	ODOR (UNITS)	TURBIDITY (UNITS)	pH (UNITS)	ALKALINITY	ACIDITY (pH 4)	ACIDITY (pH 8)	HARDNESS	B.O.D.	CHLORIDE	FLUORIDE	SULFATE	TOTAL SOLIDS	SUSPENDED SOLIDS (TOTAL)	ALUMINUM	IRON (TOTAL)	MANGANESE	SOLUBLE ORTHO-PHOSPHATE	ABS	COLIFORM ORGANISMS MPN/100 CC OR MISC. ANALYSIS
	6	19	62	8.6	27.0	5.3	7.1	Pale Yellow	30	Faint Grassy	10	7.6	135	0	0	230	8.6	21	–	–	430	5	–	0.8	–	–	1.4	240
	9	13	62	8.0	23.0	8.0	7.2	Yellow	25	Faint Grassy	15	7.2	130	0	0	235	2.3	27	–	136	405	15	–	0.6	0	–	1.4	711,000
	12	19	62	–	4.5	1' Deep 5.5	6.5	Dark Yellow	10	Distinct Earthy	170	6.4	55	0	6	420	2.0	35	–	460	890	80	–	25.0	4.0	–	1.05	930
	3	27	63	–	11.0		6.5	Dark Yellow	20	Faint Earthy	120	6.0	26	0	40	345	1.6	12	–	360	720	125	–	12.0	3.3	–	0.05	711, 000
	6	4	63	46.0	17.0	1.5' Deep 0	6.0	Rust Brown	10	Very Faint Musty	220	3.3	0	52	104	740	2.6	14	–	950	1445	40	–	70.0	9.0	–	0.45	46, 000
	9	17	63	13.0	21.1	1' Deep 0	5.0	Rust	15	0	40	3.1	0	110	325	1900	4.0	34	–	2150	3790	65	–	100.0	14.0	–	1.04	245
	12	12	63	–	5.0	1' Deep 0	6.5	Brown	10	0	60	6.0	25	0	40	720	21.0	51	–	950	1685	180	–	60.0	9.0	–	1.00	310,000
	3	10	64	1490.0	6.7	2' Deep 6.0	7.0	Muddy	25	Faint Earthy	320	6.5	43	0	0	115	8.0	9	–	80	660	390	–	22.0	0.25	–	–	191,000
	6	5	64	26.0	23.9	1' Deep 0	6.0	Rust	20	Distinct Dis-agreeable	160	3.1	0	70	248	1300	0.0	20	–	1850	3060	235	–	120.0	8.0	–	0.57	0
	9	4	64	20.0	17.8	0.5' Deep 0	5.5	Rust	5	Distinct Earthy	80	3.4	0	54	236	1325	10.0	23	–	2150	3620	260	–	80.0	8.0	–	0.45	0
	11	20	64	134.0	8.3	1' Deep 1.6	6.0	Brown	40	Distinct Septic	250	6.2	58	0	0	332	9.0	18	–	240	900	300	–	100.0	1.7	–	0.70	380
	2	26	65	90.0	0.5	1' Deep 3.4	6.5	Brown	15	Faint Earthy	255	5.6	37	0	24	450	8.0	26	–	630	1025	120	–	40.0	2.5	–	0.15	1,800
	5	28	65	48.0	22.2	1' Deep 0	6.5	Rust	15	Faint Earthy	325	3.5	0	26	95	840		19	–	1450	1780	290	–	60.0	8.0	–	0.20	0 L 53,500 C 0 R
(2.)	6	28	65	–	–	–	–	–	–	–	–	3.0	0	Total = 3.1 as H_2SO_4		410	–	11	–	538	–	–	–	–	–	–	–	NO_3 = 0.3 PPM Spec.Cond. = 1340
	9	2	65	26.0	16.1	0.7' Deep 0	6.0	Rust	5	Faint Earthy	180	3.4	0	28	140	900	–	18	–	2,000	2,050	235	–	70.0	2.5	–	0.50	110,000 L 110,000 C 110,000 R
(2)	10	28	65	–	–	–	–	SiO_2 = 14 PPM	–	K = 8.8 PPM Na = 182 PPM	–	3.2	0	Total = 1.8 as H_2SO_4		1170 Hdns. Ca-260 Mg-127	–	25	0.4	590	Diss. Solids 2280	–	0.6	0.16	5.8	–	–	NO_3 = 0.9 PPM Spec. Cond. = 2730 PPM
	11	30	65	26.0	3.33	0.5' Deep 0.6	6.5	Yellow	30	Distinct Chemical	350	5.9	40	0	250	1050	17.0	28	–	1325	2175	170	–	80.0	3.2	–	1.40	2,400,000 L 2,400,000 C 2,400,000 R
	2	23	66	68.0	1.6	0.75' Deep 7.0	6.5	Rust	50	0	220	6.3	134	0	8	610	5.7	13	–	675	1055	195	–	50.0	2.5	–	0.45	24,000 L 22,000 C 28,000 R
	5	16	66	98.0	17.22	0.66' Deep 5.0	6.3	Brown	5	0	240	5.8	22	0	20	480	5.0	14	–	480	980	130	–	24.0	1.8	–	0	24,000 L 17,000 C 11,000 R

1. FROM PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES.
2. FROM U.S. GEOLOGICAL SURVEY SERVICE. (WATER RESOURCES DIVISION)
3. ALL RESULTS ARE IN PPM EXCEPT WHERE NOTED.

(1.) EXHIBIT II

CHEMICAL & BACTERIOLOGICAL CHARACTERISTICS OF REDSTONE CREEK @ WALTERSBURG

	DATE			STREAM FLOW (CFS)	FIELD ANALYSIS			LABORATORY ANALYSIS																			BACTERIA
	MONTH	DAY	YEAR		TEMPERATURE (DEGREES C)	DISSOLVED OXYGEN	pH (UNITS)	APPEARANCE (NO UNITS)	COLOR (PT-CO STD.)	ODOR (UNITS)	TURBIDITY (UNITS)	pH (UNITS)	ALKALINITY	ACIDITY (pH 4)	ACIDITY (pH 8)	HARDNESS	B.O.D.	CHLORIDE	FLUORIDE	SULFATE	TOTAL SOLIDS	SUSPENDED SOLIDS (TOTAL)	ALUMINUM	IRON (TOTAL)	MANGANESE	SOLUBLE ORTHO-PHOSPHATE	ABS	COLIFORM ORGANISMS MPN/100 CC OR MISC. ANALYSIS
	8	18	66	44.0	20.0	0.83' Deep 1.0	6.3	Rust	5	Distinct Dis-agreeable	80	5.6	20	0	16	555	5.0	11	–	660	1215	200	–	28.0	4.3	–	0.55	92,000 C 54,000 R
	11	7	66	217.0	4.44	1' Deep 0	6.6	Orange	15	Faint Earthy	320	5.2	18	0	180	598	9.0	27	–	1400	2728	280	–	72.0	8.5	–	0.5	–
	2	1	67	40.1	–	0.5' Deep 3.0	6.7	Brown	150	Faint Hydro-carbon	60	5.8	51	0	6	440	9.0	51	–	480	1226	152	0.14	56.0	2.5	0	0.38	2,400,000 C 540,000 C
	4	24	67	177.0	11.1	0.5' Deep 6.0	6.6	–	40	–	60	6.3	41	0	0	360	5.0	11	–	340	680	48	0	25.0	0.4	0	0.05	–
	7	27	67	16.5	18.0	0	6.1	–	1.5	Faint Earthy	105	3.3		0	120	1150	0	19	–	1200	2930	120	3.9	160.0	17.0	–	0.20	3,500 L 1,100 R
	10	16	67	48.8	16.0	0.5' Deep 0	6.2	Very Rusty	5	–	380	4.7	4	0	240	1760	5.0	0	–	1700	2752	110	1.42	200.0	5.0	0	0.13	35,000 C 9,200 C
	1	24	68	205.0	1.0	1' Deep 9.0	6.8	Decidedly Rusty	10	Very Faint Musty	60	6.5	51	0	0	234	2.8	20	–	288	634	30	1.85	32.0	0.5	0	0	160,000 C 92,000 C
	4	16	68	57.0	11.0	3' Deep 1.0	6.0	Very Rusty	70	Very Faint Earthy	180	5.7	21	0	10	562	6.0	15	–	760	294	32	0.75	70.0	2.0	0	0.30	130 L 54,000 R
(2.)	7	2	68	–	–	–	–	SiO_2 = 14 PPM	–	K = 7.5 PPM Na = 175 PPM	–	3.2	0	2.0 as H_2SO_4	–	1180 Hdns Ca=275 Mg=120	–	28	0.3	1560	Diss. Solids 2460	–	0.6	0.8	6.0	–	–	NO_3 = 0.4 PPM
	7	4	68	26.0	14.0	0.0	6.3	Very Rusty	0	Decidedly Dis-agreeable	60	5.0	18	0	196	1320	0	21	–	1788	2996	114	0.19	80.0	8.0	0.04	0.53	9,200 L 3,500 R
	10	7	68	29.0	13.0	0.5' Deep 2.0	6.5	Very Rusty	5	None	110	5.4	29	0	40	488	5.0	16	–	968	1420	132	0.20	28.0	3.4	0	1.30	350,000 L 350,000 C 350,000 R
	1	7	69	51.6	1.0	0.5' Deep 4.0	6.0	Very Rusty	30	Faint Earthy	150	6.1	69	0	0	288	16.0	4	0.1	575	1380	124	1.60	64.0	1.65	0.01	0.60	2,400,000 L 2,400,000 C 2,400,000 R
(2.)	2	20	69	–	–	–	–	–	–	Na=122	–	5.8	4	0	0	695 Hdns Ca=176 Mg=63	–	20	–	887	Diss. Solids 1330	–	–	–	–	–	–	NO_3 = 10
(2.)	3	26	69	–	–	–	–	–	–	Na = 60	–	7.7	38	0	0	355 Hdns Ca = 96 Mg = 28	–	21	–	401	Diss. Solids 665	–	–	–	–	–	–	NO_3 = 8.8 PPM
	4	2	69	57.0	10.0	0.6' Deep 4.0	6.0	Very Rusty	40	None	135	6.2	47	0	0	498	8.0	25	–	640	1112	76	0.04	40	2.5	0	0.25	970,000
(2.)	5	2	69	–	–	–	–	–	–	Na=63	–	7.4	484	0	0	425 Hdns Ca=106 Mg=39	–	13	–	484	Diss. Solids 782	–	–	–	–	–	–	NO_3 = 7.0 PPM
	7	9	69	63.0	C 19	0.6' Deep 3.0	L 6.8 C 6.7 R 6.6	Very Rusty	0	Very Faint Earthy	60	6.5	58	0	0	494	0.6	20	–	510	860	94	0.03	24	1.81	0.03	0.18	24,000
	10	1	69	22.0	C 15	0.0	L 6.5 C 6.4 R 6.4	Very Rusty	20	Very Faint Earthy	125	5.2	15	0	112	1240	5.8	27	–	1750	2614	148	0.12	90	5.85	0	0	70,000
	1	6	70	88.8	C 3	6.0	L 6.6 C 6.6 R 6.6	Very Rusty	45	Very Faint Earthy	120	6.6	86	0	0	402	0.2	18	–	390	780	74	0.05	33.5	1.75	0	0.04	10,900

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[1] EXHIBIT II

CHEMICAL & BACTERIOLOGICAL CHARACTERISTICS OF REDSTONE CREEK @ WALTERSBURG

DATE			STREAM FLOW (CFS)	FIELD ANALYSIS			LABORATORY ANALYSIS																				BACTERIA
MONTH	DAY	YEAR		TEMPERATURE (DEGREES C)	DISSOLVED OXYGEN	pH (UNITS)	APPEARANCE (NO UNITS)	COLOR (PT-CO STD.)	ODOR (UNITS)	TURBIDITY (UNITS)	pH (UNITS)	ALKALINITY	ACIDITY (pH 4)	ACIDITY (pH 8)	HARDNESS	B.O.D.	CHLORIDE	FLUORIDE	SULFATE	TOTAL SOLIDS	SUSPENDED SOLIDS (TOTAL)	ALUMINUM	IRON (TOTAL)	MANGANESE	SOLUBLE ORTHO-PHOSPHATE	ABS	COLIFORM ORGANISMS MPN / 100 CC OR MISC. ANALYSIS
4	8	70	168.8	C 10	7.0	L 6.8 C 6.8 R 6.7	Very Rusty	0	Distinct Earthy	160	6.6	36	0	0	320	1.1	16	-	340	670	82	0.15	11.2	1.32	0.05	0.03	16,090
6	29	70	0.6	4.7	-	L 7.2 C 7.2 R 7.2	Very Rusty	0	Distinct Earthy	160	4.7	9	0	36	900	3.5	16	-	1080	1448	12.8	0.03	49	4.16	0	0	3,480
9	30	70	22.0	13	0	6.6	Very Rusty	0	Faint Earthy	50	5.1	6	0	102	1200	4.5	30	-	1300	2928	114	0	119.5	5.76	0.02	0.35	622
1	5	71	995.0	-	10	7.0	Very Rusty	10	Very Faint Musty	160	6.8	38	0	0	140	3.5	11	-	88	612	180	0.05	13.6	0.80	-	0	1,609,000
3	31	71	62.0	7	3	6.0	Very Rusty	95	Very Faint Musty	80	6.5	45	0	0	610	-	16	-	605	1149	104	0.03	27.2	0.12	0.02	0.5	542,000
7	8	71	-	19	0	7.0	Very Rusty	10	Faint Musty	60	5.5	32	0	152	1544	7.2	24	-	2135	3480	40	0.005	101.6	6.24	0.11	0.28	490
10	5	71	0.90	17	0	6.4	Very Rusty	5	None	60	4.9	9	0	70	940	5.0	33	-	920	1892	64	0	52.0	5.08	0.01	0.45	120,000
1	5	72	1.86	4.5	10	6.6	Very Rusty	8	Distinct Hydro-Carbon	100	6.3	58	0	0	96	5.3	16	-	362	494	180	0.074	20.4	0.86	0.05	0	30
3	29	72	1.43	6.0	4	L 6.2 R 6.3	Clear	0	Very Faint Musty	80	5.7	21	0	100	648	1.4	16	-	295	1304	112	0.23	37.5	0.05	0.08	0.15	15, 000

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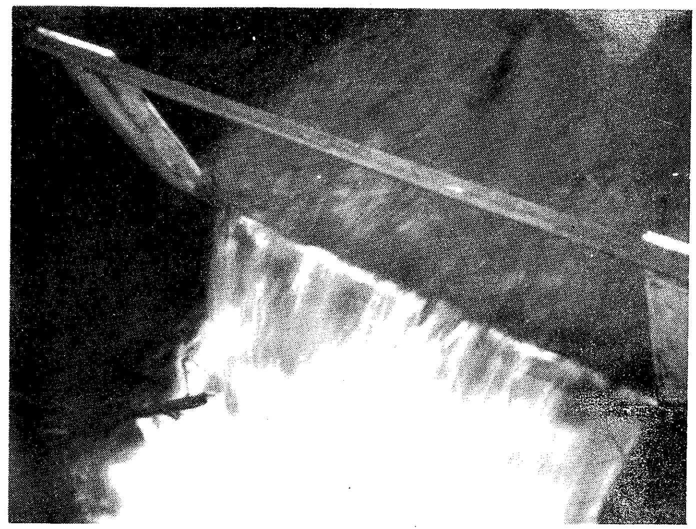
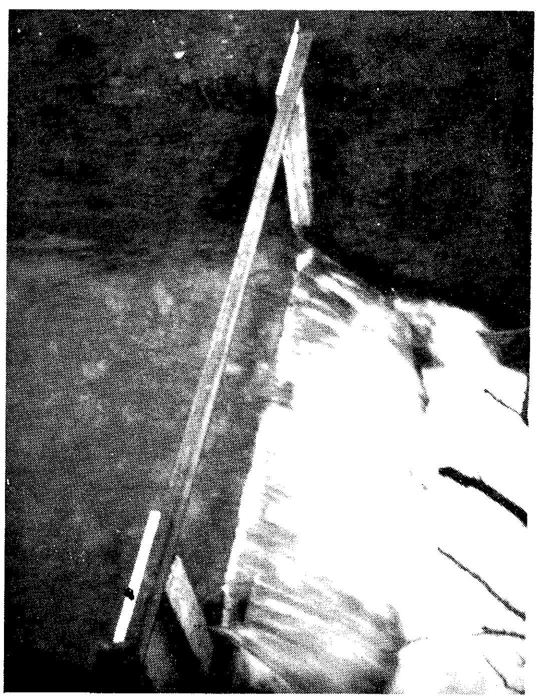
EXHIBIT III


Photographs of mine discharge at Phillips and weir installation

EXHIBIT III

Photographs of mine discharge at Phillips and weir installation

EXHIBIT IV

MINE DRAINAGE VOLUME

DISCHARGE TO REDSTONE CREEK AT PHILLIPS

Date	Head on Weircrest (feet)	Flow Mil. gal/day	Remarks
December 1969			
10	0.55'	4.5	Cloudy with rain
11	0.56'	4.6	Cloudy with rain
12	0.59'	4.9	Cloudy-rain, early morning
13	0.55'	4.5	Cloudy
14	0.58'	4.8	Cloudy- snow
15	0.58'	4.8	Cloudy-snow
16	0.58'	4.8	Cloudy-snow
17	0.58'	4.8	Cloudy
18	0.58'	4.8	Cloudy-early morning
19	0.57'	4.7	Cloudy-early morning
20	0.57'	4.7	Clear
21	0.57'	4.7	cloudy-snow
22	0.57'	4.7	Cold-snow
23	0.58'	4.8	Cold-snow
24	0.58'	4.8	Cold & snow
27	0.57'	4.7	Cold & snow
28	0.57'	4.7	cold & snow
29	0.57'	4.7	cold & rain
30	0.59'	4.9	cold & rain
30	0.60'	5.0	cold & rain
31	0.65'	5.2	cold & rain
31	0.65'	5.2	cold & rain
January 1970			
1	0.62'	5.05	cold & rain
2	0.60'	5.0	cloudy & cold
3	0.59'	4.9	cloudy & snow
4	0.59'	4.9	cloudy & snow
5	0.59'	4.9	cloudy & snow
6	0.59'	4.9	cloudy & snow
7	0.60'	5.0	cloudy & snow
9	0.57'	4.7	cloudy & snow
10	0.57'	4.7	cloudy & snow
12	0.57'	4.7	cloudy & snow
13	0.57'	4.7	cloudy & snow
14	0.57'	4.7	cloudy & snow
15	0.57'	4.7	cloudy & snow
17	0.61'	5.05	cloudy & rain
19	0.57'	4.7	cloudy & snow
20	0.57'	4.7	cloudy & snow
21	0.61'	5.05	cloudy & snow
22	.58'	4.8	cloudy & snow

Exhibit IV - Continued

23	.58'	4.8	cloudy & snow
24	.58'	4.8	cloudy & rain
25	.60'	5.0	cloudy & rain
26	.61'	5.05	cloudy & rain
27	.59'	4.9	cloudy & rain
28	.60'	5.0	cloudy & rain
29	.64'	5.2	cloudy & rain
30	.62'	5.05	cloudy & rain
31	.61'	5.05	cloudy & rain
February 1970			
1	.60'	5.0	cloudy & rain
2	.62'	5.05	cloudy & rain
3	.62'	5.05	cloudy & snow
4	.62'	5.05	cloudy & cold
5	.62'	5.05	cloudy & snow
6	.60'	5.0	cloudy & cold
7	.60'	5.0	cloudy & cold
8	.62'	5.05	cloudy & cold
9	.62'	5.05	cloudy & cold
10	.61'	5.05	cloudy & cold
11	.61'	5.05	cloudy & cold
12	.62'	5.05	cloudy & cold
13	.62'	5.05	cloudy & cold
14	.62'	5.05	cloudy & cold
15	.64'	5.20	Rain & cold
16	.62'	5.05	cloudy & cold
17	.62'	5.05	cloudy
18	.63'	5.10	sunny
19	.61'	5.05	sunny
20	.61'	5.05	sunny
21	.61'	5.05	sunny
22	.62'	5.05	sunny
23	.61'	5.05	sunny
24	.61'	5.05	sunny
25	.62'	5.05	sunny
26	.62'	5.05	sunny
27	.61'	5.05	sunny
28	.61'	5.05	sunny
March 1970			
1	.61'	5.05	sunny
2	.61'	5.05	sunny
3	.62'	5.05	sunny
4	.64	5.20	rain
5	.64'	5.20	rain
6	.63'	5.10	rain
7	.62'	5.05	rain
8	.60'	5.0	rain
9	.61'	5.05	rain
10	.61'	5.05	rain
11	.62'	5.05	rain
12	.63'	5.10	rain

Exhibit IV - Continued

13	.63'	5.10	rain
14	.61'	5.05	rain
15	.61'	5.05	rain
16	.61'	5.05	rain
17	.61'	5.05	rain
18	.65'	5.25	rain - sample taken @ 3 pm after rain.
19	.65'	5.25	rain
20	.64'	5.20	rain
21	.64'	5.20	rain
22	.64'	5.20	rain & snow
23	.65'	5.25	rain & snow
24	.63'	5.10	
25	.63'	5.10	
26	.64'	5.20	
27	.65'	5.25	
28	.65'	5.25	
29	.68'	5.60	
30	.68'	5.60	Sample taken
31	.68'	5.60	
April 1970			
1	.67'	5.55	
2	.67'	5.55	
3	.65'	5.25	
4	.65'	5.25	
5	.64'	5.20	
6	.66'	5.50	
7	.67'	5.55	
8	.68'	5.60	
9	.68'	5.60	
10	.69'	5.70	
11	.69'	5.70	
12	.68'	5.60	
13	.68'	5.60	
14	.68'	5.60	
15	.70'	6.00	Sample taken after rain
16	.70'	6.00	
17	.71'	6.05	
18	.70'	6.00	
19	.70'	6.00	
20	.70'	6.00	
21	.71'	6.05	
22	.71'	6.05	
23	.72'	6.10	
24	.71'	6.05	
25	.70'	6.00	
26	.70'	6.00	
27	.70'	6.00	
28	.70'	6.00	
29	.69'	5.70	
30	.69'	5.70	
31	.70'	6.00	

Exhibit IV - Continued

May 1970

1	.71'	6.05	Sample taken
2	.70'	6.00	
3	.70'	6.00	
4	.69'	5.70	
5	.70'	6.00	
6	.71'	6.05	Sample taken
7	.70'	6.00	
8	.70'	6.00	
9	.69'	5.70	
10	.70'	6.00	
11	.70'	6.00	
12	.69'	5.70	
13	.69'	5.70	
14	.69'	5.70	
15	.68'	5.60	
16	.68'	5.60	
17	.67'	5.55	
18	.67'	5.55	
19	.66'	5.50	
20	.66'	5.50	
21	.66'	5.50	
22	.65'	5.25	
23	.66'	5.50	
24	.66'	5.55	
25	.67'	5.55	
26	.68'	5.60	
27	.68'	5.60	
28	.67'	5.55	
29	.67'	5.55	
30	.68'	5.60	
31	.69'	5.70	

June 1970

1	.69'	5.70
2	.60'	5.70
3	.69'	5.70
4	.68'	5.60
5	.68'	5.60
6	.68'	5.60
7	.69'	5.70
8	.69'	5.70
9	.69'	5.70
10	.70'	6.00
11	.69'	5.70
12	.69'	5.70
13	.69'	5.70
14	.68'	5.60
15	.70'	6.00
16	.70'	6.00
17	.70'	6.00
18	.70'	6.00
19	.69'	5.70
20	.69'	5.70

Exhibit IV - Continued

21	.69'	5.70	
22	.68'	5.60	
23	.68'	5.60	
24	.67'	5.55	
25	.68'	5.60	
26	.68'	5.60	
July 1970			
30	0.75'	6.25	Day after a rain
31	0.58'	4.8	clear
August 1970			
3	.65'	5.25	Rain
4	0.75'	6.25	Day after a rain
5	0.65'	5.25	Cloudy
6	0.67'	5.55	Cloudy
7	0.65'	5.25	Clear
10	0.63'	5.10	cloudy
11	0.65'	5.25	clear
14	0.63'	5.10	cloudy

EXHIBIT V

MINE DRAINAGE CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS

DISCHARGE TO REDSTONE CREEK AT PHILLIPS

Sampling Date	pH	Alkalinity (to pH 4) (ppm)	Acidity (to pH 8.3) (ppm)	Sulfate (ppm)	Iron Total (ppm)	Iron Dissolved (ppm)	Manganese (ppm)	Aluminum (ppm)	E. Coli MPN/100 ml
9/17/69	6.05	190	-0-	1050	322	292	-0-	-0-	-
1/2/70	5.60	20	270	4750	365	11.2	7.2	0.32	-
1/18/70	5.70	18	340	4177	250	56	3.92	0.28	-
1/24/70	5.3	19	264	3500	195	133	3.9	0.37	Less than 2.2
1/31/70	5.7	38	250	3100	255	205	7.62	0.39	-
2/12/70	5.7	12	244	6050	195	165	7.3	0.53	-
3/18/70	6.05	156	454	4750	295	255	7.2	0.15	-
3/30/70	5.8	96	276	15500	515	230	7.8	0.84	0
4/15/70	5.60	64	326	5000	320	248	7.6	0.27	-
5/1/70	5.3	19	520	7000	275	225	11.6	0.52	0
5/1/70(1)	4.4	1320 (total)	-0-	1900	245	162	40.0	0.28	-
5/6/70	5.9	156	532	4750	333	275	8.4	0.35	-
7/31/70	4.8	20	334	4050	388	128	7.3	1.47	-

(1) Sample Analyzed By Pennsylvania Department of Environmental Resources

EXHIBIT VI

RAW AND TREATED SEWAGE CHARACTERISTICS (1) DURING TREATABILITY STUDIES

DATE	SUSPENDED SOLIDS (ppm)		SETTABLE SOLIDS (ml/l)		B.O.D. (ppm)	
July, 1970	Raw	Eff	Raw	Eff	Raw	Eff
30	147	99			220	99
31	106	40	5.0	0.9		
August, 1970						
3	213	76	8.0	0.5		
4	163	48	8.5	0.4		
5	97	20	7.0	0.3		
6	158	48	9.5	0.1	185	52
7	125	38	7.5	0.1		
10	281	98	13.0	0.8		
11	177	52	7.5	1.0		
12	175	52	8.5	0.6		
13	147	80	6.0	1.0		
14	148	60	9.0	0.8		

(1) Taken from McKeesport Sewage Treatment Plant Operating Records.

EXHIBIT VII

TABULATION OF TREATABILITY STUDIES

TEST NO. 1

Using Chlorine as Oxidizing Agent

		JAR NUMBERS					
		1	2	3	4	5	6
7/30/70	Sewage (ml)	150	150	150	150	150	0
	MD (ml)	850	850	850	850	850	1000
	Chlorine Addition (ppm)	10	30	50	100	200	0
	Ferrous Iron Test	Green	Clear Green	Very pale Green-Blue	Light Blue	Dark Blue	Green
	Color of Sludge	Yellow-Orange	Orange	Slightly Dark Orange	Light Orange	Yellow-Orange	Solids in the sewage did not fall-out
	Result of Fe^{++} Removal		Second Best	Best			

Comments: Best range for the addition of chlorine to this ratio of MD to sewage is probably between 30 to 50 ppm of chlorine.

TEST NO. 2

Using Lime Only

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	0
MD (ml)	850	850	850	850	850	1000
Lime Addition (ppm)	50ppm	100ppm	200ppm	300ppm	400ppm	0 ppm
Ferrous Iron Test	Green	Light Green	Very Light Green	Yellow Green	Yellow (Comp. Neg.)	Dark Green
Color of Sludge	Orange	Brown-Orange	Brown	Dark Blue	Light Blue	Solids in the sewage did not fall-out.
Results of Fe^{++} Removal				Second Best	Best	

Comments: Best range for the addition of lime to this ratio of MD to sewage is probably between 250 to 400 ppm and for complete removal of ferrous iron (Fe^{++}) 350 to 500 ppm.

Also a scum appeared on top of the solution in each of these jar tests. This scum is due to the air oxidizing the ferrous (Fe^{++}) during the stirring of the solution, thus, hindering sedimentation.

TEST NO. 3

Using Lime and Chlorine

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	0
MD (ml)	850	850	850	850	850	1000
Lime Addition (ppm)	50	100	200	300	400	0
Chlorine ppm.	40	40	40	40	40	0
Ferrous Iron Test	Clear Blue	Light Blue	Blue-Green Tint Only	Clear with Amber tint	Clear Yellow	Dark Green-Blue
Color of Sludge	Light Orange	Orange	Dark Green-Blue	Blue-Green	Light Blue	Solids in the sewage did not fall-out
Results of Fe^{++} Removal				Second Best	Best	

Comments: The lime was added first then stirred and allowed to settle. Then the chlorine was added; next, the solution was stirred again and allowed to settle.

Also the scum was almost totally removed, if the solution was not allowed to set for a long period of time. This was probably due to the addition of chlorine.

Best results occurred between the range of 250 to 400 ppm of lime with 40 ppm chlorine.

Best ranges for the addition of lime and chlorine are probably between 250 to 400 ppm lime and 30 to 50 ppm chlorine with the lime always being added first.

TEST NO. 4

Using Polymer Only

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	0
MD (ml)	850	850	850	850	850	1000
Calagon 269 Polymer Addition ppm	0.1	0.3	0.5	1.0	2.0	0.0
Iron Test (Fe^{++})	Dark Blue	Light Blue-Green	Blue-Green	Light Blue-Green	Dark Blue-Green	Dark Blue-Green
Color of Sludge	-	-	-	-	-	Solids in the sewage did not fall-out
Results of Fe^{++} Removal		Best		Second Best		

Comments:

Best range for the addition of polymer to this ratio of MD to sewage is probably between .3 to .5 ppm of polymer, which is also the most economical range.

Polymer had no affect on changing the color of the sludge. Also a scum appeared on top of the solution in each one of these jar tests. This scum is due to the air oxidizing the ferrous iron.

During the stirring of the solution, with the ferrous precipitate being very fine and not settling out the scum also went from a brown to green in color, while appearing in other parts of the solution as a gray smoke swirling through the solution.

TEST NO. 5

Using Polymer and Lime

	JAR NUMBERS 1	2	3	4	5	6
Sewage	150	150	150	150	150	0
MD	850	850	850	850	850	1000
Lime Add. (ppm)	50	100	200	300	400	0
Calagon 269 Polymer Addi-Tion (ppm)	0.1	0.3	0.5	1.0	2.0	0.0
Ferrous Iron Test	Green-Blue	Green-Blue	Light Green	Very Light Pale Green	Pale Green	Green-Blue
Color of Sludge	Orange	Orange-Brown	Brown Orange	Green-Blue	Blue	Solids in the sewage did not fall out
Results of Fe^{++} Removal			Second Best	Best		

Comments: The test with 400 ppm lime and 2 ppm polymer seemed to over run its end point. The supernatant from this test became very cloudy with pin point ferrous precipitate and a very thick layer of ferrous scum.

Best range for the addition of lime and polymer to this ratio of MD to sewage is probably between 200 to 350 ppm lime and .3 to .5 ppm polymer.

Also a scum appeared on top of the solution in each one of these jar tests. This scum is due to the air oxidizing the ferrous iron during the stirring of the solution with the ferrous precipitate being very fine and not settling out.

TEST NO. 6

Using Lime Polymer & Chlorine

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	0
MD (ml)	850	850	850	850	850	1000
PH			6.4	6.7	6.8	6.8
Chlorine Add. (ppm)	40	40	40	40	40	0
Lime Add. (ppm)	50	100	200	300	400	0
Calagon 269 Polymer (ppm)	.3	.3	.3	.3	.3	0
Ferrous Iron Test	Dark Blue-Green	Blue-Green	Green	Light Yellow-Green	Dark Green-Blue	Dark Green-Blue
Color of Sludge	Light Orange	Orange	Dark Orange	Orange-Brown	Dark Green-Blue	Solids in the sewage did not fall out
Results of Fe^{++} Removal			Second Best	Best	Should have had better results.	

Comments: These results were probably due to the addition of the chlorine first than the lime. Therefore, to remove all the iron or for best ferrous iron removal add lime first then chlorine. Again a scum appeared on top of the solution in each of these jar tests.

Tests with 300 and 400 ppm lime combined with 40 ppm chlorine and no polymer were made. The results obtained were about the same as the tests using polymer. The best range for the addition of lime, chlorine & polymer to this ratio of MD to sewage is probably between 200 to 400 ppm lime, 30 to 50 ppm chlorine, and .3 to .5 ppm polymer. In this test 40ppm of chlorine & 0.3 ppm of polymer were used as the optimum dosage rates.

TEST NO. 7

Using Lime and Chlorine (Chlorine Constant)

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	0
MD (ml)	850	850	850	850	850	1000
Lime Add. (ppm)	50	100	200	300	400	0
Chlorine Add. (ppm)	40	40	40	40	40	0
Ferrous Iron Test	Blue	Light Blue	Green	Yellow-Green	Dark Green-Yellow	Dark Blue-Green
Color of Sludge	Light Orange	Orange	Dark Orange	Brown	Dark Green	Solids in sewage did not fall-out.
Results of Fe^{++} Removal				Best	Second Best	

Comments

Holding the chlorine constant at 40 ppm, the best range for the addition of lime is probably between 300 to 400 ppm. The lime was added before the chlorine. The best results were obtained using this procedure.

Also a scum appeared on top of the solution in each one of these jar tests. This scum is due to the air oxidizing the ferrous iron during the stirring of the solution.

TEST NO. 8

Using Lime and Chlorine (Lime Constant)

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	0
MD (ml)	850	850	850	850	850 pH 6.8	1000
Lime Add. (ppm)	300	300	300	300	300	0
Chlorine Add. (ppm)	10	30	50	100	200	0
Ferrous Iron Test	Very Pale Green	Pale Green	Green-Blue	Blue-Green	Yellow Completely Negative	Dark Blue-Green
Color of Sludge	Green	Brown	Brown-Orange	Dark Orange	Orange	Solids in the sewage did not fall-out
Results of Fe^{++} Removal	Second Best			Not a good test	Best	

Comments: A layer of scum appeared on each of these jar tests except the one where 300 ppm lime and 200 ppm chlorine were added.

Best range for the addition of chlorine with 300 ppm lime already added is between 10 to 50 ppm chlorine for partial iron (Fe^{++}) removal, but for complete iron (Fe^{++}) removal with no scum forming 200 ppm chlorine is required.

TEST NO. 9

Lime With & Without Chlorine & Polymer

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	0
MD (ml)	850	850	850	850	850	1000
Lime Add. (ppm)	100	200	300	300	400	400
Chlorine Add. (ppm)	40	40	40	0	0	0
Calagon 269 Polymer Add. (ppm)	.5	.5	.5	0	0	0
Ferrous Iron Test	Blue-Green	Light Blue-Green	Green-Yellow	Very Pale Yellow-Green	Green	Yellow-Brown
Color of Sludge	Light Orange	Orange	Dark Orange	Green	Dark Green	Very Dark Green
Results of Fe^{++} Removal				Best	Green Due To Getting Scum in the pipe.	Second Best but has a scum problem.

Comments: All tests with lime, chlorine and polymer added had only a very thin layer of scum, while these tests which added only lime still had a scum problem.

This test shows that best results are obtained with the addition of lime only at 300 to 400 ppm if scum removal is provided.

TEST NO. 10

Lime Recirculation

	JAR NUMBERS					
	1	2	3	4	5	6
Sewage (ml)	150	150	150	150	150	150
MD (ml)	850	850	850	850	850	850
Lime Add. (ppm)	50	100	150	0 Sludge from Jar 1	0 Sludge from Jar 2	0 Sludge from Jar 3
Lime Add. (ppm)	0	0	0	25	50	75
Ferrous Iron Test	Blue	Green	Very Pale Green	Blue	Dark Blue	Dark Blue
Color of Sludge	Light Orange	Orange	Dark Orange	Dark Orange	Green	Green
Results of Fe^{++} Removal		Second Best	Best			

Comments: Recirculation of the sludge produced in Jars 1, 2, and 3, with the addition of more lime, does not aid in the removal of the ferrous iron.

TEST NO. 11

Aeration of Mine Drainage

Volume of Mine Drainage (ml)	1000
Aeration Time (Hours)	3
Settling Time (Hours)	3
Amount of Ferric Iron Precipitate (ml/l)	6.5
Ferrous Iron in Supernatant (Color)	Dark Blue

TEST NO. 12

Aeration of Mine Drainage

Volume of Mine Drainage (ml)	1000
Aeration Time (Hours)	3
Settling Time (Hours)	24
Amount of Ferric Iron Precipitate (ml/l)	5.5
Ferrous Iron in Supernatant (Color)	Dark Blue

Comments: This process is an excellent way of converting a large percentage of the ferrous iron to the ferric state. The supernatant at first appears to be very clear, but a closer observation shows that even after 24 hours of settling there is still some very fine pin point Floc in the supernatant.

TEST NO. 12

Aeration Test (Sew.&MD)

	Jar Numbers 1	2
Supernatant From Aeration Test No. 11 (ml)	500	250
Sewage (ml)		50
Initial Lime Add. (ppm)	100	200
Ferrous Iron Test	Dark Blue	Dark Blue
Lime After Recirculation (ppm)	100	100
Ferrous Iron Test	Yellow Going to Very Pale Green	Clear
Results of Fe^{++} Removal	Good	Good

Comments: It appears that to remove the ferrous iron from the MD only, you will only have to use 200 ppm lime, while to remove Fe^{++} from the MD to sewage in a 6:1 ratio you will need 300 ppm lime.

No scum appeared on top of any of these solutions.

TEST NO. 13

Aeration on Mine Drainage

(With Varying Settling Times)

Volume (ml)	1000
Aeration Time (hours)	24
Settling Times (hours)	
Jar No. 1	None
Jar No. 2	4.5
Ferric Iron (ml/l)	
Jar No. 1	2
Jar No. 2	4
Ferrous Iron (Color)	
Jar No. 1	Dark Blue
Jar No. 2	Dark Blue

Comments: In this experiment the Floc appeared to be too fine after long aeration periods.

Two to three hours aeration time appears to be adequate for proper settling.

TEST NO. 14

24 Hr. Aeration With Lime Addition & Recirculation

	Jar No. 1	Jar No. 2
Mine Drainage (Ml) (Supernatant from Test # 14)	500	500
Lime Add. (ppm)	200	300
Lime After Recirculation (ppm)	50	0
Ferrous Iron Test	Yellow	Yellow
Results of Fe^{++} Removal	Complete Iron Fe^{++} Removal	Complete Iron Fe^{++} Removal in one step

Comments: Best range, for the addition of lime to this aerated supernatant of MD only, is probably between 200 to 300 ppm lime.

Also, no scum appears on top of solution after stirring and setting.

TEST NO. 15

Short Aeration Period

Volume of Mine Drainage (Ml)	1000
Aeration Time (hours)	2
Settling Time (hours)	2
Amount of Ferric Iron (ml/l)	7
Ferrous Iron Test (Color)	Dark Blue

Comments: The supernatant resulting from this test is much more clear than any other aeration test. Thus, 2 hours aeration and 2 hours settling gives the best results for settling out the ferric iron. No scum appears on top of any of the aeration tests.

TEST NO 16

2 hr Aeration with Lime Addition And Recirculation

	Jar No 1	Jar No 2
Mine Drainage (Supernatant - Test # 16	500	500
Lime Add. (ppm)	100	200
Settling Time (minutes)	20	20
Ferrous Iron Test	Dark Blue	Yellow
Lime after Recirculation (ppm)	100 ppm	None (not recirculated)
Ferrous Iron Test	Dark Blue	
Results of Fe++ removal		Best
Comments	Best range for the addition of Lime to this aerated supernatant of MD only, is around 200 ppm lime added all at once. Again the recirculation of lime sludge and adding more lime did not increase the removal of the ferrous iron (Fe++). No scum appeared on top of any of the jar tests.	

TEST NO 17

Sewage-MD and Recirculated Sludge

8/5/70	Volume of Sewage (ml)	150
	Volume of Mine Drainage (ml)	850
	Recirculated Sludge (ml)	10
	Ferrous Iron Test (color)	Dark Blue
	Results of Fe++ Removal	Poor
	Comments	Supernatant in this jar test was very cloudy with a layer of scum. At this MD to sewage ratio Ferric Iron did not aid in floc formation.

TEST NO 18

2 Hr Aeration, 20 Hr Settling

Volume of Mine Drainage (ml)	1000
Aeration Time (hours)	2
Settling Time (hours)	20
Amount of Iron Precipitate (ml/l)	6
Ferrous Iron Test (color)	Dark Blue
Comments	Aeration for 2 hrs seems to be the best time of aeration needed to precipitate as much Fe++ as possible, while settling volume increases as settling time increases.

TEST NO 19

Aeration Followed By Lime And Polymer Addition

	Jar No 1	Jar No 2
Sewage (ml)	100	100
Mine Drainage (ml) Supernatant after 2 hr.	500	500
Aeration and 2 hr settling Lime add. (ppm)	100	200
Calagon 3000 Polymer add (ppm)	0.5	0.5
Ferrous Iron Test	Dark Blue	Light Blue-green
Color of Sludge	Orange	Green-Brown
Results of Fe++ Removal	Very poor	Poor
Comments	Polymer did not improve iron removal.	

TEST NO 20

Aeration with Lime Addition

Volume of Mine Drainage (ml)	1000
Lime Addition (ppm)	50
Aeration Time - hours	2
Settling Time - hours	2
Amount of Ferric Precipitate -ml/l	
After 2 hours	12
After 24 hours	13
Ferrous Iron Test (color)	Dark Blue
Comments	Supernatant very clear. Process appears to remove greatest amount of iron.

TEST NO 21

Test No 21 With Recirculation

	Jar No 1	Jar No 2
Supernatant (ml) Test No 21	500	500
Lime Add. (ppm)	100	150
Ferrous Iron Test	Dark Blue	Light Blue
Results of Fe++ Removal	Very Poor	Poor
Comments	Results show that recirculation did not improve iron removal.	

TEST NO 22

2 Hr. Aeration, 2 Hr. Settling With Lime

Volume Mine Drainage (ml)		850
Volume Sewage (ml)		150
	Jar No 1	Jar No 2
Supernatant After Aeration and Settling (ml)	500	500
Lime Add (ppm)	200	300
Ferrous Iron Test	Very Pale Yellow Green	Yellow
Color of Sludge	Green-Brown	Green-Brown
Results of Fe++ Removal	Second Best	Best
Comments	At a ratio of MD, Sewage of 6 to 1 Best Process appears to be to oxidize ferrous iron with air for 2 hours and settle for 2 hours. Lime in concentrations of 200 to 300 ppm should be added first.	

EXHIBIT VIII

pH OF MINE DRAINAGE AT PHILLIPS DURING TREATABILITY STUDIES

DATE	pH after + 1 hour	Holding Time (hours)	pH (1)	Comments
July 1970				
30	6.8			
31	6.8			
August				
3	6.8	8	6.8	Sample getting cloudy
4	7.0	32	6.8	Sample cloudy Build up of floc on bottom.
5	6.9	56	6.6	Same as 8/4
6	6.8	80	5.8	Same as 8/4
7	6.8	104	5.5	Supernatant beginning to clear - orange sludge forming
10	6.7	176	5.3	Supernatant clear. Scum on top of sludge of fine floc formed.
11	6.8			
14	6.7			

(1) Sample was left open to atmosphere. Drop in pH explained by CO_2 being absorbed into sample forming carbonic acid. Oxidation of ferrous iron to ferric iron develops in process and floc develops.

Exhibit IX

Preliminary Estimates of Construction Costs
Combined Sewage - Mine Drainage Treatment
Project

Sewerage Only	
Rankin Run Interceptor	160,000
Redstone Creek Interceptor	100,000
Aeration Tank - Structures	92,000
Aeration Tank - Equipment	20,000
Settling Tank - Structures	18,000
Settling Tank - Equipment	15,000
Chlorine Contact Tank	61,000
Excavation & Backfill	12,000
Electrical	20,000
Combined Mine Drainage & Sewage	
Flash Mixer - Structure	60,000
Flash Mixer - Equipment	40,000
Oxidation Tank - Structure	200,000
Oxidation Tank - Equipment	60,000
Final Settling Tank Thickener - Structure	120,000
Final Clarifier - Thickener Equipment	80,000
Sludge Drying Lagoon	40,000
Excavation and Backfill	24,000
Chemical Feed and Mixing Equipment	75,000

Exhibit IX - Continued

Control and Chemical Storage Building	300,000	
Pumping and Misc. Control Building Equipment	150,000	
Outfall Structure	10,000	
Piping	200,000	
Instrumentation and Controls	125,000	
Electrical Work	125,000	
Heating, Ventilating, Plumbing	50,000	
Miscellaneous Outside Work	40,000	
Total Construction Costs		$ 2,197,000
Engineering Legal, Financing, Interest, etc. and Contingencies Lands & Rights-of-Way		653,000
Total Project Cost		$ 2,850,000

Exhibit X

Preliminary Estimate of Annual Operation Maintenance and Administration Costs
Combined Sewage - Mine Drainage Project

Operation and Maintenance		
	Plant Superintendent	$ 10,000
	Plant Operators (2)	12,000
	Power	50,000
	Repairs	10,000
	Lubricants & Misc Parts	10,000
	Sludge Removal & Hauling	20,000
	Chemicals	65,000
	Transportation & Misc Supplies	2,000
	Water	5,000
Administration		
	Office Manager	10,000
	Billing and Collecting	5,000
	Office Supplies	500
	Telephone	250
	Auditor	250
	Insurances	800
	Engineering	1,500
	Legal	1,000
	Miscellaneous	1,700
	Total	$ 205,000