APPENDIX C

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Acid Producing Properties of Coal Mine Refuse Material
Area 43 D Mine Refuse Bank
Gum Boot Mines

An experiment was performed in order to obtain information on the acid producing properties of the coal mine refuse material associated with the mining of the Lower Mercer Coal Bed at the Gum Boot Mines on Gum Boot Run and the Instantur Mines on Twomile Run. These mines were closed in the early 1900's and the mine waste banks are more than 60 years old, but water quality tests indicated that this material was a source of acid mine drainage pollution. There was no visible pyrite or marcasite in the mine waste and it was assumed that it occurs in a finely disseminated state.

Samples of waste coal, underclay, and culm mixed with soil were collected from the Area 43 D mine refuse banks. This material was finely ground and then graded using U.S. Standard sieves. The grinding and grading of the material was done in order to:

1) Expose a greater surface area of material and increase the chemical oxidation of available pyrite (and/or marcasite?)
2) Provide an equal amount of each type of material for each of the test containers, and
3) Provide an equal distribution and size of grains of a material for each of the test containers, and therefore, an equal surface area.

An equivalent weight of each type of material that was retained on a given sieve size was added to 12 glass containers (Table I). The glass containers were separated into three groups so that the mine waste material could be exposed to different oxidizing conditions.

Group I consisted of 5 one gallon bottles in which 500 ml. of water was added to the sample. The water used in the experiment was obtained from an unpolluted stream near the mine and contained 0.08 mg/l iron, 7 mg/l sulfate, and the dissolved oxygen content was 8.5 mg/l. The large air space in the bottles resupplied the dissolved oxygen in the water that was being removed by the oxidation of pyrite (and or marcasite?)

Group II consisted of 5 one pint mason jars that were filled to the top with water to eliminate all air and then sealed so that as the oxygen was removed by chemical reaction it was not resupplied. The water was obtained from the same source as used in Group I.

Group III consisted of 2 one pint mason jars that were filled to the top with water that had been first boiled to expel oxygen. The water after boiling and cooling had a dissolved oxygen content of less than 2 mg/l. The jars were sealed.

The containers were shaken daily in order to provide mixing and in the case of Group I aeration. On testing days one container from each group was opened. The water was decanted and filtered through Whatman #42 filter paper before the water quality analysis was made. The results of the analysis for each group are shown in Table II and Graphs I - III.

CONCLUSIONS

1) The coal mine refuse banks at the Gum Boot Mines and the Instantur Mines contain acid producing materials.
2) There is no visible pyrite or marcasite in the coal mine waste and it is assumed that it occurs in a finely disseminated state.
3) There is very little calcareous material in the mine refuse and the

low pH results in aluminum being leached from clay minerals.

4) The presence of oxygen results in rapid pyrite oxidation.

5) If the oxygen content is high and it is constantly resupplied, the ferrous iron becomes oxidized to the ferric state.

6) The air sealed sample (Group II) analyzed on October 10, 1969 most closely resembles the nature of the mine seepage at the Gum Boot Mines and the Instantur Mines. It is believed that a broken air seal was responsible for the unexpected results. The dissolved oxygen content was probably low, but as oxygen was consumed in the chemical reactions, it was resupplied.

TABLE I

CLASSIFICATION, GRADATION, AND WEIGHT OF COAL MINE REFUSE MATERIAL USED IN EACH TEST CONTAINER

Classification	Gradation U.S. Standard Sieve No.	Weight Retained (grams)	Percent of Total Material Retained	
Coal	60	0.0	0.0	
	100	5.0	7.4	
	200	10.0	14.7	
	270	6.0	8.8	
	Pan	2.0	2.9	
				33.8%
Underclay	40	0.0	0.0	
	60	10.0	14.7	
	100	5.0	7.4	
	200	3.0	4.4	
	Pan	0.5	0.7	
				27.2%
Culm Mixed With Soil	60	0.0	0.0	
	100	10.0	14.7	
	200	12.0	17.6	
	270	4.0	5.9	
	Pan	0.5	0.7	
				38.9%
	Total Weight	68 grams		99.9%

TABLE II

Group I - Aerated Water

Date	Aug. 1	Aug. 5	Aug. 22	Sept. 8	Oct. 10
pH	4.40	3.50	2.85	2.75	2.55
*Total Acidity (mg/l)	14.0	47.0	192.0	290.0	506.0
Free Acidity (mg/l)	2.0	23.5	125.0	228.0	415.0
Total Iron (mg/l)	0.72	1.40	8.70	19.00	38.00
Ferrous Iron (mg/l)	0.60	0.53	1.32	1.20	1.22
Aluminum (mg/l)	0.23	1.45	10.50	17.50	36.00
Sulfate (mg/l)	25.	56.	215.	310.	550.

Group II - Air Sealed Samples (D.O. 8.5 mg/l)

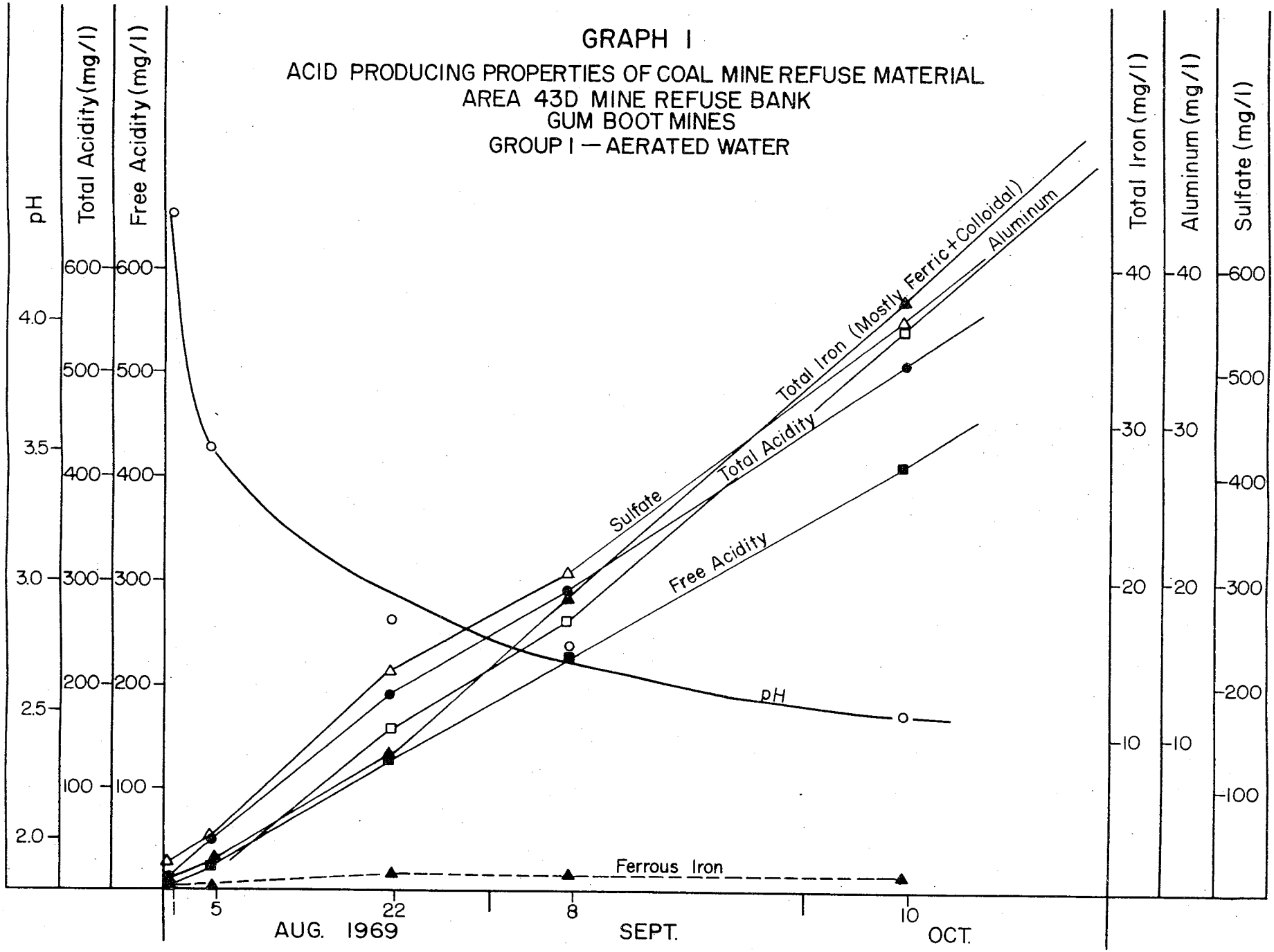
Date	Aug. 1	Aug. 5	Aug. 22	Sept. 8	Oct. 10**
pH	4.25	4.35	4.25	4.10	3.35
*Total Acidity (mg/l)	11.5	23.0	26.0	27.0	150.0
Free Acidity (mg/l)	0.5	0.5	2.0	3.0	42.0
Total Iron (mg/l)	0.80	3.48	7.90	8.00	52.00
Ferrous Iron (mg/l)	0.58	2.75	4.30	6.05	32.00
Aluminum (mg/l)	0.19	0.33	0.65	0.92	1.20
Sulfate (mg/l)	25.	31.	36.	39.	145.

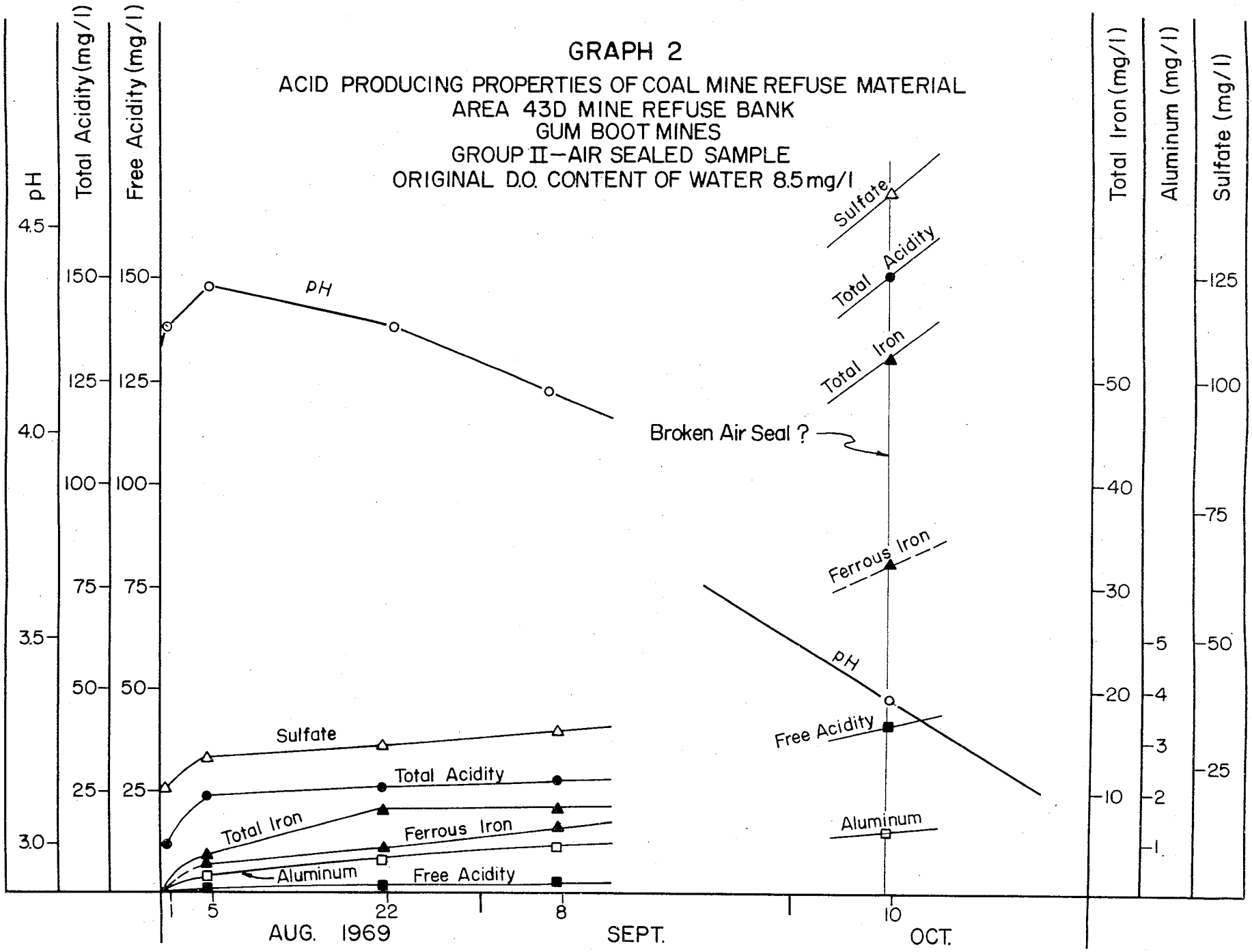
Group III - Air Sealed Samples (D.O. less than 2 mg/l)

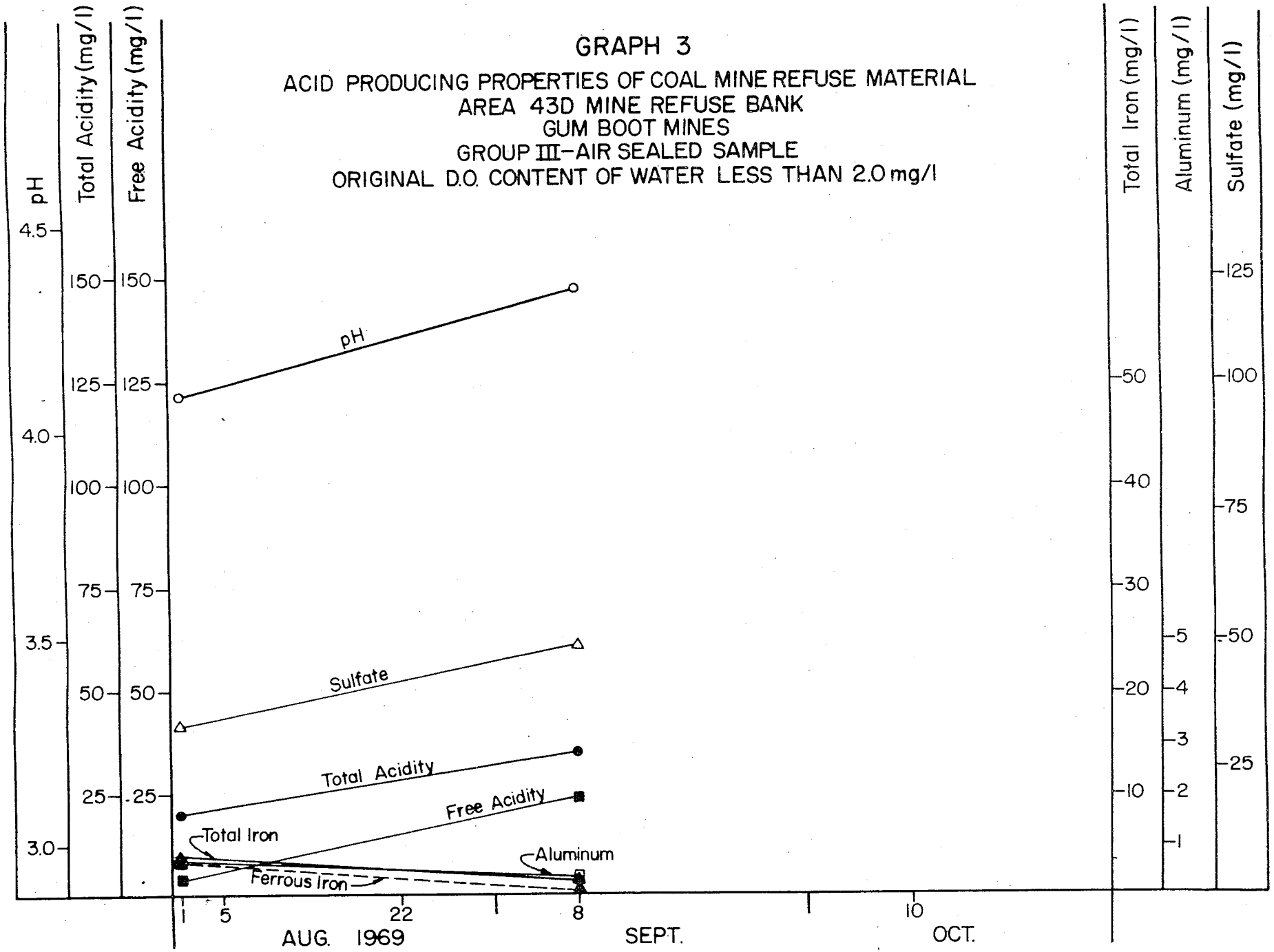
Date	Aug. 1	Sept. 8
pH	4.10	4.35
*Total Acidity (mg/l)	21.0	35.0
Free Acidity (mg/l)	3.5	24.0
Total Iron (mg/l)	3.90	1.40
Ferrous Iron (mg/l)	3.05	0.35
Aluminum (mg/l)	0.64	0.27
Sulfate (mg/l)	33.	49.

*Cold Phenophthalein Acidity (pH 8.3)

**Apparently the seal was not air tight and oxygen was resupplied. The dissolved oxygen content was probably very low, but it was constantly being supplied as it was consumed by chemical reactions. The test results of this sample most closely resembles the nature of the mine seepage from the Gum Boot and the Instantur Mines.


GRAPH I
ACID PRODUCING PROPERTIES OF COAL MINE REFUSE MATERIAL
AREA 43D MINE REFUSE BANK
GUM BOOT MINES
GROUP I — AERATED WATER
pH
Total Acidity (mg/l)
Free Acidity (mg/l)
Total Iron (mg/l)
Aluminum (mg/l)
Sulfate (mg/l)
Total Iron (Mostly Ferric+Colloidal)
Aluminum
Sulfate
Total Acidity
Free Acidity
pH
Ferrous Iron
1
5
22
8
10
AUG. 1969
SEPT.
OCT.


GRAPH 2
ACID PRODUCING PROPERTIES OF COAL MINE REFUSE MATERIAL
AREA 43D MINE REFUSE BANK
GUM BOOT MINES
GROUP II—AIR SEALED SAMPLE
ORIGINAL D.O. CONTENT OF WATER 8.5 mg/l
pH
Total Acidity (mg/l)
Free Acidity (mg/l)
Total Iron (mg/l)
Aluminum (mg/l)
Sulfate (mg/l)
4.5
4.0
3.5
3.0
150
125
100
75
50
25
50
40
30
20
10
5
4
3
2
1
125
100
75
50
25
Sulfate
Total Acidity
Total Iron
Broken Air Seal ?
Ferrous Iron
pH
Free Acidity
Aluminum
1
5
22
8
10
AUG. 1969
SEPT.
OCT.


GRAPH 3
ACID PRODUCING PROPERTIES OF COAL MINE REFUSE MATERIAL
AREA 43D MINE REFUSE BANK
GUM BOOT MINES
GROUP III–AIR SEALED SAMPLE
ORIGINAL D.O. CONTENT OF WATER LESS THAN 2.0 mg/l
pH
Total Acidity (mg/l)
Free Acidity (mg/l)
Total Iron (mg/l)
Aluminum (mg/l)
Sulfate (mg/l)
4.5
4.0
3.5
3.0
150
125
100
75
50
25
40
30
20
10
5
4
3
2
1
100
75
50
25
pH
Sulfate
Total Acidity
Free Acidity
Total Iron
Aluminum
Ferrous Iron
1
5
22
8
10
AUG. 1969
SEPT.
OCT.

ACID PRODUCING PROPERTIES OF MINE WASTE MATERIAL

AREA 24 PUMPKIN HILL ROAD

ACID PRODUCING PROPERTIES OF MINE WASTE MATERIAL
AREA 24 PUMPKIN HILL ROAD

On June 27, 1969 at 3:45 P. M., it appeared that a rainstorm was about to begin. In order to obtain information on the pollutional effects of acid producing material along a section of Pumpkin Hill Road, water quality samples were taken at three points in the vicinity of where the second tributary entering Johnson Run from the east flows through a culvert under Pumpkin Hill Road. The three points were:

1. Station 5903 which is just downstream of the culvert.

2. The drainage ditch on the east side of the road where the flow is south to the second tributary.

3. The drainage ditch on the east side of the road where the flow is north to the second tributary.

It began to rain quite heavily at 3:50 P. M. and it ended at 4:25 P. M. In addition to the water quality samples taken at these points before it began to rain, samples were taken twice during the rainstorm and once after the rain stopped.

A graph was constructed for Station 5903 showing total acidity and flow vs. time for the period from the start of rainfall to 40 minutes after it stopped. The increase in pounds of acid for each five minute interval which was attributed to the rainstorm was computed. The total acidity of 355 mg/l and a flow of 0.23 CFS at 3:45 p.m., before it began to rain, was considered to be the norm. The total acid discharge for a period of one hour and 15 minutes was about 73 lbs. and about 50 lbs. of this discharge is attributed to the rainfall.

Normally the acid discharge in lbs. per day is computed for each water quality sample. If this was done for each of the four samples taken at Station 5903, the results would be as follows:

3:45 P.M.	-	440 lbs. per day
3:58 P.M.	-	1742 lbs. per day
4:20 P.M.	-	2328 lbs. per day
5:00 P.M.	-	554 lbs. per day

These results are interesting because they show that random sampling for a year or more, although probably the best method, is on the conservative side and most likely under estimates the average daily acid discharge at some sources. The odds are too great against one being at a sampling point and collecting samples sometime during the first 15 to 30 minutes after a rainstorm begins. This is particularly true for the warmer months when precipitation is sometimes infrequent and usually of short duration. It is during these months, when stream flows are relatively low, that conditions are more favorable for pyrite oxidation of spoil banks and other areas of mine waste. A summer rainstorm of short duration can add a large slug of acid into a stream by removing the products of pyrite oxidation that have built up on the surface of the spoil in a relatively short period of time.

WATER QUALITY TEST RESULTS INDICATING THE ACID PRODUCING PROPERTIES OF MINE WASTE MATERIAL ON PUMPKIN HILL ROAD

Station 5903

Time	3:45	3:58	4:20	5:00
pH	3.15	----	2.65	----
Total Acidity (mg/l)	355	*1010	1440	395
Free Acidity (mg/l)	182	----	850	----
Total Iron (mg/l)	19	----	370	----
Sulfates (mg/l)	2000	----	3500	----
Turbidity	None	Extremely Turbid	Extremely Turbid	Moderately Turbid
Color	None	Orange	Orange	Sl. Yellow

*Probably lower than to be expected due to insufficient time for mixing.

Drainage Ditch - Flow South

Time	3:45	3:59	4:20	5:00
pH	3.10	2.75	----	----
Total Acidity (mg/l)	370	1570	640	430
Free Acidity (mg/l)	184	1160	----	----
Total Iron (mg/l)	22	470	----	----
Sulfates (mg/l)	2200	3200	----	----
Turbidity	None	Extremely Turbid	Extremely Turbid	Slightly Turbid
Color	None	Reddish	Reddish	Sl. Yellow

Drainage Ditch - Flow North

Time	3:46	3:59	4:21	5:01
pH	3.15	2.35	----	----
Total Acidity (mg/l)	242	8100	6900	575
Free Acidity (mg/l)	153	4700	----	----
Total Iron (mg/l)	19	3100	----	----
Sulfates (mg/l)	1900	9700	----	----
Turbidity	None	Extremely Turbid	Extremely Turbid	Moderately Turbid
Color	None	Red	Red	Yellow

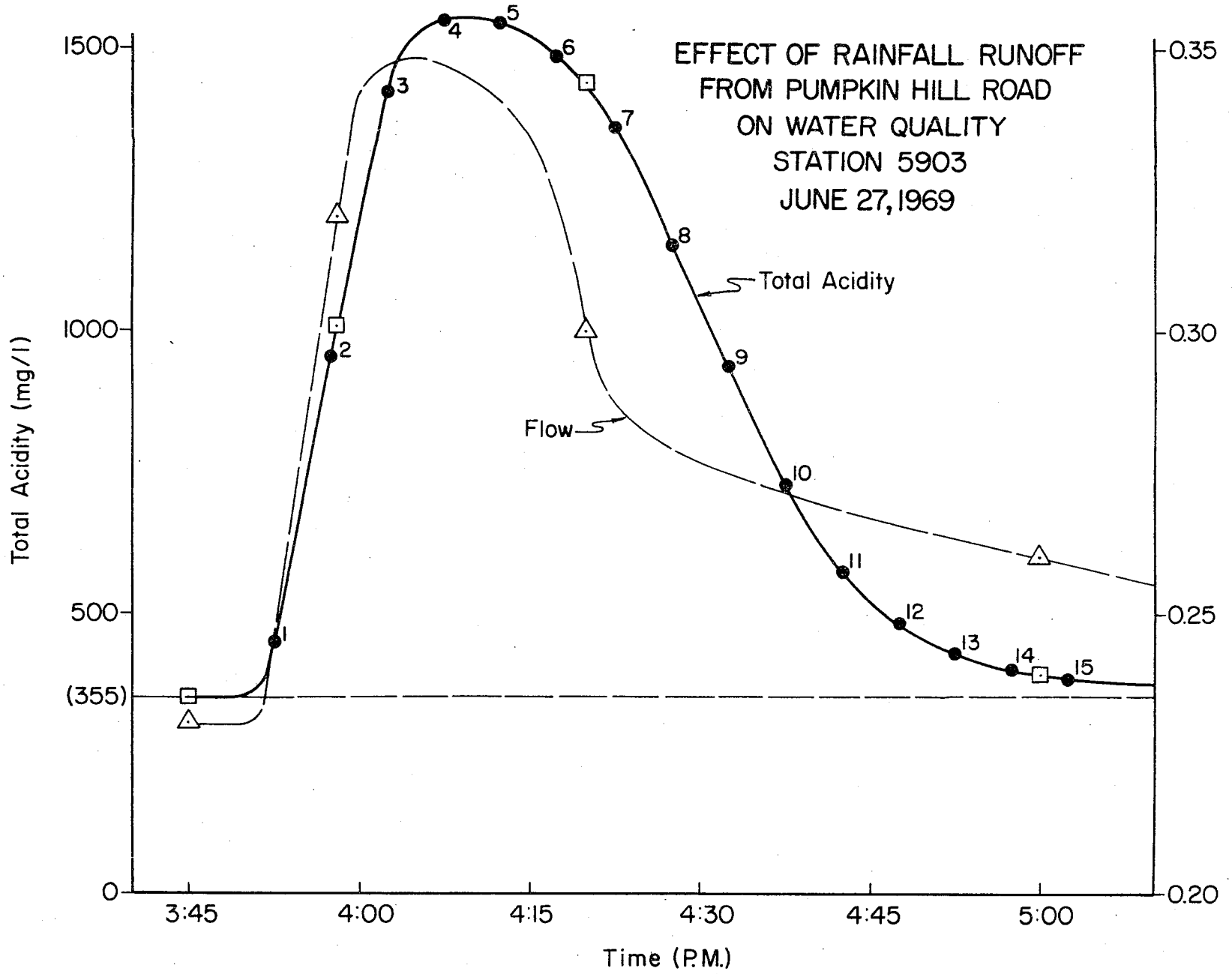
STATION 5903 - POUNDS OF ACID FOR A PERIOD OF ONE HOUR, 15 MINUTES, ATTRIBUTED TO THE RAINFALL ON THE AFTERNOON OF JUNE 27, 1969.

Five Minute Period	Total Acidity (Less 355 mg/l)	X	Flow (CFS)	X	(5.39/288)	=	Pounds of Acid
1	90		0.245		.0187		0.41
2	595		0.313		.0187		3.48
3	1065		0.347		.0187		6.91
4	1200		0.347		.0187		7.79
5	1190		0.341		.0187		7.59
6	1130		0.322		.0187		6.80
7	1005		0.287		.0187		5.39
8	795		0.279		.0187		4.15
9	580		0.275		.0187		2.98
10	370		0.271		.0187		1.88
11	220		0.268		.0187		1.10
12	125		0.266		.0187		0.62
13	75		0.263		.0187		0.37
14	45		0.261		.0187		0.22
15	25		0.259		.0187		0.12

Acid discharge attributed to rainfall (1 hr., 15 min.) 49.81 lbs.

The normal acid discharge during this period would be:
355 mg / l x 0.23 CFS x (.0187 x 15) = 22.95 lbs.

Total acid discharge (1 hr., 15 min.) would be:
49.81 + 22.95 = 72.76 lbs.


EFFECT OF RAINFALL RUNOFF
FROM PUMPKIN HILL ROAD
ON WATER QUALITY
STATION 5903
JUNE 27, 1969
Total Acidity
Flow
Total Acidity (mg/l)
Flow (CFS)
Time (P.M.)
1500
1000
500
(355)
0
0.35
0.30
0.25
0.20
3:45
4:00
4:15
4:30
4:45
5:00
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

SAMPLE LOCATION 5938
GUM BOOT RUN
DRAINAGE AREA 169.0 ACRES

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
12	12	68	4.75	3.6	0.2	0.0	5.	0.03		0.28	5.
12	20	68	4.90	4.3	0.0	0.0	6.	0.04		0.19	0.
1	25	69	4.60	4.0	0.2	0.0	7.	0.04		1.02	22.
3	6	69	4.85	3.5	0.0	0.0	6.	0.04		0.06	0.
4	29	69	4.80	3.5	0.0	0.0	6.	0.01		0.32	0.
5	16	69	5.00	3.0	0.0	0.0	5.	0.04		0.28	0.
6	10	69	4.95	3.5	0.0	0.0	7.	0.02		0.05	0.
6	25	69	5.00	3.0	0.0	0.0	7.	0.03		0.06	0.
7	22	69	5.05	3.5	0.0	0.0	3.	0.15		0.04	0.
8	15	69	4.90	3.0	0.0	0.0	6.	0.08		0.04	0.
9	4	69	5.00	3.0	0.0	0.0	8.	0.06		0.02	0.
10	7	69	4.95	2.0	0.0	0.0	4.	0.17		0.02	0.
10	23	69	5.00	3.5	0.0	0.0	5.	0.08		0.02	0.
MINIMUM			4.60	2.0	0.0	0.0	3.	0.01			
MAXIMUM			5.05	4.3	0.2	0.0	8.	0.17			
AVERAGE			4.90	3.3	0.0	0.0	6.	0.06			

SAMPLE LOCATION 5939
GUM BOOT RUN
DRAINAGE AREA 214.0 ACRES

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
11	19	68	4.70	7.2	0.2	0.0	18.	0.10		0.78	30.
11	29	68	4.80	4.0	0.0	0.0	9.	0.08		0.72	0.
12	12	68	4.60	6.0	0.5	0.0	7.	0.07		0.35	11.
12	20	68	4.90	4.7	0.0	0.0	7.	0.08		0.23	0.
1	25	69	4.55	4.0	0.2	0.0	7.	0.06		1.27	27.
3	6	69	4.85	3.5	0.0	0.0	6.	0.04		0.08	0.
4	29	69	4.75	3.5	0.2	0.0	9.	0.04		0.41	8.
5	16	69	4.90	3.5	0.0	0.0	7.	0.06		0.35	0.
6	10	69	4.90	3.5	0.0	0.0	8.	0.05		0.06	0.
6	25	69	4.95	3.0	0.0	0.0	9.	0.05		0.07	0.
7	22	69	4.90	3.5	0.0	0.0	10.	0.25		0.05	0.
8	15	69	4.80	3.0	0.0	0.0	12.	0.15		0.05	0.
9	4	69	4.95	3.5	0.0	0.0	12.	0.16		0.02	0.
10	7	69	4.95	6.5	0.0	0.0	11.	0.29		0.03	0.
10	23	69	4.70	4.0	0.5	0.0	9.	0.14		0.02	0.
11	18	69	4.95	3.0	0.0	0.0	9.	0.08		1.04	0.
MINIMUM			4.55	3.0	0.0	0.0	6.	0.04			
MAXIMUM			4.95	7.2	0.5	0.0	18.	0.29			
AVERAGE			4.82	4.1	0.1	0.0	9.	0.11			

SAMPLE LOCATION 5940
TRIBUTARY GUM BOOT RUN
DRAINAGE AREA 122.0 ACRES

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
11	19	68	4.10	17.0	5.8	0.0	34.	0.46		0.45	41.
11	28	68	4.35	12.0	2.0	0.0	36.	0.21		0.25	16.
12	11	68	4.10	22.0	4.6	0.0	41.	0.35		0.20	24.
12	20	68	3.95	19.0	5.2	0.0	28.	0.45		0.14	14.
1	25	69	4.20	9.0	2.0	0.0	13.	0.19		0.74	36.
3	6	69	3.30	31.0	21.0	0.0	90.	0.29	2.7	0.05	8.
4	29	69	3.70	30.0	19.0	0.0	46.	0.51	0.5	0.23	38.
5	16	69	3.75	25.0	13.0	0.0	43.	0.38		0.20	27.
6	10	69	3.60	33.0	25.0	0.0	51.	0.52		0.04	7.
6	25	69	3.60	35.0	24.0	0.0	75.	0.65		0.04	8.
7	22	69	3.35	65.0	49.0	0.0	103.	0.55	1.3	0.03	10.
8	15	69	3.60	46.0	21.0	0.0	90.	2.07		0.03	7.
9	4	69	3.65	52.0	27.0	0.0	107.	1.74		0.01	4.
10	7	69	3.35	62.0	39.0	0.0	95.	0.54		0.02	5.
10	23	69	3.60	48.0	26.0	0.0	50.	0.39		0.01	3.
11	19	69	3.95	20.5	5.0	0.0	28.	0.36		0.45	50.
MINIMUM			3.30	9.0	2.0	0.0	13.	0.19			
MAXIMUM			4.35	65.0	49.0	0.0	107.	2.07			
AVERAGE			3.76	32.9	18.0	0.0	58.	0.60			

SAMPLE LOCATION 5941
NE GUM BOOT MINE SEAL

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
12	20	68	3.35	46.0	26.0	0.0	112.	1.60		0.0082	2.
1	25	69	3.45	35.0	21.0	0.0	77.	0.45		0.0338	6.
3	6	69	3.45	46.0	31.0	0.0	77.	0.89	1.3	0.0166	4.
4	29	69	3.65	29.0	21.0	0.0	75.	0.34		0.0688	11.
5	16	69	3.55	29.0	19.0	0.0	72.	0.33		0.0525	8.
5	29	69	3.45	27.0	20.0	0.0	66.	0.29	2.3	0.0496	7.
6	10	69	3.55	24.0	17.0	0.0	62.	0.33		0.0258	3.
6	25	69	3.55	26.0	18.0	0.0	64.	0.33		0.0098	1.
MINIMUM			3.35	24.0	17.0	0.0	62.	0.29			
MAXIMUM			3.65	46.0	31.0	0.0	112.	1.60			
AVERAGE			3.50	32.8	21.6	0.0	76.	0.57			

SAMPLE LOCATION 5942
SW GUM BOOT MINE SEAL

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
11	19	68	2.75	335.0	230.0	0.0	630.	127.00	11.0	0.094	170.
11	29	68	3.40	290.0	155.0	0.0	445.	108.00	2.3	0.096	150.
12	12	68	2.85	260.0	160.0	0.0	460.	87.40	4.9	0.098	137.
12	20	68	2.80	225.0	160.0	0.0	327.	82.60	4.2	0.099	120.
1	25	69	3.25	190.0	135.0	0.0	262.	72.40		0.110	113.
3	6	69	3.10	245.0	175.0	0.0	344.	70.50	4.3	0.110	145.
4	29	69	3.25	360.0	260.0	0.0	396.	117.50	4.4	0.135	262.
5	16	69	3.25	300.0	215.0	0.0	374.	103.20	4.2	0.109	176.
5	29	69	3.20	230.0	180.0	0.0	344.	80.70	3.5	0.107	133.
6	10	69	3.15	195.0	140.0	0.0	318.	61.00	3.8	0.115	121.
6	25	69	3.20	270.0	165.0	0.0	348.	67.60		0.111	162.
7	22	69	2.90	298.0	208.0	0.0	378.	88.30		0.099	159.
8	15	69	3.05	230.0	158.0	0.0	391.	68.60		0.115	143.
9	4	69	3.15	275.0	183.0	0.0	399.	69.50		0.109	162.
10	7	69	3.10	290.0	195.0	0.0	397.	72.30		0.109	170.
10	23	69	3.25	274.0	206.0	0.0	387.	73.20		0.105	155.
11	18	69	3.25	260.0	168.0	0.0	370.	67.60		0.105	147.
MINIMUM			2.75	190.0	135.0	0.0	262.	61.00			
MAXIMUM			3.40	360.0	260.0	0.0	630.	127.00			
AVERAGE			3.11	266.0	182.0	0.0	386.	83.40			

SAMPLE LOCATION 5943
GUM BOOT RUN
DRAINAGE AREA 393.0 ACRES

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
11	19	68	3.60	40.0	22.0	0.0	75.	3.01		1.44	310.
11	29	68	3.70	31.0	14.0	0.0	66.	0.38	1.5	1.33	222.
12	12	68	3.50	37.0	18.0	0.0	49.	1.82	1.1	0.64	127.
12	20	68	3.45	39.0	16.0	0.0	59.	23.50		0.43	91.
1	25	69	3.85	20.0	8.0	0.0	30.	1.69		2.34	252.
3	6	69	3.20	75.0	52.0	0.0	116.	5.55	1.1	0.15	60.
4	29	69	3.55	47.0	34.0	0.0	58.	4.23		0.74	189.
5	16	69	3.35	43.0	30.0	0.0	53.	3.57		0.64	148.
6	10	69	3.25	52.0	37.0	0.0	61.	7.61		0.12	33.
6	25	69	3.30	54.0	34.0	0.0	64.	7.43		0.13	39.
7	22	69	3.05	129.0	95.0	0.0	172.	5.92		0.09	63.
8	15	69	3.20	88.0	63.0	0.0	168.	5.45		0.09	40.
9	4	69	3.25	87.0	54.0	0.0	180.	6.49		0.05	21.
10	7	69	3.20	105.0	69.0	0.0	155.	6.02		0.05	27.
10	23	69	3.40	113.0	79.0	0.0	148.	5.36		0.04	25.
11	18	69	3.45	105.0	60.0	0.0	155.	4.61		1.92	1084.
MINIMUM			3.05	20.0	8.0	0.0	30.	0.38			
MAXIMUM			3.85	129.0	95.0	0.0	180.	23.50			
AVERAGE			3.39	66.6	42.8	0.0	101.	5.79			

SAMPLE LOCATION 5944
GUM BOOT RUN
DRAINAGE AREA 1165.0 ACRES

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
11	22	68	3.85	24.0	8.4	0.0	35.	0.99		3.09	399.
11	29	68	4.10	16.0	6.4	0.0	30.	0.54		5.14	444.
12	12	68	3.90	16.0	5.6	0.0	30.	0.37		2.47	213.
12	20	68	3.95	14.0	4.6	0.0	28.	0.58		1.67	126.
2	5	69	4.00	11.0	4.0	0.0	19.	0.44		4.32	256.
2	13	69	3.70	18.0	6.0	0.0	21.	1.03	0.8	1.56	152.
2	26	69	3.70	23.0	9.0	0.0	42.	1.03		0.78	97.
3	8	69	3.75	29.0	15.0	0.0	52.	1.60	1.0	0.51	80.
3	22	69	3.90	14.0	7.0	0.0	19.	0.66	0.4	5.56	419.
4	3	69	3.90	13.0	5.0	0.0	17.	0.26	0.4	9.26	649.
4	18	69	3.90	22.0	12.0	0.0	34.	0.82		2.47	293.
5	1	69	3.85	21.0	11.0	0.0	34.	0.35		2.26	256.
5	16	69	3.85	17.0	11.0	0.0	36.	0.23		2.47	226.
6	11	69	3.65	36.0	20.0	0.0	53.	0.89		0.41	80.
6	25	69	3.70	33.0	18.0	0.0	52.	0.48		0.51	91.
7	23	69	3.45	45.0	28.0	0.0	76.	0.82	1.5	0.29	70.
8	15	69	3.55	35.0	20.0	0.0	75.	0.23		0.33	62.
9	4	69	3.65	37.0	20.0	0.0	81.	0.31		0.17	35.
10	23	69	3.65	44.0	25.0	0.0	62.	0.54		0.16	38.
MINIMUM			3.45	11.0	4.0	0.0	17.	0.23			
MAXIMUM			4.10	45.0	28.0	0.0	81.	1.60			
AVERAGE			3.79	24.6	12.4	0.0	42.	0.64			

SAMPLE LOCATION 5945
BUCK RUN
DRAINAGE AREA 729.0 ACRES

MO.	DAY	YR.	PH	TOTAL ACID MG/L	FREE ACID MG/L	ALK. MG/L	SO4 MG/L	TOTAL IRON MG/L	MN MG/L	FLOW CFS	ACID PPD
2	5	69	4.65	2.5	0.5	0.0	3.	0.02		3.30	45.
4	3	69	4.50	5.5	0.5	0.0	5.	0.01		7.08	210.
4	18	69	4.95	3.0	0.0	0.0	5.	0.03		1.89	0.
5	1	69	5.00	2.5	0.0	0.0	4.	0.04		1.73	0.
5	16	69	5.10	2.0	0.0	0.0	5.	0.03		1.89	0.
6	11	69	5.30	1.5	0.0	0.5	6.	0.04		0.31	0.
MINIMUM			4.50	1.5	0.0	0.0	3.	0.01			
MAXIMUM			5.30	5.5	0.5	0.5	6.	0.04			
AVERAGE			4.92	2.8	0.2	0.1	5.	0.03			