V STREAM AND DISCHARGE MONITORING PROGRAM

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1.0 General

The initial discharges of the Southern Latrobe Syncline study area were determined by the Pennsylvania Department of Environmental Resources. Monitoring points in the study area were located according to information contained in a previous report (Gibbs & Hill Inc., 1972). Refer to Volume II, Plate 1 for monitor locations. These discharges were monitored for a one year period (November 73 to October 74).

The outcrop inventory phase of the project, produced evidence of additional discharges in the study area. Further field investigation revealed a total of 12 additional discharges and a monitoring and sampling program was instituted for a six month period. (July 1974 to December 1974). This period overlapped the monitoring of the original discharges by four months. Locations of the additional discharges may be found in Volume II-Plates 1 and 2.

2.0 Monitoring

To determine the volume of flow, all monitoring points were divided into two categories; those with flow and stream bed characteristics suited to placement of weirs, and those whose flow and stream bed characteristics required establishment of current meter gaging stations.

Table V-1 indicates the type of weir installed on each discharge with the exceptions of M06 and M12. Current meter gaging stations were established on discharges M06 and M12.

To determine what other factors, if any, influenced the entire study area basin, additional current meter gaging stations were

established on the streams draining the area. Current meter gaging station No. 1 was located on Jack's Run above its confluence with Sewickley Creek, current meter gaging station No. 2 was established on Sewickley Creek below its confluence with Jack's Run, and current meter gaging station No. 3 was established on Sewickley Creek below its confluence with Buffalo Run. See Volume II, Plate 1 for locations of current meter gaging stations 1, 2, and 3.

3.0 Flow Computations

The discharge flow (Q) monitored by weirs was determined using the following formulas:

18" 90˚ V-notch:

Cone-Formula $Q = 2.49H^{2.48}$

Where Q = discharge in sec.-ft.

H = head on the weir in feet

Rectangular weir:

Francis Formula $Q = 3.33H^{1.5} (L-0.2H)$

Where Q = discharge in sec-ft.

H = head on the weir in feet

L = length of the rectangular portion of the weir.

Compound weir: (See Note 1)

$Q = 3.9H^{1.72} - 1.5 + 3.3Lh^{1.5}$

Where Q = discharge in sec-ft

H = head measured above the V-notch in feet

L = combined length of the horizontal portions in feet

h = head above the horizontal crests in feet.

NOTE 1:

Discharge Q measured by compound weirs was determined by two methods. The Cone formula was used to determine discharges when the head was lower than the rectangular portion and a formula developed by the Bureau of Reclamation, U.S. Department of the Interior was used when the head involved both portions of the compound weir.

TABLE V - 1. TYPE OF WEIR INSTALLATION

SOURCE	WEIR TYPE
M100	18" 90° V-Notch
M101	18" 90° V-Notch
M103	18" 90° V-Notch
M104	18" 90° V-Notch
M106	1' x 3' Rectangular
M107	1' x 2' Rectangular
M108	1' x 2' Rectangular
M109	18" 90° V-Notch
M110	18" 90° V-Notch
M111	18" 90° V-Notch
M05	1' x 3' Compound (8" V)
M07	1' x 4' Compound (8" V)
M08	1' x 4' Compound (8" V)
M08A	18" 90° V-Notch
M09	1' x 4' Compound (8" V)
M10	1' x 4' Rectangular
M11	18" 90° V-Notch
M62A	18" 90° V-Notch
M62B	18" 90° V-Notch
M62C	18" 90° V-Notch
M63	18" 90° V-Notch

Flows at current meter gaging stations M06, M12, GS1, GS2, and GS3 were measured by determining the stream bed profile using a level and a minimum of 20 readings in the stream itself during each sample collection. Velocity was determined by using an Ott current meter (model No. 74940) at each point in the profile. The area of water in the plane of the section was determined and multiplied by the velocity to give discharge in sec-ft. All flows were converted from sec-ft, to million gallons per day (MGD) by using conversion factors (Chemical Rubber Co., 1970 50th ed.).

4.0 Sample Collection

Water samples were collected at each discharge point and current meter gaging stations #1, #2, and #3 on a monthly basis. The following are sampling dates for each month and special notes and observations made on those days.

DATE	OBSERVATIONS
20 November 1973	All weirs in good condition
20 December 1973	Flooded condition at GS#2 and #3
22 January 1974	Weir on M07 missing, flooded conditions at GS#2 and #3
27 February 1974	No readings taken on M06, M07 and M63
21 March 1974	Flooded conditions at M10, M11, GS#1, GS#2, and GS#3
22 April 1974	Weir on M63 replaced
23 May 1974	No readings taken on M63
20 June 1974	All weirs in good condition

22 July 1974	Began sampling M100 series discharges
21 August 1974	All weirs good condition, source M105 destroyed by strip mine operation
19 September 1974	All weirs good condition
22 October 1974	Source M101 dry, M11 weir washed out
November 1974	All weirs in good condition, M101, M110 dry
December 1974	All weirs good condition

At each sampling point a 300 ml sample was obtained to be analyzed for pH, acidity, alkalinity and sulfate. A 50 ml sample was obtained to be analyzed for ferrous iron and total iron.

In accordance with correspondence from the Division of Mine Area Restoration, Bureau of Resource Programming, Department of Environmental Resources, the 50 ml sample was acidified in the field by the addition of 5.0 ml of concentrated hydrochloric acid.

All samples were shipped to Buchart-Horn Laboratory in York, Pennsylvania, the authorized laboratory for analyzing AMD samples.

5.0 Composite Samples

To determine a reasonable approximation of water quality expected with the proposed abatement plan (Section VI) a special sample collection was undertaken in August 1975. These samples were analyzed by the Environmental Engineering Laboratory of L. Robert Kimball Consulting Engineers due to time limitations.

To approximate water quality following Phase II - Mine seal, grout curtain and flume construction in the Stauffer Run area, Discharge (A) was collected. This composite sample was made by combining discharges M101, M103, M62A, M62B, M62C, M63 and M05 in proportion to their combined mean flow.

TABLE V - 2. MAKE-UP OF COMPOSITE SAMPLES

SOURCE	MEAN FLOW	COMPOSITE SAMPLES % CONTRIBUTION	ML OF SAMPLE
DISCHARGE (A)			
M101	0.008	0.70	14
M103	0.011	0.95	19
M62A	0.014	1.21	24
M62B	0.069	5.98	120
M62C	0.011	0.95	19
M63	0.078	6.76	135
M05	0.963	83.45	1669
	1.154	100.00	2000
DISCHARGE (B)			
Discharge A	1.154	32.73	655
M104	0.035	1.00	20
M06	2.337	66.27	1325
	3.526	100.00	2000
DISCHARGE (C)			
Discharge B	3.526	58.83	1176
M07	2.468	41.17	824
	5.994	100.00	2000
DISCHARGE (D)			
M10	2.213	27.68	554
M11	0.768	9.61	192
M12	5.013	62.71	1254
	7.994	100.00	2000
DISCHARGE (E)			
M08	0.220	13.05	361
M08A	0.018	1.48	30
M09	0.981	80.47	1609
	1.219	100.00	2000

Discharge (B) approximates the quality expected at M06 following implementation of Phase III - Pipe Diversion of M05 and M104. This composite discharge was made by combining Discharge (A), M06 and M104 proportionate to their combined mean flow.

An approximation of the water quality expected following Phase IV - Settling pond construction on Wilson Run was obtained as Discharge (C) a combination of Discharge (B) and M07 at their combined flows.

Individual components of Discharge (A) were clear, but when mixed an appearance of yellowboy ($Fe(OH)_3$) indicated that (1) some neutralization of acid had occurred, or (2) the solubility of iron had been exceeded. Similar results were observed during the preparation of Discharges (B) and (C).

An approximation of water quality expected following Phase V - Settling pond construction on Boyer Run and Sewickley Creek is presented by Discharge (D) a composite of M10, M11 and M12 for Sewickley Creek and Discharge (E) a composite of M08, M08A and M09 for Boyer Run. Table V-2 outlines the method and composition of the special samples. Results of the analyses are presented in Table V-3.

TABLE V - 3

RESULTS OF COMPOSITE SAMPLE ANALYSES
(All results except pH in milligrams per liter)

DISCHARGE	pH	ACIDITY	ALKALINITY	FERROUS IRON	TOTAL IRON	SULFATE
A	3.0	376	0	26	56.6	960
B	5.3	159	14	36.5	53.3	804
C	6.1	117	78	30	46.9	720
D	6.1	196	112	56	63.1	848
E	6.3	128	172	32	37.3	576

COMPOSITE SAMPLE LOADING IN POUNDS PER DAY
(All results except pH in pounds per day)

A	3.0	3620.9	0	250.4	545.1	9244.9
B	5.3	4678.5	411.9	1074.0	1568.3	23657.3
C	6.1	5852.3	3901.6	1500.6	2345.9	36014.3
D	6.1	13075.1	7471.5	3735.8	4209.4	56570.0
E	6.3	1302.1	1749.7	325.5	379.4	5859.4