1. Title and Study Area

Stream Sediment Investigation
Bluewater Creek - Carbon County, Montana

2. Purpose of Study

At the present time there are two basic types of stream pollution recognized by law in Montana. These are: (1) Industrial pollution such as metallic wastes from copper mines, and (2) Municipal pollution such as raw sewage wastes from a community. A third stream pollutant, sediment, was thought to be detrimental to trout fishing in Montana, but was never actually proven to be a hazard to the present and future trout fishing. In view of this, the basic purpose of this study is to determine the actual relationships between stream sedimentation and the production of trout.

3. Statement of Objectives

Specifically, the following relationships are being measured on Bluewater Creek: (1) The effects of sediment on the trout population, trout egg incubation and trout food (insects); (2) The effects of discharge(the volume of water flowing down a stream) on the trout population; and (3) The effects of water temperature on the trout population and trout egg incubation.

4. A. Name of Person Assigned to Project

Donald R. Bianchi

B. Supervisor - Fletcher Newby
Coordinator - Arthur N. Whitney and George D. Holton

C. Cooperating Agency

United States Geological Survey - Water Quality Branch

5. A. Date of Inception

May 1, 1960

B. Anticipated Date of Completion

June 30, 1964

6. A. Cost of Project(To Date)

$38,591.36

B. Average Annual Cost

$11,004.92

C. Estimated Cost of Total Project

$44,019.69

May 1, 1960 - April 30, 1961 - Annual cost $8,141.83

During the first year of this study five stations, numbered 1 to 5 starting upstream, were located on Bluewater Creek. These stations represented areas of different sediment concentrations. Thermographs to measure water temperatures continuously and water level recorders to measure the volume of water flowing in the stream(discharge) were installed. Sediment samples were usually taken at least twice a week. Fall spawned, eyed(about halfway through incubation period) rainbow trout eggs were planted at each station in man-made redds(nests made of gravel for fish eggs). Tables 1, 2, 3, and 4 summarize the data collected during the first year.

May 1, 1961 - June 30, 1962 - Annual cost $13,640.10

During the second year of this study water temperatures and the volume of water flowing in the stream were measured continuously. Sediment samples were usually collected at least twice a week. Eyed rainbow trout eggs were planted in man-made redds in the spring and fall of 1961. In the spring of 1962, freshly spawned rainbow trout and cutthroat trout eggs were planted in man-made redds. This data is summarized in Tables 1, 2, 3, and 4. In the fall of 1961 the Fish and Game Department purchased the Mark VI Groundwater Standpipe. This standpipe apparatus was used to measure the seepage of the water(apparent velocity) through the gravel in the man-made redds plus the dissolved oxygen content of the water moving through the redds which contained the 1961 fall spawned rainbow trout eggs and 1962 spring spawned rainbow and cutthroat trout eggs. By measuring these two factors one can determine what sediment is actually doing to the environment surrounding the eggs within the redds. If the seepage within the gravel become too slow the wastes given off by the eggs will not be carried away, plus the eggs will not have a sufficient oxygen supply and will sufficate.

Estimates of the fish populations and the numbers of organisms per square feet in Bluewater Creek were,also, made during the second year of this study. Fish population estimates were made with direct current, electro-fishing gear from 4,000 square foot sections. Organisms were collected with a square foot bottom sampler. Tables 5 and 6 summarize this data.

July 1, 1962 - June 30, 1963 - Annual cost $10,337.76

During the third year of this study, water temperatures and discharge data were again collected continuously and sediment samples were collected at least once a week. The United States Geological Survey has not returned the sediment and discharge data for this year, so they can not be included in this report. The temperature data is summarized in Table 1.

During the spring of 1963, freshly spawned grayling and longnose sucker eggs were planted in man-made redds at each station. During the incubation period of these eggs the standpipe apparatus was operated every third day in each redd. The results of this experiment are summarized in Table 4.

July 1, 1963 - January 1, 1964 - Annual cost $6,471.67

During the first part of the fourth year of this study, water temperatures and discharge data were collected continuously and sediment samples were collected at least once a week.

Estimates of the fish populations in Bluewater Creek were repeated with direct current, electro-fishing gear. This data is summarized in Table 5.

At the present time brown trout and kokanee eggs are planted in man-made redds on Bluewater Creek and the standpipe apparatus is being operated once a week at each station.

TABLE 1

The average yearly maximum and minimum water temperatures in degrees Fahrenheit at stations on Bluewater Creek.

YEAR		AVERAGE YEARLY TEMPERATURES (of) STATIONS			
		2	3	4	5
May 1, 1960 - April 30, 1961					
	Maximum	57°F		57°F	
	Minimum	42°F		45°F	
May 1, 1961 - June 30, 1962					
	Maximum	57°F		57°F	
	Minimum	42°F		45°F	
July 1, 1962 - June 30, 1963					
	Maximum	56°F	58°F	58°F	52°F
	Minimum	44°F	45°F	47°F	44°F

TABLE 2

The average yearly discharge in cubic feet per second at five stations on Bluewater Creek.

YEAR	AVERAGE YEARLY DISCHARGE (CFS) STATIONS				
	1	2	3	4	5
May 1, 1960 - April 30, 1961	12	27	25	17	33
May 1, 1961 - June 30, 1962	11	29	24	21	31
July 1, 1962 - June 30, 1963	Not yet received from United States Geological Survey.				

TABLE 3

The average yearly sediment load in tons per day at five stations on Bluewater Creek.

YEAR	AVERAGE YEARLY SEDIMENT LOAD (TONS/DAY) STATIONS				
	1	2	3	4	5
May 1, 1960 - April 30, 1961	0.65	5	8	7	27
May 1, 1961 - June 30, 1962	0.83	7	13	16	45
July 1, 1962 - June 30, 1963	Not yet received from United States Geological Survey.				

TABLE 4

The percent survival of eggs planted in man-made redd on Bluewater Creek during the past three years.

TIME & EGG SPECIES	PERCENT EGG SURVIVAL STATIONS				
Fall - 1960					
Eyed rainbow	98	0	0	0	0
Spring - 1961					
Eyed rainbow	97	78	46	30	43
Fall - 1961					
Eyed rainbow	95	61	10	0	0
Spring - 1962					
Rainbow	33	8	3	1	1
Cutthroat	57	6	2	0	13
Spring - 1963					
Grayling	34	6	0	0	0
Longnose sucker	97	99	95	99	92
Winter - 1963 - 1964					
Brown trout	Planted at present time in redds.				
Kokanee	Planted at present time in redds.				

TABLE 5

Average number of trout and rough fish captured from 4,000 square foot sections at five stations on Bluewater Creek.

YEAR		NUMBER OF FISH CAPTURED STATIONS				
		1	2	3	4	5
1961	Trout	216	218	55	8	6
	Rough Fish	7	17	225	1201	378
1963	Trout	135	166	78	12	2
	Rough Fish	6	11	601	1139	775

TABLE 6

Average number of organisms per square foot sample at five stations on Bluewater Creek.

YEAR	NUMBER OF ORGANISMS STATIONS				
	1	2	3	4	5
1961	30.4	33.6	4.6	3.5	2.1

Practical Application of Project

Stream fishing in Montana is largly dependent upon the production of Wild trout. Wild trout require a certain quality of water in a stream for continued production. This study has shown that large sediment concentrations in a stream are disasterous to trout production. In Bluewater Creek, large sediment concentrations practically eliminated trout food(insects), trout reproduction, and therefore, the trout population. If the truth were known, no doubt hundreds of miles of sport fishing has been removed or are in the process of being removed from the fishermen of Montana as a result of high sediment concentrations. Not too many years ago, Bluewater Creek was a trout stream for its entire length. Now people do not even bother to fish the lower two-thirds of this stream. The reasons for high sediment concentration in Montana streams can usually be blamed on one or more of the following common practices: (1) Overgrazing the floodplain of a stream; (2) Overgrazing the entire watershed; (3) Stream alterations such as channel realignment; (4) Row crop production on steep sloping land, and (5) Irrigation return water. Through good land management these practices can be corrected or prevented and many of Montana's streams could again produce trout or increase their trout production. This study has revealed the need of incorporating better land management into fisheries management. Programs that would help alleviate this threat to future trout fishing in Montana streams might be: (1) Recognition by law of sediment pollution along with industrial and municipal pollution as a detriment to outdoor recreation in Montana; (2) Better land management practices through cooperation with other federal and state agencies as well as individual landowners; (3) Cooperation in erosion control projects such as stream bank fencing and lining irrigation ditches which are contributing large amounts of sediment to a stream; and (4) Purchase and fencing of fishing access sites which will reduce erosion through reduced land use.