REDWATER RIVER STUDY

MONTANA

JULY - AUGUST, 1975

TECHNICAL INVESTIGATIONS BRANCH

SURVEILLANCE AND ANALYSIS DIVISION

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION VIII

MARCH, 1976

INTRODUCTION

On March 13, 1975, the Montana Department of Health and Environmental Sciences requested, through the Office of Energy Activities, a baseline biological and chemical survey of the Redwater River in McCone County. This survey was requested in conjunction with the Poplar River study, thus combining two survey trips into one. The Montana Department of Health and Environmental Sciences requested data needed to predict the effects on water quality of a coal gasification plant proposed by the Burlington Northern railroad in this area.

Biologists from the Surveillance and Analysis Division conducted a cursory-baseline survey which included selected chemical, fish, and macro-benthos sampling, from July 29, 1975 through August 3, 1975.

GENERAL

The Redwater River is located in the north-east portion of the state of Montana. The river originates near the town of Watkins, and flows in a generally north-easterly direction for about 135 km. (84 miles) where it terminates at its confluence with the Missouri River, downstream of the town of Poplar (Fig. 1).

There is one major tributary to the Redwater River in the study area. This is East Redwater Creek which flows in a north-westerly direction and joins the Redwater River approximately 15 km. (10 miles) upstream from its mouth.

The Redwater River drainage is characterized by cold winters and low precipitation. The precipitation, most of which occurs during the spring and early summer months, had subsided at the time of the survey. As a result, during the study the river was near low flow conditions.

METHODS

Fish sampling was conducted with trap nets, seines or electro-fishing. Trap nets used during the survey had 0.76 by 0.91 m. (2.5 x 3 ft.) frames or 0.76 by 1.52 m. (2.5 x 5 ft.) frames. The smaller nets had a 0.63 cm. (¼ in.) mesh and the larger frame nets had 1.27 cm. (½ in.) mesh. Each net had either a 15.2 m. (50 ft.) or 30.5 m. (100 ft.) lead. All trap nets were set for 24 hour periods.

Two haul seines were used to capture fish from pool areas. A 1.83 by 30.48 m. (6 x 100 ft.) seine with 1.27 cm. (½ in.) mesh was used in small pools. Larger pools required the use of a 3.05 by 76.2 m. (10 x 250 ft.) seine with 2.54 cm. (1 in.) mesh.

Electro-fishing was conducted with a Coffelt[1] system capable of generating a maximum of 300 volts, 10 amps. and 200 pulses per second. A single probe with 91.4 m. (300 ft.) of cable was used to shock the fish. The samples kept for reference were preserved in 10% formalin.

1. Any mention of product names does not constitute E.P.A. endorsement.

Macro-invertebrates were collected by means of a Petersen Grab. Samples were sieved with a U.S. Standard No. 30 sieve and organisms remaining on the sieve were placed in pint jars with 10 percent formalin. Organisms were also hand picked from selected rocks and debris. These samples were also preserved in 10 percent formalin.

All water samples taken for metals, Total Dissolved Solids and Total Suspended Solids were "grab" type samples and were transported to the Regional Laboratory in Denver, Colorado for processing.

WATER QUALITY EVALUATION

To determine existing water quality, "grab" type samples were collected on two consecutive days (July 29 and July 30). In addition, samplers made field determinations at each of five stations (Fig. 1) for temperature, pH, flows and conductivity. Samples for dissolved oxygen were fixed in the field and analyses were determined at a later time. Samples for alkalinity were also taken in the field, held on ice, and analyzed at the end of each sampling day. Results of all field and laboratory determinations and detailed station location descriptions are listed in the Appendix.

BIOLOGICAL EVALUATION

Generally, the majority of aquatic invertebrates throughout the entire study area were pollution sensitive types (Table 4). The main limiting factor in their distribution seemed to be the composition of the substrate. A rubble type substrate lends itself to a more diverse population due to the variability in characteristics. The number of small habitats available reduces the intense competition for food and space. As rubble is silted-in the space for habitation is reduced and the competition for the remaining space results in the reduction in numbers of less tolerant organisms. In a primarily shifting silt and sand substrate only a few types of organisms can adapt to the environment. The upper reaches of the study area were characterized by rubble and gravel bottom. The lower stretches gradually changed from a rubble type substrate to that of shifting silt and sand with rubble restricted to riffle areas. In the riffle areas the rubble interstices were filled with silt and sand.

A diversity of fish species were captured throughout the entire system (Table 5). Warm water game fish were observed throughout the study area, but appeared to be predominant in the lower stream reach as reflected by catch data from the first station near the mouth (RW-1) and the second station eight miles upstream (RW-2). One young of the year Walleye was identified at the upper-most station, near Circle (RW-5), indicating the probable use of the upper river by adult Walleye for spawning activities. With such a diversity of

warm water game fish, a major portion of the river is probably utilized for spawning and propagation. Further studies would be warranted to determine the extent of spawning activities in the Redwater River, especially by migrating Missouri River fish.

Chemical analysis also showed total dissolved solids (TDS) ranging from 1640 to 3470 mg/ℓ (Appendix, Table 2). High TDS during the survey contributed to high salinity or specific conductivity, 2400 to 4625 micromhos (Appendix, Table 3). In water of 4000 micromhos or above, sac fry of Walleye and Northern Pike have a very low survival success.[2] Thus, continual propagation of a sport fishery in the Redwater River could be diminished if salinities are increased during the spring spawning or propagation periods.

Aluminum was also present in the water samples taken for chemical analysis. Values ranging from 400 to 1800 µg/ℓ were observed.

Increased amounts of aluminum might prove harmful to a fisheries population. In most natural waters, ionizable aluminum is in the form of anionic or neutral precipitates, and anything greater than 0.1 mg/ℓ of aluminum would be deleterious to growth and survival of fish.[3] High sodium levels were also observed in the samples taken for chemical analysis. Values ranging from 827,000 to 413,000 µg/ℓ were recorded. (Appendix, Table 2).

SUMMARY

The Montana Department of Health and Environmental Sciences requested EPA provide a baseline biological and chemical survey of the Redwater River. Biologists from the Surveillance and Analysis Division conducted a study which included selected chemical, fish, and macro-benthos sampling.

Chemical analyses revealed some probable problem areas with the physical characteristics of the water. Large amounts of total dissolved solids (TDS), contributing to an increase in salinity, could be a problem if amounts were increased. Sodiums were also high,

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[2]Peterka, John J. 1972. Effects of saline waters upon survival of fish eggs and larvae and upon the ecology of the Fathead Minnow in North Dakota. Dept. of Zoology, N. Dakota State University. WI-221-013-72.

[3]Freeman, R.A. and W.H. Everhart. 1971. Toxicity of aluminum hydroxide complexes in neutral and basic media to rainbow trout. Trans. Amer. Fish. Soc. 100 (4):644-658.

but did not seem to have any detrimental effect on the fish population. Amounts of aluminum found were relatively high, and if increased, could effect the fish population.

Fish sampling established the existance of a sport fisheries population in the Redwater River. In all probability warm water game fish use the river for spawning and propagation. This was substantiated by one young of the year Walleye found in the upper reaches of the river near the town of Circle.

Macro-benthos sampling indicated the majority of aquatic invertebrates to be pollution sensitive types. With increased silt deposits, intermediate and pollution tolerant organisms could increase in numbers.

APPENDIX

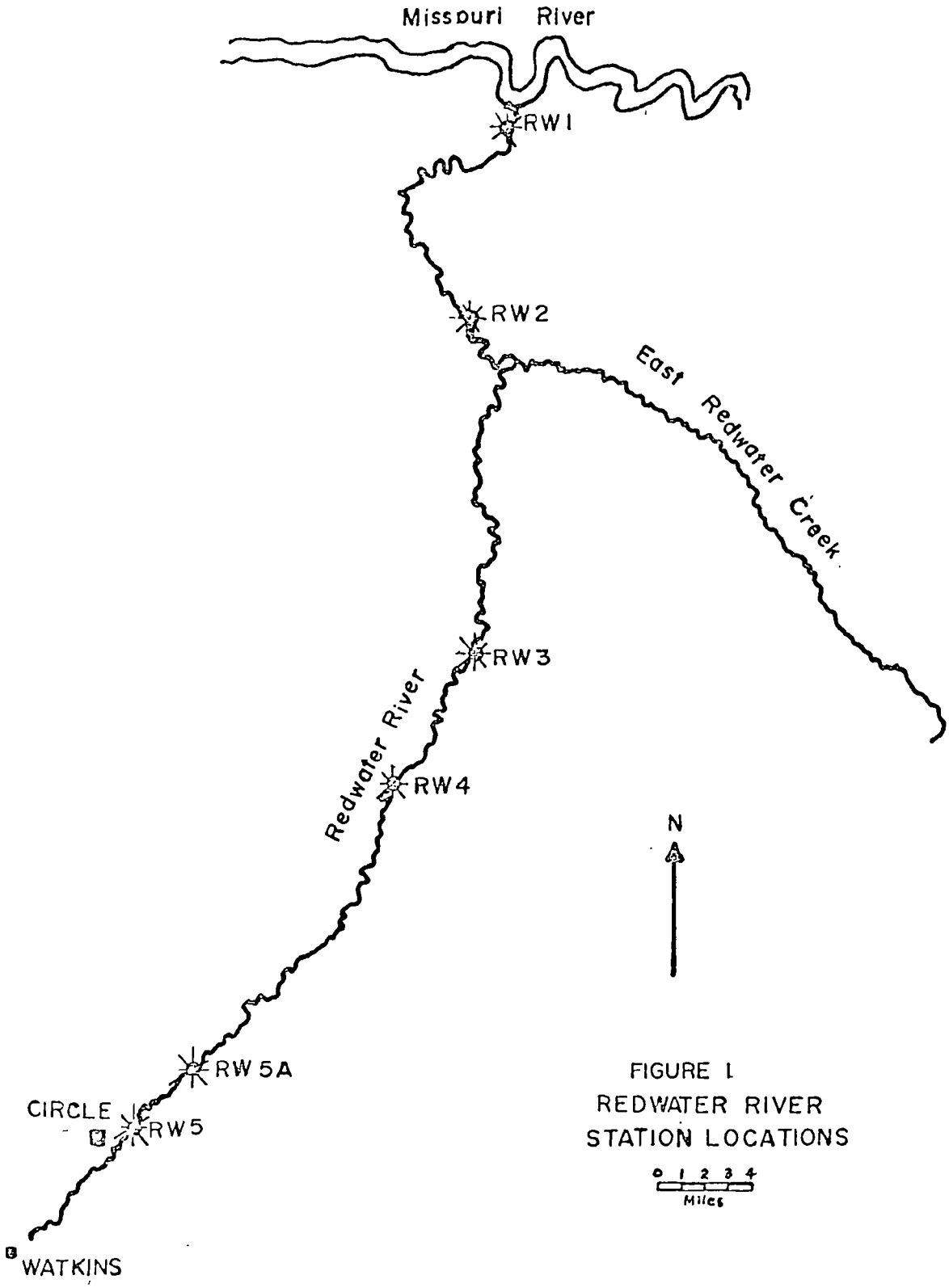

FIGURE 1
REDWATER RIVER
STATION LOCATIONS

TABLE 1

STATION DESCRIPTION

Station #1	Redwater River approximately two and one-half miles south of Missouri River bridge on State Highway 13 and approximately fourteen miles east on improved county dirt road and approximately two-thirds of a mile from the confluence with the Missouri River.
Station #2	Redwater River approximately four and one-half miles north of Vida to State Secondary Highway 201 and approximately ten miles east and approximately two and one-fourth miles north to concrete pad.
Station #3	Redwater River approximately six miles south of Vida on State Highway 13 and approximately eight miles east on improved county dirt road then approximately one mile south on improved county dirt road then approximately three and one-half miles south-east to the river.
Station #4	Redwater River approximately fifteen miles south of Vida on State Highway 13 to Duck Creek Road. Then approximately six and three-fourths miles east then approximately one mile north and approximately one-half mile east of ranch to concrete pad.
Station #5	Redwater River upstream of State Highway 20 bridge.

Note: The majority of fish samples were taken approximately three miles north-west of Circle on State Highway 13 and approximately one mile east on dirt road to river.

TABLE 2

REDWATER RIVER CHEMICAL ANALYSIS
JULY 29 - AUGUST 3, 1975

	RW-1		RW-2		RW-3		RW-4		RW-5	
	7/29/75	7/30/75	7/29/75	7/30/75	7/29/75	7/30/75	7/29/75	7/30/75	7/29/75	7/30/75
Sodium µg/ℓ	517,000	548,000	413,000	434,000	651,000	620,000	827,000	796,000	806,000	816,000
Hg* "	0.5	0.5	0.3	1.1	0.5	0.6	14	2.0	0.3	11
Se "	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
As "	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Al "	1,600	1,600	1,800	1,700	800	600	400	500	500	1,100
B "	<100	500	350	<100	300	600	500	900	900	550
Fe "	2,350	1,750	2,250	2,100	1,150	1,000	700	700	1,100	950
Cu "	6	6	4	4	4	4	4	4	8	8
Ca "	43,200	42,200	46,200	40,200	45,200	47,200	44,200	48,200	92,400	95,200
Mg "	57,500	44,500	67,000	54,000	95,500	76,500	118,000	92,500	143,500	137,000
Zn "	10	10	10	10	5	10	10	5	10	5
TSS mg/ℓ	90	66	162	118	36	33	26	31	24	69
TDS "	1,880	1,850	1,680	1,640	2,300	2,250	3,100	3,030	3,460	3,470

* Results questionable

TABLE 3

REDWATER RIVER PHYSIO-CHEMICAL DATA
JULY 29 - AUGUST 3, 1975

	RW-1	RW-2	RW-3	RW-4	RW-5
D.O.-mg/ℓ	6.5	6.1	7.2	8.7	7.3
pH	8.1	8.3	7.7	7.8	7.6
S.C.-micromhos	2925	2400	3200	4100	4625
Time	0930	1215	1435	1500	1730
Temp. ^{o}C	24.5	25.5	26.5	26	27
Alka.-mg/ℓ	476	434	518	572	498
Flow-c.f.s.	5.5	5.2	3.8	3.7	-

TABLE 4

REDWATER RIVER BENTHIC INVERTEBRATES
JULY 29 - AUGUST 3, 1975

Station	RW-1	RW-2	RW-3	RW-4	RW-5
Organisms					
Ephemeroptera					
Hexagenia sp.	X				
Heptagenia sp.	X	X		X	
Caenis sp.	X	X	X	X	X
Baetis sp.	X	X	X	X	X
Habrophlebia sp.			X	X	
Ameletus sp.	X		X		
Trichoptera					
Polycentropus sp.	X		X	X	
Hydropsyche sp.	X	X	X	X	X
Cheumatopsyche sp.	X	X	X	X	X
Agraylea sp.				X	
Odonata					
Anisoptera					
Petaluridae	X				
Zygoptera	X		X		X
Diptera					
Chironominae	X	X	X	X	X
Simulium sp.	X	X			
Tabanidae	X				X
Annelida					
Oligochaeta	X	X	X	X	X
Coleoptera					
Dubiraphia sp.	X				X
Amphipoda					
Hylella sp.	X		X	X	X
Pelecypoda			X		
Megaloptera					
Sialis sp.				X	X

TABLE 5

REDWATER RIVER FISH DATA
JULY 29 - AUGUST 3, 1975

	RW-1	RW-2	RW-3	RW-4	RW-5
Northern pike (Esox lucius)	X	X			
Sauger (Stizostedion canadense)	X	X			
Walleye (Stizostedion vitreum)	X	X			X
Burbot (Lota lota)	X				
Goldeye (Hiodon alosoides)	X	X	X	X	
Channel catfish (Ictalurus punctatus)	X				
Black bullhead (Ictalurus melas)	X	X	X	X	X
Stonecat (Noturus flavus)	X	X	X		
Carp (Cyprinus carpio)	X	X	X	X	X
Carpsucker (Carpoides carpio)	X	X	X		X
Shorthead redhorse (Moxostoma macrolepidotum)	X	X	X	X	X
Smallmouth buffalo (Ictiobus bubalus)	X				
White sucker (Catostomus commersoni)	X	X	X	X	X
Longnose sucker (Catostomus catostomus)		X	X	X	X

Table 5 - continued

	RW-1	RW-2	RW-3	RW-4	RW-5
Green sunfish (*Lepomis cyanellus*)				X	X
Golden shiner (*Notemigonus crysoleucas*)	X	X	X	X	X
Brassy minnow (*Hybognathus hankinsoni*)	X	X	X	X	X
Fathead minnow (*Pimephales promelas*)		X	X	X	
Longnose dace (*Rhinichthys cataractae*)		X	X	X	
Lake chub (*Couesius plumbeus*)			X	X	
Total No. of species	15	15	13	12	10