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Streamflow and Water-Quality Data for the Blackfoot River Basin, Western Montana, September 1995 through May 1997

By Sean M. Lawlor

Open-File Report 00-80

In cooperation with
MONTANA FISH, WILDLIFE AND PARKS

U.S. Department of the Interior

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Multiply	By	To obtain
cubic foot per second (ft^3/s)	0.028317	cubic meter per second
mile (mi)	1.609	kilometer
square mile (mi^2)	2.59	square kilometer
ton per day (ton/d)	907.2	kilogram per day
ton per acre-foot (ton/acre-ft)	0.7357	kilogram per cubic meter

Temperature can be converted from degrees Celsius (°C) to degrees Fahrenheit (°F) by the following equation:

$$°F = 9/5\ (°C) + 32$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Water-year definition: A water year is the 12-month period from October 1 through September 30. It is designated by the calendar year in which it ends.

Chemical concentration in water is reported in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is a unit expressing the solute mass (milligrams) per unit volume (liter) of water and is about the same as parts per million unless concentrations are more than 7,000 milligrams per liter (Hem, 1989, p. 55). One thousand micrograms per liter is equivalent to 1 milligram per liter.

Abbreviated water-quality units used in this report:

col/100 mL	colonies per 100 milliliters
µg/L	microgram per liter
µS/cm	microsiemens per centimeter at 25 degrees Celsius
mg/L	milligram per liter
mm	millimeter

Acronyms used in this report:

MFWP	Montana Fish, Wildlife and Parks
NWQL	U.S. Geological Survey National Water Quality Laboratory
USGS	U.S. Geological Survey

STREAMFLOW AND WATER-QUALITY DATA FOR THE BLACKFOOT RIVER BASIN, WESTERN MONTANA, SEPTEMBER 1995 THROUGH MAY 1997

By Sean M. Lawlor

ABSTRACT

The aquatic resources of the Blackfoot River basin may be affected by natural-resource, agricultural, and residential development. Concern about the effects of past, current, and future activities have resulted in efforts by State, Federal, and private entities to characterize the aquatic resources of the Blackfoot River basin. Baseline data were obtained to describe current conditions and to serve as a reference for future environmental assessments.

This report presents physical, chemical, and biological data from September 1995 through May 1997 for surface-water sites in the Blackfoot River basin. Samples were collected periodically at 13 sites on the Blackfoot River and selected major tributaries. The types of data presented include instantaneous streamflow, onsite measurements of water-quality properties, bacteria, and laboratory analyses for concentrations of chemical constituents and suspended sediment.

INTRODUCTION

The Blackfoot River originates near Lincoln, in western Montana (fig. 1). Along the 135-mi reach of stream from near the Continental Divide to the Clark Fork near Missoula, six major tributaries enter the Blackfoot River: Alice Creek, Landers Fork, Nevada Creek, North Fork Blackfoot River, Monture Creek, and Clearwater River. Principal surface-water uses in the 2,300 mi^2 Blackfoot River basin are irrigation, stock watering, instream flow for aquatic life, waterfowl, and recreation.

Cattle and grain production, logging, mining, and recreation are the primary land uses. Cattle and grain production are the major agricultural land uses in the valley floor, whereas logging and small-scale hard-rock mining generally occur in the mountainous parts of the basin. Recreational activities occur throughout the basin, but fishing and boating along the Blackfoot River are the most common (Duffield and others, 1987).

The Blackfoot River dissects geologically complex, mineralized terranes of the Northern Rocky Mountains (Moore and others, 1991). A variety of metals, including gold, silver, lead, and copper, have been mined in this area from numerous small placer and hard-rock mining operations. The basin is extensively glaciated, with glacial deposits extending from the surrounding mountains into the valley floor. Perennial and seasonal wetlands are present in potholes of the valley glacial deposits and provide nesting sites for the area's abundant waterfowl, as well as habitat for a variety of plant species. Coniferous forests and upland grasses predominate in the mountains and foothills, whereas interspersed grasses, sagebrush, conifers, and deciduous riparian communities are found on the valley floor.

The Blackfoot River is classified as a Class I trout stream by Montana Fish, Wildlife and Parks. The trout fishery is a complex, multispecies assemblage (Spence, 1975; Peters and Spoon, 1989). In general, eastern brook trout and cutthroat trout are the dominant species in the headwater reaches. Brown trout predominate in the middle reaches and rainbow trout predominate in the lower reaches. Bull trout also are found in the middle and lower reaches of the river. The benthic community in much of the Blackfoot River basin is a diverse assemblage of insect larvae typical of temperate, cobble-bed rivers (Spence, 1975).

The aquatic resources of the Blackfoot River basin may be affected by natural-resource, agricultural, and residential development. Mining and logging have resulted in localized water-quality degradation and stream sedimentation (Moore and others, 1991). Livestock grazing, irrigation, and agricultural chemical applications have resulted in riparian and range degradation, dewatering, and nutrient enrichment of streams (Rothrock and others, 1998).

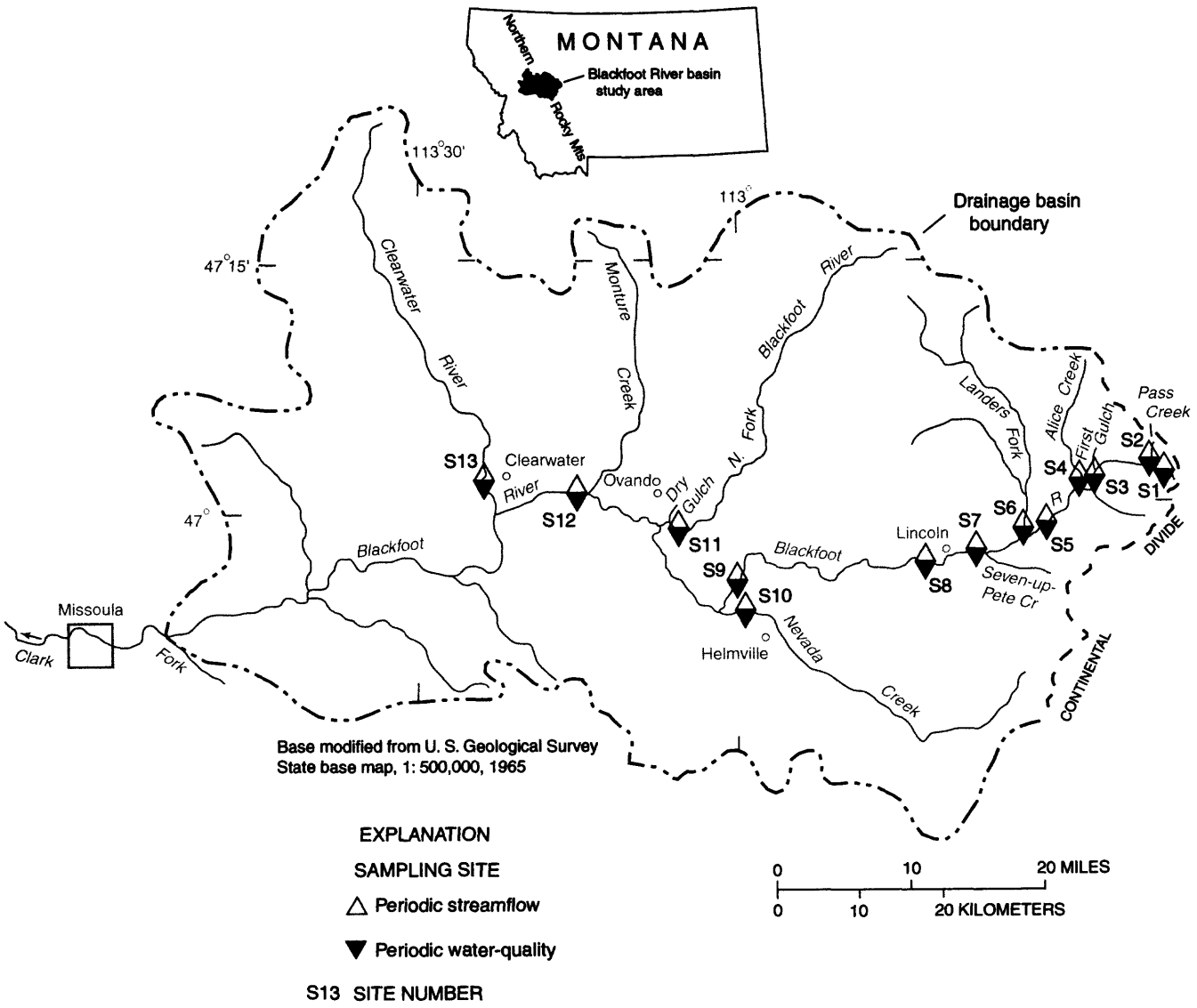

Figure 1. Location of the Blackfoot River basin and sampling sites, western Montana.

Residential development and associated septic systems near stream corridors can affect the quality of shallow ground water and surface water. Elevated trace-element concentrations in bed sediment derived from historical mining in the headwaters of the Blackfoot River extend farther downstream than elevated trace-element concentrations in water. This sediment enriched with trace elements will likely continue to migrate downstream and may affect aquatic life (Moore and others, 1991).

Concern about the effects of past, current, and future activities have resulted in efforts by State, Federal, and private entities to characterize the aquatic resources of the Blackfoot River basin. Baseline data were needed to describe current conditions and to serve as a reference for future environmental assessments. Consequently, the U.S. Geological Survey (USGS), in cooperation with Montana Fish, Wildlife and Parks (MFWP), initiated a two-year effort to obtain streamflow and water-quality data for the Blackfoot River and selected tributaries.

Purpose and Scope

The purpose of this report is to present physical, chemical, and biological data collected from 13 surface-water sampling sites (table 1) in the Blackfoot

River basin during the period September 1995 through May 1997. Samples were collected periodically at a prorated frequency of four times per year. Data presented in this report include measurements of streamflow quantity and quality, and quality-assurance data.

Site-Numbering System

To simplify site identification, surface-water sites are assigned a site number from S1 to S13 (fig. 1; table 1). In addition, each site is assigned an eight-digit or fifteen-digit station-identification number. Eight-digit station-identification numbers for surface-water sites represent the standard USGS numbering system for streamflow-gaging stations or routine streamflow-measurement sites. Fifteen-digit station-identification numbers are used for miscellaneous or temporary surface-water stations. The fifteen-digit numbers represent the approximate latitude and longitude of the site (first 13 digits), plus the sequence number (last 2 digits).

STREAMFLOW AND WATER-QUALITY DATA

Streamflow was measured and water-quality samples were collected periodically over two years on the mainstem of the Blackfoot River and selected tributaries. Samples were collected at a prorated frequency of four times per year, with sampling times distributed seasonally in order to characterize the hydrologic variability of the quantity and quality of the surface water of the Blackfoot River basin. The types of data collected for all sites include instantaneous streamflow, onsite measurements of water-quality properties (specific conductance, pH, and air and water temperature), and laboratory analytical results for chemical constituents and suspended sediment. At selected sites, dissolved oxygen and bacteria (fecal coliform and fecal streptococci) concentrations also were measured onsite. Streamflow and water-quality data are presented in table 2 (tables 2-5 at back of report).

The quality of data was maintained through documented procedures designed to provide environmentally representative data. Acceptable performance of the procedures was verified with quality-control samples that were collected systematically to provide a measure of the accuracy, precision, and bias of the environmental data and to identify problems associated with sample collection, processing, or analysis. These quality-control data are presented in tables 3 and 4.

Data-Collection Methods

Instantaneous streamflow at the time of sampling was determined from either a stage-discharge relation or by discharge measurement. Discharge measurements were made according to established USGS procedures as outlined in Rantz and others (1982).

Cross-sectional water samples for analysis of chemical constituents and suspended sediment were

Table 1. Sampling sites in the Blackfoot River basin, western Montana

[Site number shown in figure 1 and described in text. Station number described in text]

Site number	Station number	Station name
S1	470226112224501	Blackfoot River above Pass Creek, near Lincoln, Montana
S2	470314112223901	Pass Creek near Lincoln, Montana
S3	12334620	Blackfoot River below First Gulch, near Lincoln, Montana
S4	470114112280701	Alice Creek near Lincoln, Montana
S5	12334650	Blackfoot River below Alice Creek, near Lincoln, Montana
S6	12334680	Landers Fork near Lincoln, Montana
S7	12334700	Blackfoot River below Seven-up-Pete Creek, near Lincoln, Montana
S8	12334800	Blackfoot River at Dalton Mountain Road bridge, near Lincoln, Montana
S9	12335100	Blackfoot River above Nevada Creek, near Helmville, Montana
S10	465330113021601	Nevada Creek at mouth, near Helmville, Montana
S11	12338300	North Fork Blackfoot River above Dry Gulch, near Ovando, Montana
S12	12338700	Blackfoot River at Scotty Brown Bridge, near Ovando, Montana
S13	12339450	Clearwater River near Clearwater, Montana

collected from multiple verticals across the stream using depth- and width-integration methods described by Knapton (1985) and Edwards and Glysson (1988). These methods provide a vertically and laterally discharge-weighted sample that is representative of the entire flow through the cross section of a stream. Sampling equipment consisted of standard USGS depth-integrating samplers (DH-81, DH-48TM, and D-74TM), which are either constructed of plastic or coated with a non-metallic epoxy paint, and equipped with nylon nozzles that can be interchanged depending on flow conditions.

Onsite measurements of specific conductance, pH, air and water temperature, and dissolved oxygen were made during collection of periodic water-quality samples. Onsite sample processing, including sample splitting, filtration, and preservation, was performed according to procedures described by Horowitz and others (1994), Ward and Harr (1990), and Knapton (1985). Water samples for bacteria were cultured and enumerated in the field according to Knapton (1985).

Water samples were analyzed for selected common ions, nutrients, and trace elements by the USGS National Water Quality Laboratory (NWQL) in Arvada, Colorado. Common ions and nutrients were analyzed for dissolved concentrations, whereas arsenic, cadmium, copper, iron, lead, manganese, and zinc were analyzed for total-recoverable concentrations. Analytical methods for chemical constituents are described by Fishman and Friedman (1989) and Fishman (1993).

Cross-sectional water samples also were collected for analysis of suspended sediment whenever periodic water-quality samples were collected. These samples were analyzed for suspended-sediment concentration and the percentage of suspended sediment finer than 0.062-mm diameter (silt size and smaller) by the USGS sediment laboratory in Helena, Mont., according to methods described by Guy (1969) and Lambing and Dodge (1993).

Quality Assurance

Quality-assurance procedures used for the collection and field processing of water-quality samples are described by Horowitz and others (1994), Ward and Harr (1990), Edwards and Glysson (1988), Knapton and Nimick (1991), and Knapton (1985). Standard procedures used by the NWQL for internal sample handling and quality assurance are described by Friedman and Erdmann (1982), Jones (1987), and Pritt and Raese (1992). Quality-assurance procedures used for the collection and processing of suspended-sediment samples by the Montana District are described by Lambing and Dodge (1993).

The quality of analytical results reported for water-quality samples was evaluated by quality-control samples that were submitted from the field and analyzed concurrently in the laboratory with routine samples. These quality-control samples consisted of replicates and field blanks which provide quantitative information on the precision and bias of the overall field and laboratory process. Each type of quality-control sample was submitted at a proportion equivalent to about 6 percent of the total number of water-quality samples; therefore, the total number of quality-control samples represented about 13 percent of the total number of water-quality samples.

In addition to quality-control samples submitted from the field, internal quality-assurance practices at the NWQL are performed systematically to provide quality control of analytical procedures (Pritt and Raese, 1992). These internal practices include analyses of quality-control samples such as calibration standards, standard reference water samples, replicate samples, deionized-water blanks, or spiked samples at a proportion equivalent to at least 10 percent of the sample load. The NWQL participates in a blind-sample program where standard reference water samples prepared by the USGS Branch of Quality Systems are routinely inserted into the sample line for each analytical method at a frequency proportional to the sample load. The laboratory also participates in evaluation studies twice-yearly with the U.S. Environmental Protection Agency, the Canadian Center for Inland Water, and the Branch of Quality Systems to assess analytical performance.

Replicate data can be obtained in different ways to provide an assessment of precision (reproducibility) of analytical results. Replicate samples are two or more samples considered to be essentially identical in composition. Replicate field samples can be obtained by either repeating the collection process to obtain two or more samples or by splitting a single sample into two or more subsamples, which are then analyzed separately. Likewise, a single sample can be analyzed two

or more times in the laboratory to obtain a measure of analytical precision.

Precision of analytical results for field replicates is affected by numerous sources of variability within the field and laboratory environments, including sample collection, sample processing, and sample analysis. To provide data on overall reproducibility of results for samples exposed to all sources of variability, replicate samples were obtained in the field by splitting a composite stream sample. Paired analyses of field replicate samples (table 3) were used to estimate precision for each parameter, expressed as a relative standard deviation, in percent. Values less than the minimum reporting level were treated as being equal to the minimum reporting level for calculating the relative standard deviation. Relative standard deviations estimated from differences in the paired analytical results for field replicates were typically within 10 percent for most parameters, and all were within 20 percent, except nitrite (dissolved) and arsenic (total recoverable). Because nitrite and arsenic concentrations in the replicates were all near or less than the minimum reporting level, the relative standard deviation in excess of 20 percent is considered to be insignificant owing to the exaggerated effect of small differences when expressed in units of percent.

Blank samples of deionized water were routinely analyzed to identify the presence and magnitude of contamination that potentially could bias analytical results. The particular type of blank sample tested was a "field" blank. Field blanks are aliquots of deionized water that are certified as trace-element free and are processed through the same sampling equipment used to collect stream samples. These blanks are then subjected to the same processing (sample splitting, filtration, preservation, transportation, and laboratory handling) as stream samples. Blank samples are analyzed for the same constituents as those of stream samples to identify whether any detectable concentrations exist. Results of analyses of blank samples are presented in table 4. Almost all concentrations in blanks were less than the minimum reporting levels and none of the few detectable concentrations were greater than twice the minimum reporting level. Therefore, the sampling and analytical process was essentially free of any significant contamination bias.

Water-Quality Guidelines

General information is provided in this section to enable the reader to compare various water-quality guidelines to the constituent concentrations measured in the Blackfoot River basin during 1995-97 (table 2). The Montana water-quality maximum guideline concentrations for selected water uses are shown in table 5. Figure 2 graphically illustrates the hardness-dependent variation in freshwater aquatic-life standards for acute and chronic toxicity for selected trace elements.

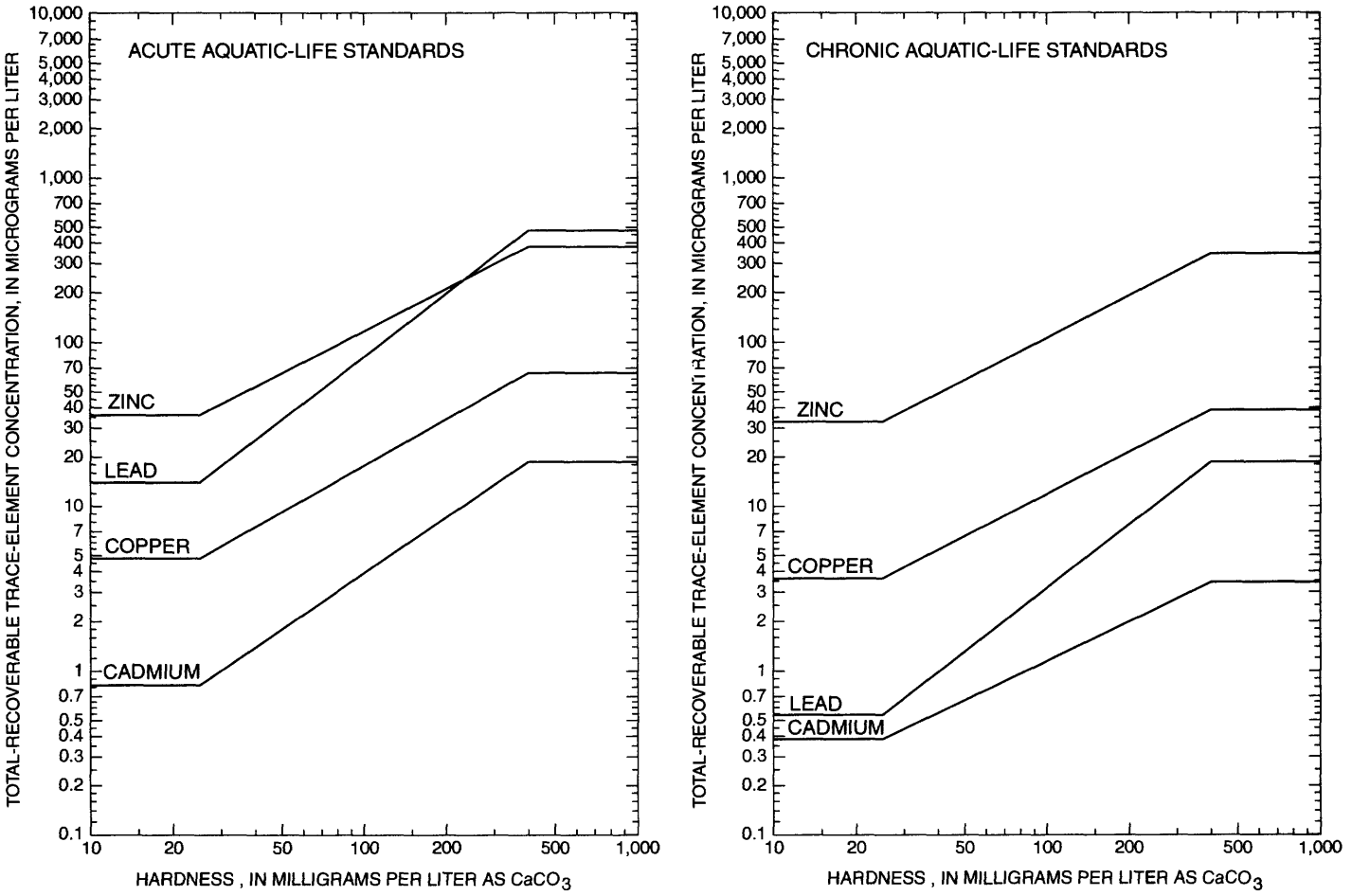

Figure 2. Relation between water hardness and freshwater aquatic-life standards for acute and chronic toxicity of selected total-recoverable trace elements (Montana Department of Environmental Quality, 1995).

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DATA

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana

[Site number shown in figure 1 and described in text. Abbreviations: ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25°C; °C, degrees Celsius; mg/L, milligrams per liter; col/100mL, colonies per 100 milliliters; K, results based on non-ideal colony count; ton/acre-ft, tons per acre-foot; ton/d, tons per day; µg/L, micrograms per liter; mm, millimeter. Symbols: <, less than minimum reporting level; --, no data]

Site number	Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved, onsite (mg/L)	Oxygen, dissolved, onsite (percent saturation)	Coliform, fecal (col/100 mL)
S1	09-07-95	1250	2.8	293	7.5	9.5	10.0	--	--	--
	11-02-95	0920	2.4	304	7.4	-10.0	2.0	--	--	--
	04-19-96	1230	28	192	7.8	6.0	4.5	--	--	--
	06-20-96	1500	13	300	7.7	9.0	14.5	--	--	--
	08-21-96	1400	2.4	242	8.0	20.0	14.5	--	--	--
	10-24-96	1250	1.2	321	7.4	3.0	4.0	--	--	--
	04-14-97	1100	3.0	410	7.4	2.0	2.0	--	--	--
	05-30-97	1620	52	146	7.7	20.5	9.0	--	--	--
S2	09-07-95	1130	.38	165	7.9	7.5	9.5	--	--	--
	11-02-95	0810	.19	159	7.6	-13.0	1.0	--	--	--
	04-19-96	1100	7.9	111	8.1	4.0	3.0	--	--	--
	06-20-96	1330	1.5	137	8.1	16.0	9.0	--	--	--
	08-21-96	1310	.20	162	8.1	18.0	11.0	--	--	--
	10-24-96	1200	.19	158	7.8	3.0	5.0	--	--	--
	04-14-97	1200	.41	159	7.9	3.0	2.5	--	--	--
	05-30-97	1510	8.2	107	7.9	21.0	10.0	--	--	--
S3	09-07-95	1030	6.0	232	8.0	13.0	12.5	--	--	--
	11-02-95	1020	8.1	228	7.8	-6.0	0.0	--	--	--
	04-19-96	1000	99	163	7.8	3.0	2.0	--	--	--
	06-20-96	1230	26	233	8.0	16.0	10.0	--	--	--
	08-21-96	1200	5.6	226	8.0	16.0	13.0	--	--	--
	10-24-96	1100	4.5	219	7.7	1.5	1.5	--	--	--
	04-14-97	1300	7.8	245	7.7	4.5	1.5	--	--	--
	05-30-97	1415	113	154	7.9	22.5	12.5	--	--	--
S4	09-07-95	0920	11	236	8.2	10.5	10.5	--	--	--
	11-02-95	1200	6.1	243	7.9	-2.0	2.5	--	--	--
	04-19-96	0845	102	167	7.9	1.0	2.0	--	--	--
	06-20-96	0815	48	206	8.2	3.0	6.5	--	--	--
	08-21-96	1040	12	239	8.2	12.5	10.0	--	--	--
	10-24-96	1015	9.0	237	8.0	1.0	2.5	--	--	--
	04-14-97	1410	8.6	220	8.2	5.5	6.5	--	--	--
	05-30-97	1315	131	168	8.2	22.5	9.5	--	--	--
S5	09-07-95	0830	19	239	8.3	11.0	9.5	--	--	--
	11-02-95	1430	19	238	8.5	.0	0.0	--	--	--
	04-18-96	1640	320	156	8.2	4.0	4.0	--	--	--
	06-20-96	0930	96	201	8.1	8.0	8.0	--	--	--
	08-21-96	0920	25	236	8.4	14.5	9.5	--	--	--
	10-24-96	0920	18	241	8.2	.5	3.0	--	--	--
	04-14-97	1520	28	232	8.4	5.0	6.5	--	--	--
	05-30-97	1200	316	156	8.1	20.5	10.5	--	--	--

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Streptococci, fecal (col/100 mL)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Alkalinity, laboratory (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
S1	09-07-95	--	140	28	16	1.5	0.1	0.8	58	84	0.2
	11-02-95	--	140	29	16	1.6	.1	.8	46	98	.2
	04-19-96	--	87	19	9.7	1.2	.1	.5	43	51	.2
	06-20-96	--	140	29	17	1.3	<.1	.5	57	90	.1
	08-21-96	--	110	24	13	1.4	.1	.7	63	56	<.1
	10-24-96	--	150	31	17	1.7	.1	.6	56	100	<.1
	04-14-97	--	200	41	23	1.6	.1	.7	53	150	.3
	05-30-97	--	66	15	7.2	.9	<.1	.4	50	20	.2
S2	09-07-95	--	78	19	7.5	2.2	.1	.5	83	4.4	1.1
	11-02-95	--	78	19	7.3	2.1	.1	.4	76	6.1	1.5
	04-19-96	--	53	13	5.1	1.9	.1	.4	54	3.2	1.2
	06-20-96	--	67	16	6.5	1.8	.1	.3	69	3.1	.5
	08-21-96	--	80	20	7.4	2.0	.1	.5	81	4.5	.7
	10-24-96	--	77	19	7.2	2.1	.1	.5	77	6.3	1.0
	04-14-97	--	76	18	7.3	2.6	.1	.4	68	6.4	4.8
	05-30-97	--	48	12	4.5	1.5	.1	.3	51	2.4	.9
S3	09-07-95	--	110	24	12	1.8	.1	.8	85	32	.4
	11-02-95	--	110	24	12	1.9	.1	.7	73	36	.6
	04-19-96	--	80	18	8.4	1.4	.1	.6	61	21	.5
	06-20-96	--	120	25	13	1.5	.1	.4	67	49	.3
	08-21-96	--	110	25	11	1.7	.1	.7	89	27	.4
	10-24-96	--	100	23	11	1.9	.1	.7	71	41	.3
	04-14-97	--	120	26	13	1.9	.1	.9	65	54	1.2
	05-30-97	--	69	16	7.3	1.2	.1	.4	59	16	.3
S4	09-07-95	--	120	28	12	1.9	.1	.7	126	2.7	.2
	11-02-95	--	120	30	12	2.0	.1	.7	129	3.2	.4
	04-19-96	--	86	21	8.1	1.5	.1	.6	88	3.1	.3
	06-20-96	--	100	25	10	1.7	.1	.6	109	2.9	.2
	08-21-96	--	120	30	11	1.8	.1	.7	128	2.5	.2
	10-24-96	--	120	29	12	2.0	.1	.6	128	3.2	.2
	04-14-97	--	110	26	11	2.0	.1	.6	114	3.8	.4
	05-30-97	--	83	20	7.8	1.4	.1	.5	86	2.2	.3
S5	09-07-95	--	120	28	12	2.3	.1	.8	116	11	.6
	11-02-95	--	120	29	12	2.5	.1	.9	117	12	.6
	04-18-96	--	76	18	7.6	1.6	.1	.7	72	10	.5
	06-20-96	--	100	24	10	1.9	.1	.6	91	14	.5
	08-21-96	--	120	28	11	2.4	.1	.9	118	9.1	.5
	10-24-96	--	120	29	12	2.7	.1	.9	120	12	.3
	04-14-97	--	120	27	12	2.3	.1	.9	103	17	.8
	05-30-97	--	73	17	7.2	1.5	.1	.6	72	7.7	.3

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Dissolved solids, calculated (mg/L)	Dissolved solids (ton/ acre-ft)	Dissolved solids (ton/day)	Nitrite, dissolved (mg/L as N)	Nitrite plus nitrate, dissolved (mg/L as N)	Ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Arsenic, total recoverable (µg/L as As)
S1	09-07-95	<0.1	10	175	0.24	1.33	<0.0	<0.05	<0.02	<0.01	<1
	11-02-95	<.1	11	184	.25	1.19	<.01	<.05	<.02	<.01	<1
	04-19-96	<.1	8.0	115	.16	8.73	.01	<.05	.02	.01	<1
	06-20-96	<.1	8.4	181	.25	6 ?4	<.01	<.05	.04	<.01	<1
	08-21-96	<.1	9.6	143	.19	.92	<.01	<.05	<.02	<.01	<1
	10-24-96	<.1	10	194	.26	.63	.01	<.05	.02	<.01	<1
	04-14-97	<.1	9.0	256	.35	2.07	<.01	.09	<.02	<.01	<1
	05-30-97	<.1	7.6	81	.11	11.4	<.01	.05	<.02	<.01	<1
S2	09-07-95	<.1	9.9	94	.13	.10	<.01	<.05	<.02	<.01	<1
	11-02-95	<.1	9.0	91	.12	.05	<.01	<.05	<.02	<.01	<1
	04-19-96	<.1	7.5	65	.09	1.38	.02	<.05	.02	.01	<1
	06-20-96	<.1	8.7	78	.11	.32	<.01	<.05	.03	<.01	<1
	08-21-96	<.1	9.6	93	.13	.05	<.01	<.05	<.02	<.01	<1
	10-24-96	<.1	9.6	92	.13	.05	.02	<.05	.02	<.01	1
	04-14-97	<.1	8.3	89	.12	.10	<.01	<.05	<.02	<.01	<1
	05-30-97	<.1	8.0	60	.08	1.33	<.01	<.05	<.02	<.01	<1
S3	09-07-95	<.1	12	134	.18	2.17	<.01	<.05	<.02	<.01	<1
	11-02-95	<.1	12	131	.18	2.87	<.01	<.05	<.02	<.01	<1
	04-19-96	<.1	8.6	95	.13	25.4	.02	<.05	.02	<.01	<1
	06-20-96	<.1	9.6	139	.19	9.76	<.01	<.05	.03	<.01	<1
	08-21-96	<.1	12	131	.18	1.98	<.01	<.05	<.02	<.01	<1
	10-24-96	<.1	12	133	.18	1.61	.02	<.05	.02	<.01	<1
	04-14-97	<.1	11	146	.20	3.08	<.01	<.05	<.02	<.01	<1
	05-30-97	<.1	8.8	85	.12	26.0	<.01	<.05	<.02	<.01	<1
S4	09-07-95	<.1	11	132	.18	3.92	<.01	<.05	<.02	<.01	<1
	11-02-95	<.1	11	137	.19	2.25	<.01	<.05	<.02	<.01	<1
	04-19-96	<.1	8.9	96	.13	26.5	.02	<.05	.02	.01	<1
	06-20-96	<.1	10	116	.16	15.0	<.01	<.05	.02	<.01	<1
	08-21-96	<.1	11	134	.18	4.27	<.01	<.05	<.02	.01	<1
	10-24-96	<.1	11	135	.18	3.28	.02	<.05	.02	<.01	<1
	04-14-97	<.1	11	123	.17	2.85	<.01	<.05	<.02	.02	<1
	05-30-97	<.1	9.3	93	.13	33.0	<.01	<.05	<.02	<.01	<1
S5	09-07-95	<.1	13	137	.19	7.04	<.01	<.05	<.02	<.01	<1
	11-02-95	<.1	13	140	.19	7.19	<.01	<.05	<.02	<.01	<1
	04-18-96	<.1	10	92	.12	79.2	.02	<.05	.02	<.01	<1
	06-20-96	<.1	12	118	.16	30.5	<.01	<.05	.02	<.01	<1
	08-21-96	<.1	13	136	.18	9.16	<.01	<.05	<.02	<.01	<1
	10-24-96	<.1	13	142	.19	6.90	.01	<.05	.02	<.01	<1
	04-14-97	<.1	12	134	.18	10.1	<.01	<.05	<.02	<.01	<1
	05-30-97	<.1	10	88	.12	75.2	<.01	<.05	<.02	<.01	<1

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Cadmium, total recoverable (µg/L as Cd)	Copper, total recoverable (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Manganese, total recoverable (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Sediment, suspended (mg/L)	Sediment, discharge, suspended (ton/d)	Sediment, suspended, (percent finer than 0.062 mm)
S1	09-07-95	5	8	60	8	450	1,600	3	0.02	82
	11-02-95	6	7	50	2	450	2,100	1	.01	67
	04-19-96	5	34	110	12	350	1,300	1	.08	62
	06-20-96	11	170	800	9	1,600	3,600	3	.11	74
	08-21-96	3	9	80	3	220	850	1	.01	38
	10-24-96	6	10	60	2	740	2,300	1	<.01	57
	04-14-97	6	15	80	3	730	2,500	1	.01	57
	05-30-97	2	15	50	7	110	450	2	.28	74
S2	09-07-95	<1	<1	<10	<1	10	<10	1	<.01	67
	11-02-95	<1	<1	20	<1	<10	<10	1	<.01	75
	04-19-96	<1	1	40	<1	<10	<10	2	.04	47
	06-20-96	<1	1	20	<1	<10	<10	1	<.01	75
	08-21-96	<1	<1	20	<1	<10	<10	1	<.01	50
	10-24-96	<1	<1	20	<1	<10	<10	1	<.01	56
	04-14-97	<1	<1	<10	<1	<10	<10	1	<.01	50
	05-30-97	<1	<1	30	<1	<10	<10	1	.02	62
S3	09-07-95	<1	1	140	<1	80	90	1	.02	80
	11-02-95	<1	<1	180	<1	170	170	1	.02	64
	04-19-96	<1	3	120	<1	30	170	1	.27	50
	06-20-96	<1	1	100	<1	50	420	1	.07	80
	08-21-96	<1	1	180	<1	80	90	2	.03	60
	10-24-96	<1	1	170	<1	130	130	3	.04	64
	04-14-97	<1	1	170	<1	80	290	1	.02	78
	05-30-97	<1	3	70	<1	20	180	1	.31	54
S4	09-07-95	<1	<1	70	<1	20	<10	1	.03	67
	11-02-95	<1	<1	70	<1	<10	<10	1	.02	71
	04-19-96	<1	3	140	<1	<10	<10	5	1.4	81
	06-20-96	<1	1	120	<1	10	<10	3	.39	89
	08-21-96	<1	<1	50	<1	<10	<10	2	.06	53
	10-24-96	<1	<1	60	<1	<10	<10	1	.02	70
	04-14-97	<1	<1	90	<1	<10	<10	1	.02	75
	05-30-97	<1	2	100	<1	11	<10	4	1.4	85
S5	09-07-95	<1	<1	20	<1	<10	<10	1	.05	80
	11-02-95	<1	<1	70	<1	<10	<10	2	.10	74
	04-18-96	<1	3	210	<1	20	50	8	6.9	63
	06-20-96	<1	1	100	<1	10	60	3	.78	88
	08-21-96	<1	<1	50	<1	<10	<10	2	.14	53
	10-24-96	<1	<1	30	<1	<10	<10	3	.15	61
	04-14-97	<1	1	90	<1	<10	20	1	.08	75
	05-30-97	<1	3	120	<1	15	60	5	4.3	69

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved, onsite (mg/L)	Oxygen, dissolved, onsite (percent saturation)	Coliform, fecal (col/100 mL)
S6	09-05-95	0830	70	260	8.2	12.0	9.5	--	--	--
	11-02-95	1310	29	257	8.4	-2.0	5.5	--	--	--
	04-18-96	1510	238	230	8.3	4.0	4.0	--	--	--
	06-19-96	1220	832	193	8.1	14.5	7.0	--	--	--
	08-20-96	1450	84	253	8.2	23.0	11.5	--	--	--
	10-23-96	1515	34	261	7.1	4.0	5.0	--	--	--
	04-14-97	1630	20	266	8.4	5.0	7.0	--	--	--
	05-30-97	0900	1,050	197	8.2	13.0	5.5	--	--	--
S7	09-05-95	1045	59	252	8.4	15.0	11.0	9.6	103	K15
	10-31-95	0930	23	252	8.3	-4.0	1.0	12.0	101	45
	04-18-96	1200	574	185	8.1	4.0	3.0	11.2	100	--
	06-19-96	1430	893	193	8.3	9.0	9.0	10.6	109	<1
	08-20-96	1300	89	248	8.4	22.5	11.0	9.4	101	K2
	10-23-96	1330	33	253	7.1	4.0	4.0	10.7	97	1
	04-10-97	1620	38	234	8.4	-.5	2.0	12.7	108	<1
	05-27-97	1500	1,300	189	8.4	16.0	9.0	9.9	101	K1
S8	09-05-95	1300	110	310	8.4	23.0	14.0	9.3	102	22
	10-31-95	1200	93	322	8.2	0.0	3.5	11.8	105	K1
	04-18-96	0900	802	224	8.0	2.0	3.0	9.6	85	K5
	06-19-96	1700	1,170	213	8.2	9.0	11.0	9.3	99	K3
	08-20-96	1030	169	301	8.3	10.5	9.5	8.9	92	20
	10-23-96	1110	98	324	7.8	3.5	6.0	10.1	96	7
	04-10-97	1400	81	324	8.3	-1.0	5.0	9.8	90	<1
	05-29-97	1520	1,470	214	8.3	19.0	11.5	9.4	101	K3
S9	09-05-95	1520	160	297	8.4	21.0	17.0	--	--	--
	11-01-95	0810	134	311	8.3	-7.0	0.0	--	--	--
	04-17-96	1630	956	228	8.3	7.0	6.5	--	--	--
	06-19-96	0845	1,710	215	8.2	9.5	8.0	--	--	--
	08-20-96	0730	226	293	8.4	4.0	12.0	--	--	--
	10-23-96	0900	191	309	8.0	1.5	3.5	--	--	--
	04-10-97	1210	195	317	8.4	1.0	2.5	--	--	--
	05-29-97	1220	2,040	221	8.2	22.5	10.5	--	--	--
S10	09-06-95	0930	30	429	8.3	13.0	16.0	6.7	79	180
	10-31-95	1445	24	450	8.6	-2.0	1.0	12.8	105	K7
	04-17-96	1400	330	278	8.7	8.0	6.5	--	--	24
	06-18-96	0930	150	310	8.2	7.0	14.0	9.5	108	350
	08-19-96	1100	28	383	8.5	22.0	16.0	11.8	139	98
	10-22-96	0930	33	426	8.4	3.0	2.5	11.4	98	61
	04-09-97	0940	117	457	8.2	-1.0	0.0	13.2	105	K150
	05-28-97	1210	394	327	8.1	23.0	14.0	--	--	140
S11	09-06-95	1200	204	262	8.4	19.5	10.5	--	--	--
	11-01-95	1010	156	269	8.4	-2.5	3.5	--	--	--
	04-17-96	1030	876	221	8.3	7.0	4.5	--	--	--
	06-18-96	1230	2,530	147	8.4	9.0	6.5	--	--	--
	08-19-96	1330	273	265	8.4	25.0	13.5	--	--	--
	10-22-96	1130	154	275	8.5	4.0	6.0	--	--	--
	04-10-97	1030	155	281	8.4	-1.0	2.5	--	--	--
	05-28-97	1430	2,470	174	8.2	24.0	8.5	--	--	--

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Streptococci, fecal (col/100 mL)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Alkalinity, laboratory (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
S6	09-05-95	--	130	34	12	1.1	<.1	.5	140	2.9	.3
	11-02-95	--	140	35	12	1.2	<.1	.5	139	3.0	.3
	04-18-96	--	120	31	11	1.1	<.1	.5	125	3.2	.4
	06-19-96	--	100	27	8.6	.8	<.1	.4	99	1.6	2.0
	08-20-96	--	130	34	11	1.1	<.1	.4	136	2.4	2.9
	10-23-96	--	140	36	12	1.2	<.1	.5	142	3.0	.2
	04-14-97	--	140	37	12	1.2	<.1	.6	142	3.2	.3
	05-30-97	--	98	25	8.3	.8	<.1	.4	103	1.7	.2
S7	09-05-95	24	130	32	12	1.5	.1	.6	133	5.0	.4
	10-31-95	<1	130	33	12	1.6	.1	.6	131	5.8	.3
	04-18-96	--	96	24	8.8	1.6	.1	.7	92	7.3	.4
	06-19-96	K1	100	26	8.8	1.0	<.1	.4	101	3.3	.2
	08-20-96	45	130	32	11	1.5	.1	.6	131	4.5	.4
	10-23-96	<1	130	33	12	1.7	.1	.6	134	5.8	.2
	04-10-97	<1	130	31	12	2.2	.1	.7	116	12	.6
	05-27-97	K1	93	24	8.3	1.1	.1	.5	96	3.9	.2
S8	09-05-95	K22	160	44	13	2.1	.1	.9	167	5.8	.7
	10-31-95	K3	130	30	14	2.8	.1	.9	--	5.5	.6
	04-18-96	K11	120	31	9.7	1.8	.1	.8	114	7.1	.5
	06-19-96	K5	110	30	9.2	1.3	.1	.5	112	3.5	.3
	08-20-96	37	150	42	12	1.9	.1	.8	160	5.1	.5
	10-23-96	250	170	45	13	2.2	.1	.9	171	6.2	.4
	04-10-97	K3	180	48	14	2.4	.1	.9	170	6.5	1.0
	05-29-97	K11	110	28	8.7	1.4	.1	.6	110	4.1	.3
S9	09-05-95	--	160	41	13	2.3	.1	.9	160	5.1	.7
	11-01-95	--	160	44	13	2.3	.1	.8	167	5.7	.6
	04-17-96	--	120	32	9.5	2.0	.1	.9	118	6.5	.6
	06-19-96	--	110	31	9.1	1.5	.1	.6	113	3.3	.4
	08-20-96	--	150	41	12	2.0	.1	.8	157	5.0	.6
	10-23-96	--	160	43	13	2.3	.1	.9	165	5.5	.4
	04-10-97	--	170	46	14	2.8	.1	1.0	166	6.3	1.0
	05-29-97	--	100	27	8.5	1.5	.1	.7	112	4.1	.4
S10	09-06-95	79	180	49	15	18	.6	4.8	202	27	3.3
	10-31-95	22	200	56	15	18	.6	4.1	209	34	3.4
	04-17-96	40	120	32	8.9	11	.4	3.8	120	20	2.2
	06-18-96	200	140	39	11	11	.4	3.1	149	14	1.5
	08-19-96	270	170	47	13	14	.5	3.8	180	25	2.6
	10-22-96	650	190	53	14	15	.5	3.9	196	33	3.3
	04-09-97	730	200	53	17	23	.7	4.3	174	58	4.8
	05-28-97	170	130	33	11	13	.5	3.4	135	31	2.2
S11	09-06-95	--	140	31	14	1.4	.1	.5	140	3.9	.3
	11-01-95	--	140	32	14	1.4	.1	.5	143	4.2	.3
	04-17-96	--	120	30	10	1.1	<.1	.5	118	<.10	<.1
	06-18-96	--	78	20	6.8	.7	<.1	.4	78	1.5	.1
	08-19-96	--	140	32	14	1.3	<.1	.5	141	3.8	.3
	10-22-96	--	150	33	16	1.6	.1	.6	148	4.5	.1
	04-10-97	--	160	35	17	2.1	.1	.7	147	5.5	.7
	05-28-97	--	81	20	7.2	.8	<.1	.4	89	2.0	.2

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Dissolved solids, calculated (mg/L)	Dissolved solids (ton/ acre-ft)	Dissolved solids (ton/day)	Nitrite, dissolved (mg/L as N)	Nitrite plus nitrate, dissolved (mg/L as N)	Ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Arsenic, total recoverable (µg/L as As)
S6	09-05-95	<.1	7.4	142	.19	26.9	<.01	<.05	.02	<.01	<1
	11-02-95	<.1	7.8	143	.19	11.2	<.01	.05	<.02	<.01	<1
	04-18-96	<.1	5.4	128	.17	82.3	.02	.10	.02	.02	<1
	06-19-96	<.1	5.3	105	.14	236	<.01	<.05	.02	.01	<1
	08-20-96	<.1	7.2	141	.19	31.9	<.01	<.05	<.02	<.01	<1
	10-23-96	<.1	7.9	146	.20	13.4	.01	<.05	.02	<.01	<1
	04-14-97	<.1	7.8	148	.20	7.99	<.01	.07	<.02	<.01	<1
	05-30-97	<.1	5.7	104	.14	296	<.01	.07	<.02	<.01	<1
S7	09-05-95	<.1	8.8	140	.19	22.3	<.01	<.05	<.02	<.01	<1
	10-31-95	<.1	9.4	141	.19	8.77	<.01	<.05	<.02	<.01	<1
	04-18-96	<.1	7.9	106	.14	164	.02	<.05	.02	.01	<1
	06-19-96	<.1	6.5	107	.15	257	<.01	<.05	.02	<.01	<1
	08-20-96	<.1	8.7	137	.19	33.0	<.01	<.05	<.02	<.01	<1
	10-23-96	<.1	9.8	143	.20	12.8	.01	<.05	.01	<.01	<1
	04-10-97	<.1	11	140	.19	14.3	<.01	<.05	<.02	<.01	<1
	05-27-97	<.1	8.0	104	.14	364	<.01	.05	<.02	<.01	<1
S8	09-05-95	<.1	12	179	.24	53.1	<.01	<.05	<.02	<.01	<1
	10-31-95	.1	12	--	--	--	<.01	<.05	<.02	<.01	<1
	04-18-96	<.1	9.2	128	.17	278	.01	<.05	<.02	<.01	<1
	06-19-96	<.1	8.3	120	.16	380	<.01	<.05	.02	<.01	1
	08-20-96	<.1	11	169	.23	77.2	<.01	<.05	<.02	<.01	1
	10-23-96	<.1	12	182	.25	48.2	.01	<.05	.01	<.01	<1
	04-10-97	<.1	12	187	.25	40.8	<.01	.05	<.02	<.01	<1
	05-29-97	<.1	9.1	118	.16	468	<.01	.05	<.02	<.01	1
S9	09-05-95	<.1	12	171	.23	73.9	<.01	<.05	<.02	<.01	2
	11-01-95	.1	12	179	.24	64.6	<.01	<.05	<.02	<.01	2
	04-17-96	<.1	11	133	.18	344	<.01	<.05	<.02	.01	2
	06-19-96	<.1	9.0	123	.17	566	<.01	<.05	.02	<.01	2
	08-20-96	<.1	11	167	.23	102	<.01	<.05	<.02	<.01	1
	10-23-96	<.1	12	176	.24	90.8	.01	<.05	.02	<.01	<1
	04-10-97	<.1	12	184	.25	96.6	<.01	<.05	<.02	<.01	2
	05-29-97	<.1	10	120	.16	659	<.01	.05	<.02	<.01	2
S10	09-06-95	.2	27	266	.36	21.5	<.01	<.05	<.02	.08	8
	10-31-95	.2	28	284	.39	18.4	<.01	<.05	<.02	.06	5
	04-17-96	.1	18	168	.23	150	.02	<.05	.04	.09	5
	06-18-96	.2	27	197	.27	79.6	<.01	<.05	.02	.15	6
	08-19-96	.2	26	240	.33	18.1	<.01	<.05	.02	.12	7
	10-22-96	.2	28	268	.36	23.9	.01	<.05	.01	.06	5
	04-09-97	.2	25	290	.39	91.6	<.01	.06	<.05	.09	6
	05-28-97	.2	26	201	.27	213	<.01	<.05	<.02	.11	5
S11	09-06-95	<.1	7.5	143	.19	78.8	<.01	.13	<.02	<.01	<1
	11-01-95	<.1	7.7	146	.20	61.6	<.01	.11	<.02	<.01	<1
	04-17-96	<.1	6.3	119	.16	282	.01	.07	.02	<.01	<1
	06-18-96	<.1	5.2	81	.11	557	<.01	<.05	.02	<.01	<1
	08-19-96	<.1	7.4	145	.20	107	<.01	.20	<.02	<.01	<1
	10-22-96	<.1	8.1	153	.21	63.8	.02	.18	.02	<.01	<1
	04-10-97	<.1	7.5	157	.21	65.8	<.01	.19	<.02	<.01	<1
	05-28-97	<.1	5.8	91	.12	605	<.01	.07	<.02	<.01	<1

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Cadmium, total recoverable (µg/L as Cd)	Copper, total recoverable (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Manganese, total recoverable (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Sediment, suspended (mg/L)	Sediment, discharge, suspended (ton/d)	Sediment, suspended, (percent finer than 0.062 mm)
S6	09-05-95	<1	1	450	<1	20	<10	38	7.2	98
	11-02-95	<1	<1	<10	<1	10	<10	1	.08	60
	04-18-96	<1	<1	70	<1	<10	<10	5	3.2	84
	06-19-96	<1	1	170	<1	10	<10	20	45	71
	08-20-96	<1	<1	<10	<1	<10	<10	2	.45	53
	10-23-96	<1	<1	<10	<1	<10	<10	1	.09	56
	04-14-97	<1	<1	<10	<1	<10	<10	2	.11	88
	05-30-97	<1	2	690	1	40	<10	108	306	63
S7	09-05-95	<1	1	220	<1	20	<10	11	1.8	94
	10-31-95	<1	<1	20	<1	10	<10	1	.06	67
	04-18-96	<1	2	170	<1	10	30	7	11	80
	06-19-96	<1	2	180	<1	10	<10	23	55	65
	08-20-96	<1	<1	<10	<1	<10	<10	2	.48	48
	10-23-96	<1	<1	<10	<1	<10	<10	1	.09	50
	04-10-97	<1	<1	30	<1	<10	<10	1	.10	78
	05-27-97	<1	3	420	<1	27	20	50	176	76
S8	09-05-95	<1	<1	<10	<1	10	<10	7	2.1	68
	10-31-95	<1	<1	40	<1	20	<10	4	1.0	71
	04-18-96	<1	4	200	1	20	20	20	32	73
	06-19-96	<1	2	290	<1	20	<10	29	92	75
	08-20-96	<1	<1	50	<1	<10	<10	2	.91	88
	10-23-96	<1	<1	40	<1	<10	<10	4	1.1	62
	04-10-97	<1	<1	60	<1	10	<10	9	2.0	65
	05-29-97	<1	3	580	<1	40	<10	67	266	75
S9	09-05-95	<1	<1	30	<1	20	<10	5	2.2	74
	11-01-95	<1	<1	80	<1	30	<10	5	1.8	75
	04-17-96	<1	5	760	2	40	10	--	--	--
	06-19-96	<1	3	630	<1	50	<10	65	300	82
	08-20-96	<1	<1	50	<1	<10	<10	4	2.4	82
	10-23-96	<1	<1	60	<1	10	<10	5	2.6	80
	04-10-97	<1	<1	210	<1	30	<10	13	6.8	85
	05-29-97	<1	4	950	2	60	<10	92	507	85
S10	09-06-95	<1	<1	70	<1	20	<10	3	.24	97
	10-31-95	<1	<1	230	<1	30	<10	14	.91	85
	04-17-96	<1	3	800	1	70	<10	40	38	92
	06-18-96	<1	1	400	<1	60	<10	20	7.3	98
	08-19-96	<1	1	190	<1	30	<10	6	.45	89
	10-22-96	<1	<1	370	<1	40	<10	17	1.5	96
	04-09-97	<1	2	1,200	<1	180	<10	80	25	85
	05-28-97	<1	2	440	<1	56	<10	33	35	83
S11	09-06-95	<1	<1	<10	<1	10	<10	1	.55	78
	11-01-95	<1	<1	20	<1	<10	<10	2	.84	65
	04-17-96	<1	<1	80	<1	<10	10	7	17	83
	06-18-96	<1	2	430	2	20	<10	51	348	69
	08-19-96	<1	<1	<10	<1	<10	<10	1	.74	60
	10-22-96	<1	<1	<10	<1	<10	<10	2	.83	78
	04-10-97	<1	<1	<10	<1	<10	<10	1	.42	60
	05-28-97	<1	3	570	<1	30	<10	67	447	61

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved, onsite (mg/L)	Oxygen, dissolved, onsite (percent saturation)	Coliform, fecal (col/100 mL)
S12	09-06-95	1420	439	274	8.6	21.0	15.5	9.6	110	8
	11-01-95	1220	419	289	8.4	-2.5	0.0	12.6	99	--
	04-16-96	1330	2,530	216	8.3	10.5	5.0	11.8	109	K2
	06-18-96	1545	5,870	170	8.0	7.0	6.5	11.7	109	--
	08-19-96	1530	600	272	8.6	26.0	16.0	11.4	133	K4
	10-22-96	1320	460	299	8.5	5.0	5.0	12.6	114	K4
	04-09-97	1420	697	336	8.7	3.5	4.5	14.2	126	<1
	05-29-97	0830	6,060	171	8.1	17.0	8.5	10.1	100	30
S13	09-06-95	1645	42	142	8.8	25.5	21.5	--	--	--
	11-01-95	1500	89	141	8.5	-1.0	5.5	--	--	--
	04-17-96	0815	1,010	103	8.5	3.5	3.5	--	--	--
	06-18-96	1800	1,110	104	7.9	8.0	16.0	--	--	--
	08-19-96	1800	103	137	8.7	23.0	20.5	--	--	--
	10-22-96	1530	54	150	8.7	7.0	8.0	--	--	--
	04-09-97	1645	390	141	8.3	2.0	4.5	--	--	--
	05-28-97	1800	2,320	98	7.8	24.0	11.5	--	--	--

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Streptococci, fecal (col/100 mL)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Alkalinity, laboratory (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
S12	09-06-95	9	140	34	13	2.8	.1	.9	146	5.7	.6
	11-01-95	--	150	37	14	3.0	.1	.9	155	6.5	.6
	04-16-96	K8	100	26	8.7	2.6	.1	1.2	103	6.7	.6
	06-18-96	--	84	22	7.1	1.3	.1	.3	84	2.4	.5
	08-19-96	330	140	34	13	2.3	.1	.8	144	4.9	.5
	10-22-96	--	150	37	13	3.6	.1	1.1	157	7.5	.7
	04-09-97	--	170	43	16	7.5	.2	1.8	157	20	2.2
	05-29-97	30	80	20	6.9	1.7	.1	.7	85	4.1	.3
S13	09-06-95	--	72	19	5.9	1.4	.1	.5	75	1.4	.5
	11-01-95	--	72	19	5.9	1.5	.1	.5	74	1.4	.4
	04-17-96	--	53	14	4.4	1.4	.1	.7	53	1.6	8.0
	06-18-96	--	52	14	4.1	1.0	.1	.4	52	.9	.4
	08-19-96	--	68	18	5.5	1.3	.1	.5	72	1.2	.4
	10-22-96	--	72	19	6.0	1.5	.1	.5	79	1.7	.3
	04-09-97	--	75	20	6.3	1.7	.1	.6	72	1.8	.6
	05-28-97	--	46	12	3.8	1.0	.1	.5	49	1.2	.4

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Dissolved solids, calculated (mg/L)	Dissolved solids (ton/ acre-ft)	Dissolved solids (ton/day)	Nitrite, dissolved (mg/L as N)	Nitrite plus nitrate, dissolved (mg/L as N)	Ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Arsenic, total recoverable (µg/L as As)
S12	09-06-95	<.1	9.7	154	.21	183	<.01	<.05	<.02	<.01	1
	11-01-95	<.1	11	166	.23	188	<.01	<.05	<.02	<.01	1
	04-16-96	<.1	10	118	.16	805	.01	.05	.02	.02	2
	06-18-96	<.1	7.3	91	.12	1,450	<.01	<.05	.03	<.01	1
	08-19-96	<.1	9.2	151	.21	245	<.01	.07	.02	<.01	<1
	10-22-96	<.1	11	168	.23	209	.01	<.02	.04	<.01	1
	04-09-97	.1	13	198	.27	373	<.01	<.05	<.02	.01	2
	05-29-97	<.1	8.2	94	.13	1,540	<.01	.06	<.02	.02	1
S13	09-06-95	<.1	6.5	80	.11	9.1	<.01	<.05	<.02	<.01	<1
	11-01-95	<.1	7.4	80	.11	19.3	<.01	<.05	<.02	<.01	<1
	04-17-96	<.1	8.9	71	.10	193	.02	<.05	.02	<.01	<1
	06-18-96	<.1	6.5	59	.08	175	<.01	<.05	.02	<.01	<1
	08-19-96	<.1	5.9	76	.10	21.1	<.01	<.05	<.02	<.01	<1
	10-22-96	<.1	7.8	84	.11	12.3	<.01	<.05	.01	<.01	<1
	04-09-97	<.1	8.6	82	.11	86.5	<.01	<.05	<.02	<.01	<1
	05-28-97	<.1	8.0	56	.08	354	<.01	<.05	<.02	<.01	<1

Table 2. Streamflow and water-quality data for the Blackfoot River basin, western Montana (Continued)

Site number	Date	Cadmium, total recoverable (µg/L as Cd)	Copper, total recoverable (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Manganese, total recoverable (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Sediment, suspended (mg/L)	Sediment, discharge, suspended (ton/d)	Sediment, suspended, (percent finer than 0.062 mm)
S12	09-06-95	<1	<1	20	<1	<10	<10	2	2.4	86
	11-01-95	<1	<1	40	<1	10	<10	4	4.5	81
	04-16-96	<1	4	430	2	30	<10	40	280	75
	06-18-96	<1	3	550	<1	30	<10	55	872	74
	08-19-96	<1	<1	40	<1	<10	<10	4	6.5	81
	10-22-96	<1	<1	40	<1	<10	<10	3	3.7	77
	04-09-97	<1	<1	260	<1	30	<10	13	24	98
	05-29-97	<1	3	610	<1	40	<10	67	1,100	75
S13	09-06-95	<1	<1	<10	<1	10	<10	1	.11	88
	11-01-95	<1	<1	40	<1	20	<10	3	.72	57
	04-17-96	<1	2	110	<1	10	<10	3	8.2	91
	06-18-96	<1	<1	60	<1	<10	<10	3	9.0	91
	08-19-96	<1	<1	10	<1	<10	<10	1	.28	54
	10-22-96	<1	<1	20	<1	<10	<10	2	.29	70
	04-09-97	<1	<1	70	<1	<10	<10	2	2.1	79
	05-28-97	<1	1	100	<1	11	<10	4	25	90

Table 3. Water-quality data for replicate samples from sites in the Blackfoot River basin, western Montana

[Site numbers shown in figure 1 and described in text. Abbreviations: µS/cm, microseimens per centimeter at 25°C; mg/L milligrams per liter; lab, laboratory; ton/acre-ft, tons per acre-foot; µg/L, micrograms per liter; mm, millimeter. Symbols: <, less than minimum reporting level; --, no data]

Site number	Date	Time	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Alkalinity, lab (mg/L as $CaCO_3$)
S2	06-20-96	1330	137	8.1	67	16	6.5	1.8	0.1	0.3	69
		1335	137	8.1	69	17	6.5	1.8	.1	.3	69
S5	04-14-97	1520	232	8.4	120	27	12	2.3	.1	.9	103
		1525	232	8.4	110	27	12	2.3	.1	.8	103
S7	04-18-96	1200	185	8.1	96	24	8.8	1.6	.1	.7	92
		1205	185	8.1	96	24	8.7	1.6	.1	.7	92
S9	08-20-96	0730	293	8.4	150	41	12	2.0	.1	.8	157
		0735	293	8.4	150	40	12	2.0	.1	.9	157
	10-23-96	0900	309	8.0	160	43	13	2.3	.1	.9	165
		0905	309	8.0	140	42	13	2.4	.1	.9	165
S12	11-01-95	1220	289	8.4	150	37	14	3.0	.1	.9	155
		1225	289	8.4	150	37	14	3.1	.1	.9	154
S13	05-28-97	1800	98	7.8	46	12	3.8	1.0	.1	.5	49
		1805	98	7.8	46	12	3.7	1.0	.1	.5	49

Site number	Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Dissolved solids, calculated (mg/L)	Dissolved solids (tons/ acre-ft)	Nitrite, dissolved (mg/L as N)	Nitrite plus nitrate, dissolved (mg/L as N)	Ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)
S2	06-20-96	3.1	0.5	<0.1	8.7	78	0.11	<0.01	<0.05	0.03	<0.01
		3.0	.5	<.1	8.6	79	.11	<.01	<.05	.02	<.01
S3	04-14-97	17	.8	<.1	12	134	.18	<.01	<.05	<.02	<.01
		17	.7	<.1	12	133	.18	<.01	<.05	<.02	<.01
S7	04-18-96	7.3	.4	<.1	7.9	106	.14	.02	<.05	.02	.01
		7.3	.4	<.1	9.5	107	.15	.02	<.05	.02	.01
S9	08-20-96	5.0	.6	<.1	11	167	.23	<.01	<.05	<.02	<.01
		4.7	.7	<.1	11	165	.22	<.01	<.05	.02	.01
	10-23-96	5.5	.4	<.1	12	176	.24	.01	<.05	.02	<.01
		5.6	.4	<.1	12	175	.24	.02	<.05	.01	<.01
S12	11-01-95	6.5	.6	<.1	11	166	.23	<.01	<.05	<.02	<.01
		6.6	.6	<.1	11	166	.23	<.01	<.05	<.02	<.01
S13	05-28-97	1.2	.4	<.1	8.0	56	.08	<.01	<.05	<.02	<.01
		1.2	.6	<.1	8.0	57	.08	--	--	--	--

Site number	Date	Arsenic, total recoverable (µg/L as As)	Cadmium, total recoverable (µg/L as Cd)	Copper, total recoverable (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Manganese, total recoverable (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)	Sediment, suspended (mg/L)	Sediment suspended, (percent finer than 0.062 mm)
S2	06-20-96	<1	<1	1	20	<1	<10	<10	1	75
		<1	<1	<1	20	<1	<10	<10	--	--
S3	04-14-97	<1	<1	1	90	<1	<10	20	1	75
		<1	<1	<1	90	<1	<10	20	--	--
S7	04-18-96	<1	<1	2	170	<1	10	30	7	80
		<1	<1	2	170	<1	10	30	7	81
S9	08-20-96	2	<1	<1	50	<1	<10	<10	4	82
		<1	<1	<1	60	<1	<10	<10	--	--
	10-23-96	<1	<1	<1	60	<1	10	<10	5	80
		<1	<1	<1	60	<1	10	<10	6	76
S12	11-01-95	1	<1	<1	40	<1	10	<10	4	81
		2	<1	<1	40	<1	10	<10	--	--
S13	05-28-97	<1	<1	1	100	<1	11	<10	4	90
		2	<1	<1	110	<1	12	<10	--	--

Table 4. Water-quality data for field-blank samples from sites in the Blackfoot River basin, western Montana

[Site numbers shown in figure 1 and described in text. Abbreviations: µS/cm, microseimens per centimeter at 25°C; mg/L milligrams per liter; lab, laboratory; ton/acre-ft, tons per acre-foot; µg/L, micrograms per liter; mm, millimeter. Symbols: <, less than minimum reporting level; --, no data]

Date	Time	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Calcium, dissolved (mg/L as Ca)	Mag-nesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)
09-06-95	1120	2	6.6	<0.02	<0.01	<0.2	<0.1	1.2	<0.1
11-01-95	1430	2	--	<.02	<.01	<.2	<.1	1.1	<.1
04-19-96	0800	--	--	<.02	<.01	<.2	<.1	1.6	<.1
06-20-96	1200	2	6.7	<.02	<.01	<.2	<.1	<1	<.1
08-21-96	0830	1	5.8	<.02	<.01	<.2	<.1	1.2	<.1
10-24-96	0830	3	5.8	<.02	<.01	<.2	<.1	1.5	<.1
04-14-97	1030	2	6.1	<.02	<.01	<.2	<.1	1.7	<.1
05-30-97	1115	1	6.1	<.02	<.01	<.2	<.1	1.3	<.1

Date	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Nitrite, dissolved (mg/L as N)	Nitrite plus nitrate, dissolved (mg/L as N)	Ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)
09-06-95	<0.1	<0.1	<0.1	<0.01	<0.05	<0.02	<0.01
11-01-95	<.1	<.1	<.1	<.01	<.05	<.02	<.01
04-19-96	<.1	<.1	<.1	<.01	<.05	<.02	<.01
06-20-96	<.1	<.1	<.1	<.01	<.05	.02	<.01
08-21-96	<.1	<.1	.2	<.01	<.05	<.02	<.01
10-24-96	<.1	<.1	.1	<.01	<.05	<.02	<.01
04-14-97	<.1	<.1	<.1	<.01	<.05	<.02	<.01
05-30-97	<.1	<.1	<.1	--	--	--	--

Date	Arsenic, total recov-erable (µg/L as As)	Cadmium, total recov-erable (µg/L as Cd)	Copper, total recoverable (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Manganese, total recov-erable (µg/L as Mn)	Zinc, total recoverable (µg/L as Zn)
09-06-95	<1	<1	<1	<10	<1	<10	<10
11-01-95	<1	<1	2	<10	<1	<10	<10
04-19-96	<1	<1	<1	<10	<1	<10	<10
06-20-96	<1	<1	<1	<10	<1	<10	<10
08-21-96	<1	<1	<1	<10	<1	<10	<10
10-24-96	<1	<1	<1	<10	<1	<10	<10
04-14-97	<1	<1	<1	<10	<1	<10	<10
05-30-97	<1	<1	<1	<10	<1	<10	<10

Table 5. Montana water-quality maximum guideline concentrations for selected water uses

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter. Symbol: --, no guideline concentration has been adopted]

Constituent	Maximum guideline concentration for indicated water use				
	Human consumption[1]	Aquatic life[1,2]		Irrigation[3]	Livestock watering[3]
		Acute	Chronic		
TRACE ELEMENTS					
Arsenic (µg/L)	18	360	190	100	200
Cadmium (µg/L)	5	[4]3.9	[4]1.1	50	50
Copper (µg/L)	1,000	[4]18	[4]12	5,000	500
Iron (µg/L)	300	--	1,000	20,000	--
Lead (µg/L)	15	[4]82	[4]3.2	10,000	100
Manganese (µg/L)	50	--	--	10,000	--
Zinc (µg/L)	--	[4]120	[4]110	--	--
NUTRIENTS					
Nitrogen, ammonia (mg/L)[5]	--	[6].15	[6].02	--	--
Nitrogen, nitrite (mg/L)[5]	1	--	--	--	10
Nitrogen, nitrite plus nitrate (mg/L)[5]	10	--	--	--	100

[1]Montana Department of Environmental Quality (1995).

[2]Aquatic-life standards refer to total-recoverable concentrations.

[3] Montana Department of Health and Environmental Science (1986, p. 8)

[4]Concentration listed for the protection of aquatic life is based on a water hardness of 100 milligrams per liter as calcium carbonate. Standards for cadmium, copper, lead, and zinc vary with water hardness (see fig. 2).

[5]A plant nutrient, excessive amounts of which may cause violations of Administrative Rules of Montana (ARM) 16.20.633.(1)(e).

[6]Concentration listed for the protection of aquatic life is based on a pH between 8 and 9 and a temperature less than 15 degrees Celsius.

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