WATER-QUALITY, BED-SEDIMENT, AND BIOLOGICAL DATA (OCTOBER 1995 THROUGH SEPTEMBER 1996) AND STATISTICAL SUMMARIES OF DATA FOR STREAMS IN THE UPPER CLARK FORK BASIN, MONTANA

By Kent A. Dodge, Michelle I. Hornberger, and Ellen V. Axtmann

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CONVERSION FACTORS AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
cubic foot per second (ft^3/s)	0.028317	cubic meter per second
foot (ft)	0.3048	meter (m)
gallon (gal)	3.785	liter (L)
gallon (gal)	3,785	milliliter (ml)
inch (in.)	25.4	millimeter (mm)
inch (in.)	25,400	micrometer (µm)
mile (mi)	1.609	kilometer
ounce (oz)	28.35	gram (g)
part per million	1	microgram per gram (µg/g)
square mile (mi^2)	2.59	square kilometer
ton per day (ton/d)	907.2	kilogram per day

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

$$°F = 9/5\ (°C) + 32$$

Abbreviated water-quality units used in this report:

µg/g micrograms per gram
µg/L micrograms per liter
µg/mL micrograms per milliliter
µS/cm microsiemens per centimeter at 25 degrees Celsius
mg/L milligrams per liter

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.

Water-Quality, Bed-Sediment, and Biological Data (October 1995 through September 1996) and Statistical Summaries of Data for Streams in the Upper Clark Fork Basin, Montana

By Kent A. Dodge, Michelle I. Hornberger, *and* Ellen V. Axtmann

Abstract

Water, bed sediment, and biota were sampled in streams from Warm Springs to below Missoula as part of a program to characterize aquatic resources in the upper Clark Fork basin of western Montana. Sampling stations were located on the Clark Fork and major tributaries. Water-quality data were obtained periodically at 12 stations during October 1995 through September 1996 (water year 1996). Data for 14 bed-sediment and 13 biological stations were obtained in August 1996. The primary constituents analyzed were trace elements associated with tailings from historical mining and smelting activities.

Water-quality data include concentrations of selected major ions, trace elements, and suspended sediment in stream samples collected periodically during water year 1996. Daily values of streamflow, suspended-sediment concentration, and suspended-sediment discharge are given for three stations. Bed-sediment data include trace-element concentrations in the fine-grained and bulk fractions. Biological data include trace-element concentrations in whole-body tissue of aquatic benthic insects. Quality-assurance data are reported for analytical results of water, bed sediment, and biota. Statistical summaries of water-quality, bed-sediment, and biological data are provided for the period of record at each station since 1985.

INTRODUCTION

The Clark Fork originates near Warm Springs in western Montana at the confluence of Silver Bow and Warm Springs Creeks (fig. 1). Along the 148-mi reach of stream from Silver Bow Creek in Butte to the Clark Fork at Milltown Reservoir, six major tributaries enter: Blacktail Creek, Warm Springs Creek, Little Blackfoot River, Flint Creek, Rock Creek, and Blackfoot River. Principal surface-water uses in the 6,000-mi^2 Clark Fork basin above Missoula include irrigation, stock watering, light industry, hydroelectric power generation, and habitat for trout fisheries. Current land uses primarily are cattle production, logging, mining, and recreation. Large-scale mining and smelting had been prevalent land uses in the upper basin for more than one hundred years, but are now largely discontinued.

Deposits of copper, gold, silver, and lead ores were extensively mined, milled, and smelted in the drainages of Silver Bow and Warm Springs Creeks from about 1860 to 1980. Moderate- and small-scale mining also occurred in the basins of most of the major tributaries to the upper Clark Fork. Tailings derived from mineral processing commonly contain large quantities of trace elements such as cadmium, copper, lead, and zinc. Tailings have been eroded, mixed with stream sediment, and transported downstream since the late 1800's and redeposited in stream channels, on flood plains, and in the Warm Springs Ponds and Milltown Reservoir. The widely dispersed tailings continue to be eroded, transported, and redeposited along the stream channel and flood plain, especially during high flows. The occurrence of trace elements in elevated concentrations can pose a risk to aquatic biota and human health because they may accumulate to potentially toxic levels.

Concern about the potential toxicity of tailings to aquatic biota and human health has resulted in a comprehensive effort by State, Federal, and private entities to characterize the aquatic resources in the upper Clark Fork basin to guide and monitor remedial cleanup activities. A long-term data base was

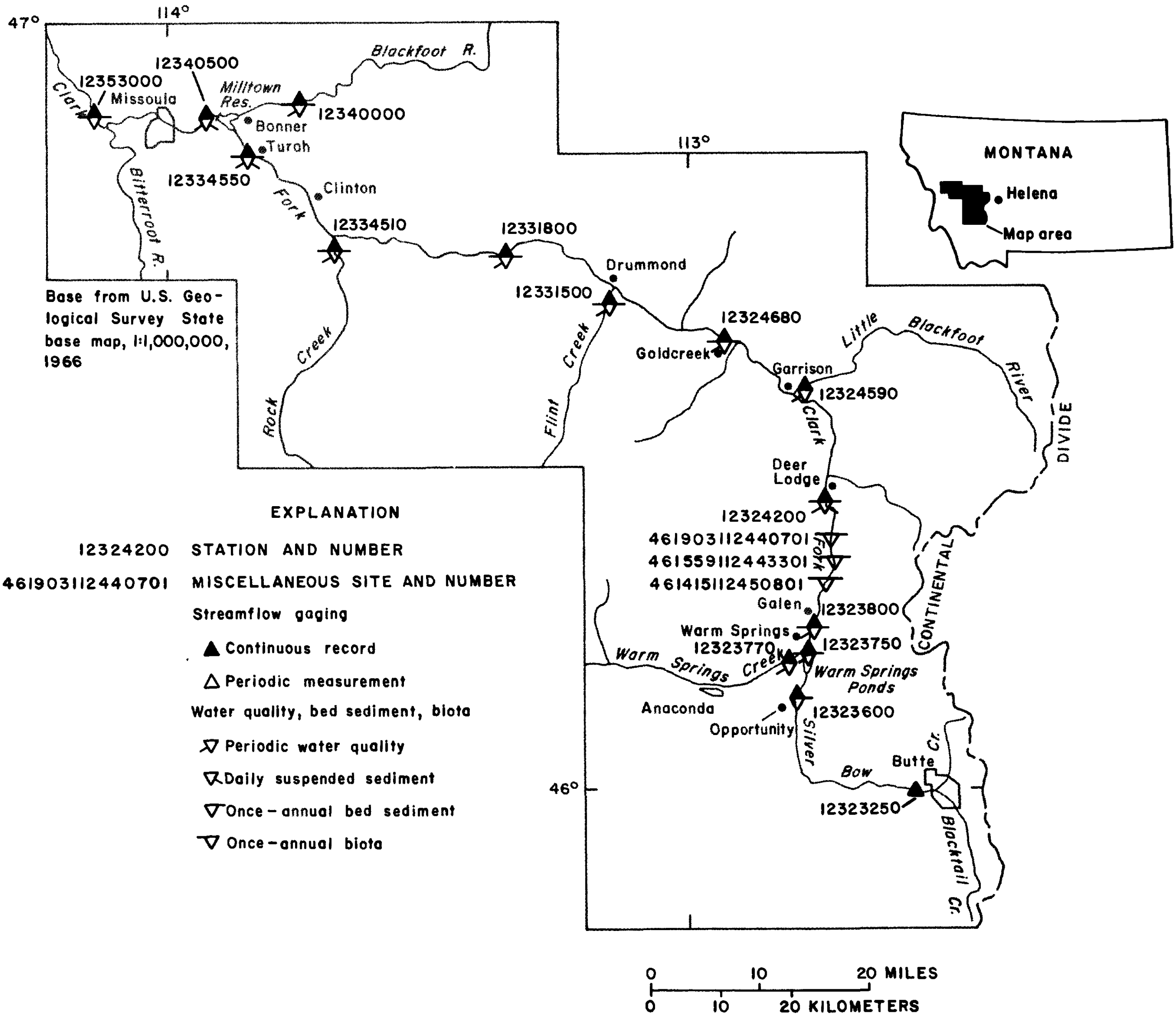

Figure 1. Location of study area.

considered necessary to detect trends over time in order to evaluate the effectiveness of remediation. Water-quality data have been collected by the U.S. Geological Survey (USGS) at selected sites in the upper Clark Fork basin since 1985 (Lambing, 1987, 1988, 1989, 1990, and 1991; Lambing and others, 1994, 1995; and Dodge and others, 1996). Trace-element data for bed sediment and biota (aquatic benthic insects) have been collected intermittently since 1986 at selected sites as part of studies on bed-sediment contamination and bioaccumulation of metals conducted by the USGS National Research Program (Axtmann and Luoma, 1991; Cain and others, 1992). In March 1993, an expanded sampling program for water, bed sediment, and biota was implemented in cooperation with the U.S. Environmental Protection Agency to provide systematic, long-term monitoring. In 1996, water-quality and daily sediment sampling in the expanded program was scaled back to a less extensive network and reduced sampling frequency. A portion of the sampling program--daily suspended-sediment sampling at Clark Fork above Missoula--was resumed in March 1996 in cooperation with the Confederated Salish and Kootenai Tribes. Three bed sediment and biological sampling sites were added in 1996 in the reach between Galen and Deer Lodge to improve the spatial resolution of accumulation characteristics.

The purpose of this report is to present water-quality data for 12 stations and trace-element data for 14 bed-sediment and 13 biological stations in the upper Clark Fork basin collected from October 1995 through September 1996 (water year 1996). Quality-assurance data are presented for water quality, bed sediment, and biota. Statistical summaries also are provided for water-quality, bed-sediment, and biological data collected since 1985.

SAMPLING LOCATIONS AND TYPES OF DATA

Sampling stations in the upper Clark Fork basin are located on both the Clark Fork mainstem and major tributaries from Warm Springs to below Missoula (fig. 1). Streamflow-gaging stations are operated at selected sampling stations, plus on Silver Bow Creek from Butte to Opportunity. Mainstem sampling sites were selected to divide the upper Clark Fork into reaches of relatively uniform length, with each reach encompassing either a major tributary or depositional environment (Warm Springs Ponds and Milltown Reservoir). Tributaries were sampled to describe water-quality characteristics for major hydrologic sources in the upper basin and to provide reference comparisons to the mainstem for bed sediment and biota. Water-quality data were obtained periodically at 12 stations; daily suspended-sediment data were obtained at 3 of these stations. Data for 14 bed-sediment and 13 biological stations were obtained once-annually (table 1).

Table 1. Type and period of data collection at sampling stations in the upper Clark Fork basin, Montana

[Abbreviation: P, present (1996). Symbol: --, no data]

Station number (fig. 1)	Station name	Continuous-record streamflow	Periodic water quality[1]	Daily suspended sediment	Fine-grained bed sediment[2]	Bulk bed sediment[2]	Biota[2]
12323250	Silver Bow Creek below Blacktail Creek, at Butte	10/83-P	03/93-08/95	--	--	--	--
12323600	Silver Bow Creek at Opportunity	07/88-P	03/93-08/95	03/93-09/95	07/92-P	08/93-08/95	07/92, 08/94-08/95
12323750	Silver Bow Creek at Warm Springs	03/72-09/79, 04/93-P	03/93-P	04/93-09/95	07/92-P	08/93, 08/95-P	07/92-P
12323770	Warm Springs Creek at Warm Springs	10/83-P	03/93-P	--	08/95	08/95	08/95
12323800	Clark Fork near Galen	07/88-P	07/88-P	--	08/87, 08/91-P	08/93-P	08/87, 08/91-P
461415112450801	Clark Fork below Lost Creek, near Galen	--	--	--	08/96	08/96	08/96
461559112443301	Clark Fork near Racetrack	--	--	--	08/96	08/96	08/96
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	--	--	--	08/96	08/96	08/96
12324200	Clark Fork at Deer Lodge	10/78-P	03/85-P	03/85-08/86, 04/87-P	08/86, 08/87, 08/90-P	08/93-P	08/86,08/87,08/90-P
12324590	Little Blackfoot River near Garrison	10/72-P	03/85-P	--	08/86, 08/87, 08/94	08/94	08/87, 08/94
12324680	Clark Fork at Goldcreek	10/77-P	03/93-P	--	07/92-P	08/93-P	07/92-P
12331500	Flint Creek near Drummond	08/90-P	03/85-P	--	08/86, 08/89, 07/92-P	08/93-P	08/86, 07/92-P
12331800	Clark Fork near Drummond	04/93-P	03/93-P	--	08/86, 08/87, 08/91-P	08/93-P	08/86, 08/91-P
12334510	Rock Creek near Clinton	10/72-P	03/85-P	--	08/86, 08/87, 08/89, 08/91-P	08/93-P	08/87, 08/91-P
12334550	Clark Fork at Turah Bridge, near Bonner	03/85-P	03/85-P	03/85-P	08/86, 08/91-P	08/93-P	08/86, 08/91-P
12340000	Blackfoot River near Bonner	10/39-P	03/85-P	07/86-03/87, 06/88-09/95	08/86, 08/87, 08/91, 08/93-P	08/93-08/94	08/86,08/87,08/91, 08/93, 08/96
12340500	Clark Fork above Missoula	03/29-P	07/86-P	07/86-03/87, 06/88-01/96 03/96-P	--	--	--
12353000	Clark Fork below Missoula[3]	10/29-P	03/85-08/95	--	08/86, 08/90-P	08/93-P	08/86, 08/90-P

[1]Onsite measurements of physical properties and laboratory analyses of selected major ions, trace elements, and suspended sediment.
[2]Laboratory analyses of trace elements.
[3]Bed sediment and biota sampled about 30 miles downstream from water-quality station to conform to previous sampling location.

A list of properties and constituents analyzed in samples of water, bed sediment, and biota is given in table 2. Results of analyses for water, bed sediment, and biota for water year 1996 are listed in tables 4 through 20 at the back of the report. Statistical summaries of water-quality, bed-sediment, and biological data collected since 1985 are given in tables 21-24 at the back of the report.

Quality assurance of data was maintained through the use of 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 sampling, processing, or analysis.

WATER-QUALITY DATA

Water-quality data consist of measurements of physical properties and concentrations of chemical and physical constituents analyzed in stream samples. Samples were collected 4 to 6 times per year on a schedule designed to describe seasonal and hydrologic variability.

Methods

Cross-sectional water samples were collected from multiple verticals across the stream using depth- and width-integration methods described by USGS (1977), 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 suspended-sediment samplers (DH-81 and D-74TM) which are either constructed of plastic or coated with a non-metallic epoxy paint, and equipped with nylon nozzles.

Onsite measurements of water temperature, specific conductance, and pH were made during collection of periodic water-quality samples. Onsite sample processing, including filtration and acidification, was performed according to procedures described by Horowitz and others (1994), Ward and Harr (1990), USGS (1977), and Knapton (1985). Instantaneous streamflow at the time of water sampling was determined at all stations, either by direct measurement or from stage-discharge rating tables (Rantz and others, 1982).

Water samples were analyzed for the constituents listed in table 2 by the USGS National Water Quality Laboratory (NWQL) in Arvada, Colo. The trace elements arsenic, cadmium, copper, iron, lead, manganese, and zinc were analyzed for both dissolved and total-recoverable concentrations. Analytical methods are described by Fishman and Friedman (1989) and Fishman (1993).

Table 2. Properties and constituents analyzed in samples of water, bed sediment, and biota from the upper Clark Fork basin, Montana

Water		Bed sediment	Biota
Property	**Constituent**	**Constituent**	**Constituent**
Streamflow	Hardness	Cadmium	Cadmium
Specific conductance	Calcium	Chromium	Chromium
pH	Magnesium	Copper	Copper
Temperature	Arsenic	Iron	Iron
	Cadmium	Lead	Lead
	Copper	Manganese	Manganese
	Iron	Nickel	Nickel
	Lead	Silver	Zinc
	Manganese	Zinc	
	Zinc		
	Suspended sediment		

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).

At the three daily suspended-sediment stations (table 1), suspended-sediment samples were collected 2 to 7 times per week. These samples were collected by local contracted observers using the depth-integration method at a single vertical near mid-stream. The samples were analyzed for suspended-sediment concentration and were used to determine daily mean suspended-sediment concentrations according to methods described by Porterfield (1972).

Results

Water-quality data for samples collected periodically during October 1995 through September 1996 (water year 1996) are presented in table 4. The types of data include instantaneous streamflow, onsite measurements of water-quality properties, and analytical results for chemical constituents and suspended sediment.

Daily streamflow and suspended-sediment data for water year 1996 at the three daily suspended-sediment stations are given in tables 5 through 7. Monthly descriptive statistics for each parameter are provided along with totals for the annual discharge of water and suspended sediment. The total suspended-sediment discharge for the Clark Fork above Missoula represents only a partial year due to temporary suspension of the daily sediment program.

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 by the Montana District sediment laboratory 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, spikes, and 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 5 percent of the total number of water-quality samples. Therefore, the total number of quality-control samples represented about 15 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 Technical Development and 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 external evaluation studies twice-yearly with the U.S. Environmental Protection Agency, the Canadian Center for Inland Water, and the Branch of Technical Development and 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 variability. 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 precision for samples exposed to all sources of variability, replicate samples were obtained in the field by splitting a composite stream sample. Analyses of these field replicates indicate the reproducibility of environmental data that are affected by the combined variability potentially introduced by field and laboratory processes.

Analytical precision was evaluated by excluding field sources of variability. Replicate analyses were made of an individual sample selected randomly in the laboratory from the group of samples comprising each analytical run. A separate analysis of the sample was made at the beginning and end of each analytical run to provide information on laboratory analytical precision independent of possible effects on precision caused by field collection and processing of samples.

Spiked samples are used to evaluate the ability of an analytical method to accurately measure a known amount of analyte added to a sample. Because some constituents in stream water can potentially interfere with the analysis of a targeted analyte, it is important to determine whether such effects are causing inaccurate analyses. Deionized-water blanks and aliquots of stream samples were spiked in the laboratory with known amounts of the same trace elements analyzed in water samples. Analyses of spiked blanks indicate if the spiking procedure and analytical method are within control for a water matrix that is presumably free of chemical interference. Analyses of spiked aliquots of stream samples indicate if the chemical matrix of the stream water interferes with the analytical measurement and whether these interferences could contribute significant bias to reported trace-element concentrations for stream samples.

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 routinely tested was a "field" blank. Field blanks are aliquots of deionized water that are certified as trace-element free and are processed through the 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.

All water samples were handled in accordance with chain-of-custody procedures that provide documentation of sample identity, shipment, receipt, and laboratory handling. All samples submitted from a sampling episode were stored and analyzed as a discrete sample group, independent of other samples submitted to the NWQL. Therefore, statistical descriptions of quality-control data generated for this program are directly applicable to the analytical results for stream samples reported herein.

Data-quality objectives (table 3) were established for water-quality data as part of the study plan for the expanded long-term monitoring program that was initiated in 1993. The objectives identify analytical requirements of detectability and serve as a guide for identifying questionable data by establishing limits for precision and bias of laboratory results. Comparisons of quality-control data to data-quality objectives are used to evaluate whether sampling and analytical procedures are producing environmentally representative data in a consistent manner. Data that did not meet the objectives were evaluated for acceptability, and corrective action was taken, when appropriate.

The precision of analytical results for a constituent can be determined by estimating a standard deviation of the differences between replicate measurements for several sets of samples. These replicate measurements may consist either of individual analyses of a pair of samples considered to be essentially identical (field replicates) or multiple analyses of an individual sample (laboratory replicates). The differences in concentration between replicate analyses can be used to estimate a standard deviation according to the following equation (Taylor, 1987):

$$S = \sqrt{\frac{\Sigma d^2}{2k}} \quad (1)$$

where

S = standard deviation of the difference in concentration between replicate analyses,

d = difference in concentration between each pair of replicate analyses, and

k = number of pairs of replicate analyses.

Table 3. Data-quality objectives for analyses of water-quality samples collected in the upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter; mm, millimeter. Symbol: --, not determined]

Constituent	Data-quality objectives		
	Detectability	Precision	Bias
	Minimum reporting level, in units	Maximum relative standard deviation of laboratory replicate analyses, in percent	Maximum deviation of spike recovery, in percent
Calcium, dissolved	0.1 mg/L	20	--
Magnesium, dissolved	.1 mg/L	20	--
Arsenic, total recoverable	1 µg/L	20	25
Arsenic, dissolved	1 µg/L	20	25
Cadmium, total recoverable	1 µg/L	20	25
Cadmium, dissolved	.1 µg/L	20	25
Copper, total recoverable	1 µg/L	20	25
Copper, dissolved	1 µg/L	20	25
Iron, total recoverable	10 µg/L	20	25
Iron, dissolved	3 µg/L	20	25
Lead, total recoverable	1 µg/L	20	25
Lead, dissolved	.5 µg/L	20	25
Manganese, total recoverable	10 µg/L	20	25
Manganese, dissolved	1 µg/L	20	25
Zinc, total recoverable	10 µg/L	20	25
Zinc, dissolved	3 µg/L	20	25
Sediment, suspended	1 mg/L	--	--
Sediment, suspended (percent finer than 0.062 mm)	1 percent	--	--

Precision also can be expressed as a relative standard deviation (RSD), in percent, which is computed from the standard deviation and the mean concentration for all the replicate analyses. Expressing precision relative to a mean concentration standardizes comparison of precision among individual constituents. The RSD, in percent, is calculated according to the following equation (Taylor, 1987):

$$RSD = \frac{S}{\bar{x}} \times 100 \qquad (2)$$

where

RSD = relative standard deviation,

S = standard deviation, and

$\bar{x}$ = mean of all replicate concentrations.

Paired analyses of field replicates are presented in table 8. The precision estimated for each constituent based on these paired results, which include both field and laboratory sources of variability, is reported in table 9. Statistics for precision of field-replicate analyses were based on the values reported in table 8, which are rounded to standard USGS reporting levels for the particular constituent and its analytical method (Timme, 1994).

Data-quality objectives for precision are not directly applicable to field replicates because of the inability to determine whether the variability results from field sample collection and processing, or laboratory handling and analysis. However, a statistical calculation of precision for the field replicates is provided in table 9 to illustrate overall reproducibility of environmental data that incorporates both field and laboratory sources of variability. Relative standard deviations estimated from differences in analytical results between field replicates were within 20 percent for all constituents, except dissolved lead. This exceedance was a mathematical artifact caused by the predominance of low concentrations at or below the minimum reporting level.

Analytical precision for chemical constituents based on replicate laboratory analyses of individual samples, which includes only laboratory sources of variability, is reported in table 10. Statistics for analytical precision of laboratory-replicate analyses are based on unrounded values stored in laboratory data files. Concentrations less than the minimum reporting level (censored values) were included in the calculations by arbitrarily substituting a value of one-half the reporting level.

The data-quality objective for analytical precision is a maximum relative standard deviation of 20 percent for laboratory-replicate analyses. Precision estimates for laboratory-replicate analyses were within the 20-percent relative standard deviation limits for almost all constituents (table 10). However, laboratory-replicate analyses for dissolved cadmium and total-recoverable zinc did not meet objectives. The reason for exceedance of the 20-percent limit for dissolved cadmium was the imprecision of one pair of analyses at the analytical detection limit. The exceedance of the 20-percent limit for total-recoverable zinc was due to poor precision for one pair of analyses. Excluding this one pair of replicate analyses results in a relative standard deviation of 1.4 percent. The large effects on the precision statistics by individual samples is partly a function of the small sample sizes imposed by the reduced sampling frequency. The precision data, therefore, indicate that reproducibility is random and not an indication of systematic analytical procedure problems.

Analyses of an unspiked sample and a spiked aliquot of the same sample provide a measure of the recovery efficiency for the analytical method within the chemical matrix of the sample. Spike recovery, in percent, was calculated using equation 3 (see below).

The data-quality objective for acceptable spike recovery of trace elements in water samples was a maximum deviation of 25 percent from a theoretical 100-percent recovery of added constituent. At the laboratory, a spiked deionized-water blank and a spiked aliquot of a stream sample were prepared and analyzed along with the original unspiked sample. The differences between the spiked and unspiked sample concentrations were determined and used to compute recovery according to equation 3. If the spike recovery for a trace element was outside a range of 75 to 125 percent, the instrument was recalibrated and the entire sample set and spiked samples were reanalyzed for that particular trace element until recoveries were within acceptable limits. Results of recovery efficiency for individual trace elements in spiked deionized-water blanks and spiked stream samples are presented in tables 11 and 12, respectively.

The mean spike recovery for deionized-water samples spiked with trace elements ranged from 82.3 to 104.1 percent. The mean spike recovery for spiked stream samples ranged from 88.4 to 105.9 percent. The 95-percent confidence intervals (Taylor, 1987) for the mean of spike recovery for each constituent did not

$$\text{Spike recovery in percent} = \frac{\text{spiked sample concentration} - \text{unspiked sample concentration}}{\text{spike concentration}} \times 100 \qquad (3)$$

exceed a 25-percent deviation from an expected 100-percent recovery except for dissolved iron in spiked deionized-water blanks, and total-recoverable cadmium and iron in spiked stream water. The principal factor contributing to exceeding the 25 percent deviation is the small number of sample sets (3) measured as a result of reduced sampling frequency. Because all mean spike recoveries were within the 25 percent limit, spike recoveries for each trace element were considered to be within the limits of data-quality objectives and indicate acceptable analytical performance for stream samples. High or low bias is indicated if the confidence interval does not include 100 percent. All laboratory-spiked stream samples (table 12) had confidence intervals for percent recovery that included 100 percent. Because of the small number of sample sets, and mean spike recoveries that met data-quality objectives, no adjustments were made to analytical results for stream samples on the basis of spike recoveries.

Analytical results for field blanks are presented in table 13. A field blank with constituent concentrations equal to or less than the minimum reporting level for the analytical method indicates that the entire process of sample collection, field processing, and laboratory analysis is presumably free of significant contamination. If detectable concentrations in field blanks were equal to or greater than twice the minimum reporting level (typical measurement precision at the detection level), the concentrations were noted during data review. Analytical results from the field blank for the next sample set is evaluated for a consistent trend that may indicate systematic contamination. Sporadic, infrequent exceedances of twice the minimum reporting level probably represent random contamination or instrument calibration error that is not persistent in the process and which is not likely to cause significant positive bias in analytical results. However, if concentrations for a particular constituent exceed twice the minimum reporting level in field blanks from two consecutive field trips, blank samples are collected from individual components of the processing sequence and are submitted for analysis in order to identify the source of contamination.

Constituent concentrations in field blanks were almost always less than the minimum reporting level. There was only one occurrence of a value equaling twice the minimum reporting level, and there were no occurrences of detectable concentrations for any trace element in two consecutive blank samples. Therefore, the analytical results for field blanks indicate no systematic contamination that would bias the reported water-quality data for stream samples.

BED-SEDIMENT DATA

Bed-sediment data consist of analyses of solid-phase concentrations of trace elements in the fine-grained and bulk fractions. Bed-sediment samples are collected once-annually during low, stable flow conditions to facilitate data comparisons between years.

Methods

Bed-sediment samples were collected in August 1996 using protocols described by E.V. Axtmann (U.S. Geological Survey, written commun., 1994). Samples were collected from the surfaces of streambed deposits in low-velocity areas near the edge of the stream using an acid-washed polypropylene scoop. Whenever possible, samples were collected from both sides of the stream. Three composite samples of fine-grained bed sediment and one composite sample of bulk bed sediment were collected at each site.

Individual samples of fine-grained bed sediment were collected by scooping material from the surfaces of three to five randomly selected deposits along pool or low-velocity areas. The three to five individual samples were combined to form a single composite sample. This collection process was repeated three times to obtain three composite samples. Each composite sample was wet-sieved onsite through a 0.064-mm nylon-mesh sieve using ambient stream water. The fraction of bed sediment in each composite sample that was finer than 0.064 mm was transferred to an acid-washed 500-mL polyethylene bottle and transported to the laboratory on ice.

Individual samples of bulk bed sediment also were collected by scooping material from the surfaces of three to five randomly selected deposits. Because the streambed at most sampling locations is predominantly gravel and cobble, deposits were selected where cobbles and gravel could be excluded from the samples. Bulk bed-sediment samples are not sieved and generally are composed of particles smaller than about 10 mm in diameter. The individual unsieved samples were composited into an acid-washed polyethylene bottle and transported to the laboratory on ice.

Bed-sediment samples were prepared for analysis at the USGS National Research Program laboratory in Boulder, Colo. Fine-grained and bulk bed-sediment samples were oven-dried at 60 °C and ground using an acid-washed ceramic mortar and pestle. Duplicate aliquots of approximately 0.6 g of sediment from each of the three composite fine-grained bed sediment samples were digested using a hot, concentrated nitric acid reflux according to methods described by Luoma and Bryan (1981). Triplicate aliquots were analyzed from the single composite sample of bulk bed sediment. After a digestion period of up to several weeks, the aliquots were evaporated to dryness on a hot plate. The dry residue was redissolved with 20 mL of 0.6 N (normal) hydrochloric acid. The reconstituted aliquots then were filtered through a 0.45-μm filter using a syringe and in-line disposable filter cartridge. The filtrate was subsequently diluted to either a 1:5 or 1:10 ratio with 0.6 N hydrochloric acid. These final solutions were assigned a sequential number and sent without station identification to the Geology Department at the University of Montana, Missoula, Mont., to be analyzed for cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc using Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES). Silver was analyzed in undiluted digests by flame atomic absorption (AA) at the USGS National Research Program laboratory in Boulder, Colo.

Results

Solid-phase concentrations of trace elements measured in samples of fine-grained and bulk bed sediment collected during August 1996 are summarized in tables 14 and 15, respectively. Liquid-phase concentrations, in μg/mL, that were analyzed in the reconstituted aliquots of digested bed sediment were converted to solid-phase concentrations, in μg/g, using the following equation:

$$\mu g/g = \frac{\mu g/mL \times \text{volume of digested sample, in mL}}{\text{dry weight of sample, in g} \times \text{dilution ratio}} \quad (4)$$

The reported solid-phase concentrations in table 14 and 15 are the means of all analyses of replicate aliquots from each composite sample collected at the site. Because the conversion from liquid-phase to solid-phase concentration is dependent on both the dilution ratio and the dry weight of the sample, minimum reporting levels for some trace elements may differ between stations and among years.

Quality Assurance

The protocols for field collection and processing of bed-sediment samples are designed to prevent contamination from metal sources. Non-metallic sampling and processing equipment was acid-washed and rinsed with deionized water prior to the first sample collection. Nylon-mesh sieves were washed in a laboratory-grade detergent and rinsed with deionized water. All equipment was given a final rinse onsite with stream water. Sampling equipment that was reused at each site was rinsed between sites with 10-percent nitric acid, deionized water, and stream water. Separate sieves were used at each site and, therefore, did not require between-site cleaning.

Quality assurance of analytical results for bed sediment included laboratory instrument calibration with standard solutions and analysis of quality-control samples designed to identify the presence and magnitude of bias (E.V. Axtmann, written commun., 1994). Quality-control samples consisted of standard reference materials and procedural blanks. Each type of sample was analyzed in a proportion equivalent to about 10 to 20 percent of the total number of bed-sediment samples.

Standard reference materials (SRM) are commercially prepared materials that have certified concentrations of trace elements. Replicate analyses of standard reference materials are used to indicate the reproducibility of analytical results and the ability of the method to accurately measure a known quantity of a constituent. Recovery efficiency of trace-element analyses of standard reference materials for bed sediment is summarized in table 16. Two standard reference materials consisting of agricultural soils representing low and high concentrations of trace elements were analyzed to test recovery efficiency for a range of concentrations generally similar to those occurring in the upper Clark Fork basin. The digestion process used to analyze bed-sediment samples is not a "total" digestion (does not liberate elements associated with crystalline lattices); therefore, 100-percent recovery may not be achieved for elements strongly bound to the sediment. The percent recovery of trace elements in standard reference materials under such conditions serve to indicate which trace elements display strong sediment-binding characteristics and whether analytical recovery is consistent between multiple sets of analyses.

Although data-quality objectives have not been established for bed sediment, elements with mean recoveries outside a 25-percent deviation from complete recovery were chromium, copper, and silver for the low-concentration range (SRM 2709), and chromium for the high-concentration range (SRM 2711). Mean recoveries were 100 percent or less for all elements, except cadmium and silver, indicating that the digestion during sample preparation does not release all of the element from the solid-phase matrix. The most notable recovery anomaly was 261 percent for silver in the low-range SRM. The reason for this high recovery is believed to be the result of analyzing concentrations near the detection limit, coupled with signal enhancement resulting from matrix interference. No adjustments were made to trace-element concentrations in bed-sediment samples on the basis of recovery efficiencies.

Procedural blanks for bed-sediment samples consisted of the same reagents used for sample digestion and reconstitution. Concentrated nitric acid used for sample digestion was heated and evaporated to dryness. After evaporation, 0.6 N hydrochloric acid was added quantitatively to the dry residue to obtain the same dilution ratio as that used in the analysis of bed sediment. Procedural blanks, therefore, represent the same chemical matrix as the reagents used to digest and reconstitute bed-sediment samples. Analytical results for procedural blanks can indicate the presence and magnitude of potential contamination associated with sample handling and analysis in the laboratory environment. Results of trace-element analyses of procedural blanks for bed sediment are in table 17.

Analytical results of procedural blanks are reported as a liquid-phase concentration, in µg/mL, which is equivalent to parts per million. Determination of the significance of a detectable blank concentration is based on the magnitude of the equivalent solid-phase concentration, in µg/g, relative to the ambient concentration of the trace element in bed-sediment samples. Because sample weights of individual aliquots may vary, the relative significance of blank concentrations may differ among samples. If a detectable blank concentration, after conversion to a solid-phase concentration, represents 10 percent or more of the ambient solid-phase concentration, then the blank concentration is subtracted to remove potential contamination bias. Almost all procedural blanks had concentrations less than analytical detection levels. No detectable concentrations were twice the detection level or greater than 10 percent of the ambient concentration. Therefore, no adjustments were made to trace-element concentrations in bed-sediment samples on the basis of procedural blanks.

BIOLOGICAL DATA

Biological data consist of analyses of solid-phase concentrations of trace elements in the whole-body tissue of aquatic benthic insects. Insect samples are collected once-annually at the same stations where bed-sediment samples are collected (table 1). Biota samples are collected concurrently with bed-sediment samples to facilitate comparisons of results between years and between concentrations in bed sediment and biota.

Methods

Insect samples were collected using protocols described by M.I. Hornberger (U.S. Geological Survey, written commun., 1994). Immature stages of aquatic benthic insects were collected using a large nylon-mesh kick net. A single riffle at each station was sampled repeatedly until an adequate number of individuals was collected to provide sufficient mass for analysis. Targeted taxa for collection were *Hydropsyche* spp., Family Trichoptera (caddisflies); *Arctopsyche grandis*, Family Trichoptera; and *Claassenia sabulosa*, Family Plecoptera (stoneflies). Samples of each taxon were stored separately, by genus, in acid-washed plastic containers. Containers were kept on ice in the field while the insects were allowed to evacuate the gut contents in ambient stream water for a period of six to eight hours. Excess water then was drained and insects were frozen for transport to the laboratory.

Insect samples were processed and analyzed at the USGS National Research Program laboratory in Menlo Park, Calif. Insects were thawed and rinsed with ultra-pure deionized water to remove particulate matter, then sorted to their lowest possible taxonomic level. When large numbers of specimens were collected from a station, similar-sized individuals were composited into replicate subsamples. Subsamples were placed in tared scintillation vials and oven-dried at 70 °C. Subsamples were weighed to obtain a final dry weight and digested by reflux using concentrated nitric acid (Cain and others, 1992). After digestion, insect samples were evaporated to dryness on a hot plate. The dry residue was reconstituted in 0.6 N hydrochloric acid, filtered through a 0.45-μm filter, and analyzed undiluted by ICAPES for cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc.

Results

Solid-phase concentrations of trace elements in whole-body tissue of aquatic insects collected during August 1996 are summarized in table 18. The variability in the number of composite samples between species and between sites reflects the difference in insect abundance, with number of composite samples increasing with abundance of insects. Liquid-phase concentrations analyzed in the reconstituted samples were converted to solid-phase concentrations using equation 4. As in bed sediment, minimum reporting levels may differ between sites as a result of variable sample weights. In general, the smaller the biological sample weight (a function of insect abundance), the higher the minimum reporting level. Therefore, higher minimum reporting levels do not necessarily imply a higher trace-element concentration in tissue.

Two genera of *Hydropsyche* were collected for this study: *Hydropsyche occidentalis* and *Hydropsyche morosa* group. Two species of *Hydropsyche* were identified within the *morosa* group (*H. cockerelli* and *H. tana*). Results of analyses are listed for the individual species within the *morosa* group where positive identification was possible. In some instances (as noted at the individual station), a sample was not positively identifiable as *H. cockerelli* although it could be identified as belonging to the *morosa* group. These samples are most likely *H. cockerelli* based on a distinct head pattern. However, the small size of the insect made it difficult to definitively determine the species. When positive identification of species was not possible, *Hydropsyche* spp. was used.

Quality Assurance

The protocols for field collection and processing of biota samples are designed to prevent contamination from metal sources. Non-metallic nets, sampling, and processing equipment were employed in all sample collection. Equipment was acid-washed and rinsed in ultra-pure deionized water prior to the first sample collection. Nets and equipment were thoroughly rinsed in ambient stream water at each new mainstem station. New nets and depuration chambers were used for the tributary stations. In addition, biota samples were collected concurrently with bed-sediment samples along an increasing concentration gradient to minimize effects from station-to-station carryover contamination.

Quality assurance of analytical results for biota samples included laboratory instrument calibration with standard solutions and analyses of quality-control samples designed to identify the presence and magnitude of bias (M.I. Hornberger, written commun., 1994). Quality-control samples consisted of standard reference material and procedural blanks. Each type of sample was analyzed in a proportion equivalent to about 10 to 20 percent of the total number of biota samples.

Recovery efficiency for trace-element analyses of standard reference material for biota is summarized in table 19. The reference material tested was oyster tissue. Data-quality objectives have not been established for analytical recovery in biota, but mean recoveries were within 25 percent of complete recovery for all trace elements, with the exception of lead (mean recovery within 28 percent). A slightly low bias is indicated for iron and manganese (confidence interval does not include 100 percent). No adjustments were made to trace-element concentrations for insect samples on the basis of recovery efficiency.

Results of trace-element analyses of procedural blanks for biota are in table 20. Procedural blanks for biota consisted of the same reagents used to digest and reconstitute tissue of aquatic insects. The blanks were analyzed undiluted at a proportion of one blank per site. Analytical results for blanks indicated no significant contamination bias, although a blank correction for iron was applied to the Blackfoot River samples. The change of iron concentrations using this correction is very small (less than 15 μg/g) and does not significantly affect the iron concentrations in the samples. The adjusted values are reported in table 18. No other adjustments for procedural blanks were necessary because all blanks had concentrations that, when converted to solid-phase concentrations, were less than 10 percent of ambient solid-phase trace-element concentrations in insects.

STATISTICAL SUMMARIES OF DATA

Statistical summaries of water-quality, bed-sediment, and biological data are provided in tables 21-24 for the period of record at each station since 1985. The summaries include the period of record, number of samples, maximum, minimum, mean, and median of concentrations.

Statistical summaries of water-quality data (table 21) are based on results of samples collected periodically during the station's period of record. Statistical summaries of bed-sediment (table 22 and 23) and biological data (table 24) are based on results of samples collected once-annually during the indicated years. Because not all stations were sampled for bed sediment and biota every year, these data do not represent a consecutive annual record.

Sample sizes and statistics for bed-sediment data are based on the annual mean concentrations determined from the combined results of composite samples for a given year. Therefore, sample sizes for bed sediment represent the number of years sampled. Sample sizes and statistics for biological data are based on individual analyses for each composite sample collected in individual years rather than the combined annual mean concentration. Biota sample sizes therefore reflect differences in species abundance between sites and between years. The statistics for biota describe the full range of trace-element concentrations measured among all available composite samples. The abundance of aquatic insects at a particular site in a given year limits the biomass of the sample which, in turn, may result in different taxa analyzed between years or in variable analytical detection limits. Where minimum reporting levels vary between years, statistical summaries are provided only as a general indication of the range of detection.

The presence or absence of insect species at a given site can vary between years and may result in different taxa being analyzed in the long-term period of record. Because *Hydropsyche* insects were not sorted to the species level during 1986-89, statistics for stations sampled during those years are based on the results of all *Hydropsyche* species combined. At some sites, statistics for the *Hydropsyche morosa* group are based on the combined results for two or more species because these samples could not be identified clearly to the species, but had *morosa* characteristics.

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DATA

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996

[Abbreviations: ft^3/s, cubic feet per second; °C, degrees Celsius; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; mm, millimeter; ton/d, tons per day. Symbols: <, less than minimum reporting level; --, no data]

12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Feb 1996									
08...	0900	183	384	8.4	0.5	150	44	9.9	94
Mar									
12...	0715	147	461	8.7	2.0	190	57	11	36
Apr									
16...	0940	223	401	8.7	7.0	160	49	9.6	31
May									
14...	0810	284	348	8.3	9.0	140	42	8.3	45
Jun									
05...	1645	447	300	8.8	15.5	120	37	7.2	38
Jul									
22...	0945	103	365	8.9	16.0	150	44	10	33

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Feb 1996								
08...	60	<1	0.2	64	32	1,100	93	15
Mar								
12...	25	<1	.3	80	40	640	60	10
Apr								
16...	24	<1	<.1	39	17	450	31	7
May								
14...	33	<1	<.1	28	12	1,000	31	8
Jun								
05...	30	<1	<.1	22	12	510	21	3
Jul								
22...	27	<1	<.1	12	7	160	19	2

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
08...	1.0	390	310	80	25	58	29	80
Mar								
12...	<.5	600	530	130	34	12	4.8	87
Apr								
16...	<.5	200	110	70	15	9	5.4	88
May								
14...	<.5	130	61	60	9	43	33	82
Jun								
05...	<.5	80	47	20	<3	26	31	76
Jul								
22...	<.5	90	54	<10	6	4	1.1	84

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Apr 1996									
16...	1045	57	365	8.2	6.0	180	55	11	6
May									
14...	0915	113	267	8.2	7.0	130	40	7.3	12
Jun									
05...	1750	379	154	7.9	11.0	73	23	3.8	23
Jul									
22...	1045	67	269	8.2	12.0	130	40	7.4	6

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Apr 1996								
16...	4	<1	<0.1	11	3	110	4	1
May								
14...	5	<1	<.1	52	5	820	10	5
Jun								
05...	11	<1	<.1	85	14	1,200	25	9
Jul								
22...	5	<1	<.1	8	2	100	7	1

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Apr 1996								
16...	<0.5	280	260	<10	<3	6	0.92	85
May								
14...	<.5	310	140	20	<3	51	16	75
Jun								
05...	<.5	280	57	30	<3	69	71	74
Jul								
22...	<.5	160	150	<10	3	5	.90	87

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12323800--CLARK FORK NEAR GALEN, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Feb 1996									
08...	1030	251	380	8.2	1.0	160	46	10	78
Mar									
12...	0830	205	435	8.4	2.0	180	54	11	32
Apr									
16...	1220	290	398	8.5	7.0	170	52	10	26
May									
14...	1030	407	330	8.1	9.0	140	42	8.2	37
Jun									
05...	1525	841	235	8.6	13.0	100	31	5.7	36
Jul									
22...	1145	165	336	8.6	15.0	150	44	9.1	25

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Feb 1996								
08...	53	<1	0.2	87	32	1,400	81	13
Mar								
12...	23	<1	.2	60	32	600	48	9
Apr								
16...	21	<1	<.1	38	14	470	22	6
May								
14...	26	<1	<.1	59	10	1,200	20	9
Jun								
05...	12	<1	<.1	72	14	1,200	21	8
Jul								
22...	21	<1	<.1	11	7	140	10	1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
08...	0.8	400	260	100	22	51	35	85
Mar								
12...	<.5	490	380	100	23	17	9.4	89
Apr								
16...	<.5	220	120	60	7	14	11	81
May								
14...	<.5	250	70	70	4	58	64	75
Jun								
05...	<.5	230	43	50	4	67	152	58
Jul								
22...	<.5	90	58	<10	4	4	1.8	74

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12324200--CLARK FORK AT DEER LODGE, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Feb 1996									
08...	1225	992	376	8.0	1.0	140	41	9.2	220
Mar									
12...	1015	437	430	8.2	2.5	190	56	12	35
Apr									
16...	1355	444	447	8.2	8.5	200	59	12	28
May									
14...	1220	558	371	8.3	11.0	160	48	9.6	38
Jun									
05...	1945	1,010	242	8.1	14.0	100	32	5.9	56
Jul									
22...	1315	172	399	8.6	18.0	180	52	11	22

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Feb 1996								
08...	36	5	0.2	960	85	19,000	190	140
Mar								
12...	20	<1	.1	94	23	1,300	41	12
Apr								
16...	17	<1	<.1	96	14	1,100	14	11
May								
14...	20	<1	.2	150	14	2,100	13	21
Jun								
05...	20	<1	<.1	240	27	3,100	31	30
Jul								
22...	20	<1	<.1	18	10	130	6	1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
08...	1.3	1,900	130	1,100	50	976	2,610	55
Mar								
12...	<.5	220	70	100	20	68	80	60
Apr								
16...	<.5	180	31	80	13	53	64	54
May								
14...	<.5	240	36	130	8	129	194	47
Jun								
05...	<.5	260	45	130	10	177	483	57
Jul								
22...	<.5	60	33	<10	6	6	2.8	70

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Apr 1996									
16...	1520	400	189	7.9	6.0	88	26	5.7	6
May									
14...	1405	459	191	8.0	9.5	86	25	5.8	8
Jun									
05...	0800	693	179	8.0	9.5	82	24	5.3	7
Jul									
22...	1420	81	269	8.4	19.5	130	37	8.3	7

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Apr 1996								
16...	4	<1	<0.1	4	2	590	89	3
May								
14...	4	<1	<.1	4	1	1,200	34	4
Jun								
05...	5	<1	<.1	6	2	520	44	2
Jul								
22...	6	<1	<.1	<1	<1	190	8	<1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Apr 1996								
16...	2.5	40	7	<10	3	27	29	69
May								
14...	.5	70	10	20	<3	63	78	60
Jun								
05...	<.5	40	12	<10	4	29	54	57
Jul								
22...	<.5	40	16	<10	3	2	.44	79

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12324680--CLARK FORK AT GOLDCREEK, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Feb 1996									
08...	1415	1,560	286	7.9	0.5	110	32	7.5	31
Mar									
13...	0915	1,020	308	8.2	2.0	130	40	8.5	20
Apr									
16...	1700	1,020	338	8.1	8.0	150	45	9.4	18
May									
17...	0845	1,810	245	8.1	8.0	100	31	6.3	48
Jun									
05...	1000	2,060	226	8.0	11.0	96	29	5.7	26
Jul									
22...	1530	372	390	8.4	20.0	180	53	11	17

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Feb 1996								
08...	14	<1	<0.1	120	36	3,200	100	16
Mar								
13...	10	<1	<.1	66	15	1,500	61	9
Apr								
16...	11	<1	<.1	68	10	1,000	29	9
May								
17...	13	<1	<.1	230	15	4,900	36	36
Jun								
05...	11	<1	<.1	93	13	1,900	27	14
Jul								
22...	15	<1	<.1	18	8	200	<3	2

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
08...	0.6	380	37	170	26	216	910	43
Mar								
13...	<.5	150	20	70	10	80	220	69
Apr								
16...	<.5	130	14	60	8	59	162	64
May								
17...	<.5	380	20	240	9	355	1,730	52
Jun								
05...	<.5	210	15	90	4	121	673	56
Jul								
22...	<.5	60	21	10	7	11	11	77

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12331500--FLINT CREEK NEAR DRUMMOND, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Feb 1996									
11...	1415	352	203	8.1	0.5	85	22	7.3	19
Mar									
13...	1100	186	253	8.3	3.0	120	31	9.7	13
Apr									
17...	0840	388	204	8.1	5.0	90	24	7.4	16
May									
18...	0700	547	149	8.0	7.5	66	18	5.1	29
Jun									
05...	1130	539	152	8.0	9.0	68	19	5.0	29
Jul									
22...	1645	102	335	8.6	19.0	160	44	12	19

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Feb 1996								
11...	10	<1	<0.1	15	6	1,500	200	14
Mar								
13...	7	<1	<.1	5	2	630	77	6
Apr								
17...	7	<1	.1	12	5	1,300	160	12
May								
18...	6	<1	<.1	9	3	1,600	86	26
Jun								
05...	9	<1	<.1	9	5	1,200	48	22
Jul								
22...	12	<1	<.1	4	1	420	8	7

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
11...	2.1	220	32	40	7	82	78	72
Mar								
13...	.9	100	14	20	<3	32	16	87
Apr								
17...	.7	160	15	30	<3	70	73	87
May								
18...	.7	340	25	70	<3	121	179	72
Jun								
05...	.7	280	32	60	3	96	140	66
Jul								
22...	<.5	150	40	20	3	30	8.3	80

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12331800--CLARK FORK NEAR DRUMMOND, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Feb 1996									
08...	1645	3,520	189	7.8	0.5	74	21	5.2	27
Mar									
13...	1250	1,280	338	8.2	4.5	150	44	10	27
Apr									
17...	1100	1,720	337	8.1	7.0	150	44	10	19
May									
17...	0700	2,270	264	8.0	9.0	120	35	7.5	40
Jun									
05...	1300	2,670	245	8.0	13.0	110	33	6.9	30
Jul									
23...	0915	466	475	8.3	17.0	220	63	14	19

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Feb 1996								
08...	11	<1	<0.1	120	16	3,300	150	19
Mar								
13...	11	<1	<.1	110	17	2,300	55	14
Apr								
17...	10	<1	<.1	66	9	1,300	50	12
May								
17...	13	1	<.1	200	13	3,900	31	31
Jun								
05...	13	<1	<.1	92	13	2,300	27	23
Jul								
23...	15	<1	<.1	20	6	270	7	3

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
08...	0.9	420	39	210	20	289	2,750	38
Mar								
13...	<.5	230	16	150	14	126	435	79
Apr								
17...	<.5	160	17	80	7	83	385	70
May								
17...	<.5	380	15	250	10	259	1,590	65
Jun								
05...	<.5	240	23	120	5	149	1,070	61
Jul								
23...	<.5	70	17	20	6	16	20	84

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12334510--ROCK CREEK NEAR CLINTON, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Apr 1996									
17...	1340	1,220	86	7.8	6.0	38	9.6	3.3	1
May									
16...	1440	3,060	58	7.6	7.0	25	6.5	2.1	2
Jun									
06...	0830	3,550	58	7.4	7.0	26	6.8	2.1	2
Jul									
25...	1030	558	127	8.2	14.0	57	15	4.7	<1

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Apr 1996								
17...	<1	<1	<0.1	5	<1	270	110	<1
May								
16...	<1	<1	<.1	27	2	1,400	92	2
Jun								
06...	<1	<1	<.1	4	2	770	69	1
Jul								
25...	<1	<1	<.1	<1	<1	70	15	<1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Apr 1996								
17...	<0.5	10	2	<10	<3	13	43	65
May								
16...	<.5	60	3	<10	<3	154	1,270	42
Jun								
06...	<.5	30	3	<10	<3	83	796	54
Jul								
25...	<.5	<10	3	<10	3	3	4.5	65

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Feb 1996									
11...	1100	3,600	240	7.9	0.5	100	29	7.3	23
Mar									
13...	1525	2,060	286	8.2	5.0	130	37	9.0	18
Apr									
17...	1605	3,610	235	8.1	8.0	100	29	7.3	10
May									
16...	1200	6,070	161	7.9	9.0	70	20	4.9	15
Jun									
06...	1045	7,300	147	7.9	10.5	66	19	4.4	14
Jul									
23...	1145	1,250	291	8.4	16.0	130	38	9.4	7

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Feb 1996								
11...	13	<1	<0.1	180	19	2,000	110	11
Mar								
13...	9	<1	<.1	56	15	1,400	48	9
Apr								
17...	5	<1	<.1	62	9	750	56	6
May								
16...	5	<1	<.1	70	7	2,500	61	14
Jun								
06...	6	<1	<.1	52	8	1,500	54	9
Jul								
23...	7	<1	<.1	8	4	150	7	<1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
11...	0.6	230	17	110	22	100	972	61
Mar								
13...	<.5	140	12	80	12	74	412	79
Apr								
17...	<.5	90	13	40	7	48	468	62
May								
16...	<.5	220	13	120	5	188	3,080	54
Jun								
06...	<.5	140	15	80	7	128	2,520	55
Jul								
23...	<.5	30	9	10	6	8	27	76

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12340000--BLACKFOOT RIVER NEAR BONNER, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Apr 1996									
18...	1030	5,130	174	8.0	4.5	88	23	7.3	2
May									
16...	0800	7,470	159	8.0	7.5	80	21	6.7	2
Jun									
06...	1315	8,900	158	8.1	13.5	79	21	6.5	2
Jul									
25...	1310	1,400	233	8.6	17.5	120	30	10	1

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Apr 1996								
18...	<1	<1	<0.1	29	4	400	65	2
May								
16...	<1	<1	<.1	10	3	1,200	31	2
Jun								
06...	<1	<1	<.1	6	3	1,200	30	2
Jul								
25...	1	<1	<.1	3	<1	60	4	<1

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Apr 1996								
18...	<0.5	30	2	<10	4	30	416	75
May								
16...	<.5	70	2	<10	<3	124	2,500	69
Jun								
06...	<.5	70	4	<10	<3	130	3,120	66
Jul								
25...	<.5	10	3	<10	<3	6	23	79

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1995 through September 1996 (Continued)

12340500--CLARK FORK ABOVE MISSOULA, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Feb 1996									
09...	0930	9,840	183	7.9	1.0	72	20	5.3	69
Mar									
14...	0825	3,710	245	8.2	3.0	110	31	8.7	10
Apr									
18...	0830	9,230	198	8.1	5.5	95	26	7.4	5
May									
16...	0930	14,000	163	8.1	8.0	78	21	6.1	7
Jun									
06...	1515	16,600	154	8.1	10.5	76	21	5.7	7
Jul									
25...	1430	2,480	261	8.4	18.0	120	33	9.9	4

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Feb 1996								
09...	9	5	<0.1	400	11	13,000	200	78
Mar								
14...	4	<1	<.1	37	7	1,300	88	5
Apr								
18...	3	<1	<.1	18	4	510	62	3
May								
16...	2	<1	<.1	28	4	1,400	37	5
Jun								
06...	3	<1	<.1	37	5	1,400	40	6
Jul								
25...	3	<1	<.1	6	3	90	7	<1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Feb 1996								
09...	1.2	1,100	230	1,100	15	824	21,900	59
Mar								
14...	<.5	100	17	70	5	97	972	44
Apr								
18...	<.5	50	10	20	6	36	897	75
May								
16...	<.5	110	8	40	<3	123	4,650	70
Jun								
06...	<.5	110	16	50	<3	119	5,330	72
Jul								
25...	<.5	30	19	<10	<3	6	40	92

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1995 through September 1996

[Abbreviations: ft^3/s, cubic feet per second; mg/L, milligrams per liter; ton/d, tons per day. Symbol: ---, no data]

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
				1995					
	October			November			December		
1	244	8	5.3	263	15	11	364	19	19
2	240	10	6.5	253	21	14	383	19	20
3	251	12	8.1	257	24	17	350	19	18
4	261	12	8.5	260	21	15	336	19	17
5	266	12	8.6	262	17	12	271	20	15
6	263	10	7.1	267	14	10	259	20	14
7	264	10	7.1	264	13	9.3	259	21	15
8	266	10	7.2	286	13	10	204	22	12
9	267	10	7.2	306	13	11	185	22	11
10	272	10	7.3	283	13	9.9	207	23	13
11	272	11	8.1	283	13	9.9	297	24	19
12	274	11	8.1	296	13	10	341	24	22
13	276	13	9.7	292	14	11	329	24	21
14	270	15	11	291	14	11	298	25	20
15	266	15	11	293	14	11	289	25	20
16	262	15	11	292	14	11	287	25	19
17	260	14	9.8	283	14	11	275	26	19
18	269	13	9.4	292	14	11	220	26	15
19	271	13	9.5	273	14	10	210	27	15
20	274	12	8.9	265	14	10	210	27	15
21	279	12	9.0	257	14	9.7	200	27	15
22	281	11	8.3	269	14	10	200	27	15
23	280	12	9.1	282	15	11	187	28	14
24	281	12	9.1	280	17	13	180	28	14
25	277	12	9.0	287	17	13	169	29	13
26	276	13	9.7	313	17	14	180	29	14
27	274	13	9.6	294	17	13	183	30	15
28	269	12	8.7	293	17	13	186	30	15
29	269	12	8.7	315	17	14	175	30	14
30	267	12	8.7	328	18	16	179	31	15
31	266	12	8.6	---	---	---	191	31	16
TOTAL	8,307	---	267.9	8,479	---	351.8	7,604	---	499
MEAN	268	12	8.6	283	15	12	245	25	16
MAX	281	15	11	328	24	17	383	31	22
MIN	240	8	5.3	253	13	9.3	169	19	11

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1995 through September 1996 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
	1996								
	January			**February**			**March**		
1	197	31	16	115	17	5.3	210	50	28
2	204	32	18	120	18	5.8	229	32	20
3	225	32	19	130	20	7.0	230	57	35
4	208	32	18	130	21	7.4	235	52	33
5	190	32	16	150	22	8.9	233	39	25
6	200	33	18	250	85	57	244	44	29
7	220	33	20	533	359	517	289	42	33
8	233	33	21	936	835	2,110	326	68	60
9	222	34	20	1,020	555	1,530	336	71	64
10	227	34	21	587	131	208	380	107	110
11	222	34	20	457	100	123	488	148	195
12	221	34	20	429	100	116	416	78	88
13	223	34	20	447	92	111	399	63	68
14	225	34	21	452	83	101	394	58	62
15	241	34	22	432	75	87	393	47	50
16	257	33	23	374	67	68	326	46	40
17	252	32	22	343	60	56	307	42	35
18	204	29	16	330	57	51	311	44	37
19	192	28	15	324	57	50	302	41	33
20	225	29	18	317	58	50	301	39	32
21	228	32	20	312	63	53	301	40	33
22	220	34	20	295	59	47	298	33	27
23	210	29	16	273	57	42	292	36	28
24	190	22	11	264	55	39	259	44	31
25	180	16	7.8	207	52	29	269	45	33
26	160	14	6.0	200	52	28	292	48	38
27	140	14	5.3	190	50	26	284	39	30
28	130	15	5.3	190	48	25	274	32	24
29	130	15	5.3	195	49	26	276	37	28
30	120	15	4.9	---	---	---	275	29	22
31	120	16	5.2	---	---	---	281	31	24
TOTAL	6,216	---	490.8	10,002	---	5,584.4	9,450	---	1,395
MEAN	201	28	16	345	114	193	305	51	45
MAX	257	34	23	1,020	835	2,110	488	148	195
MIN	120	14	4.9	115	17	5.3	210	29	20

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1995 through September 1996 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment	
		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)
	1996								
	April			May			June		
1	294	51	40	368	29	29	753	55	112
2	321	51	44	360	24	23	738	47	94
3	319	40	34	369	20	20	757	48	98
4	311	34	29	360	20	19	831	71	159
5	311	30	25	349	25	24	933	132	333
6	310	39	33	339	19	17	972	126	331
7	323	43	38	333	15	13	943	90	229
8	357	59	57	328	19	17	944	84	214
9	394	99	105	353	21	20	1,010	93	254
10	461	166	207	372	21	21	1,080	114	332
11	583	244	384	396	36	38	1,130	119	363
12	569	150	230	420	33	37	1,100	101	300
13	514	83	115	465	54	68	1,030	87	242
14	482	61	79	549	120	178	992	73	196
15	455	57	70	625	170	287	977	66	174
16	440	57	68	687	196	364	959	62	161
17	435	46	54	801	257	556	956	61	157
18	416	43	48	843	195	444	923	60	150
19	428	38	44	860	153	355	848	58	133
20	406	35	38	829	124	278	713	50	96
21	405	36	39	774	92	192	655	52	92
22	397	34	36	734	71	141	674	59	107
23	381	39	40	720	58	113	661	50	89
24	395	46	49	690	63	117	575	39	61
25	431	47	55	658	57	101	602	39	63
26	409	38	42	642	54	94	576	42	65
27	405	32	35	668	60	108	549	37	55
28	395	34	36	689	70	130	533	32	46
29	389	29	30	741	71	142	496	34	46
30	377	31	32	743	61	122	467	34	43
31	---	---	---	741	57	114	---	---	---
TOTAL	12,113	---	2,136	17,806	---	4,182	24,377	---	4,795
MEAN	404	60	71	574	73	135	813	67	160
MAX	583	244	384	860	257	556	1,130	132	363
MIN	294	29	25	328	15	13	467	32	43

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1995 through September 1996 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
				1996					
	July			August			September		
1	440	31	37	73	9	1.8	141	12	4.6
2	447	28	34	77	10	2.1	140	12	4.5
3	451	25	30	83	10	2.2	140	13	4.9
4	426	21	24	79	11	2.3	140	13	4.9
5	409	19	21	83	11	2.5	137	14	5.2
6	372	18	18	76	10	2.1	147	14	5.6
7	335	16	14	73	9	1.8	148	13	5.2
8	310	14	12	70	7	1.3	144	13	5.1
9	300	13	11	62	5	.84	138	12	4.5
10	303	11	9.0	57	5	.77	140	11	4.2
11	276	9	6.7	53	5	.72	137	12	4.4
12	265	8	5.7	55	6	.89	129	13	4.5
13	267	8	5.8	50	6	.81	126	13	4.4
14	254	8	5.5	57	6	.92	128	14	4.8
15	225	9	5.5	73	6	1.2	145	14	5.5
16	220	9	5.3	92	6	1.5	184	15	7.5
17	224	10	6.0	97	7	1.8	179	15	7.2
18	212	11	6.3	109	9	2.6	176	15	7.1
19	207	12	6.7	150	14	5.7	182	14	6.9
20	202	14	7.6	132	12	4.3	185	13	6.5
21	198	11	5.9	119	11	3.5	183	12	5.9
22	169	7	3.2	113	11	3.4	180	11	5.3
23	171	7	3.2	109	10	2.9	180	12	5.8
24	162	8	3.5	109	10	2.9	177	13	6.2
25	132	9	3.2	108	10	2.9	186	14	7.0
26	113	10	3.1	112	10	3.0	189	16	8.2
27	99	10	2.7	111	12	3.6	189	15	7.7
28	89	11	2.6	128	13	4.5	194	14	7.3
29	81	10	2.2	147	14	5.6	194	13	6.8
30	85	10	2.3	146	13	5.1	192	12	6.2
31	82	9	2.0	147	13	5.2	—	—	—
TOTAL	7,526	—	305.0	2,950	—	80.75	4,850	—	173.9
MEAN	243	13	9.8	95	9	2.6	162	13	5.8
MAX	451	31	37	150	14	5.7	194	16	8.2
MIN	81	7	2.0	50	5	.72	126	11	4.2

TOTAL FOR WATER YEAR 1996:
STREAMFLOW–119,680 ft³/s
SEDIMENT DISCHARGE–20,261.55 tons

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1995 through September 1996

[Abbreviations: ft^3/s, cubic feet per second; mg/L, milligrams per liter; ton/d, tons per day. Symbol: ---, no data]

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
					1995				
		October			**November**			**December**	
1	970	11	29	898	5	12	2,380	69	443
2	970	11	29	869	5	12	2,430	56	367
3	988	11	29	845	7	16	2,050	30	166
4	1,050	11	31	865	8	19	1,850	16	80
5	1,090	11	32	931	8	20	1,610	12	52
6	1,080	11	32	946	9	23	1,320	11	39
7	1,060	11	31	947	10	26	1,260	10	34
8	1,060	11	31	952	10	26	1,200	9	29
9	1,050	11	31	1,020	11	30	900	8	19
10	1,040	11	31	1,070	11	32	1,000	8	22
11	1,030	11	31	1,030	11	31	1,300	8	28
12	1,070	12	35	1,100	14	42	1,600	15	65
13	1,100	13	39	1,130	15	46	1,890	48	245
14	1,080	12	35	1,090	10	29	1,560	47	198
15	1,040	12	34	1,090	8	24	1,390	34	128
16	1,040	12	34	1,100	7	21	1,330	23	83
17	1,040	11	31	1,080	7	20	1,270	15	51
18	1,070	11	32	1,060	7	20	1,150	14	43
19	1,100	11	33	1,050	6	17	950	14	36
20	1,080	10	29	1,010	6	16	1,000	14	38
21	1,050	10	28	958	6	16	1,060	14	40
22	1,050	10	28	991	7	19	1,000	17	46
23	1,040	9	25	1,010	8	22	850	14	32
24	1,030	9	25	1,020	8	22	750	14	28
25	1,030	8	22	1,090	11	32	700	14	26
26	1,030	8	22	1,260	21	71	670	13	24
27	1,020	8	22	1,270	20	69	650	13	23
28	997	7	19	1,230	14	46	650	13	23
29	976	7	18	1,250	12	40	700	14	26
30	967	6	16	1,710	28	129	800	17	37
31	950	5	13	---	---	---	950	29	74
TOTAL	32,148	---	877	31,872	---	948	38,220	---	2,545
MEAN	1,037	10	28	1,062	10	32	1,233	20	82
MAX	1,100	13	39	1,710	28	129	2,430	69	443
MIN	950	5	13	845	5	12	650	8	19

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1995 through September 1996 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
				1996					
	January			February			March		
1	1,040	15	42	400	7	7.6	1,050	24	68
2	936	13	33	400	8	8.6	1,160	26	81
3	943	13	33	450	11	13	1,180	19	61
4	1,020	13	36	500	16	22	1,160	14	44
5	850	13	30	600	19	31	1,120	11	33
6	800	13	28	800	21	45	994	9	24
7	900	13	32	2,000	42	227	1,030	13	36
8	966	18	47	5,000	580	7,830	1,100	15	45
9	934	15	38	8,000	605	13,100	1,210	19	62
10	954	13	33	9,010	393	9,560	1,460	57	225
11	915	12	30	3,720	146	1,470	2,210	173	1,030
12	882	12	29	2,670	97	699	2,420	176	1,150
13	875	12	28	2,370	122	781	2,080	88	494
14	907	14	34	2,280	108	665	1,880	48	244
15	994	20	54	2,190	61	361	1,780	42	202
16	1,100	26	77	1,930	38	198	1,740	34	160
17	1,000	28	76	1,800	33	160	1,640	30	133
18	800	25	54	1,780	34	163	1,540	23	96
19	700	23	43	1,950	50	263	1,480	20	80
20	800	26	56	1,880	43	218	1,450	19	74
21	850	35	80	1,730	30	140	1,470	17	67
22	850	22	50	1,760	30	143	1,480	18	72
23	800	12	26	1,610	24	104	1,480	16	64
24	800	6	13	1,460	22	87	1,320	13	46
25	750	4	8.1	1,370	29	107	1,170	15	47
26	750	5	10	1,150	33	102	1,230	15	50
27	700	5	9.4	941	24	61	1,350	19	69
28	600	5	8.1	917	18	45	1,270	13	45
29	500	6	8.1	935	20	50	1,250	9	30
30	450	6	7.3	---	----	---	1,230	9	30
31	400	7	7.6	---	---	---	1,220	10	33
TOTAL	25,766	---	1,060.6	61,603	---	36,661.2	44,154	---	4,895
MEAN	831	15	34	2,124	92	1,260	1,424	33	158
MAX	1,100	35	80	9,010	605	13,100	2,420	176	1,150
MIN	400	4	7.3	400	7	7.6	994	9	24

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1995 through September 1996 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment	
		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)
	1996								
	April			May			June		
1	1,250	9	30	2,960	18	144	5,730	76	1,180
2	1,430	18	69	2,930	16	127	5,450	66	971
3	1,610	38	165	2,810	13	99	5,600	81	1,220
4	1,510	27	110	2,630	12	85	6,240	136	2,290
5	1,450	17	67	2,550	12	83	7,140	205	3,950
6	1,480	17	68	2,530	11	75	7,440	197	3,960
7	1,670	32	144	2,480	11	74	6,920	164	3,060
8	2,190	102	603	2,430	12	79	6,810	123	2,260
9	2,830	190	1,450	2,390	10	65	7,620	155	3,190
10	3,810	325	3,340	2,380	11	71	8,190	271	5,990
11	5,650	390	5,950	2,400	11	71	7,770	165	3,460
12	5,550	226	3,390	2,630	16	114	7,150	132	2,550
13	4,810	124	1,610	3,190	35	301	6,260	102	1,720
14	4,070	79	868	4,020	78	847	5,760	91	1,420
15	3,710	61	611	5,030	149	2,020	5,540	64	957
16	3,550	50	479	5,970	171	2,760	5,510	61	907
17	3,570	46	443	6,590	201	3,580	5,450	61	898
18	3,450	43	401	7,380	303	6,040	5,290	53	757
19	3,280	34	301	7,490	303	6,130	4,870	62	815
20	3,130	32	270	6,960	206	3,870	4,200	47	533
21	3,000	28	227	6,280	115	1,950	3,830	37	383
22	2,890	25	195	5,640	96	1,460	4,120	41	456
23	2,810	27	205	5,440	70	1,030	4,100	41	454
24	3,200	46	397	5,350	86	1,240	3,730	30	302
25	3,810	74	761	5,180	98	1,370	3,780	28	286
26	3,610	43	419	4,940	70	934	3,610	23	224
27	3,410	30	276	5,100	65	895	3,410	22	203
28	3,260	24	211	5,450	81	1,190	3,230	21	183
29	3,150	21	179	5,940	125	2,000	3,060	21	174
30	3,020	18	147	6,310	153	2,610	2,860	18	139
31	---	---	---	6,100	111	1,830	---	---	---
TOTAL	92,160	---	23,386	139,480	---	43,144	160,670	---	44,892
MEAN	3,072	73	780	4,499	86	1,390	5,356	86	1,500
MAX	5,650	390	5,950	7,490	303	6,130	8,190	271	5,990
MIN	1,250	9	30	2,380	10	65	2,860	18	139

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1995 through September 1996 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
	1996								
	July			**August**			**September**		
1	2,710	16	117	921	9	22	721	9	18
2	2,590	16	112	919	8	20	722	9	18
3	2,590	17	119	914	7	17	719	8	16
4	2,490	17	114	890	6	14	718	8	16
5	2,430	17	112	907	6	15	709	8	15
6	2,350	16	102	892	5	12	725	7	14
7	2,220	15	90	877	5	12	732	7	14
8	2,100	14	79	839	5	11	724	7	14
9	1,980	13	69	802	5	11	704	7	13
10	1,910	12	62	770	5	10	683	9	17
11	1,820	11	54	727	4	7.9	666	11	20
12	1,760	9	43	699	4	7.5	664	13	23
13	1,690	8	37	673	4	7.3	667	15	27
14	1,630	8	35	668	4	7.2	709	15	29
15	1,590	8	34	661	4	7.1	734	14	28
16	1,520	8	33	656	5	8.9	794	13	28
17	1,490	9	36	651	5	8.8	853	13	30
18	1,520	12	49	643	5	8.7	848	13	30
19	1,440	13	51	680	7	13	879	13	31
20	1,350	12	44	714	8	15	896	13	31
21	1,310	12	42	710	7	13	902	12	29
22	1,290	11	38	697	7	13	889	12	29
23	1,250	8	27	680	7	13	896	11	27
24	1,200	7	23	662	7	13	903	9	22
25	1,150	8	25	633	7	12	908	8	20
26	1,090	8	24	620	7	12	906	9	22
27	1,010	9	25	627	7	12	906	10	24
28	962	9	23	678	10	18	893	11	27
29	931	10	25	754	12	24	895	12	29
30	947	10	26	780	11	23	902	12	29
31	960	10	26	743	10	20	---	---	---
TOTAL	51,280	---	1,696	23,087	---	408.4	23,867	---	690
MEAN	1,654	11	55	745	7	13	796	11	23
MAX	2,710	17	119	921	12	24	908	15	31
MIN	931	7	23	620	4	7.1	664	7	13

TOTAL FOR WATER YEAR 1996:
STREAMFLOW-- 724,307 ft^3/s
SEDIMENT DISCHARGE--161,203.3 tons

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1995 through September 1996

[Abbreviations: ft³/s, cubic feet per second; mg/L, milligrams per liter; ton/d, tons per day. Symbol: ---, no data. Missing sediment data during January-March due to suspension of daily sediment program]

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
	1995								
	October			**November**			**December**		
1	1,530	4	17	1,460	2	7.9	5,290	38	543
2	1,530	4	17	1,310	2	7.1	5,360	31	449
3	1,550	4	17	1,380	2	7.5	4,700	19	241
4	1,660	4	18	1,330	2	7.2	4,270	14	161
5	1,680	4	18	1,520	2	8.2	3,710	12	120
6	1,650	5	22	1,550	3	13	3,150	9	77
7	1,610	5	22	1,480	3	12	3,010	7	57
8	1,600	5	22	1,510	4	16	2,740	6	44
9	1,600	5	22	1,600	4	17	2,050	6	33
10	1,590	5	21	1,680	4	18	2,100	7	40
11	1,560	5	21	1,690	4	18	2,900	9	70
12	1,580	5	21	1,720	5	23	3,140	13	110
13	1,650	4	18	1,830	5	25	3,590	17	165
14	1,640	5	22	1,790	5	24	3,730	36	363
15	1,610	5	22	1,830	4	20	3,330	25	225
16	1,600	5	22	1,860	4	20	3,040	14	115
17	1,600	5	22	1,820	4	20	2,970	7	56
18	1,660	5	22	1,790	4	19	2,630	7	50
19	1,670	4	18	1,770	4	19	2,360	7	45
20	1,670	4	18	1,730	3	14	2,370	9	58
21	1,640	4	18	1,630	3	13	2,430	10	66
22	1,620	4	17	1,680	4	18	2,290	10	62
23	1,610	4	17	1,740	5	23	2,180	10	59
24	1,610	4	17	1,740	5	23	1,980	10	53
25	1,600	4	17	1,970	6	32	1,900	10	51
26	1,610	4	17	2,490	10	67	1,800	10	49
27	1,630	4	18	2,550	10	69	1,700	10	46
28	1,610	4	17	2,550	7	48	1,600	10	43
29	1,590	3	13	2,580	7	49	1,600	10	43
30	1,570	3	13	3,840	15	156	1,800	10	49
31	1,540	3	12	---	---	---	2,000	10	54
TOTAL	49,870	---	578	55,420	---	813.9	87,720	---	3,597
MEAN	1,609	4	19	1,847	5	27	2,830	13	116
MAX	1,680	5	22	3,840	15	156	5,360	38	543
MIN	1,530	3	12	1,310	2	7.1	1,600	6	33

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1995 through September 1996 (Continued)

Day	Mean stream-flow (ft³/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft³/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft³/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)
				1996					
	January			February			March		
1	2,130	10	58	750	---	---	2,090	---	---
2	2,050	10	55	800	---	---	2,240	---	---
3	1,970	10	53	900	---	---	2,200	---	---
4	2,000	10	54	1,100	---	---	2,090	---	---
5	1,500	10	40	1,400	---	---	1,960	---	---
6	1,580	10	43	1,720	---	---	1,710	---	---
7	2,060	10	56	2,140	---	---	1,850	---	---
8	2,110	10	57	4,600	---	---	1,900	---	---
9	2,180	10	59	9,800	---	---	2,000	---	---
10	2,030	10	55	12,900	---	---	2,250	---	---
11	2,010	11	60	6,510	---	---	3,010	---	---
12	2,080	12	67	4,550	---	---	3,630	---	---
13	1,980	12	64	3,990	---	---	3,520	---	---
14	1.900	10	51	3,840	---	---	3,380	120	1,100
15	1,970	10	53	3,630	---	---	3,300	128	1,140
16	2,090	10	56	3,390	---	---	3,350	102	923
17	2,100	12	68	3,260	---	---	3,230	98	855
18	1,380	8	30	3,250	---	---	3,010	92	748
19	1,350	5	18	3,700	---	---	2,900	70	548
20	1,670	9	41	3,790	---	---	2,900	78	611
21	2,100	12	68	3,480	---	---	3,020	87	709
22	1,900	---	---	3,430	---	---	3,000	65	526
23	1,820	---	---	3,230	---	---	2,960	47	376
24	1,670	---	---	2,920	---	---	2,400	18	117
25	1,340	--	---	2,690	---	---	2,140	19	110
26	1,330	--	---	2,220	---	---	2,560	23	159
27	1,300	--	---	1,850	---	---	2,480	19	127
28	1,000	---	---	1,830	---	---	2,380	14	90
29	800	---	---	1,830	---	---	2,410	17	111
30	750	---	---	---	---	---	2,290	14	87
31	700	---	---	---	---	---	2,320	13	81
TOTAL	52,850	---	---	99,500	---	---	80,480	---	---
MEAN	1,705	---	---	3,431	---	---	2,596	---	---
MAX	2,180	---	---	12,900	---	---	3,630	---	---
MIN	700	---	---	750	---	---	1,710	---	---

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1995 through September 1996 (Continued)

Day	Mean stream-flow (ft³/s)	Suspended sediment Mean concen-tration (mg/L)	Suspended sediment Dis-charge (ton/d)	Mean stream-flow (ft³/s)	Suspended sediment Mean concen-tration (mg/L)	Suspended sediment Dis-charge (ton/d)	Mean stream-flow (ft³/s)	Suspended sediment Mean concen-tration (mg/L)	Suspended sediment Dis-charge (ton/d)
	1996								
	April			**May**			**June**		
1	2,310	12	75	7,690	19	394	13,800	64	2,380
2	2,790	15	113	7,540	15	305	13,200	55	1,960
3	3,160	20	171	7,200	13	253	13,400	55	1,990
4	3,120	25	211	6,820	13	239	14,600	70	2,760
5	3,090	26	217	6,510	14	246	16,300	131	5,770
6	3,210	30	260	6,210	15	252	16,700	140	6,310
7	3,680	57	566	6,060	13	213	15,900	108	4,640
8	4,940	135	1,800	5,910	14	223	16,000	96	4,150
9	6,700	205	3,710	5,760	14	218	17,500	128	6,050
10	9,370	250	6,320	5,670	11	168	18,300	176	8,700
11	13,200	292	10,400	5,630	10	152	17,700	150	7,170
12	13,400	200	7,240	6,060	12	196	16,400	102	4,520
13	12,100	105	3,430	7,360	24	477	15,000	74	3,000
14	10,800	64	1,870	9,680	46	1,200	14,000	63	2,380
15	9,830	47	1,250	12,200	105	3,460	13,500	54	1,970
16	9,310	39	980	13,800	125	4,660	13,300	50	1,800
17	9,280	37	927	14,700	145	5,760	13,700	52	1,920
18	9,200	32	795	16,000	200	8,640	13,400	48	1,740
19	8,760	27	639	16,900	215	9,810	12,300	39	1,300
20	8,320	25	562	16,100	145	6,300	10,500	34	964
21	7,970	24	516	14,800	95	3,800	9,460	26	664
22	7,570	26	531	13,800	72	2,680	9,670	26	679
23	7,320	39	771	13,300	56	2,010	10,100	31	845
24	8,400	57	1,290	13,000	53	1,860	9,420	22	560
25	10,000	85	2,300	12,700	55	1,890	9,420	20	509
26	9,910	54	1,440	12,600	54	1,840	9,060	17	416
27	9,330	36	907	13,100	61	2,160	8,800	16	380
28	8,730	28	660	14,100	76	2,890	8,600	15	348
29	8,260	21	468	14,900	91	3,660	8,090	18	393
30	7,890	18	383	15,200	95	3,900	7,530	14	285
31	---	---	---	14,600	80	3,150	---	---	---
TOTAL	231,950	---	50,802	335,900	---	73,006	385,650	---	76,553
MEAN	7,732	68	1,690	10,840	63	2,360	12,850	63	2,550
MAX	13,400	292	10,400	16,900	215	9,810	18,300	176	8,700
MIN	2,310	12	75	5,630	10	152	7,530	14	285

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1995 through September 1996 (Continued)

Day	Mean stream-flow (ft³/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft³/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft³/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)
				1996					
	July			August			September		
1	7,120	12	231	2,190	5	30	1,440	3	12
2	6,950	13	244	2,170	5	29	1,420	3	12
3	6,850	11	203	2,180	5	29	1,420	4	15
4	6,630	9	161	2,160	5	29	1,410	4	15
5	6,350	9	154	2,180	5	29	1,420	4	15
6	6,100	9	148	2,160	5	29	1,430	4	15
7	5,900	9	143	2,120	5	29	1,450	4	16
8	5,600	9	136	2,030	5	27	1,450	4	16
9	4,800	9	117	1,920	4	21	1,420	4	15
10	4,580	9	111	1,850	4	20	1,390	4	15
11	4,400	9	107	1,780	4	19	1,350	5	18
12	4,200	8	91	1,720	4	19	1,330	6	22
13	3,960	8	86	1,630	3	13	1,360	7	26
14	3,780	7	71	1,640	3	13	1,450	6	23
15	3,650	7	69	1,630	3	13	1,460	6	24
16	3,530	7	67	1,590	3	13	1,550	5	21
17	3,380	6	55	1,580	2	8.5	1,630	5	22
18	3,380	6	55	1,550	3	13	1,620	5	22
19	3,250	6	53	1,570	3	13	1,630	5	22
20	3,080	6	50	1,640	3	13	1,640	5	22
21	2,970	5	40	1,590	4	17	1,630	5	22
22	2,870	5	39	1,560	4	17	1,610	5	22
23	2,810	6	46	1,520	4	16	1,610	5	22
24	2,620	6	42	1,480	3	12	1,600	5	22
25	2,550	5	34	1,440	3	12	1,630	5	22
26	2,460	6	40	1,380	3	11	1,630	4	18
27	2,340	6	38	1,420	4	15	1,620	4	17
28	2,270	6	37	1,450	4	16	1,610	4	17
29	2,200	6	36	1,510	5	20	1,600	4	17
30	2,220	6	36	1,570	4	17	1,590	4	17
31	2,270	5	31	1,490	4	16	---	---	---
TOTAL	125,070	---	2,771	53,700	---	578.5	45,400	---	564
MEAN	4,035	7	89	1,732	4	19	1,513	5	19
MAX	7,120	13	244	2,190	5	30	1,640	7	26
MIN	2,200	5	31	1,380	2	8.5	1,330	3	12

TOTAL FOR WATER YEAR 1996:
STREAMFLOW-- 1,603,510 ft³/s
SEDIMENT DISCHARGE (partial year)-- 218,787.4 tons

Table 8. Chemical and suspended-sediment analyses of field replicates for water samples, upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter; mm, millimeter. Symbols: <, less than minimum reporting level; --, no data]

Station number	Station name	Date	Time	Hardness total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
12324590	Little Blackfoot River near Garrison	05-14-96	1405	86	25	5.8	8
		05-14-96	1410	86	25	5.7	8
12324680	Clark Fork at Goldcreek	04-16-96	1700	150	45	9.4	18
		04-16-96	1705	150	45	9.3	18
12334550	Clark Fork at Turah Bridge, near Bonner	02-11-96	1100	100	29	7.3	23
		02-11-96	1105	100	28	7.2	22

Station number	Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
12324590	05-14-96	4	<1	<0.1	4	1	1,200	34	4
	05-14-96	5	<1	<.1	4	1	1,100	33	4
12324680	04-16-96	11	<1	<.1	68	10	1,000	29	9
	04-16-96	10	<1	<.1	73	11	1,000	31	10
12334550	02-11-96	13	<1	<.1	180	19	2,000	110	11
	02-11-96	13	<1	<.1	180	19	1,900	95	11

Station number	Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment, suspended, diameter, percent finer than 0.062 mm
12324590	05-14-96	0.5	70	10	20	<3	63	60
	05-14-96	<.5	70	10	10	<3	66	58
12324680	04-16-96	<.5	130	14	60	8	59	64
	04-16-96	<.5	130	15	70	8	56	66
12334550	02-11-96	.6	230	17	110	22	98	61
	02-11-96	.8	210	17	110	18	102	--

Table 9. Precision of chemical and suspended-sediment analyses of field replicates for water samples, upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter; mm, millimeter. Symbol, --, insufficient data for statistical calculation]

Constituent and reporting unit	Number of replicate pairs	Standard deviation, in units (+/-)	Relative standard deviation, in percent (+/-)
Calcium, dissolved, mg/L	3	0.41	1.2
Magnesium, dissolved, mg/L	3	.07	1.0
Arsenic, total recoverable, µg/L	3	.41	2.5
Arsenic, dissolved, µg/L	3	.58	6.2
Cadmium, total recoverable, µg/L	3	.0	.0
Cadmium, dissolved, µg/L	3	.0	.0
Copper, total recoverable, µg/L	3	2.0	2.4
Copper, dissolved, µg/L	3	.41	4.0
Iron, total recoverable, µg/L	3	58	4.2
Iron, dissolved, µg/L	3	6.2	11
Lead, total recoverable, µg/L	3	.41	5.0
Lead, dissolved, µg/L	3	.13	30
Manganese, total recoverable, µg/L	3	8.2	5.8
Manganese, dissolved, µg/L	3	.41	3.0
Zinc, total recoverable, µg/L	3	5.8	9.1
Zinc, dissolved, µg/L	3	1.6	17
Sediment, suspended, mg/L	3	2.4	3.2
Sediment, suspended, percent finer than 0.062 mm	2	--	--

Table 10. Precision of chemical analyses of laboratory replicates for water samples, upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter]

Constituent and reporting unit	Number of replicate pairs	Standard deviation, in units (+/-)	Relative standard deviation, in percent (+/-)	Within limits of data-quality objective
Calcium, dissolved, mg/L	6	0.33	1.0	Yes
Magnesium, dissolved, mg/L	6	.05	.6	Yes
Arsenic, total recoverable, µg/L	6	.33	1.3	Yes
Arsenic, dissolved, µg/L	6	.37	2.8	Yes
Cadmium, total recoverable, µg/L	6	.0	.0	Yes
Cadmium, dissolved, µg/L	6	.02	36	No
Copper, total recoverable, µg/L	6	3.2	3.9	Yes
Copper, dissolved, µg/L	6	.70	4.5	Yes
Iron, total recoverable, µg/L	6	277	15	Yes
Iron, dissolved, µg/L	6	.95	1.8	Yes
Lead, total recoverable, µg/L	6	.29	2.6	Yes
Lead, dissolved, µg/L	6	.01	3.2	Yes
Manganese, total recoverable, µg/L	6	2.5	1.7	Yes
Manganese, dissolved, µg/L	6	.26	.9	Yes
Zinc, total recoverable, µg/L	6	28	27	No
Zinc, dissolved, µg/L	6	.81	8.4	Yes

Table 11. Recovery efficiency for trace-element analyses of laboratory-spiked deionized-water blanks

[Abbreviation: µg/L, micrograms per liter]

Constituent and reporting unit	Number of samples	95-percent confidence interval for spike recovery, in percent	Mean spike recovery, in percent	Within limits of data-quality objective
Arsenic, total recoverable, µg/L	6	101-107	104.1	Yes
Arsenic, dissolved, µg/L	3	77.1-102	89.7	Yes
Cadmium, total recoverable, µg/L	4	79.7-84.9	82.3	Yes
Cadmium, dissolved, µg/L	4	92.2-98.4	95.3	Yes
Copper, total recoverable, µg/L	4	93.5-106	99.6	Yes
Copper, dissolved, µg/L	4	91.4-107	99.2	Yes
Iron, total recoverable, µg/L	3	76.0-104	89.8	Yes
Iron, dissolved, µg/L	3	70.9-111	90.8	Yes
Lead, total recoverable, µg/L	4	80.2-115	97.4	Yes
Lead, dissolved, µg/L	4	93.3-108	100.5	Yes
Manganese, total recoverable, µg/L	3	77.9-100	89.2	Yes
Manganese, dissolved, µg/L	3	91.6-101	96.5	Yes
Zinc, total recoverable, µg/L	3	82.8-92.8	87.8	Yes
Zinc, dissolved, µg/L	3	84.3-108	96.1	Yes

Table 12. Recovery efficiency for trace-element analyses of laboratory-spiked stream samples, upper Clark Fork basin, Montana

[Abbreviation: µg/L, micrograms per liter]

Constituent and reporting unit	Number of samples	95-percent confidence interval for spike recovery, in percent	Mean spike recovery, in percent	Within limits of data-quality objective
Arsenic, total recoverable, µg/L	6	96.0-110	102.8	Yes
Arsenic, dissolved, µg/L	3	94.4-117	105.9	Yes
Cadmium, total recoverable, µg/L	3	57.8-119	88.4	Yes
Cadmium, dissolved, µg/L	3	91.5-109	100.2	Yes
Copper, total recoverable, µg/L	3	92.3-108	100.3	Yes
Copper, dissolved, µg/L	3	91.9-110	101.1	Yes
Iron, total recoverable, µg/L	3	73.3-114	93.8	Yes
Iron, dissolved, µg/L	3	88.5-114	101.5	Yes
Lead, total recoverable, µg/L	3	98.4-113	105.6	Yes
Lead, dissolved, µg/L	3	90.4-120	105.1	Yes
Manganese, total recoverable, µg/L	3	79.1-102	90.3	Yes
Manganese, dissolved, µg/L	3	92.9-106	99.5	Yes
Zinc, total recoverable, µg/L	3	74.8-124	99.3	Yes
Zinc, dissolved, µg/L	3	90.2-116	103.2	Yes

Table 13. Chemical analyses of field blanks for water samples

[Abbreviations: °C, degrees Celsius; μg/L, micrograms per liter; μS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter. Symbol: <, less than minimum reporting level]

Date	Time	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)
Feb 1996										
08..	2000	4	5.6	<0.02	<0.01	<1	<1	<1	<0.1	2
Mar										
12...	1400	2	5.6	<.02	<.01	<1	<1	<1	<.1	<1
Apr										
17...	1730	3	5.8	<.02	<.01	<1	<1	<1	<.1	<1
May										
16...	1830	3	5.6	<.02	<.01	<1	<1	<1	<.1	<1
Jun										
05...	2130	2	5.4	<.02	<.01	<1	<1	<1	<.1	<1
Jul										
25...	1000	2	6.4	<.02	<.01	<1	<1	<1	<.1	<1

Date	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)
Feb 1996									
08..	<1	<10	<3	<1	<0.5	<10	<1	<10	<3
Mar									
12...	<1	<10	<3	<1	<.5	<10	<1	<10	<3
Apr									
17...	<1	<10	<3	<1	<.5	<10	<1	<10	<3
May									
16...	<1	<10	<3	<1	<.5	<10	<1	<10	<3
Jun									
05...	<1	<10	<3	<1	<.5	<10	<1	<10	<3
Jul									
25...	<1	<10	<3	<1	<.5	<10	<1	<10	3

Table 14. Trace-element analyses of fine-grained bed sediment, upper Clark Fork basin, Montana, August 1996

[Fine-grained sediment is material less than 0.064 millimeter in diameter. Concentrations are the mean of all analyses for replicate aliquots from each composite sample. Abbreviation: µg/g, micrograms per gram of dry sample weight. Symbol: <, less than]

Station number (fig. 1)	Station name	Number of composite samples	Concentration, in µg/g								
			Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Silver	Zinc
12323600	Silver Bow Creek at Opportunity	3	42.0	23.2	4,670	38,400	834	3,940	21.4	17.2	10,800
12323750	Silver Bow Creek at Warm Springs	3	6.7	24.8	344	20,800	73	1,470	14.6	2.1	845
12323800	Clark Fork near Galen	3	7.8	29.9	1,140	28,400	143	4,320	19.7	4.8	1,370
461415112450801	Clark Fork below Lost Creek, near Galen	3	9.0	32.9	1,730	30,800	197	5,900	19.9	6.8	1,680
461559112443301	Clark Fork near Racetrack	3	8.5	30.1	1,370	29,000	155	2,390	18.4	6.1	1,550
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	3	8.1	28.9	1,280	28,200	152	3,910	16.9	6.2	1,570
12324200	Clark Fork at Deer Lodge	3	7.6	36.5	1,210	29,400	155	2,480	19.0	6.0	1,460
12324680	Clark Fork at Goldcreek	3	5.8	34.5	766	24,300	88	2,290	17.2	4.2	1,180
12331500	Flint Creek near Drummond	3	3.1	27.9	64	25,600	174	4,780	14.9	6.6	777
12331800	Clark Fork near Drummond	3	5.2	35.4	609	23,800	83	1,340	16.8	4.0	1,200
12334510	Rock Creek near Clinton	3	<1.5	27.9	10	19,100	<13	554	13.0	.8	45
12334550	Clark Fork at Turah Bridge, near Bonner	3	3.5	34.7	356	21,700	49	749	16.2	2.6	917
12340000	Blackfoot River near Bonner	2	<1.5	24.7	19	18,400	<13	542	13.3	.7	61
12353000	Clark Fork below Missoula[1]	3	1.9	27.6	136	19,500	12	1,260	13.3	1.4	436

[1]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 15. Trace-element analyses of bulk bed sediment, upper Clark Fork basin, Montana, August 1996

[Bulk bed sediment collected in this study generally is material smaller than about 10 millimeters in diameter. Concentrations are the mean of all analyses for replicate aliquots for each composite sample. Abbreviation: µg/g, micrograms per gram of dry sample weight. Symbol: <, less than]

Station number (fig. 1)	Station name	Number of composite samples	Concentration, in µg/g								
			Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Silver	Zinc
12323750	Silver Bow Creek at Warm Springs	1	1.7	11.8	86	11,200	21	884	9.2	1.0	238
12323800	Clark Fork near Galen	1	2.6	23.0	408	31,300	64	1,880	9.9	1.9	653
461415112450801	Clark Fork below Lost Creek, near Galen	1	2.5	12.0	455	16,000	72	1,740	7.7	2.1	632
461559112443301	Clark Fork near Racetrack	1	3.4	16.4	594	18,200	87	1,500	9.9	2.6	743
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1	3.9	17.3	651	20,100	89	1,860	10.0	2.8	804
12324200	Clark Fork at Deer Lodge	1	2.1	19.6	370	20,200	67	653	10.1	1.7	529
12324680	Clark Fork at Goldcreek	1	5.2	29.5	747	22,900	75	2,600	15.9	3.6	1,020
12331500	Flint Creek near Drummond	1	1.5	13.9	30	14,300	84	2,190	6.8	5.3	336
12331800	Clark Fork near Drummond	1	3.9	26.9	491	20,600	58	1,430	13.9	2.8	939
12334510	Rock Creek near Clinton	1	<1.5	14.3	7	11,100	<13	258	8.2	.4	21
12334550	Clark Fork at Turah Bridge, near Bonner	1	2.9	23.8	336	17,900	49	1,320	14.0	2.0	769
12353000	Clark Fork below Missoula[1]	1	<1.5	12.6	58	11,300	<13	444	7.1	.6	163

[1]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 16. Recovery efficiency for trace-element analyses of standard reference materials for bed sediment

[Abbreviations: µg/g, micrograms per gram of dry sample weight; SRM, standard reference material. Symbol: --, recovery could not be determined because all analyses were less than the analytical detection limit of 1.5 µg/g for cadmium and 12.5 µg/g for lead]

Constituent	Number of measurements	Dilution ratio	Certified concentration (µg/g)	Mean SRM recovery (percent)	95-percent confidence interval for SRM recovery (percent)
			SRM sample 2709		
Cadmium	5	1:5	0.4	--	--
Chromium	5	1:5	130	70.6	62.2-79.0
Copper	5	1:5	35	63.0	55.2-70.8
Iron	5	1:5	35,000	83.6	81.5-85.7
Lead	5	1:5	19	--	--
Manganese	5	1:5	538	83.9	82.6-85.2
Nickel	5	1:5	88	89.3	87.9-90.7
Silver	5	1:1	.4	261	220-302
Zinc	5	1:5	106	87.4	84.0-90.8
			SRM sample 2711		
Cadmium	7	1:10	41.7	106	105-107
Chromium	7	1:10	47.0	73.9	67.0-80.8
Copper	7	1:10	114	90.4	87.2-93.6
Iron	7	1:10	28,900	85.7	83.4-88.0
Lead	7	1:10	1,160	100	98.8-101
Manganese	7	1:10	638	83.1	81.7-84.5
Nickel	7	1:10	20.6	92.6	91.4-93.8
Silver	7	1:1	4.6	96.8	91.0-103
Zinc	7	1:10	350	92.8	89.9-95.7

Table 17. Trace-element analyses of procedural blanks for bed sediment

[Abbreviation: µg/mL, micrograms per milliliter. Dilution ratio is the proportion of initial volume of concentrated nitric acid used as a digesting reagent to final volume of solution after addition of 0.6 N hydrochloric acid used for reconstituting dried residue. Symbols: <, less than; --, no data]

Sample identification	Dilution ratio	Trace-element concentration, in µg/mL								
		Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Silver	Zinc
A	1:1	--	--	--	--	--	--	--	<0.01	--
A	1:5	<0.009	<0.009	<0.006	<0.015	<0.08	<0.006	<0.009	--	0.006
B	1:1	--	--	--	--	--	--	--	<.01	--
B	1:5	<.009	<.009	<.006	<.015	<.08	<.006	<.009	--	<.006
C	1:1	--	--	--	--	--	--	--	<.01	--
C	1:5	<.009	<.009	<.006	<.015	<.08	<.006	<.009	--	.008
D	1:1	--	--	--	--	--	--	--	<.01	--
D	1:5	<.009	<.009	<.006	<.015	<.08	<.006	<.009	--	<.006
E	1:1	--	--	--	--	--	--	--	<.01	--
E	1:5	<.009	<.009	<.006	<.015	<.08	<.006	<.009	--	.010
F	1:1	--	--	--	--	--	--	--	<.01	--
F	1:5	<.009	<.009	<.006	<.015	<.08	<.006	<.009	--	.007
G	1:1	--	--	--	--	--	--	--	<.01	--
G	1:5	<.009	<.009	<.006	<.015	<.08	<.006	<.009	--	.008
H	1:1	--	--	--	--	--	--	--	<.01	--
H	1:5	<.009	<.009	<.006	.028	<.08	<.006	<.009	--	<.006
I	1:1	--	--	--	--	--	--	--	<.01	--
I	1:5	<.009	<.009	<.006	.019	<.08	<.006	<.009	--	<.006

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 1996

[Analyses are of whole-body tissue of aquatic insects. Composite samples made by combining similar-sized insects of the same species into a sample of sufficient mass for analysis. Concentrations for biota samples composed of two or more composite samples are the means of all analyses. Abbreviations: µg/g, micrograms per gram of dry sample weight. Symbol: <, less than minimum reporting level]

Taxon	Number of composite samples	Concentration, in µg/g							
		Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
12323750 Silver Bow Creek at Warm Springs									
Hydropsyche cockerelli	4	0.7	1.0	42.2	768	4.9	876	0.8	174
Hydropsyche spp.	1	1.2	<1.5	40.7	767	<10.2	804	2.0	162
12323800 Clark Fork near Galen									
Hydropsyche cockerelli	1	1.4	<1.3	74.7	1,130	<7.9	1,400	1.0	136
Hydropsyche occidentalis	4	1.3	1.4	96.4	1,350	7.8	2,330	1.8	197
Hydropsyche tana	1	1.5	1.4	92.9	1,340	9.0	2,160	2.1	206
461415112450801 Clark Fork below Lost Creek, near Galen									
Hydropsyche cockerelli	3	2.4	2.0	137	1,730	13.4	1,700	1.7	229
Hydropsyche occidentalis	3	1.5	1.7	124	1,470	11.5	2.150	1.5	237
Hydropsyche spp.	1	1.8	2.4	121	1,340	20.5	1,950	2.8	225
461559112443301 Clark Fork near Racetrack									
Hydropsyche cockerelli	2	1.2	1.1	84.4	1,030	7.7	963	1.0	163
Hydropsyche occidentalis	2	1.4	1.5	100	1,310	10.1	2,610	1.2	229
Hydropsyche spp.	1	1.0	.7	82.9	1,140	5.7	910	1.1	151
461903112440701 Clark Fork at Dempsey Creek diversion, near Racetrack									
Arctopsyche grandis	1	1.7	<2.4	30.8	340	<14.5	510	1.0	87
Hydropsyche cockerelli	1	.9	1.0	87.6	831	6.8	697	1.9	162
Hydropsyche occidentalis	2	1.5	1.2	121	1,140	9.9	2,220	1.2	236
Hydropsyche spp.	1	1.6	1.4	104	1,070	10.5	1,150	1.6	191
12324200 Clark Fork at Deer Lodge									
Arctopsyche grandis	1	2.4	<1.3	39.1	676	<7.8	727	<1.3	178
Hydropsyche cockerelli	1	1.3	1.7	105	1,210	13.9	672	1.4	185
Hydropsyche occidentalis	4	1.5	1.9	154	1,580	14.8	1,890	1.4	257
12324680 Clark Fork at Goldcreek									
Arctopsyche grandis	5	2.6	1.0	60.0	695	3.9	817	.8	175
Claassenia sabulosa	3	2.1	.4	50.0	140	1.2	87	.2	245
Hydropsyche cockerelli	3	2.5	1.9	114	1,460	9.4	921	1.3	214
Hydropsyche occidentalis	1	1.7	1.4	81.3	1,040	8.6	1,140	1.1	177
12331500 Flint Creek near Drummond									
Arctopsyche grandis	5	.5	2.0	18.8	1,930	11.8	1,750	2.1	226
Hydropsyche cockerelli	2	.6	2.0	18.6	2,100	15.4	1,210	2.3	181
Hydropsyche occidentalis	1	.7	1.6	17.6	1,870	24.9	2,050	2.4	188
12331800 Clark Fork near Drummond									
Arctopsyche grandis	4	1.6	1.0	49.7	713	4.6	726	.7	181
Claassenia sabulosa	4	1.9	.5	65.9	126	.8	138	.1	243
Hydropsyche cockerelli	3	1.7	1.7	77.6	1,360	8.4	903	1.2	202
Hydropsyche occidentalis	1	<1.0	<1.0	53.1	972	<7.3	843	.8	157

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 1996 (Continued)

Taxon	Number of com-posite samples	Concentration, in µg/g							
		Cad-mium	Chro-mium	Cop-per	Iron	Lead	Manga-nese	Nickel	Zinc
		12334510 Rock Creek near Clinton							
Arctopsyche grandis	3	.4	1.1	9.9	621	<2.9	326	1.1	154
Claassenia sabulosa	2	.3	.4	27.6	110	<1.3	47.0	.3	215
Hydropsyche spp.	1	<.5	1.1	15.0	837	<3.1	299	.8	135
		12334550 Clark Fork at Turah Bridge, near Bonner							
Arctopsyche grandis	5	1.7	1.7	40.2	1,030	3.6	613	1.0	199
Claassenia sabulosa	3	2.4	.5	45.3	106	<.8	62.1	.1	255
Hydropsyche cockerelli	3	1.2	2.0	50.8	1,390	5.7	572	1.1	192
Hydropsyche occidentalis	1	1.3	1.0	44.9	977	<5.5	596	1.8	158
		12340000 Blackfoot River near Bonner							
Hydropsyche occidentalis	2	.4	1.1	13.2	1,190	1.8	521	1.6	124
Hydropsyche spp.	1	.6	1.6	13.9	1,120	2.9	525	2.8	132
		12353000 Clark Fork below Missoula[1]							
Arctopsyche grandis	3	.3	1.1	13.1	659	1.1	641	.6	134
Claassenia sabulosa	3	.9	.4	56.1	136	<.7	114	.2	215
Hydropsyche cockerelli	3	.4	1.6	24.5	1,210	2.1	715	1.1	134
Hydropsyche spp.	1	.5	.8	20.8	894	1.1	756	1.1	124

[1]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 19. Recovery efficiency for trace-element analyses of standard reference material for biota

[Abbreviations: SRM, standard reference material; µg/g, micrograms per gram of dry sample weight]

Constituent	Number of measurements	Certified concentration (µg/g)	Mean SRM recovery (percent)	95-percent confidence interval for SRM recovery (percent)
		SRM sample 1566 a		
Cadmium	12	4.15	103	98.3-108
Chromium	12	1.43	84.3	64.3-104
Copper	12	66.3	97.7	91.9-104
Iron	12	539	93.2	88.2-98.2
Lead	12	.37	128	97.0-159
Manganese	12	12.3	94.5	89.6-99.4
Nickel	12	2.25	96.5	81.5-112
Zinc	12	830	99.4	95.0-104

Table 20. Trace-element analyses of procedural blanks for biota

[Procedural blanks were not diluted prior to analysis. Abbreviation: µg/mL, micrograms per milliliter. Symbol: <, less than]

Station number	Station name	Dilution ratio	Trace-element concentration, in µg/mL							
			Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
12323750	Silver Bow Creek at Warm Springs	1:1	<0.003	<0.004	<0.004	0.05	<0.02	0.01	<0.01	<0.01
12323800	Clark Fork near Galen	1:1	<.003	<.004	<.002	<.01	<.02	.01	<.01	<.01
461415112450801	Clark Fork below Lost Creek, near Galen	1:1	<.003	<.004	.006	.05	<.02	.01	<.01	<.01
461559112443301	Clark Fork near Racetrack	1:1	<.003	<.004	<.002	.02	<.02	.01	<.01	<.01
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:1	<.003	.010	<.002	.05	<.02	.12	<.01	<.01
12324200	Clark Fork at Deer Lodge	1:1	<.003	<.004	<.002	.05	.04	<.01	<.01	<.01
12324680	Clark Fork at Goldcreek	1:1	<.003	<.004	.010	.05	<.02	<.01	<.01	<.01
12331500	Flint Creek near Drummond	1:1	<.003	.010	<.002	.02	.06	<.01	<.01	<.01
12331800	Clark Fork near Drummond	1:1	<.003	<.004	.006	.05	<.02	<.01	<.01	<.01
12334510	Rock Creek near Clinton	1:1	<.003	<.004	<.002	.04	<.02	.01	<.01	.07
12334550	Clark Fork at Turah Bridge, near Bonner	1:1	<.003	<.004	<.002	.02	<.02	.01	<.01	<.01
12340000	Blackfoot near Bonner	1:1	<.003	<.004	<.002	.38	.04	.01	<.01	<.01
12353000	Clark Fork below Missoula	1:1	<.003	<.004	.030	.10	<.02	<.01	<.01	<.01

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996

[Abbreviations: ft^3/s, cubic feet per second; °C, degrees Celsius; μg/L, micrograms per liter; μS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; mm, millimeter; ton/d, tons per day. Symbols: <, less than minimum reporting level[1]; --, indicates insufficient data greater than minimum reporting level to compute statistic]

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT. Period of record for water-quality data: March 1993-September 1996					
Streamflow, instantaneous (ft^3/s)	36	452	24	161	134
Specific conductance, onsite (μS/cm)	34	614	281	446	448
Temperature, water (°C)	35	22.0	.5	11.3	12.0
pH, onsite (standard units)	34	9.3	8.0	8.7	8.8
Hardness, total (mg/L as $CaCO_3$)	34	260	120	187	190
Calcium, dissolved (mg/L)	34	78	36	55	55
Magnesium, dissolved (mg/L)	34	19	6.7	12	12
Arsenic, total recoverable (μg/L)	34	94	12	26	21
Arsenic, dissolved (μg/L)	34	60	8	21	19
Cadmium, total recoverable (μg/L)	34	<1	<1	--	<1
Cadmium, dissolved (μg/L)	34	.3	<.1	[2].1	<.1
Copper, total recoverable (μg/L)	34	80	10	30	24
Copper, dissolved (μg/L)	34	40	7	15	12
Iron, total recoverable (μg/L)	34	3,000	130	494	395
Iron, dissolved (μg/L)	34	93	3	18	14
Lead, total recoverable (μg/L)	34	15	<1	[2]3	2
Lead, dissolved (μg/L)	34	1.0	<.5	--	<.5
Manganese, total recoverable (μg/L)	34	600	80	231	195
Manganese, dissolved (μg/L)	34	530	34	151	110
Zinc, total recoverable (μg/L)	34	180	<10	[2]68	60
Zinc, dissolved (μg/L)	34	73	<3	[2]15	10
Sediment, suspended concentration (mg/L)	36	229	2	17	7
Sediment, suspended discharge (ton/d)	36	279	.26	13	2.0
Sediment, suspended (percent finer than 0.062 mm)	35	97	63	82	82

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for water quality data: March 1993-September 1996					
Streamflow, instantaneous (ft^3/s)	22	379	2.8	106	84
Specific conductance, onsite (μS/cm)	21	795	154	327	269
Temperature, water (°C)	22	16.0	.5	8.3	8.8
pH, onsite (standard units)	21	8.6	7.4	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	21	420	73	162	130
Calcium, dissolved (mg/L)	21	130	23	50	40
Magnesium, dissolved (mg/L)	21	22	3.8	9.3	7.4
Arsenic, total recoverable (μg/L)	21	23	3	9	6
Arsenic, dissolved (μg/L)	21	14	3	5	4
Cadmium, total recoverable (μg/L)	21	<1	<1	--	<1
Cadmium, dissolved (μg/L)	21	<.1	<.1	--	<.1
Copper, total recoverable (μg/L)	21	88	4	26	10
Copper, dissolved (μg/L)	21	16	1	4	3
Iron, total recoverable (μg/L)	21	1,400	40	411	140
Iron, dissolved (μg/L)	21	30	4	12	9
Lead, total recoverable (μg/L)	21	14	<1	[2]3	1
Lead, dissolved (μg/L)	21	1.8	<.5	--	<.5
Manganese, total recoverable (μg/L)	21	1,400	120	339	280
Manganese, dissolved (μg/L)	21	570	57	189	120
Zinc, total recoverable (μg/L)	21	60	<10	[2]17	10
Zinc, dissolved (μg/L)	21	10	<3	[2]3	<3
Sediment, suspended concentration (mg/L)	22	90	3	25	12
Sediment, suspended discharge (ton/d)	22	71	.14	12	1.4
Sediment, suspended (percent finer than 0.062 mm)	22	88	57	77	77

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT. **Period of record for water-quality data: July 1988-September 1996**					
Streamflow, instantaneous (ft^3/s)	77	1,050	14	205	126
Specific conductance, onsite (μS/cm)	65	720	220	444	445
Temperature, water (°C)	76	22.5	.0	9.5	9.2
pH, onsite (standard units)	64	9.0	7.5	8.4	8.4
Hardness, total (mg/L as $CaCO_3$)	63	370	96	196	200
Calcium, dissolved (mg/L)	63	110	29	58	59
Magnesium, dissolved (mg/L)	63	22	5.7	12	12
Arsenic, total recoverable (μg/L)	63	78	3	20	15
Arsenic, dissolved (μg/L)	63	53	4	14	12
Cadmium, total recoverable (μg/L)	63	3	<1	[2].4	<1
Cadmium, dissolved (μg/L)	63	1	<.1	[2].1	<1
Copper, total recoverable (μg/L)	62	240	8	42	30
Copper, dissolved (μg/L)	63	50	3	12	10
Iron, total recoverable (μg/L)	63	9,200	90	728	350
Iron, dissolved (μg/L)	63	110	3	19	11
Lead, total recoverable (μg/L)	63	28	<1	[2]5	2
Lead, dissolved (μg/L)	63	3	<.5	[2].4	<.5
Manganese, total recoverable (μg/L)	63	1,400	80	320	270
Manganese, dissolved (μg/L)	63	380	33	136	110
Zinc, total recoverable (μg/L)	63	360	10	69	50
Zinc, dissolved (μg/L)	63	110	3	18	12
Sediment, suspended concentration (mg/L)	77	338	2	24	9
Sediment, suspended discharge (ton/d)	77	459	.12	28	2.3
Sediment, suspended (percent finer than 0.062 mm)	76	97	58	79	79

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT. Period of record for water-quality data: March 1985-September 1996					
Streamflow, instantaneous (ft^3/s)	129	1,920	23	286	213
Specific conductance, onsite (µS/cm)	112	642	242	503	524
Temperature, water (°C)	128	23.0	.0	9.3	10.0
pH, onsite (standard units)	77	8.7	7.4	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	69	270	100	212	230
Calcium, dissolved (mg/L)	69	81	32	63	66
Magnesium, dissolved (mg/L)	69	18	5.9	13	14
Arsenic, total recoverable (µg/L)	79	215	8	28	18
Arsenic, dissolved (µg/L)	79	39	7	14	13
Cadmium, total recoverable (µg/L)	79	5	<1	[2].7	<1
Cadmium, dissolved (µg/L)	79	2	<.1	[2].1	<1
Copper, total recoverable (µg/L)	78	1,500	11	123	52
Copper, dissolved (µg/L)	79	120	4	14	10
Iron, total recoverable (µg/L)	79	29,000	60	2,510	790
Iron, dissolved (µg/L)	79	190	<3	[2]18	10
Lead, total recoverable (µg/L)	79	200	<1	[2]16	6
Lead, dissolved (µg/L)	79	6	<.5	[2].7	<1
Manganese, total recoverable (µg/L)	79	4,600	30	368	210
Manganese, dissolved (µg/L)	79	400	1	48	34
Zinc, total recoverable (µg/L)	79	1,700	10	144	70
Zinc, dissolved (µg/L)	79	230	3	18	13
Sediment, suspended concentration (mg/L)	129	2,250	2	95	24
Sediment, suspended discharge (ton/d)	129	8,690	.29	224	12
Sediment, suspended (percent finer than 0.062 mm)	120	99	40	71	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for water-quality data: March 1985-September 1996					
Streamflow, instantaneous (ft^3/s)	66	2,080	21	305	184
Specific conductance, onsite (μS/cm)	54	300	120	219	215
Temperature, water (°C)	65	22	.0	7.4	7.0
pH, onsite (standard units)	53	8.5	7.0	8.0	8.0
Hardness, total (mg/L as $CaCO_3$)	48	140	51	100	99
Calcium, dissolved (mg/L)	48	43	14	29	28
Magnesium, dissolved (mg/L)	48	9.4	3.3	6.8	7.0
Arsenic, total recoverable (μg/L)	53	17	4	7	6
Arsenic, dissolved (μg/L)	53	7	3	5	5
Cadmium, total recoverable (μg/L)	53	2	<1	[2].4	<1
Cadmium, dissolved (μg/L)	53	1	<.1	--	<1
Copper, total recoverable (μg/L)	52	45	<1	[2]6	3
Copper, dissolved (μg/L)	53	7	<1	[2]2	2
Iron, total recoverable (μg/L)	53	25,000	20	1,590	330
Iron, dissolved (μg/L)	53	120	<3	[2]37	26
Lead, total recoverable (μg/L)	53	25	<1	[2]4	1
Lead, dissolved (μg/L)	52	6	<.5	[2].6	<1
Manganese, total recoverable (μg/L)	53	1,100	<10	[2]92	30
Manganese, dissolved (μg/L)	53	30	1	8	7
Zinc, total recoverable (μg/L)	53	140	<10	[2]18	10
Zinc, dissolved (μg/L)	53	24	<3	[2]4	3
Sediment, suspended concentration (mg/L)	66	1,410	1	64	10
Sediment, suspended discharge (ton/d)	66	7,920	.08	190	5.6
Sediment, suspended (percent finer than 0.062 mm)	66	95	49	75	79

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12324680--CLARK FORK AT GOLDCREEK MONT. Period of record for water-quality data: March 1993-September 1996					
Streamflow, instantaneous (ft^3/s)	35	3,920	87	847	605
Specific conductance, onsite (μS/cm)	34	496	226	365	378
Temperature, water (°C)	35	20.0	.0	8.9	8.0
pH, onsite (standard units)	34	8.7	7.9	8.3	8.2
Hardness, total (mg/L as $CaCO_3$)	34	230	96	160	165
Calcium, dissolved (mg/L)	34	68	29	47	50
Magnesium, dissolved (mg/L)	34	15	5.7	10	10
Arsenic, total recoverable (μg/L)	34	75	8	18	14
Arsenic, dissolved (μg/L)	34	18	6	10	10
Cadmium, total recoverable (μg/L)	34	2	<1	--	<1
Cadmium, dissolved (μg/L)	34	<.1	<.1	--	<.1
Copper, total recoverable (μg/L)	33	440	8	62	40
Copper, dissolved (μg/L)	33	36	3	9	7
Iron, total recoverable (μg/L)	34	12,000	60	1,400	680
Iron, dissolved (μg/L)	34	100	<3	[2]23	16
Lead, total recoverable (μg/L)	33	73	<1	[2]9	5
Lead, dissolved (μg/L)	33	.6	<.5	--	<.5
Manganese, total recoverable (μg/L)	34	1,100	30	181	130
Manganese, dissolved (μg/L)	34	43	11	21	20
Zinc, total recoverable (μg/L)	34	510	10	77	55
Zinc, dissolved (μg/L)	34	26	<3	[2]9	8
Sediment, suspended concentration (mg/L)	35	752	2	79	28
Sediment, suspended discharge (ton/d)	35	7,960	.94	407	47
Sediment, suspended (percent finer than 0.062 mm)	35	93	43	75	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12331500--FLINT CREEK NEAR DRUMMOND, MONT. **Period of record for water-quality data: March 1985-September 1996**					
Streamflow, instantaneous (ft^3/s)	84	892	4.2	185	120
Specific conductance, onsite (μS/cm)	73	507	135	298	299
Temperature, water (°C)	82	21.0	.0	8.6	9.0
pH, onsite (standard units)	70	8.8	7.5	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	63	260	60	142	140
Calcium, dissolved (mg/L)	63	73	17	38	38
Magnesium, dissolved (mg/L)	63	20	4.3	11	11
Arsenic, total recoverable (μg/L)	70	57	7	19	15
Arsenic, dissolved (μg/L)	70	20	5	9	9
Cadmium, total recoverable (μg/L)	70	3	<1	[2].3	<1
Cadmium, dissolved (μg/L)	70	.1	<.1	--	<1
Copper, total recoverable (μg/L)	69	32	1	8	7
Copper, dissolved (μg/L)	70	7	<1	[2]2	2
Iron, total recoverable (μg/L)	70	7,200	70	1,140	610
Iron, dissolved (μg/L)	70	240	4	43	28
Lead, total recoverable (μg/L)	70	87	<1	[2]14	9
Lead, dissolved (μg/L)	70	7	<.5	[2]1	<5
Manganese, total recoverable (μg/L)	70	1,600	50	251	160
Manganese, dissolved (μg/L)	70	120	14	43	38
Zinc, total recoverable (μg/L)	70	290	<10	[2]49	30
Zinc, dissolved (μg/L)	70	27	<3	[2]7	4
Sediment, suspended concentration (mg/L)	84	556	3	58	31
Sediment, suspended discharge (ton/d)	84	904	.03	52	9.4
Sediment, suspended (percent finer than 0.062 mm)	84	98	28	81	84

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT. Period of record for water-quality data: March 1993-September 1996					
Streamflow, instantaneous (ft^3/s)	35	3,520	149	1,180	942
Specific conductance, onsite (μS/cm)	34	630	189	391	416
Temperature, water (°C)	35	21.0	.5	9.7	9.0
pH, onsite (standard units)	34	8.5	7.8	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	34	300	74	176	185
Calcium, dissolved (mg/L)	34	83	21	51	54
Magnesium, dissolved (mg/L)	34	22	5.2	12	12
Arsenic, total recoverable (μg/L)	34	62	8	20	16
Arsenic, dissolved (μg/L)	34	19	7	11	11
Cadmium, total recoverable (μg/L)	34	2	<1	--	<1
Cadmium, dissolved (μg/L)	34	.2	<.1	--	<.1
Copper, total recoverable (μg/L)	32	360	5	63	36
Copper, dissolved (μg/L)	32	21	1	8	6
Iron, total recoverable (μg/L)	34	8,800	50	1,520	870
Iron, dissolved (μg/L)	34	150	<3	[2]26	12
Lead, total recoverable (μg/L)	30	56	<1	[2]13	6
Lead, dissolved (μg/L)	30	1.2	<.5	[2].4	<.5
Manganese, total recoverable (μg/L)	34	880	20	209	135
Manganese, dissolved (μg/L)	34	50	8	18	15
Zinc, total recoverable (μg/L)	34	490	<10	[2]98	50
Zinc, dissolved (μg/L)	34	21	3	9	8
Sediment, suspended concentration (mg/L)	35	530	2	93	42
Sediment, suspended discharge (ton/d)	35	4,720	1.9	493	103
Sediment, suspended (percent finer than 0.062 mm)	35	91	38	73	73

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for water-quality data: March 1985-September 1996					
Streamflow, instantaneous (ft^3/s)	65	3,550	113	914	548
Specific conductance, onsite (µS/cm)	56	155	55	105	98
Temperature, water (°C)	65	18	.0	7.9	8.0
pH, onsite (standard units)	55	8.6	6.9	7.9	7.9
Hardness, total (mg/L as $CaCO_3$)	47	90	25	50	50
Calcium, dissolved (mg/L)	47	23	6.5	13	13
Magnesium, dissolved (mg/L)	47	8.0	2.1	4.3	4.3
Arsenic, total recoverable (µg/L)	53	2	<1	[2].9	<1
Arsenic, dissolved (µg/L)	53	1	<1	[2]1	<1
Cadmium, total recoverable (µg/L)	53	3	<1	[2].4	<1
Cadmium, dissolved (µg/L)	53	1	<.1	--	<1
Copper, total recoverable (µg/L)	51	41	<1	[2]5	3
Copper, dissolved (µg/L)	52	6	<1	[2]1	1
Iron, total recoverable (µg/L)	53	2,100	20	365	200
Iron, dissolved (µg/L)	53	110	5	36	34
Lead, total recoverable (µg/L)	51	19	<1	[2]3	1
Lead, dissolved (µg/L)	51	5	<.5	[2].7	<1
Manganese, total recoverable (µg/L)	53	90	<10	[2]19	10
Manganese, dissolved (µg/L)	53	8	<1	[2]2	2
Zinc, total recoverable (µg/L)	53	60	<10	[2]10	<10
Zinc, dissolved (µg/L)	53	15	<3	[2]3	<3
Sediment, suspended concentration (mg/L)	65	157	1	21	6
Sediment, suspended discharge (ton/d)	65	1,280	.31	116	9.8
Sediment, suspended (percent finer than 0.062 mm)	65	95	35	70	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for water-quality data: Marcvh 1985-September 1996					
Streamflow, instantaneous (ft^3/s)	132	9,370	296	1,760	1,010
Specific conductance, onsite (μS/cm)	107	483	147	315	332
Temperature, water (°C)	131	22.0	.0	9.0	9.5
pH, onsite (standard units)	78	8.7	7.4	8.1	8.2
Hardness, total (mg/L as $CaCO_3$)	68	210	66	138	140
Calcium, dissolved (mg/L)	68	59	19	39	39
Magnesium, dissolved (mg/L)	68	14	4.4	10	10
Arsenic, total recoverable (μg/L)	77	110	5	12	8
Arsenic, dissolved (μg/L)	77	17	4	6	5
Cadmium, total recoverable (μg/L)	77	4	<1	[2].5	<1
Cadmium, dissolved (μg/L)	77	1	<.1	--	<1
Copper, total recoverable (μg/L)	75	500	3	53	24
Copper, dissolved (μg/L)	76	25	2	6	5
Iron, total recoverable (μg/L)	77	19,000	60	1,590	550
Iron, dissolved (μg/L)	77	190	<3	[2]27	16
Lead, total recoverable (μg/L)	73	100	<1	[2]12	6
Lead, dissolved (μg/L)	73	7	<.5	[2].6	<1
Manganese, total recoverable (μg/L)	77	2,000	10	183	90
Manganese, dissolved (μg/L)	77	31	1	8	7
Zinc, total recoverable (μg/L)	77	1,100	<10	[2]93	40
Zinc, dissolved (μg/L)	77	39	<3	[2]9	7
Sediment, suspended concentration (mg/L)	132	1,370	2	69	23
Sediment, suspended discharge (ton/d)	132	34,700	3.5	771	64
Sediment, suspended (percent finer than 0.062 mm)	121	98	27	72	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12340000--BLACKFOOT RIVER NEAR BONNER, MONT. **Period of record for water-quality data: March 1985-September 1996**					
Streamflow, instantaneous (ft^3/s)	96	10,300	344	2,560	1,230
Specific conductance, onsite (μS/cm)	73	294	131	205	203
Temperature, water (°C)	96	20.5	.0	8.7	8.5
pH, onsite (standard units)	56	8.7	7.5	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	49	140	55	101	95
Calcium, dissolved (mg/L)	49	37	14	26	24
Magnesium, dissolved (mg/L)	49	13	4.9	9.0	8.4
Arsenic, total recoverable (μg/L)	56	4	<1	[2]1	1
Arsenic, dissolved (μg/L)	56	2	<1	[2].9	<1
Cadmium, total recoverable (μg/L)	56	2	<1	[2].5	<1
Cadmium, dissolved (μg/L)	56	1	<.1	--	<1
Copper, total recoverable (μg/L)	53	34	<1	[2]8	6
Copper, dissolved (μg/L)	54	7	<1	[2]2	2
Iron, total recoverable (μg/L)	56	3,600	20	619	250
Iron, dissolved (μg/L)	56	100	<3	[2]21	14
Lead, total recoverable (μg/L)	52	25	<1	[2]5	2
Lead, dissolved (μg/L)	52	8	<.5	[2]1	<1
Manganese, total recoverable (μg/L)	56	180	<10	[2]39	20
Manganese, dissolved (μg/L)	56	11	<1	[2]3	2
Zinc, total recoverable (μg/L)	56	60	<10	[2]12	<10
Zinc, dissolved (μg/L)	56	15	<3	[2]4	<3
Sediment, suspended concentration (mg/L)	96	271	1	32	8
Sediment, suspended discharge (ton/d)	96	7,540	1.1	537	26
Sediment, suspended (percent finer than 0.062 mm)	94	98	42	78	80

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1996 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12340500--CLARK FORK ABOVE MISSOULA, MONT. Period of record for water-quality data: July 1986-September 1996					
Streamflow, instantaneous (ft^3/s)	98	16,600	720	4,150	2,210
Specific conductance, onsite (µS/cm)	75	399	145	260	270
Temperature, water (°C)	95	19.5	.0	9.0	8.5
pH, onsite (standard units)	55	8.6	7.9	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	55	170	61	120	120
Calcium, dissolved (mg/L)	55	46	14	32	32
Magnesium, dissolved (mg/L)	55	13	5.3	9.4	9.5
Arsenic, total recoverable (µg/L)	55	69	2	6	4
Arsenic, dissolved (µg/L)	55	9	1	3	3
Cadmium, total recoverable (µg/L)	55	5	<1	--	<1
Cadmium, dissolved (µg/L)	55	.1	<.1	--	<.1
Copper, total recoverable (µg/L)	53	400	2	21	8
Copper, dissolved (µg/L)	54	11	1	3	2
Iron, total recoverable (µg/L)	55	13,000	60	785	270
Iron, dissolved (µg/L)	55	200	<3	[2]24	16
Lead, total recoverable (µg/L)	50	78	<1	[2]5	2
Lead, dissolved (µg/L)	50	1	<.5	[2].6	<.5
Manganese, total recoverable (µg/L)	55	1,100	10	79	50
Manganese, dissolved (µg/L)	55	230	7	19	15
Zinc, total recoverable (µg/L)	55	1,100	<10	[2]44	20
Zinc, dissolved (µg/L)	55	16	<3	[2]5	4
Sediment, suspended concentration (mg/L)	98	824	2	40	10
Sediment, suspended discharge (ton/d)	98	21,900	6.1	977	58
Sediment, suspended (percent finer than 0.062 mm)	93	99	44	86	90

[1]Multiple minimum reporting levels during the period of record may result in varying values identified with a less-than (<) symbol.

[2]Value is estimated by using a log-probability regression to predict the values of data less than the minimum reporting level (Helsel and Cohn, 1988).

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1996

[Fine-grained bed sediment is material less than 0.064 millimeter in diameter. Concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates either too few samples or insufficient data greater than the minimum reporting level to compute statistic. Number of samples represents the number of years that the constituent was analyzed, with each year represented by a single mean concentration of composite samples. Values for single samples are arbitrarily listed in the "Mean" column]

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for fine-grained bed-sediment data: 1992-96					
Cadmium	5	42.0	27.1	34.7	36.7
Chromium	4	30.1	23.2	26.3	25.9
Copper	5	6,280	4,560	5,020	4,670
Iron	5	41,200	34,400	38,200	38,400
Lead	5	1,030	752	870	834
Manganese	5	3,940	1,680	2,740	2,460
Nickel	4	21.4	14.5	17.0	16.2
Silver	5	19.6	13.7	16.5	17.2
Zinc	5	10,800	6,850	8,750	8,680
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.					
Period of record for fine-grained bed-sediment data: 1992-96					
Cadmium	5	12.2	6.0	8.7	8.2
Chromium	4	24.8	12.8	19.3	19.8
Copper	5	769	259	525	536
Iron	5	26,000	19,500	21,500	20,800
Lead	5	99	58	77	74
Manganese	5	17,700	1,470	8,620	8,150
Nickel	4	16.5	14.4	15.3	15.2
Silver	5	2.1	.3	1.1	1.0
Zinc	5	2,220	620	1,430	1,450
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for fine-grained bed-sediment data: 1995					
Cadmium	1	--	--	3.9	--
Chromium	1	--	--	33.4	--
Copper	1	--	--	892	
Iron	1	--	--	21,900	--
Lead	1	--	--	85	--
Manganese	1	--	--	8,790	--
Nickel	1	--	--	21.9	--
Silver	1	--	--	3.2	--
Zinc	1	--	--	421	--

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for fine-grained bed-sediment data: 1987, 1991-96					
Cadmium	7	20.1	7.5	12.3	11.9
Chromium	4	30.9	22.1	26.6	26.6
Copper	7	2,300	1,140	1,410	1,230
Iron	7	39,800	22,600	29,100	28,400
Lead	7	235	116	156	143
Manganese	7	15,600	4,320	10,100	12,200
Nickel	4	23.2	17.7	20.6	20.8
Silver	7	5.5	2.8	3.9	3.7
Zinc	7	3,560	1,370	2,240	2,330
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT					
Period of record for fine-grained bed-sediment data: 1996					
Cadmium	1	--	--	9.0	--
Chromium	1	--	--	32.9	--
Copper	1	--	--	1,730	--
Iron	1	--	--	30,800	--
Lead	1	--	--	197	--
Manganese	1	--	--	5,900	--
Nickel	1	--	--	19.9	--
Silver	1	--	--	6.8	--
Zinc	1	--	--	1,680	--
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996					
Cadmium	1	--	--	8.5	--
Chromium	1	--	--	30.1	--
Copper	1	--	--	1,370	--
Iron	1	--	--	29,000	--
Lead	1	--	--	155	--
Manganese	1	--	--	2,390	--
Nickel	1	--	--	18.4	--
Silver	1	--	--	6.1	--
Zinc	1	--	--	1,550	--
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996					
Cadmium	1	--	--	8.1	--
Chromium	1	--	--	28.9	--
Copper	1	--	--	1,280	--
Iron	1	--	--	28,200	--
Lead	1	--	--	152	--
Manganese	1	--	--	3,910	--
Nickel	1	--	--	16.9	--
Silver	1	--	--	6.2	--
Zinc	1	--	--	1,570	--

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of samples	Maxi- mum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT. Period of record for fine-grained bed-sediment data: 1986-87, 1990-96					
Cadmium	9	9.0	5.1	7.2	7.6
Chromium	4	36.5	19.5	30.0	31.9
Copper	9	4,180	837	1,620	1,210
Iron	9	31,700	22,600	27,600	28,400
Lead	9	242	121	166	159
Manganese	9	6,020	1,460	2,790	2,440
Nickel	4	19.0	15.0	16.5	16.0
Silver	9	7.9	2.4	4.7	4.6
Zinc	9	1,730	977	1,400	1,460
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT. Period of record for fine-grained bed-sediment data: 1986-87, 1994					
Cadmium	3	.9	.2	.6	.7
Chromium	1	--	--	22.1	--
Copper	3	85	38	54	40
Iron	3	26,400	16,100	22,100	23,800
Lead	3	53	37	43	40
Manganese	3	2,700	907	1,550	1,040
Nickel	1	--	--	13.6	--
Silver	3	.9	<.5	[1].5	.3
Zinc	3	180	161	170	170
12324680--CLARK FORK AT GOLDCREEK, MONT. Period of record for fine-grained bed-sediment data: 1992-96					
Cadmium	5	6.2	5.4	5.8	5.8
Chromium	4	37.8	31.6	34.0	33.2
Copper	5	1,030	653	802	766
Iron	5	27,500	20,500	24,500	24,300
Lead	5	152	88	112	107
Manganese	5	2,610	1,180	2,050	2,290
Nickel	4	17.2	15.0	16.4	16.7
Silver	5	4.2	2.3	3.2	3.2
Zinc	5	1,320	1,120	1,200	1,180
12331500--FLINT CREEK NEAR DRUMMOND, MONT. Period of record for fine-grained bed-sediment data: 1986, 1989, 1992-96					
Cadmium	7	4.5	<1.0	[1]2.7	3.1
Chromium	4	27.9	21.1	24.8	25.2
Copper	7	73	55	62	63
Iron	7	28,100	21,100	24,100	23,600
Lead	7	240	151	187	181
Manganese	7	5,510	2,710	3,990	3,910
Nickel	4	14.9	11.7	13.2	13.0
Silver	6	7.8	5.0	6.3	6.4
Zinc	7	777	610	684	674

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991-96					
Cadmium	8	5.4	4.1	4.8	4.8
Chromium	4	35.4	17.0	29.1	32.0
Copper	8	614	469	557	565
Iron	8	26,100	16,500	22,100	23,500
Lead	8	135	83	102	100
Manganese	8	2,780	1,220	1,900	1,910
Nickel	4	16.8	14.0	15.6	15.8
Silver	8	4.0	2.1	3.0	3.0
Zinc	8	1,230	1,030	1,130	1,130
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 89, 1991-96					
Cadmium	9	<1.5	<.3	--[1]	[1]<.8
Chromium	4	27.9	16.5	22.5	22.8
Copper	9	15	3	12	13
Iron	9	21,400	13,100	17,800	18,000
Lead	9	16	<3	[1]8	9
Manganese	9	598	126	338	278
Nickel	4	13.7	10.8	12.6	12.8
Silver	8	.8	<.3	[1].3	<.5
Zinc	9	58	36	48	48
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1991-96					
Cadmium	7	5.2	3.1	3.7	3.5
Chromium	4	34.7	15.3	24.0	23.0
Copper	7	561	300	382	323
Iron	7	23,200	15,100	18,900	17,300
Lead	7	115	49	75	70
Manganese	7	1,670	671	1,080	1,130
Nickel	4	16.2	11.6	13.9	14.0
Silver	7	2.9	1.3	2.1	2.1
Zinc	7	1,160	775	911	880
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991, 1993-96					
Cadmium	7	<1.5	<.3	--[1]	[1]<.8
Chromium	4	24.7	15.1	19.3	18.6
Copper	7	25	16	21	21
Iron	7	19,100	12,400	16,300	15,800
Lead	7	20	<13	[1]12	11
Manganese	7	672	298	497	497
Nickel	4	13.3	11.7	12.6	12.6
Silver	7	.7	<.3	[1].3	<5
Zinc	7	73	54	63	61

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for fine-grained bed-sediment data: 1986, 1990-96					
Cadmium	8	2.6	1.1	1.7	1.8
Chromium	4	27.6	18.8	23.4	23.6
Copper	8	293	98	162	137
Iron	8	21,100	14,500	18,700	19,500
Lead	8	58	12	39	36
Manganese	8	2,530	752	1,500	1,300
Nickel	4	14.1	13.3	13.5	13.4
Silver	8	2.1	.4	1.2	1.2
Zinc	8	675	319	433	422

[1]Value determined by arbitrarily substituting one-half of the detection level for censored (<) values, when both uncensored and censored values are used in determining the mean. When all data are below the detection level, the median is determined by ranking the censored values in order of detection level. No mean is reported when all values are below the detection level.

[2]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1996

[Bulk bed sediment is material smaller than about 10 mm in diameter. Concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates either too few samples or insufficient data greater than the minimum reporting level to compute statistic. Number of samples represents the number of years that the constituent was analyzed, with each year represented by a single mean concentration of composite samples. Values for single samples are arbitrarily listed in the "Mean" column]

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for bulk bed-sediment data: 1993-95					
Cadmium	3	12.7	6.7	9.3	8.5
Chromium	3	14.9	9.6	12.4	12.7
Copper	3	1,550	831	1,120	976
Iron	3	27,200	18,600	21,800	19,700
Lead	3	300	221	256	248
Manganese	3	1,670	671	1,030	745
Nickel	3	8.9	6.0	7.2	6.8
Silver	3	4.8	3.4	4.0	3.9
Zinc	3	3,420	2,050	2,580	2,270
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1993, 1995-96					
Cadmium	3	1.7	<1.1	[1]1.2	1.2
Chromium	3	11.8	9.9	10.6	10.1
Copper	3	111	42	80	86
Iron	3	12,300	9,160	10,900	11,200
Lead	3	33	11	22	21
Manganese	3	884	543	752	830
Nickel	3	9.2	5.5	7.6	8.1
Silver	3	1.0	<.3	[1].5	<.5
Zinc	3	303	137	226	238
12327700--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1995					
Cadmium	1	--	--	1.0	--
Chromium	1	--	--	9.7	--
Copper	1	--	--	205	
Iron	1	--	--	8,980	--
Lead	1	--	--	34	--
Manganese	1	--	--	2,650	--
Nickel	1	--	--	7.8	--
Silver	1	--	--	.9	
Zinc	1	--	--	148	--

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1996 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for bulk bed-sediment data: 1993-96					
Cadmium	4	6.0	1.5	3.5	3.3
Chromium	4	23.0	4.2	15.1	16.6
Copper	4	685	223	464	475
Iron	4	31,300	9,930	22,400	24,200
Lead	4	87	41	68	72
Manganese	4	5,410	1,280	2,530	1,710
Nickel	4	12.5	4.9	9.0	9.4
Silver	4	1.9	.7	1.4	1.6
Zinc	4	1,280	498	782	674
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT					
Period of record for bulk bed-sediment data: 1996					
Cadmium	1	--	--	2.5	--
Chromium	1	--	--	12.0	--
Copper	1	--	--	455	--
Iron	1	--	--	16,000	--
Lead	1	--	--	72	--
Manganese	1	--	--	1,740	--
Nickel	1	--	--	7.7	--
Silver	1	--	--	2.1	--
Zinc	1	--	--	632	--
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996					
Cadmium	1	--	--	3.4	--
Chromium	1	--	--	16.4	--
Copper	1	--	--	594	--
Iron	1	--	--	18,200	--
Lead	1	--	--	87	--
Manganese	1	--	--	1,500	--
Nickel	1	--	--	9.9	--
Silver	1	--	--	2.6	--
Zinc	1	--	--	743	--
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996					
Cadmium	1	--	--	3.9	--
Chromium	1	--	--	17.3	--
Copper	1	--	--	651	--
Iron	1	--	--	20,100	--
Lead	1	--	--	89	--
Manganese	1	--	--	1,860	--
Nickel	1	--	--	10.0	--
Silver	1	--	--	2.8	--
Zinc	1	--	--	804	--

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1996 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for bulk bed-sediment data: 1993-96					
Cadmium	4	3.1	2.0	2.4	2.2
Chromium	4	19.6	12.1	15.3	14.7
Copper	4	449	281	371	376
Iron	4	20,200	13,200	16,700	16,800
Lead	4	85	45	68	70
Manganese	4	2,060	653	1,190	1,020
Nickel	4	10.2	7.7	9.1	9.2
Silver	4	1.7	<.7	[1]1.3	1.5
Zinc	4	619	456	551	564
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for bulk bed-sediment data: 1994					
Cadmium	1	--	--	<1.2	--
Chromium	1	--	--	14.7	--
Copper	1	--	--	19	--
Iron	1	--	--	15,600	--
Lead	1	--	--	12	--
Manganese	1	--	--	420	--
Nickel	1	--	--	8.6	--
Silver	1	--	--	<.7	--
Zinc	1	--	--	73	--
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for bulk bed-sediment data: 1993-96					
Cadmium	4	5.2	2.3	3.3	2.9
Chromium	4	29.5	17.6	22.7	21.8
Copper	4	747	282	468	420
Iron	4	22,900	15,500	19,200	19,100
Lead	4	75	46	66	72
Manganese	4	2,600	649	1,300	970
Nickel	4	15.9	9.1	12.4	12.2
Silver	4	3.6	<.7	[1]1.8	1.6
Zinc	4	1,020	549	735	686
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-96					
Cadmium	4	3.2	.3	1.7	1.6
Chromium	4	13.9	4.9	10.0	10.6
Copper	4	40	19	28	28
Iron	4	15,000	8,630	12,800	13,900
Lead	4	120	51	84	82
Manganese	4	3,200	1,150	2,250	2,320
Nickel	4	8.0	5.8	6.6	6.4
Silver	4	5.3	3.3	4.4	4.5
Zinc	4	429	190	310	310

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1996 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-96					
Cadmium	4	3.9	1.5	2.2	1.8
Chromium	4	26.9	13.8	20.2	20.0
Copper	4	491	173	294	256
Iron	4	20,600	14,100	16,800	16,200
Lead	4	61	35	50	51
Manganese	4	1,430	711	1,040	1,020
Nickel	4	13.9	9.0	11.0	10.6
Silver	4	2.8	.5	1.6	1.4
Zinc	4	939	434	623	559
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for bulk bed-sediment data: 1993-96					
Cadmium	4	<1.5	<.8	--[1]	[1]<1.2
Chromium	4	14.3	6.6	10.2	9.8
Copper	4	7	4	6	6
Iron	4	11,100	6,380	9,070	9,400
Lead	4	<13	5	[1]5	5
Manganese	4	258	91	172	170
Nickel	4	8.2	4.9	6.2	6.0
Silver	4	.4	.1	[1].2	[1]<.5
Zinc	4	29	16	22	20
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-96					
Cadmium	4	2.9	<.5	[1]1.4	1.2
Chromium	4	23.8	6.9	13.8	12.3
Copper	4	336	75	179	152
Iron	4	17,900	9,530	12,800	11,900
Lead	4	49	21	34	34
Manganese	4	1,320	234	613	450
Nickel	4	14.0	6.4	9.0	7.8
Silver	4	2.0	<.3	[1].7	[1].3
Zinc	4	769	281	476	428
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-94					
Cadmium	2	<1.2	<.8	--[1]	--
Chromium	2	17.7	6.7	12.2	--
Copper	2	19	14	16	--
Iron	2	16,600	10,300	13,400	--
Lead	2	10	8	9	--
Manganese	2	305	179	242	--
Nickel	2	9.8	7.6	8.7	--
Silver	2	<.7	<.5	--[1]	--
Zinc	2	58	33	46	--

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1996 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
		12353000--CLARK FORK BELOW MISSOULA, MONT.[2]			
		Period of record for bulk bed-sediment data: 1993-96			
Cadmium	4	<1.5	.5	[1].6	[1].6
Chromium	4	12.6	4.4	7.8	7.0
Copper	4	77	22	46	43
Iron	4	11,300	6,160	8,640	8,550
Lead	4	19	<13	[1]11	9
Manganese	4	444	223	350	366
Nickel	4	7.1	3.5	5.6	5.8
Silver	4	.6	<.3	[1].4	[1].4
Zinc	4	172	88	131	132

[1]Value determined by arbitrarily substituting one-half of the detection level for censored (<) values, when both uncensored and censored values are used in determining the mean and/or median. When all data are below the detection level, the median is determined by ranking the censored values in order of detection level. No mean is reported when all values are below the detection level.

[2]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996

[Concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates either too few samples or insufficient data greater than the minimum reporting level to compute statistic, or element not analyzed. Number of composite samples represents the total of all individual composite samples collected for every year that the constituent was analyzed. Values for single samples are arbitrarily listed in the "Mean" column. Because *Hydropsyche* insects were not sorted to the species level during 1986-89, statistics for stations sampled during those years are based on the results of all *Hydropsyche* species combined. At some sites, statistics for the *Hydropsyche morosa* group are based on the combined results for two or more species]

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
	12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.				
	Period of record for biological data: 1992, 94-95				
	Hydropsyche cockerelli				
Cadmium	5	6.3	4.1	4.9	4.7
Chromium	5	8.0	1.0	3.7	3.1
Copper	5	462	269	365	333
Iron	5	1,180	689	931	953
Lead	5	21.7	19.0	20.3	20.1
Manganese	5	718	180	460	434
Nickel	5	2.1	.7	1.4	1.6
Zinc	5	898	749	818	805
	Hydropsyche tana				
Cadmium	6	9.2	4.8	6.8	6.9
Chromium	6	11.5	.9	4.5	1.8
Copper	6	456	10.5	236	298
Iron	6	1,520	857	1,100	1,050
Lead	6	21.0	15.6	18.6	18.3
Manganese	6	969	307	634	675
Nickel	6	1.8	.7	1.4	1.6
Zinc	6	1,070	760	961	1,020
	12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.				
	Period of record for biological data: 1992-96				
	Hydropsyche cockerelli				
Cadmium	14	2.1	.5	1.0	.8
Chromium	14	1.3	.5	.8	.9
Copper	14	96.9	25.1	52.2	45.0
Iron	14	1,240	553	798	761
Lead	14	5.7	.3	3.5	3.5
Manganese	14	2,450	528	1,140	914
Nickel	14	1.8	.7	1.0	.8
Zinc	14	276	118	190	191
	Hydropsyche occidentalis				
Cadmium	3	1.1	.4	.8	.9
Chromium	3	.9	.3	.6	.7
Copper	3	46.5	38.6	41.5	39.4
Iron	3	1,040	372	803	998
Lead	3	<3.6	<2.3	[1]1.6	1.7
Manganese	3	2,250	1,780	2,060	2,140
Nickel	3	1.5	.7	1.0	.9
Zinc	3	202	149	184	201

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.--Continued Period of record for biological data: 1992-95					
Hydropsyche spp.					
Cadmium	2	2.3	1.2	1.8	--
Chromium	2	1.4	<1.5	[1]1.1	--
Copper	2	47.6	40.7	44.1	--
Iron	2	767	619	692	--
Lead	2	5.1	<10.2	[1]5.1	--
Manganese	2	1,100	804	951	--
Nickel	2	2.0	<.4	[1]1.1	--
Zinc	2	284	162	223	--
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT. Period of record for biological data: 1995					
Arctopsyche grandis					
Cadmium	1	--	--	2.4	--
Chromium	1	--	--	1.9	--
Copper	1	--	--	98.8	--
Iron	1	--	--	684	--
Lead	1	--	--	5.6	--
Manganese	1	--	--	2,280	--
Nickel	1	--	--	2.3	--
Zinc	1	--	--	222	--
12323800--CLARK FORK NEAR GALEN, MONT. Period of record for biological data: 1987, 1991-96					
Hydropsyche cockerelli					
Cadmium	11	2.7	1.3	1.7	1.7
Chromium	11	3.3	.8	1.3	1.2
Copper	11	181	74.7	103	98.7
Iron	11	1,500	901	1,180	1,620
Lead	11	9.3	1.2	5.9	7.5
Manganese	11	2,950	1,400	2,060	2,120
Nickel	11	3.1	1.0	1.6	1.4
Zinc	11	299	136	220	227
Hydropsyche morosa group					
Cadmium	5	3.2	2.4	2.5	2.4
Chromium	5	4.6	1.8	2.6	2.2
Copper	5	185	156	173	175
Iron	5	1,890	1,360	1,510	1,430
Lead	5	12.4	7.1	8.5	7.9
Manganese	5	3,960	2,360	3,500	3,860
Nickel	5	3.6	1.9	2.3	2.1
Zinc	5	349	292	309	303

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.--Continued					
Period of record for biological data: 1987, 1991-96					
Hydropsyche occidentalis					
Cadmium	16	1.6	1.0	1.2	1.2
Chromium	16	6.6	.7	1.7	1.5
Copper	16	101	66.7	80.7	78.2
Iron	16	1,400	642	1,080	1,110
Lead	16	9.1	1.6	5.7	5.8
Manganese	16	4,070	1,980	2,780	2,500
Nickel	16	3.5	1.1	1.7	1.7
Zinc	16	278	170	207	201
Hydropsyche tana					
Cadmium	1	--	--	1.5	--
Chromium	1	--	--	1.4	--
Copper	1	--	--	92.9	--
Iron	1	--	--	1,340	--
Lead	1	--	--	9.0	--
Manganese	1	--	--	2,160	--
Nickel	1	--	--	2.1	--
Zinc	1	--	--	206	--
Hydropsyche spp.					
Cadmium	4	3.5	2.6	3.0	3.0
Chromium	0	--	--	--	--
Copper	4	154	135	148	152
Iron	4	1,540	1,190	1,400	1,450
Lead	4	13.5	10.5	12.2	12.4
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	4	329	279	308	313
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.					
Period of record for biological data: 1996					
Hydropsyche cockerelli					
Cadmium	3	2.8	2.2	2.4	2.2
Chromium	3	2.1	1.8	2.0	2.0
Copper	3	147	121	137	144
Iron	3	1,900	1,560	1,730	1,730
Lead	3	14.8	12.1	13.4	13.3
Manganese	3	1,850	1,590	1,700	1,670
Nickel	3	2.0	1.6	1.7	1.7
Zinc	3	235	221	229	231

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.--Continued					
Period of record for biological data: 1996					
Hydropsyche occidentalis					
Cadmium	3	1.6	1.4	1.5	1.5
Chromium	3	1.8	1.7	1.7	1.7
Copper	3	132	121	124	121
Iron	3	1,540	1,360	1,470	1,510
Lead	3	12.4	10.7	11.5	11.5
Manganese	3	2,190	2,100	2,150	2,170
Nickel	3	1.5	1.4	1.5	1.5
Zinc	3	245	230	237	237
Hydropsyche spp.					
Cadmium	1	--	--	1.8	--
Chromium	1	--	--	2.4	--
Copper	1	--	--	121	--
Iron	1	--	--	1,340	--
Lead	1	--	--	20.5	--
Manganese	1	--	--	1,950	--
Nickel	1	--	--	2.8	--
Zinc	1	--	--	225	--
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for biological data: 1996					
Hydropsyche cockerelli					
Cadmium	2	1.3	1.1	1.2	--
Chromium	2	1.4	.7	1.1	--
Copper	2	98.2	70.6	84.4	--
Iron	2	1,200	862	1,030	--
Lead	2	8.7	6.7	7.7	--
Manganese	2	1,050	878	963	--
Nickel	2	1.0	1.0	1.0	--
Zinc	2	186	139	163	--
Hydropsyche occidentalis					
Cadmium	2	1.5	1.4	1.4	--
Chromium	2	1.5	1.5	1.5	--
Copper	2	107	93.5	100	--
Iron	2	1,320	1,300	1,310	--
Lead	2	10.1	10.1	10.1	--
Manganese	2	2,640	2,580	2,610	--
Nickel	2	1.3	1.2	1.2	--
Zinc	2	230	229	229	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
461559112443301--CLARK FORK NEAR RACETRACK, MONT.--Continued					
Period of record for biological data: 1996					
Hydropsyche spp.					
Cadmium	1	--	--	1.0	--
Chromium	1	--	--	.7	--
Copper	1	--	--	82.9	--
Iron	1	--	--	1,140	--
Lead	1	--	--	5.7	--
Manganese	1	--	--	910	--
Nickel	1	--	--	1.1	--
Zinc	1	--	--	151	--
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for biological data: 1996					
Arctopsyche grandis					
Cadmium	1	--	--	1.7	--
Chromium	1	--	--	<2.4	--
Copper	1	--	--	30.8	--
Iron	1	--	--	340	--
Lead	1	--	--	<14.5	--
Manganese	1	--	--	510	--
Nickel	1	--	--	1.0	--
Zinc	1	--	--	87	--
Hydropsyche cockerelli					
Cadmium	1	--	--	.9	--
Chromium	1	--	--	1.0	--
Copper	1	--	--	87.6	--
Iron	1	--	--	831	--
Lead	1	--	--	6.8	--
Manganese	1	--	--	697	--
Nickel	1	--	--	1.9	--
Zinc	1	--	--	162	--
Hydropsyche occidentalis					
Cadmium	2	1.5	1.4	1.5	--
Chromium	2	1.3	1.2	1.2	--
Copper	2	125	117	121	--
Iron	2	1,180	1,100	1,140	--
Lead	2	10.1	9.7	9.9	--
Manganese	2	2,280	2,170	2,220	--
Nickel	2	1.2	1.2	1.2	--
Zinc	2	240	232	236	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.--Continued Period of record for biological data: 1996					
Hydropsyche spp.					
Cadmium	1	--	--	1.6	--
Chromium	1	--	--	1.4	--
Copper	1	--	--	104	--
Iron	1	--	--	1,070	--
Lead	1	--	--	10.5	--
Manganese	1	--	--	1,150	--
Nickel	1	--	--	1.6	--
Zinc	1	--	--	191	--
12324200--CLARK FORK AT DEER LODGE, MONT. Period of record for biological data: 1986-87, 1990-96					
Arctopsyche grandis					
Cadmium	1	--	--	2.4	--
Chromium	1	--	--	<1.3	--
Copper	1	--	--	39.1	--
Iron	1	--	--	676	--
Lead	1	--	--	<7.8	--
Manganese	1	--	--	727	--
Nickel	1	--	--	<1.3	--
Zinc	1	--	--	178	--
Hydropsyche cockerelli					
Cadmium	16	2.3	.8	1.4	1.3
Chromium	16	3.2	.4	1.7	1.8
Copper	16	136	54.7	96.5	101
Iron	16	3,340	490	1,170	1,050
Lead	16	18.2	4.3	9.4	8.9
Manganese	16	1,030	499	705	686
Nickel	16	2.4	.3	1.2	1.3
Zinc	16	391	132	188	184
Hydropsyche occidentalis					
Cadmium	19	2.7	.8	1.4	1.3
Chromium	19	2.3	.6	1.8	1.9
Copper	19	160	49	114	112
Iron	19	1,640	557	1,370	1,420
Lead	19	16.2	6.3	11.3	10.9
Manganese	19	2,840	1,130	1,840	1,830
Nickel	19	12.9	1.1	2.2	1.5
Zinc	19	299	196	243	238

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi- mum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT.--Continued					
Period of record for biological data: 1986-87, 1990-96					
Hydropsyche spp.					
Cadmium	3	2.0	1.2	1.6	1.6
Chromium	0	--	--	--	--
Copper	3	222	103	145	111
Iron	3	2,220	1,110	1,520	1,240
Lead	3	15.0	5.6	8.8	5.7
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	3	203	185	195	197
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for biological data: 1987, 1994					
Arctopsyche grandis					
Cadmium	9	.4	.2	.3	.3
Chromium	9	.8	.6	.7	.8
Copper	9	14.0	9.1	11.5	11.8
Iron	9	325	177	242	230
Lead	9	1.3	.5	.8	.8
Manganese	9	596	318	471	492
Nickel	9	.6	.4	.5	.5
Zinc	9	179	113	146	145
Claassenia sabulosa					
Cadmium	4	.3	.1	.2	.2
Chromium	4	.8	.7	.8	.8
Copper	4	34.0	20.0	27.9	28.8
Iron	4	200	98	138	127
Lead	4	<.7	<.4	--[1]	<.6
Manganese	4	62.1	46.7	53.4	51.3
Nickel	4	.7	.5	.6	.5
Zinc	4	233	191	206	201
Hydropsyche cockerelli					
Cadmium	1	--	--	.6	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	28.4	--
Iron	1	--	--	478	--
Lead	1	--	--	3.6	--
Manganese	1	--	--	399	--
Nickel	1	--	--	1.2	--
Zinc	1	--	-	123	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.--Continued					
Period of record for biological data: 1987, 1994					
Hydropsyche occidentalis					
Cadmium	1	--	--	<.7	--
Chromium	1	--	--	1.3	--
Copper	1	--	--	15.1	--
Iron	1	--	--	426	--
Lead	1	--	--	<3.7	--
Manganese	1	--	--	434	--
Nickel	1	--	--	.8	--
Zinc	1	--	-	110	--
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for biological data: 1992-96					
Arctopsyche grandis					
Cadmium	10	6.6	1.4	2.7	2.5
Chromium	10	2.3	.8	1.1	1.0
Copper	10	61.1	28.8	46.0	48.2
Iron	10	737	339	553	564
Lead	10	4.5	2.3	3.4	3.6
Manganese	10	1,100	592	862	851
Nickel	10	1.0	.2	.7	.8
Zinc	10	309	165	196	184
Claassenia sabulosa					
Cadmium	10	2.5	.6	1.4	1.1
Chromium	10	1.6	.3	.7	.6
Copper	10	66.6	33.0	52.0	50.0
Iron	10	230	63.0	151	151
Lead	10	1.6	.5	1.0	1.0
Manganese	10	179	65.1	104	91.4
Nickel	10	.7	.2	.3	.3
Zinc	10	296	166	239	258
Hydropsyche cockerelli					
Cadmium	9	2.6	.6	1.9	2.0
Chromium	9	4.2	.7	2.0	1.9
Copper	9	122	33.5	74.4	66.6
Iron	9	1,510	589	896	631
Lead	9	10.1	4.5	6.7	6.0
Manganese	9	954	538	711	596
Nickel	9	1.5	.6	1.2	1.2
Zinc	9	218	137	185	200

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12324680--CLARK FORK AT GOLDCREEK, MONT.--Continued					
Period of record for biological data: 1992-96					
Hydropsyche morosa group					
Cadmium	4	1.7	1.1	1.4	1.4
Chromium	4	1.4	1.3	1.4	1.4
Copper	4	72.9	43.8	60.5	62.7
Iron	4	1,320	612	1,050	1,130
Lead	4	6.9	2.4	4.6	4.6
Manganese	4	1,030	538	804	822
Nickel	4	1.4	.9	1.2	1.2
Zinc	4	190	137	167	170
Hydropsyche occidentalis					
Cadmium	8	1.7	.7	1.2	1.3
Chromium	8	1.7	.4	1.0	1.1
Copper	8	81.3	26.4	46.6	45.4
Iron	8	1,180	466	786	752
Lead	8	8.6	2.9	5.5	5.5
Manganese	8	1,800	530	1,140	1,050
Nickel	8	1.2	.8	1.0	1.0
Zinc	8	207	97	168	174
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for biological data: 1986, 1992-96					
Arctopsyche grandis					
Cadmium	27	.8	.2	.4	.4
Chromium	27	4.7	.6	2.0	1.9
Copper	27	21.7	9.8	15.7	15.3
Iron	27	2,460	606	1,430	1,410
Lead	27	17.5	3.7	9.5	9.3
Manganese	27	2,480	848	1,600	1,390
Nickel	27	2.7	.6	1.4	1.3
Zinc	27	275	151	204	199
Hydropsyche cockerelli					
Cadmium	6	.7	.2	.4	.4
Chromium	6	2.2	1.0	1.4	1.1
Copper	6	28.3	9.5	18.4	18.6
Iron	6	2,180	996	1,510	1,360
Lead	6	17.9	3.1	9.6	9.1
Manganese	6	1,440	401	1,040	1,130
Nickel	6	2.3	.9	1.8	1.9
Zinc	6	193	85	149	159

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12331500--FLINT CREEK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1992-96					
Hydropsyche occidentalis					
Cadmium	5	1.0	.2	.6	.7
Chromium	5	17.6	.7	5.1	1.6
Copper	5	26.4	15.1	19.6	18.4
Iron	5	2,550	912	1,790	1,870
Lead	5	29.2	5.8	18.3	24.0
Manganese	5	2,690	1,400	1,870	1,750
Nickel	5	6.9	.8	3.4	3.5
Zinc	5	243	128	182	188
Hydropsyche tana					
Cadmium	2	<1.2	<.1	--[1]	--
Chromium	2	10.3	.6	5.4	--
Copper	2	16.0	5.4	10.7	--
Iron	2	1,320	729	1,020	--
Lead	2	15.3	5.0	10.2	--
Manganese	2	1,400	1,180	1,290	--
Nickel	2	3.1	.5	1.8	--
Zinc	2	139	107	123	--
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for biological data: 1986, 1991-96					
Arctopsyche grandis					
Cadmium	17	1.8	.7	1.3	1.3
Chromium	17	1.1	.2	.8	.9
Copper	17	55.3	18.2	32.1	28.2
Iron	17	931	240	548	547
Lead	17	11.8	2.1	4.5	3.9
Manganese	17	2,010	462	871	669
Nickel	17	1.9	.2	.6	.6
Zinc	17	308	142	190	183
Claassenia sabulosa					
Cadmium	24	2.2	.3	1.2	1.3
Chromium	24	3.3	.3	.8	.6
Copper	24	130	18.0	46.9	52.6
Iron	24	290	76.0	137	110
Lead	24	2.2	.2	.8	.8
Manganese	24	270	45.9	134	144
Nickel	24	1.1	.1	.3	.2
Zinc	24	469	140	262	240

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1991-96					
Hydropsyche cockerelli					
Cadmium	11	1.7	.7	1.4	1.5
Chromium	11	1.8	.4	1.4	1.5
Copper	11	85.6	37.9	57.9	55.9
Iron	11	1,450	506	904	817
Lead	11	9.2	5.1	6.9	6.7
Manganese	11	929	549	760	743
Nickel	11	1.2	.5	.9	1.1
Zinc	11	209	164	183	184
Hydropsyche morosa group					
Cadmium	6	1.3	1.1	1.2	1.2
Chromium	6	2.8	1.9	2.3	2.2
Copper	6	57.4	50.2	55.2	55.8
Iron	6	1,730	1,380	1,570	1,600
Lead	6	10.8	7.0	8.9	9.0
Manganese	6	1,940	1,260	1,610	1,620
Nickel	6	1.7	1.3	1.5	1.5
Zinc	6	250	227	239	240
Hydropsyche occidentalis					
Cadmium	9	1.5	.7	1.0	1.1
Chromium	9	8.1	.4	2.6	2.0
Copper	9	57.2	13.3	47.2	51.1
Iron	9	1,800	424	1,070	972
Lead	9	12.5	2.9	7.2	7.3
Manganese	9	2,920	619	1,580	1,200
Nickel	9	2.4	.5	1.4	1.7
Zinc	9	283	157	219	221
Hydropsyche spp.					
Cadmium	1	--	--	2.6	--
Chromium	0	--	--	--	--
Copper	1	--	--	85.0	--
Iron	1	--	--	940	--
Lead	1	--	--	9.1	--
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	1	--	--	260	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
		12334510--ROCK CREEK NEAR CLINTON, MONT. **Period of record for biological data: 1987, 1991-96**			
		Arctopsyche grandis			
Cadmium	25	.4	.06	.2	.1
Chromium	25	2.9	.5	1.1	1.0
Copper	25	12.3	4.7	8.2	7.6
Iron	25	799	191	442	421
Lead	25	<2.9	.1	.4	.3
Manganese	25	364	113	223	216
Nickel	25	1.6	.2	.7	.6
Zinc	25	189	84	125	121
		Claassenia sabulosa			
Cadmium	13	.3	.05	.2	.1
Chromium	13	1.8	.4	.8	.6
Copper	13	40.7	18.1	29.2	28.5
Iron	13	118	49.8	85.7	83.8
Lead	13	1.0	.1	.3	.3
Manganese	13	51.2	15.7	31.4	30.3
Nickel	13	.9	.1	.3	.3
Zinc	13	242	164	203	211
		Hydropsyche cockerelli			
Cadmium	3	<.2	<.2	--[1]	<.2
Chromium	3	1.0	.9	.9	.9
Copper	3	13.1	6.0	8.6	6.6
Iron	3	609	485	530	497
Lead	3	<1.1	<1.1	--[1]	<1.1
Manganese	3	258	192	219	208
Nickel	3	.9	.4	.6	.4
Zinc	3	99	82	89	86
		Hydropsyche occidentalis			
Cadmium	4	<1.0	<.3	--[1]	<.3
Chromium	4	2.4	.9	1.6	.9
Copper	4	17.6	9.6	12.0	10.2
Iron	4	752	520	642	648
Lead	4	6.0	1.2	3.0	1.2
Manganese	4	268	169	228	215
Nickel	4	1.7	.6	1.2	.9
Zinc	4	144	99	121	117

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.--Continued					
Period of record for biological data: 1987, 1991-96					
Hydropsyche spp.					
Cadmium	1	--	--	<.5	--
Chromium	1	--	--	1.1	--
Copper	1	--	--	15.0	--
Iron	1	--	--	837	--
Lead	1	--	--	<3.1	--
Manganese	1	--	--	299	--
Nickel	1	--	--	.8	--
Zinc	1	--	--	135	--
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for biological data: 1986, 1991-96					
Arctopsyche grandis					
Cadmium	20	1.9	.6	1.1	.9
Chromium	20	2.6	.6	1.4	1.4
Copper	20	48.6	20.1	28.9	26.3
Iron	20	1,380	420	719	685
Lead	20	5.0	2.1	3.1	2.9
Manganese	20	825	351	556	534
Nickel	20	1.4	.4	.8	.7
Zinc	20	240	152	185	176
Claassenia sabulosa					
Cadmium	17	2.5	.3	1.1	.8
Chromium	17	2.0	.4	.8	.6
Copper	17	76.5	38.3	54.5	53.4
Iron	17	181	58.6	98.9	97.9
Lead	17	1.0	.2	.6	.6
Manganese	17	117	42.0	71.8	64.3
Nickel	17	.6	.1	.2	.1
Zinc	17	283	144	218	230
Hydropsyche cockerelli					
Cadmium	15	1.4	.6	.8	.7
Chromium	15	8.0	1.0	2.0	1.6
Copper	15	63.6	26.4	39.7	40.2
Iron	15	1,580	688	1,030	1,030
Lead	15	6.3	2.2	4.1	4.3
Manganese	15	788	426	550	537
Nickel	15	2.6	.6	1.1	1.0
Zinc	15	224	148	180	180

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.--Continued					
Period of record for biological data: 1986, 1991-96					
Hydropsyche morosa group					
Cadmium	1	--	--	1.1	--
Chromium	1	--	--	4.6	--
Copper	1	--	--	26.8	--
Iron	1	--	--	986	--
Lead	1	--	--	6.6	--
Manganese	1	--	--	1,320	--
Nickel	1	--	--	1.7	--
Zinc	1	--	--	231	--
Hydropsyche occidentalis					
Cadmium	10	1.3	.3	.7	.7
Chromium	10	2.4	.6	1.5	1.5
Copper	10	44.9	34.1	38.3	38.2
Iron	10	1,130	472	871	898
Lead	10	8.2	3.0	5.0	4.6
Manganese	10	1,510	454	775	656
Nickel	10	1.8	.6	.9	.8
Zinc	10	231	145	182	175
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for biological data: 1986-87, 1991, 1993, 1996					
Arctopsyche grandis					
Cadmium	6	.3	<.1	[1].2	[1].2
Chromium	0	--	--	--	--
Copper	6	17.9	12.1	14.3	13.1
Iron	6	483	108	327	431
Lead	6	2.1	<.6	[1]1.1	[1]<1.9
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	6	366	123	223	136
Claassenia sabulosa					
Cadmium	9	.6	.1	.4	.5
Chromium	0	--	--	--	--
Copper	9	51.0	32.0	43.0	44.0
Iron	9	199	68.0	116	113
Lead	9	.6	<.3	[1].3	<.5
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	9	233	184	203	197

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.--Continued					
Period of record for biological data: 1986-87, 1991, 1993, 1996					
Hydropsyche occidentalis					
Cadmium	9	.5	.1	.2	.2
Chromium	9	2.1	.8	1.5	1.5
Copper	9	20.6	13.0	14.9	14.5
Iron	9	1,530	1,060	1,270	1,260
Lead	9	1.9	1.1	1.3	1.6
Manganese	9	527	414	463	452
Nickel	9	1.8	.9	1.2	1.2
Zinc	9	150	123	138	144
Hydropsyche spp.					
Cadmium	1	--	--	.6	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	13.9	--
Iron	1	--	--	1,120	--
Lead	1	--	--	2.9	--
Manganese	1	--	--	525	--
Nickel	1	--	--	2.8	--
Zinc	1	--	--	132	--
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for biological data: 1986, 1990-96					
Arctopsyche grandis					
Cadmium	9	.9	.3	.4	.4
Chromium	9	2.7	.5	1.1	1.0
Copper	9	22.0	9.4	14.8	16.0
Iron	9	813	343	510	497
Lead	9	1.9	.9	1.3	1.3
Manganese	9	1,090	511	723	668
Nickel	9	1.0	.4	.7	.6
Zinc	9	169	106	137	137
Claassenia sabulosa					
Cadmium	25	1.0	.2	.5	.4
Chromium	25	1.2	.05	.5	.5
Copper	25	61.5	31.1	46.1	46.5
Iron	25	152	66.6	94.4	87.3
Lead	25	1.3	.1	.4	.3
Manganese	25	168	48.9	98.5	93.0
Nickel	25	.3	.1	.2	.2
Zinc	25	286	146	201	200

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1996 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]--Continued Period of record for biological data: 1986, 1990-96					
Hydropsyche cockerelli					
Cadmium	21	.7	.2	.5	.6
Chromium	21	3.4	.8	1.9	1.9
Copper	21	39.3	12.4	27.5	27.5
Iron	21	1,590	645	1,150	1,200
Lead	21	3.6	1.2	2.1	1.9
Manganese	21	1,180	353	726	664
Nickel	21	1.5	.5	1.2	1.1
Zinc	21	172	77.4	144	158
Hydropsyche occidentalis					
Cadmium	8	.9	.2	.4	.2
Chromium	8	3.5	.2	1.4	1.2
Copper	8	30.5	18.9	23.4	20.7
Iron	8	1,420	482	806	731
Lead	8	3.5	.7	1.8	1.8
Manganese	8	1,460	667	949	956
Nickel	8	2.2	.5	1.0	.8
Zinc	8	193	116	141	131
Hydropsyche spp.					
Cadmium	1	--	--	.5	--
Chromium	1	--	--	.8	--
Copper	1	--	--	20.8	--
Iron	1	--	--	894	--
Lead	1	--	--	1.1	--
Manganese	1	--	--	756	--
Nickel	1	--	--	1.1	--
Zinc	1	--	--	124	--

[1]Values determined by arbitrarily substituting one-half of the detection level for censored (<) values, when both uncensored and censored values are used in determining the mean. When all data are below the detection level, the median is determined by ranking the censored values in order of detection level. No mean is reported when all values are below the detection level.

[2]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

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