In cooperation with the
U.S. ENVIRONMENTAL PROTECTION AGENCY

Water-Quality, Bed-Sediment, and Biological Data (October 1999 Through September 2000) and Statistical Summaries of Data for Streams in the Upper Clark Fork Basin, Montana

By Kent A. Dodge, Michelle I. Hornberger, and Carlos Primo C. David

Open-File Report 01-379

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CONVERSION FACTORS, ABBREVIATED WATER-QUALITY UNITS, AND ACRONYMS

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:

$$^{\circ}F = 9/5\ (^{\circ}C) + 32$$

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.

Acronyms used in the report:

ICAPES	Inductively Coupled Argon Plasma Emission Spectroscopy
LRL	laboratory reporting levels
LT-MDL	long-term method detection levels
NWQL	USGS National Water Quality Laboratory, Denver, Colo.
RSD	relative standard deviation
SRM	standard reference material
USGS	U.S. Geological Survey

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By Kent A. Dodge, Michelle I. Hornberger[1], *and* Carlos Primo C. David[1]

Abstract

Water, bed sediment, and biota were sampled in streams from Butte 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 15 stations during October 1999 through September 2000 (water year 2000). Data for 14 bed-sediment and 14 biological stations were obtained in September 2000. 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. 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 1870 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 arsenic, 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 can 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 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

[1]U.S. Geological Survey, Menlo Park, Calif.

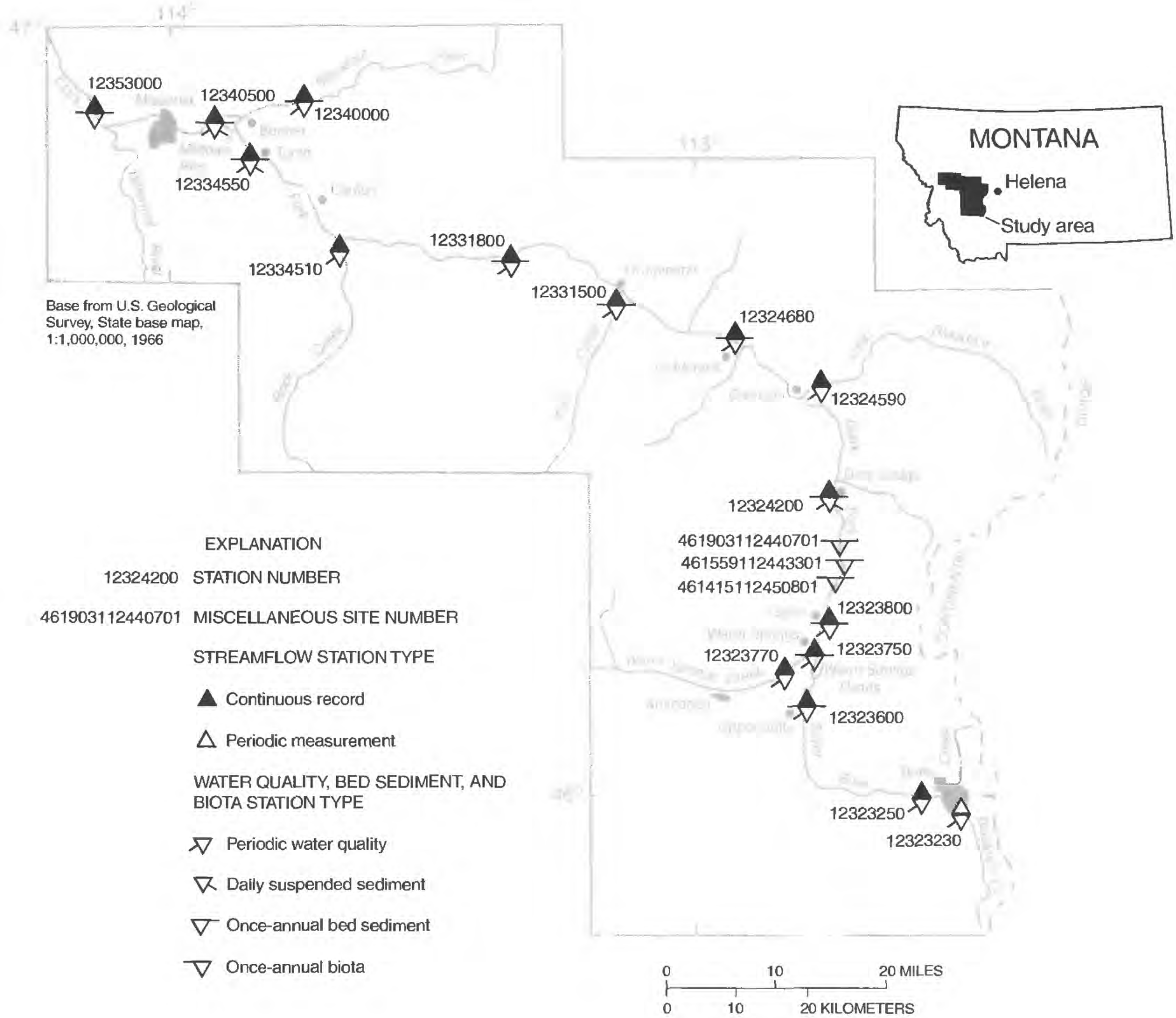

Figure 1. Location of study area.

basin since 1985 (Lambing, 1987, 1988, 1989, 1990, and 1991; Lambing and others, 1994, 1995; and Dodge and others, 1996, 1997, 1998, 1999, 2000). 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; Axtmann and others, 1997; Cain and others, 1992, 1995; Hornberger and others, 1997). 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 to better quantify the seasonal and annual variability in selected constituents.

The purpose of this report is to present water-quality data for 15 stations and trace-element data for 14 bed-sediment and 14 biological stations in the upper Clark Fork basin collected from October 1999 through September 2000 (water year 2000). 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 the Clark Fork mainstem and major tributaries from Butte to below Missoula (fig. 1). 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 15 stations; daily suspended-sediment data were obtained at 3 of these stations. Trace-element data for 14 bed-sediment and 14 biological stations were obtained once-annually (table 1).

A list of properties measured onsite and constituents analyzed in samples of water, bed sediment, and biota is given in table 2. Results of analyses for water, bed sediment, biota, and associated quality-assurance data for water year 2000 are listed in tables 4 through 20 at the back of the report. Statistical summaries of water-quality, bed-sediment, and biological data collected between March 1985 and September 2000 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 6 to 8 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 Knapton (1985), Ward and Harr (1990), Wilde and others (1998), and Edwards and Glysson (1999). These methods provide a vertically and laterally discharge-weighted composite 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-48, 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 air and water temperature, specific conductance, and pH were made during collection of periodic water-quality samples. Onsite sample processing, including filtration and preservation, was performed according to procedures described by Knapton (1985), Ward and Harr (1990), and Horowitz and others (1994). 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 Denver, 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).

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 8 times per week. These samples were collected by local contract observers using the depth-integration method at a single vertical near mid-stream. The samples were analyzed for suspended-sediment

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

[Abbreviations: P, present. 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]
12323230	Blacktail Creek at Harrison Avenue, at Butte	--	03/93-08/95, 12/96-P	--	--	--	--
12323250	Silver Bow Creek below Blacktail Creek, at Butte	10/83-P	03/93-08/95, 12/96-P	--	--	--	--
12323600	Silver Bow Creek at Opportunity	07/88-P	03/93-08/95, 12/96-P	03/93-09/95	07/92-P	08/93-08/95, 08/97-P	07/92, 08/94, 08/95, 08/97-P
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, 08/97, 08/99	08/95, 08/97, 08/99	08/95, 08/97, 08/99
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-P	08/96-P	08/96-P
461559112443301	Clark Fork near Racetrack	--	--	--	08/96-P	08/96-P	08/96-P
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	--	--	--	08/96-P	08/96-P	08/96-P
12324200	Clark Fork at Deer Lodge	10/78-P	03/85-P	03/85-08/86, 04/87-P	08/86, 08/97, 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, 08/98	08/94, 08/98	08/87, 08/94 08/98
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, 08/91-99	08/93-99	08/87, 08/91-99
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	07/86-04/87, 06/88-09/95	08/86, 08/87, 08/91, 08/93-96, 08/98-P	08/93, 08/94, 08/99-P	08/86, 08/87, 08/91, 08/93, 08/96, 08/98, 09/00
12340500	Clark Fork above Missoula	03/29-P	07/86-P[3]	07/86-04/87, 06/88-01/96, 03/96-P	08/97-P	08/97-P	08/97-P
12353000	Clark Fork below Missoula[4]	10/29-P	03/85-09/95	--	08/86, 08/90-P	08/93-P	08/86, 08/90-P

[1]Onsite measurements of physical properties and laboratory analyses of major ions, trace elements, and suspended sediment. Prior to March 1993, laboratory analyses included only trace elements and suspended sediment, with the exception of Clark Fork below Missoula.
[2]Laboratory analyses of trace elements.
[3]Prior to October 1989, water-quality data for Clark Fork above Missoula only included suspended-sediment data.
[4]Bed sediment and biota sampled about 30 miles downstream from streamflow-gaging station to conform to previous sampling location. Water-quality sampling discontinued in 1995.

Table 2. Properties measured onsite 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		

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 1999 through September 2000 (water year 2000) 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 2000 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.

Quality Assurance

Quality-assurance procedures used for the collection and field processing of water-quality samples are described by Ward and Harr (1990), Knapton and Nimick (1991), Horowitz and others (1994), Wilde and others, (1998), and Edwards and Glysson (1999). 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 (1995). 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, 1995). These internal practices include analyses of quality-control samples such as calibration standards, standard reference water samples, replicate samples, deionized-water blanks, or spiked samples at a proportion equivalent to at least 10 percent of the sample load. The NWQL participates in a blind-sample program where standard reference water samples prepared by the USGS Branch of Quality Systems are routinely inserted into the sample line for each analytical method at a frequency proportional to the sample load. The laboratory also participates in external evaluation studies twice-yearly with the U.S. Environmental Protection Agency, the Canadian Center for Inland Water, and the Branch of Quality Systems to assess analytical performance.

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

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 stream samples for chemical analysis were obtained in the field by splitting a composite stream sample and replicate stream samples for suspended-sediment analysis were obtained in the field by concurrently collecting two independent cross-sectional samples. 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 with laboratory replicates, which excluded field sources of variability. Two independent 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 the reproducibility of laboratory analytical results independent of possible variability 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 acceptable 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

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
	Laboratory reporting level[1]		Maximum relative standard deviation of laboratory replicate analyses, in percent	Maximum deviation of spike recovery, in percent
Calcium, dissolved	0.02	mg/L	20	--
Magnesium, dissolved	.01	mg/L	20	--
Arsenic, total recoverable	3	µg/L	20	25
Arsenic, dissolved	.9-2	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	20	µg/L	20	25
Iron, dissolved	10	µg/L	20	25
Lead, total recoverable	1	µg/L	20	25
Lead, dissolved	1	µg/L	20	25
Manganese, total recoverable	3	µg/L	20	25
Manganese, dissolved	1	µg/L	20	25
Zinc, total recoverable	1-31	µg/L	20	25
Zinc, dissolved	1	µg/L	20	25
Sediment, suspended	1	mg/L	--	--
Sediment, suspended (percent finer than 0.062 mm)	1	percent	--	--

[1]For those constituents showing a range of values, the laboratory reporting level changed during water year 2000.

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.

During water year 1999, the NWQL began implementation of a new, statistically based convention for establishing reporting levels and for reporting low-concentration data (Childress and others, 1999). Quality-control data are collected on a continuing basis to determine long-term method detection levels (LT-MDLs) and laboratory reporting levels (LRLs). These values are re-evaluated each year and, consequently, may change from year to year. The methods are designed to limit the possible occurrence of a false positive or false negative error to 1 percent or less. Accordingly, concentrations are reported as less than the LRL for samples in which the analyte was either not detected or did not pass identification criteria. Analytes that are detected at concentrations between the LT-MDL and LRL and that pass identification criteria are estimated. Estimated concentrations are noted with a remark code of "E." These data need to be used with the understanding that their uncertainty is greater than that of data reported without the "E" remark code.

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):

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

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.

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. The data-quality objective used to evaluate precision of results for field replicates was a maximum relative standard deviation of 20 percent. Precision estimates for the field replicate analysis were within the 20-percent relative standard deviation limit for all constituents except dissolved copper. The exceedance for dissolved copper was a result of poor comparison in one replicate sample set; therefore, results for field replicates indicated acceptable reproducibility.

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. The data-quality objective for analytical precision of laboratory-replicate analyses is a maximum relative standard deviation of 20 percent. Precision estimates for laboratory-replicate analyses (table 10) were within the 20-percent relative standard deviation limit for all constituents except total-recoverable cadmium and dissolved lead. The exceedance of both constituents was an artifact of comparing analytical results that were below laboratory equipment detection capabilities.

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. 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, in percent, according to equation 3 below. 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

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

particular trace element until recoveries were improved to the extent possible.

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 97.4 to 107.8 percent. The mean spike recovery for spiked stream samples ranged from 94.6 to 105.3 percent. The 95-percent confidence intervals (Taylor, 1987) for the mean of spike recovery for each constituent analyzed in stream samples (table 12) did not exceed a 25-percent deviation from an expected 100-percent recovery.

High or low bias is indicated if the confidence interval does not include 100 percent recovery. All laboratory-spiked stream samples (table 12) had confidence intervals for percent recovery that included 100 percent, except total-recoverable lead which ranged from 103 to 108 percent. Because the mean spike recoveries for all constituents 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 laboratory reporting level (LRL) 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 LRL (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 were evaluated for a consistent trend that may indicate systematic contamination. Sporadic, infrequent exceedances of twice the LRL 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 a long-term record of analytical results. However, if concentrations for a particular constituent exceed twice the LRL 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 LRL. Total-recoverable zinc had two consecutive exceedances of twice the LRL. Because the exceedances were only slightly higher than the LRL, occurred at the time of an analytical method change, and were followed by non-detectable concentrations in subsequent blanks, these occurrences were considered sporadic, and not persistent in the field or analytical process. 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 trace-element concentrations in the fine-grained and bulk (fine plus coarse) fractions of the bed-sediment sample. Bed-sediment samples are collected once-annually during low, stable flow conditions to facilitate data comparisons among years.

Methods

Bed-sediment samples were collected in September 2000 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 two composite samples 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 were not sieved and generally were 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 Menlo Park, Calif. 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). Two aliquots were similarly digested 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 analyzed for cadmium, chromium, copper, iron, lead, manganese, nickel, silver, and zinc using Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES).

Results

Concentrations of trace elements measured in samples of fine-grained and bulk bed sediment collected during September 2000 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 among 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, U.S. Geological Survey, 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 (SRMs) are commercially prepared materials that have certified concentrations of trace elements. Replicate analyses of SRMs 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 SRMs for bed sediment is summarized in table 16. Two SRMs 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 SRMs when using less than a total digestion is useful 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, percent recoveries are shown in table 16 to illustrate analytical performance. Chromium for both low-concentration range (SRM 2709) and high-concentration range (SRM 2711) showed mean recoveries outside a 25-percent deviation from complete (100 percent) recovery. Chromium recovery was consistently low for both SRM2709 and SRM2711 (72.2 and 50.7 percent, respectively). Cadmium and silver were below the analytical detection limit in the low-range SRM (2709). The reason for the lack of measurable recoveries for the low range cadmium and silver is believed to be the result of analyzing concentrations very close to the detection limit, coupled with signal enhancement resulting from matrix interference. Mean recoveries for all other constituents in both the low and high concentration range were within 25 percent. 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. All procedural blanks had concentrations less than analytical detection levels. None of the detectable concentrations in blanks were 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 trace-element concentrations in the whole-body tissue of aquatic benthic insects. Insect samples are collected once-annually at the same sites and dates as bed-sediment samples (table 1), allowing for a direct comparison of annual results.

Methods

Insect samples were collected using protocols described in Hornberger and others (1997). 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., *Brachycentrus* spp., and *Arctopsyche grandis* of the Order Trichoptera (caddisflies), and *Claassenia sabulosa* of the Order Plecoptera (stoneflies). Samples of each taxon were sorted by genus and placed in acid-washed plastic containers. Samples were frozen on dry ice within 30 minutes of collection in a small amount of ambient river water. In previous years (1986-98), benthic insects were depurated for a period of 6-8 hours in an effort to evacuate gut contents. In 1998, a comparison of samples collected using both methods showed no significant difference in metal concentrations in benthic insects, with the exception of copper. Average copper concentrations in depurated samples were 8-25 percent lower than samples frozen within 30 minutes of collection (M.I. Hornberger, unpub. data, 2000). The change in the field protocol minimizes the chance of metal loss through cell membranes during depuration and is consistent with methods established by Cain and Luoma (1998).

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

Concentrations of trace elements in whole-body tissue of aquatic insects collected during September 2000 are summarized in table 18. The variability in the number of composite samples among species and among sites reflects differences in insect abundance, with the number of composite samples increasing with the relative abundance of insects. Liquid-phase concentrations analyzed in the reconstituted samples were converted to solid-phase concentrations using equation 4. As with bed sediment, minimum reporting levels may differ among 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 species of *Hydropsyche* were targeted for collection in this study due to their occurrence at most, but not all, sites: *Hydropsyche occidentalis* and *Hydropsyche cockerelli*. *Hydropsyche* species that could not be positively identified were considered to belong to the *morosa* group and are categorized as *Hydropsyche* spp. or *Hydropsyche morosa* group. *Arctopsyche grandis*, *Brachycentrus* spp., and *Claasenia sabulosa* also were collected, where available, to represent additional insect taxa that are fairly widely distributed in the upper Clark Fork basin.

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 were used for the tributary stations. Biota samples were collected along an increasing concentration gradient to minimize effects from potential 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. Quality-control samples consisted of SRM 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 the SRM for biota is summarized in table 19. The reference material tested was lobster hepatopancreas. Data-quality objectives have not been established for analytical recovery in biota, but percent recoveries are shown to illustrate analytical performance. Mean recoveries were within 6 percent of certified values for cadmium, iron, manganese, and zinc. Recoveries for copper and nickel were within 12 percent. The high bias reported for chromium may be due to an inter-element matrix interference within the SRM. Lead recoveries could not be measured due to the very low solution concentration of lead in the biota standard (less than 10 parts per billion). However, a quality-control standard commercially prepared, available through the National Institute of Standards and Technology, with a similar solution concentration as the SRM samples was analyzed throughout the analysis. Recoveries for all reported elements were within 10 percent of the quality-control standard. No adjustments were made to the trace-element concentrations for the 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. With the exception of chromium, all concentrations in the blanks were below detection levels. The detectable concentrations of chromium are within the range of instrument variability and are insignificant in relation to the measured concentrations in the insect samples; thus, no adjustments were made to trace-element concentrations in biota.

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 1986. 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 cross-sectional samples collected periodically by the USGS during the station's period of record. They do not include supplemental single-vertical samples collected by a contract observer at Clark Fork at Turah Bridge near Bonner, Blackfoot River near Bonner, and Clark Fork above Missoula from 1997 to 1999. Inclusion of supplemental sample results targeted for high-flow conditions would disproportionately skew the long-term statistics at these three sites relative to the other sites in the network. 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 abundances at each site and among all 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 among years or in variable analytical detection limits. Where minimum reporting levels vary among 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 among 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 between 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 1999 through September 2000

[Abbreviations: ft^3/s, cubic feet per second; °C, degrees Celsius; E, estimated; 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]

12323230--BLACKTAIL CREEK AT HARRISON AVENUE, AT BUTTE, 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)
NOV 1999									
15...	1445	6.7	297	8.0	7.5	120	33	8.3	3
MAR 2000									
06...	1200	6.4	288	7.8	7.0	110	32	8.1	E2
APR									
04...	1045	7.0	277	7.9	6.0	110	31	7.5	E2
MAY									
09...	0900	7.4	279	7.8	8.0	110	31	7.4	4
22...	0950	7.2	271	7.9	10.5	100	30	7.1	4
JUN									
04...	1435	5.0	284	8.2	17.5	110	32	7.9	4
JUL									
21...	0730	3.0	350	7.6	9.5	140	40	9.7	4
SEP									
01...	0720	2.4	328	7.7	10.0	130	37	8.9	E2

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)
NOV 1999								
15...	2	<0.1	<0.1	5	E1	603	26	E0.9
MAR 2000								
06...	3	<.1	<.1	3	2	349	100	<1
APR								
04...	2	<.1	<.1	3	2	341	120	<1
MAY								
09...	3	<.1	<.1	3	2	344	120	<1
22...	3	<.1	<1.0	3	2	393	130	<1
JUN								
04...	4	<.1	<.1	4	2	302	67	<1
JUL								
21...	2	<.1	<1.0	3	2	139	30	<1
SEP								
01...	2	<.1	<1.0	3	2	286	23	<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)
NOV 1999								
15...	<1	53	33	<31	2	15	0.27	70
MAR 2000								
06...	<1	53	45	5	3	6	.10	83
APR								
04...	<1	36	32	3	2	4	.08	86
MAY								
09...	<1	48	43	5	2	3	.06	90
22...	<1	53	46	4	4	5	.10	96
JUN								
04...	<1	33	30	2	3	3	.04	92
JUL								
21...	<1	45	43	6	5	5	.04	96
SEP								
01...	<1	66	44	6	3	3	.02	66

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (Continued)

12323250--SILVER BOW CREEK BELOW BLACKTAIL CREEK, AT BUTTE, 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)
NOV 1999									
15...	1530	21	522	7.9	7.0	170	47	12	13
MAR 2000									
06...	1315	23	525	7.9	9.0	170	47	12	11
APR									
04...	1210	24	493	7.9	10.0	160	46	11	10
MAY									
09...	1000	22	470	7.6	8.5	150	42	10	9
22...	1105	21	481	7.7	12.5	160	45	11	8
JUN									
04...	1545	16	506	8.1	20.0	170	47	12	10
JUL									
21...	0830	14	546	7.5	13.5	160	46	12	10
SEP									
01...	0815	13	562	7.5	15.0	170	48	12	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)
NOV 1999								
15...	8	1	.2	82	7	1,180	24	36
MAR 2000								
06...	11	2	1	76	20	843	31	14
APR								
04...	7	2	.7	54	16	834	31	15
MAY								
09...	7	1	.8	30	14	426	47	3
22...	7	1	<1	26	39	322	23	2
JUN								
04...	9	.9	.7	27	16	244	18	2
JUL								
21...	7	1	1	31	13	107	21	1
SEP								
01...	7	.7	.8	16	9	92	20	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)
NOV 1999								
15...	<1	428	305	285	118	19	1.1	86
MAR 2000								
06...	<1	595	534	426	318	20	1.2	71
APR								
04...	<1	510	487	319	237	18	1.2	84
MAY								
09...	<1	352	348	257	241	9	.53	92
22...	<1	269	252	254	248	6	.34	85
JUN								
04...	E1	268	246	178	155	4	.17	89
JUL								
21...	<1	208	189	292	266	4	.16	85
SEP								
01...	<1	176	161	234	217	4	.14	81

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (Continued)

12323600--SILVER BOW CREEK AT OPPORTUNITY, 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)
NOV 1999									
16...	0745	35	491	8.2	2.0	170	51	11	17
MAR 2000									
06...	1415	36	497	8.8	6.5	170	50	11	18
APR									
04...	1310	39	464	8.9	10.5	170	49	11	18
MAY									
09...	1115	45	464	8.6	8.5	160	47	10	16
22...	1210	45	392	9.0	14.0	150	44	9.0	13
JUN									
04...	1650	25	403	9.5	22.5	150	45	9.3	16
JUL									
21...	0920	15	599	8.6	14.5	210	62	14	22
SEP									
01...	1005	16	616	8.5	13.0	210	62	13	23

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)
NOV 1999								
16...	11	1	1	87	31	484	E9	17
MAR 2000								
06...	17	2	.8	129	43	804	15	19
APR								
04...	12	<1	.6	109	32	803	11	19
MAY								
09...	10	1	.5	84	24	667	<10	15
22...	9	.7	.3	62	19	537	E7	12
JUN								
04...	13	.6	.2	62	34	385	13	8
JUL								
21...	16	.7	.3	65	26	276	14	7
SEP								
01...	19	.9	.4	79	30	305	E9	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)
NOV 1999								
16...	<1	467	416	469	352	11	1.0	78
MAR 2000								
06...	<1	623	546	359	153	15	1.5	88
APR								
04...	<1	488	421	301	96	17	1.8	85
MAY								
09...	E.5	471	386	324	147	17	2.1	88
22...	<1	277	180	190	56	14	1.7	85
JUN								
04...	<1	174	68	144	27	10	.68	87
JUL								
21...	<1	253	188	169	71	7	.28	85
SEP								
01...	<1	460	350	251	109	9	.39	81

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (Continued)

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

Date	Time	Streamflow, instan-taneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temper-ature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magne-sium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
NOV 1999									
16...	0930	40	601	8.4	5.0	240	69	17	12
MAR 2000									
06...	1515	50	587	8.7	6.0	240	70	16	13
APR									
04...	1345	53	603	8.5	10.0	240	71	16	12
MAY									
09...	1210	60	547	8.7	11.0	220	62	16	18
22...	1300	87	395	9.0	15.5	150	43	11	25
JUN									
04...	1740	79	399	9.2	19.0	150	42	12	28
JUL									
21...	1040	29	588	9.2	17.5	260	75	18	33
SEP									
01...	1150	16	682	8.6	13.5	290	85	18	24

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)
NOV 1999								
16...	10	<.1	<.1	5	3	152	E7	E.8
MAR 2000								
06...	10	.1	<.1	8	6	222	E9	<1
APR								
04...	10	.1	<.1	10	9	262	E5	2
MAY								
09...	16	<.1	<.1	7	4	233	17	1
22...	20	E.09	<.1	9	5	297	17	1
JUN								
04...	25	<.1	<.1	9	5	270	31	1
JUL								
21...	26	<.1	<.1	7	3	88	<10	<1
SEP								
01...	22	<.1	<.1	6	3	72	<10	<1

Date	Lead, dissolved (µg/L)	Manga-nese, total recoverable (µg/L)	Manga-nese, 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)
NOV 1999								
16...	<1	151	136	<31	10	1	.11	90
MAR 2000								
06...	<1	180	133	30	13	4	.54	88
APR								
04...	<1	216	159	26	12	6	.86	69
MAY								
09...	<1	299	252	15	7	3	.49	93
22...	<1	228	111	16	4	7	1.6	92
JUN								
04...	<1	240	105	10	6	4	.85	95
JUL								
21...	<1	79	28	7	2	5	.39	67
SEP								
01...	<1	89	47	7	2	4	.17	75

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
16...	0815	48	352	8.2	3.5	170	51	10	6
APR 2000									
04...	1430	47	362	8.5	11.5	170	53	11	4
MAY									
22...	1345	48	253	8.5	15.0	120	36	6.7	5
JUN									
04...	1820	43	259	8.4	18.0	120	36	6.8	5
JUL									
21...	1015	4.8	539	8.3	16.0	270	83	15	12
SEP									
01...	1040	18	373	8.3	12.0	180	54	9.7	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)
NOV 1999								
16...	4	.2	<.1	26	E1	375	13	2
APR 2000								
04...	4	<.1	<.1	7	2	75	<10	<1
MAY								
22...	4	<.1	<.1	12	3	167	13	1
JUN								
04...	5	<.1	<.1	12	3	140	<10	1
JUL								
21...	9	<.1	<.1	8	4	44	E6	<1
SEP								
01...	7	<.1	<.1	7	4	53	E9	<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)
NOV 1999								
16...	<1	302	257	<31	1	18	2.3	82
APR 2000								
04...	<1	204	187	3	5	5	.63	69
MAY								
22...	<1	216	131	6	3	10	1.3	72
JUN								
04...	<1	208	123	3	3	7	.81	71
JUL								
21...	<1	80	61	2	2	4	.05	83
SEP								
01...	<1	136	96	3	2	3	.15	69

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (Continued)

12323800--CLARK FORK NEAR GALEN, MONT.

Date	Time	Streamflow, instan-taneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temper-ature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magne-sium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
NOV 1999									
16...	1015	89	483	8.5	4.5	210	60	14	8
MAR 2000									
06...	1610	100	489	8.5	6.0	210	61	13	9
APR									
04...	1515	106	502	8.5	10.5	220	66	14	8
MAY									
09...	1250	89	481	8.4	10.5	200	57	13	12
22...	1420	122	356	8.8	15.5	150	44	10	18
JUN									
04...	1850	120	352	8.9	19.0	140	41	9.9	20
JUL									
21...	1130	25	598	8.7	18.5	260	74	17	29
SEP									
01...	1220	32	534	8.4	14.0	240	70	15	15

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)
NOV 1999								
16...	7	E.05	<.1	8	3	137	<10	E1
MAR 2000								
06...	7	E.06	<.1	7	4	141	E7	<1
APR								
04...	7	<.1	<.1	9	4	156	<10	1
MAY								
09...	11	<.1	<.1	9	3	175	19	1
22...	15	E.05	<.1	14	5	278	10	2
JUN								
04...	19	<.1	<.1	13	5	230	18	1
JUL								
21...	23	<.1	<.1	10	6	82	<10	<1
SEP								
01...	13	E.06	<.1	9	5	79	E7	<1

Date	Lead, dissolved (μg/L)	Manga-nese, total recoverable (μg/L)	Manga-nese, 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)
NOV 1999								
16...	<1	163	129	<31	6	2	.48	81
MAR 2000								
06...	<1	177	137	18	9	4	1.1	76
APR								
04...	<1	155	121	13	6	5	1.4	60
MAY								
09...	<1	220	159	12	6	4	.96	75
22...	<1	230	81	16	4	10	3.3	75
JUN								
04...	<1	210	68	10	4	6	1.9	86
JUL								
21...	<1	114	65	8	4	3	.20	78
SEP								
01...	<1	98	46	11	4	5	.43	80

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
16...	1200	209	520	8.4	4.0	230	66	15	9
MAR 2000									
06...	1715	225	506	8.4	8.0	230	66	15	10
APR									
04...	1610	209	535	8.4	12.0	240	72	16	10
MAY									
09...	1350	108	523	8.5	11.5	220	64	15	12
22...	1530	97	451	8.7	17.5	190	57	12	16
JUN									
05...	0720	116	463	8.1	14.0	200	58	13	19
JUL									
21...	1225	29	512	8.6	19.5	220	65	14	15
SEP									
05...	1115	86	564	8.3	13.5	250	75	16	15

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)
NOV 1999								
16...	8	<.1	<.1	19	4	232	<10	2
MAR 2000								
06...	8	<.1	<.1	17	5	269	<10	2
APR								
04...	9	<.1	<.1	20	6	262	<10	2
MAY								
09...	11	<.1	<.1	16	7	146	16	2
22...	14	<.1	<.1	18	8	134	10	1
JUN								
05...	17	.1	<.1	29	7	335	E7	3
JUL								
21...	12	<.1	<.1	13	6	98	<10	1
SEP								
05...	12	.2	<.1	38	5	494	<10	5

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)
NOV 1999								
16...	<1	70	27	E15	7	10	5.6	80
MAR 2000								
06...	<1	62	30	23	10	13	7.9	70
APR								
04...	<1	60	31	20	7	13	7.3	72
MAY								
09...	<1	119	113	21	10	4	1.2	88
22...	<1	70	42	15	5	7	1.8	84
JUN								
05...	<1	157	64	28	12	15	4.7	92
JUL								
21...	<1	85	47	11	4	21	1.6	69
SEP								
05...	<1	185	29	45	5	31	7.2	84

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
16...	1245	55	281	8.4	4.0	130	38	8.8	4
APR 2000									
04...	1715	88	293	8.5	11.0	130	37	8.3	5
MAY									
24...	0835	78	281	8.1	10.0	130	39	8.8	5
JUN									
06...	0800	88	286	8.2	11.5	130	38	8.8	5
JUL									
27...	1145	27	309	8.4	18.5	150	44	10	6
SEP									
05...	1230	15	338	8.5	15.5	160	47	10	5

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)
NOV 1999								
16...	4	<.1	<.1	E1	E.8	36	<10	<1
APR 2000								
04...	5	<.1	<.1	2	E1	158	E7	<1
MAY								
24...	5	<.1	<.1	2	E1	126	13	<1
JUN								
06...	6	<.1	<.1	3	E1	124	18	<1
JUL								
27...	5	<.1	<.1	1	<1	57	E9	<1
SEP								
05...	5	<.1	<.1	1	E1	63	E6	<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)
NOV 1999								
16...	<1	6	4	<31	<1	2	.30	88
APR 2000								
04...	<1	18	7	2	4	8	1.9	84
MAY								
24...	<1	27	17	5	2	7	1.5	84
JUN								
06...	<1	25	15	<1	<1	6	1.4	84
JUL								
27...	<1	22	13	<1	<1	3	.22	88
SEP								
05...	<1	21	11	1	<1	16	.65	32

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
17...	0920	345	467	8.3	3.0	200	59	13	8
MAR 2000									
07...	0810	385	446	8.2	4.5	200	59	13	10
APR									
05...	0810	395	468	8.3	6.5	200	59	13	11
MAY									
09...	1520	260	402	8.6	12.0	170	49	11	9
22...	1655	248	393	8.8	17.5	170	50	11	11
JUN									
05...	0845	260	408	8.3	14.5	180	51	12	11
JUL									
21...	1330	93	431	8.7	21.5	190	56	13	12
SEP									
05...	1320	102	510	8.6	17.0	230	67	15	12

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)
NOV 1999								
17...	7	.1	<.1	21	3	280	<10	3
MAR 2000								
07...	7	.2	<.1	25	5	440	10	3
APR								
05...	8	.2	<.1	33	4	420	E10	5
MAY								
09...	8	<.1	<.1	9	4	129	<10	<1
22...	9	<.1	<.1	11	5	166	<10	1
JUN								
05...	11	E.05	<.1	16	5	250	<10	2
JUL								
21...	10	<.1	<.1	9	4	113	<10	<1
SEP								
05...	12	<.1	<.1	11	4	150	<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)
NOV 1999								
17...	<1	80	14	E27	5	15	14	84
MAR 2000								
07...	<1	81	25	32	9	23	24	75
APR								
05...	<1	66	25	38	5	41	44	75
MAY								
09...	<1	41	20	9	3	6	4.2	85
22...	<1	56	15	14	4	9	6.0	91
JUN								
05...	<1	87	20	15	5	13	9.1	93
JUL								
21...	<1	66	15	8	3	7	1.8	86
SEP								
05...	<1	60	7	12	2	12	3.3	78

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
17...	1030	E118	328	8.3	3.0	150	40	12	7
MAR 2000									
07...	0920	104	317	8.3	3.5	150	39	12	9
APR									
04...	1820	101	318	8.8	12.0	150	40	12	10
MAY									
09...	1625	2.8	406	8.8	13.0	180	49	14	11
22...	1800	16	275	8.7	18.5	130	36	10	12
JUN									
05...	0945	21	417	8.4	12.5	190	53	15	11
JUL									
27...	1030	8.0	512	8.3	16.0	250	68	19	13
SEP									
05...	1415	26	529	8.4	16.5	230	65	17	13

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)
NOV 1999								
17...	5	<.1	<.1	2	E.7	126	E6	2
MAR 2000								
07...	6	<.1	<.1	2	E.7	232	E9	3
APR								
04...	8	<.1	<.1	2	E.8	250	<10	3
MAY								
09...	11	<.1	<.1	2	E1	69	<10	<1
22...	10	<.1	<.1	2	2	210	E6	3
JUN								
05...	12	<.1	<.1	3	1	86	13	1
JUL								
27...	11	<.1	<.1	2	E1	72	E9	<1
SEP								
05...	12	1	<.1	2	2	166	17	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)
NOV 1999								
17...	<1	52	17	<31	1	7	E2.2	76
MAR 2000								
07...	<1	66	20	13	3	12	3.4	85
APR								
04...	<1	81	22	9	3	17	4.6	78
MAY								
09...	E.6	51	38	7	3	3	.02	79
22...	<1	118	40	10	3	13	.56	92
JUN								
05...	<1	100	78	3	4	4	.23	89
JUL								
27...	<1	110	90	4	1	13	.28	70
SEP								
05...	<1	132	63	7	3	19	1.3	55

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
17...	1120	556	474	8.3	4.5	210	60	15	8
MAR 2000									
07...	1030	570	464	8.4	6.5	220	62	15	10
APR									
05...	0915	529	483	8.4	8.5	220	62	15	10
MAY									
09...	1730	315	485	8.5	14.0	220	63	15	9
23...	0825	253	513	8.2	14.5	240	68	17	10
JUN									
05...	1045	337	508	8.4	17.5	230	65	16	12
JUL									
21...	1440	181	573	8.5	22.5	270	76	19	13
SEP									
05...	1515	194	616	8.5	17.5	280	80	19	11

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)
NOV 1999								
17...	7	E.08	<.1	11	3	184	<10	2
MAR 2000								
07...	7	E.1	<.1	28	5	366	<10	3
APR								
05...	9	<.1	<.1	13	4	278	<10	2
MAY								
09...	9	<.1	<.1	8	4	80	<10	1
23...	10	<.1	<.1	7	5	53	E6	<1
JUN								
05...	12	<.1	<.1	10	5	108	<10	<1
JUL								
21...	10	<.1	<.1	8	4	93	<10	<1
SEP								
05...	11	E.08	<.1	8	8	91	<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)
NOV 1999								
17...	<1	56	10	<31	4	12	18	73
MAR 2000								
07...	<1	63	19	27	8	20	31	74
APR								
05...	E.5	59	19	18	7	21	30	67
MAY								
09...	<1	27	13	14	4	4	3.4	91
23...	<1	32	19	11	8	3	2.0	92
JUN								
05...	<1	46	15	9	6	6	5.5	82
JUL								
21...	<1	57	13	10	3	23	11	50
SEP								
05...	<1	36	7	11	4	25	13	44

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
17...	1230	201	149	8.2	3.5	67	17	5.9	<3
APR 2000									
05...	1030	266	138	8.0	6.0	62	16	5.4	<3
MAY									
23...	1010	932	83	8.0	10.5	36	9.3	3.1	<3
JUN									
05...	1210	715	98	8.1	12.5	43	11	3.7	<3
JUL									
27...	0745	201	146	8.1	15.0	68	18	5.9	E2
SEP									
06...	1050	183	158	8.2	10.5	71	18	6.1	<3

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)
NOV 1999								
17...	<2	<.1	<.1	<1	<1	21	E6	<1
APR 2000								
05...	E.6	<.1	<.1	<1	<1	63	11	<1
MAY								
23...	E.5	<.1	<.1	1	E.9	211	20	<1
JUN								
05...	E.6	<.1	<.1	2	<1	91	<10	<1
JUL								
27...	E.7	<.1	<.1	<1	<1	67	E10	<1
SEP								
06...	E.6	<.1	<.1	<1	E.7	51	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)
NOV 1999								
17...	<1	E2	<1	<31	<1	1	.54	50
APR 2000								
05...	<1	3	<1	<1	<1	4	2.9	77
MAY								
23...	<1	13	1	3	3	16	40	70
JUN								
05...	<1	6	1	<1	2	6	12	73
JUL								
27...	<1	8	3	2	<1	5	2.7	71
SEP								
06...	<1	6	2	<1	<1	3	1.5	76

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
17...	1345	831	390	8.6	5.0	180	49	13	6
MAR 2000									
07...	1220	963	369	8.5	6.0	170	47	12	7
APR									
05...	1210	907	365	8.5	7.5	160	45	12	5
MAY									
10...	1040	1,080	234	8.4	9.0	100	29	7.6	3
23...	1155	1,230	201	8.3	12.5	88	24	6.6	3
JUN									
05...	1325	1,100	245	8.5	16.0	110	29	8.0	4
JUL									
21...	1550	452	310	8.8	21.5	140	39	11	6
SEP									
05...	1645	342	359	8.7	15.0	160	44	12	5

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)
NOV 1999								
17...	6	<.1	<.1	7	2	101	<10	E1
MAR 2000								
07...	5	<.1	<.1	12	3	252	<10	2
APR								
05...	5	<.1	<.1	8	2	212	<10	1
MAY								
10...	3	<.1	<.1	4	2	104	<10	<1
23...	3	<.1	<.1	5	2	211	12	<1
JUN								
05...	4	<.1	<.1	6	2	131	<10	<1
JUL								
21...	5	<.1	<.1	5	2	85	<10	<1
SEP								
05...	5	<.1	<.1	3	2	50	E7	<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)
NOV 1999								
17...	<1	28	3	<31	3	5	11	89
MAR 2000								
07...	<1	43	9	30	6	14	36	84
APR								
05...	<1	37	7	14	4	14	34	81
MAY								
10...	<1	14	4	6	3	5	15	78
23...	<1	21	4	11	4	14	46	74
JUN								
05...	<1	27	4	7	4	9	27	79
JUL								
21...	<1	25	5	8	2	9	11	82
SEP								
05...	<1	13	3	6	1	5	4.6	89

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (Continued)

12340000--BLACKFOOT RIVER NEAR BONNER, MONT.

Date	Time	Streamflow, instan-taneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temper-ature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magne-sium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
NOV 1999									
18...	0940	621	273	8.3	4.0	130	34	12	<3
APR 2000									
05...	1440	1330	213	8.6	9.0	100	27	9.0	<3
MAY									
23...	1415	4210	157	8.4	12.0	78	20	6.7	<3
JUN									
05...	1455	3100	175	8.4	14.5	86	22	7.5	<3
JUL									
21...	1720	816	237	8.7	21.0	120	30	11	E2
SEP									
06...	0930	541	275	8.5	12.5	130	33	12	<3

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)
NOV 1999								
18...	E1	<.1	<.1	<1	<1	26	<10	<1
APR 2000								
05...	1	<.1	<.1	3	E.8	235	38	<1
MAY								
23...	E.7	<.1	<.1	2	2	214	E9	<1
JUN								
05...	E.8	<.1	<.1	2	<1	110	<10	<1
JUL								
21...	1	<.1	<.1	<1	<1	24	E7	<1
SEP								
06...	1	<.1	<.1	<1	<1	26	<10	<1

Date	Lead, dissolved (µg/L)	Manga-nese, total recoverable (µg/L)	Manga-nese, 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)
NOV 1999								
18...	<1	E2	1	<31	<1	2	3.4	96
APR 2000								
05...	<1	20	3	1	3	12	43	86
MAY								
23...	<1	19	2	4	2	18	205	81
JUN								
05...	<1	12	2	<1	3	9	75	84
JUL								
21...	<1	6	2	1	1	1	2.2	90
SEP								
06...	<1	5	<1	1	<1	2	2.9	92

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1999 through September 2000 (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)
NOV 1999									
18...	1100	1,490	340	8.5	4.5	160	42	12	3
MAR 2000									
07...	1500	1,600	317	8.4	6.5	150	41	11	4
APR									
05...	1635	2,300	279	8.4	7.5	130	36	11	3
MAY									
10...	0830	4,860	183	8.3	8.5	86	23	7.1	E1
23...	1545	5,450	169	8.3	12.0	79	21	6.6	E2
JUN									
05...	1630	4,220	197	8.3	14.5	91	24	7.7	E2
JUL									
21...	1830	1,230	267	8.4	20.0	120	32	11	3
SEP									
06...	0755	854	307	8.4	13.5	140	37	12	3

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)
NOV 1999								
18...	4	<.1	<.1	6	1	79	<10	<1
MAR 2000								
07...	4	<.1	<.1	7	3	166	13	<1
APR								
05...	3	<.1	<.1	5	2	182	19	<1
MAY								
10...	1	<.1	<.1	5	E1	175	11	<1
23...	1	<.1	<.1	4	2	169	15	<1
JUN								
05...	2	<.1	<.1	6	2	98	<10	<1
JUL								
21...	2	<.1	<.1	2	E.7	80	E6	<1
SEP								
06...	3	<.1	<.1	3	2	56	<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)
NOV 1999								
18...	<1	23	14	<31	2	4	16	93
MAR 2000								
07...	<1	38	26	12	4	9	39	93
APR								
05...	<1	27	19	8	2	9	56	97
MAY								
10...	<1	20	9	8	3	12	157	93
23...	<1	20	8	6	3	15	221	89
JUN								
05...	<1	18	10	2	3	6	68	91
JUL								
21...	<1	26	14	3	3	6	20	88
SEP								
06...	<1	15	6	4	1	4	9.2	92

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1999 through September 2000

[Abbreviations: ft^3/s, cubic feet per second; e, estimated; 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)
				1999					
	October			November			December		
1	163	11	4.8	227	10	6.1	238	11	7.1
2	160	10	4.3	225	9	5.5	234	11	6.9
3	157	10	4.2	221	9	5.4	227	11	6.7
4	164	9	4.0	224	9	5.4	213	11	6.3
5	181	8	3.9	221	9	5.4	221	11	6.6
6	181	9	4.4	229	10	6.2	227	11	6.7
7	183	13	6.4	224	10	6.0	228	11	6.8
8	192	22	11	220	10	5.9	223	10	6.0
9	202	20	11	218	11	6.5	202	8	4.4
10	204	19	10	219	12	7.1	226	6	3.7
11	204	18	9.9	223	12	7.2	222	5	3.0
12	203	17	9.3	221	13	7.8	229	5	3.1
13	197	16	8.5	219	14	8.3	235	5	3.2
14	199	15	8.1	213	13	7.5	211	6	3.4
15	205	14	7.7	211	12	6.8	231	9	5.6
16	212	13	7.4	212	12	6.9	234	10	6.3
17	213	12	6.9	211	10	5.7	238	11	7.1
18	222	11	6.6	219	10	5.9	238	12	7.7
19	215	11	6.4	210	9	5.1	235	13	8.2
20	208	10	5.6	213	8	4.6	235	13	8.2
21	207	10	5.6	208	8	4.5	240	13	8.4
22	212	10	5.7	203	8	4.4	233	14	8.8
23	213	10	5.8	194	9	4.7	213	14	8.1
24	208	10	5.6	202	12	6.5	218	14	8.2
25	198	10	5.3	227	14	8.6	210	14	7.9
26	196	10	5.3	251	14	9.5	198	15	8.0
27	217	16	9.4	251	13	8.8	203	16	8.8
28	235	21	13	236	12	7.6	200	15	8.1
29	240	20	13	231	12	7.5	205	14	7.7
30	244	17	11	241	12	7.8	218	12	7.1
31	240	14	9.1	---	---	---	232	10	6.3
TOTAL	6,275	---	229.2	6,624	---	195.2	6,917	---	204.4
MEAN	202	13	7.4	221	11	6.5	223	11	6.6
MAX	244	22	13	251	14	9.5	240	16	8.8
MIN	157	8	3.9	194	8	4.4	198	5	3.0

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1999 through September 2000 (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)
				2000					
	January			**February**			**March**		
1	210	10	5.7	206	17	9.5	231	16	10
2	205	9	5.0	227	18	11	228	14	8.6
3	203	8	4.4	218	19	11	226	13	7.9
4	195	8	4.2	204	18	9.9	228	13	8.0
5	207	11	6.1	213	16	9.2	229	13	8.0
6	202	16	8.7	211	17	9.7	226	13	7.9
7	201	20	11	212	20	11	229	13	8.0
8	207	22	12	216	22	13	231	13	8.1
9	207	20	11	223	22	13	229	14	8.7
10	217	18	11	219	22	13	229	14	8.7
11	209	16	9.0	214	22	13	230	14	8.7
12	e205	16	8.9	216	23	13	223	13	7.8
13	e200	18	9.7	216	25	15	221	13	7.8
14	227	20	12	217	25	15	222	20	12
15	221	23	14	224	23	14	213	16	9.2
16	221	24	14	221	20	12	211	13	7.4
17	221	24	14	212	17	9.7	212	12	6.9
18	213	22	13	206	22	12	208	11	6.2
19	218	24	14	207	28	16	214	11	6.4
20	211	20	11	210	34	19	206	12	6.7
21	216	18	10	219	37	22	204	14	7.7
22	215	18	10	227	34	21	203	20	11
23	214	16	9.2	227	24	15	209	18	10
24	213	16	9.2	233	16	10	204	16	8.8
25	213	17	9.8	230	12	7.5	199	16	8.6
26	212	18	10	223	16	9.6	197	14	7.4
27	210	18	10	227	20	12	199	13	7.0
28	208	19	11	233	23	14	217	18	11
29	186	19	9.5	233	22	14	214	16	9.2
30	186	19	9.5	---	---	---	204	19	10
31	199	17	9.1	---	---	---	197	15	8.0
TOTAL	6,472	---	306.0	6,344	---	374.1	6,693	---	261.7
MEAN	209	18	9.9	219	22	13	216	15	8.4
MAX	227	24	14	233	37	22	231	20	12
MIN	186	8	4.2	204	12	7.5	197	11	6.2

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1999 through September 2000 (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)
				2000					
	April			May			June		
1	198	15	8.0	162	11	4.8	183	37	18
2	206	16	8.9	140	8	3.0	150	23	9.3
3	207	14	7.8	127	8	2.7	126	14	4.8
4	207	13	7.3	127	7	2.4	116	11	3.4
5	210	20	11	141	6	2.3	115	11	3.4
6	205	30	17	125	5	1.7	113	14	4.3
7	197	18	9.6	115	5	1.6	114	18	5.5
8	187	12	6.1	107	4	1.2	107	14	4.0
9	183	19	9.4	107	5	1.4	109	12	3.5
10	183	13	6.4	108	8	2.3	125	10	3.4
11	177	9	4.3	110	6	1.8	127	10	3.4
12	175	22	10	104	6	1.7	118	9	2.9
13	181	24	12	98	7	1.9	110	8	2.4
14	190	15	7.7	92	6	1.5	107	12	3.5
15	191	13	6.7	87	4	.94	100	12	3.2
16	186	12	6.0	76	7	1.4	115	13	4.0
17	190	15	7.7	76	5	1.0	110	9	2.7
18	191	16	8.3	106	8	2.3	94	8	2.0
19	199	14	7.5	105	6	1.7	91	10	2.5
20	204	13	7.2	107	7	2.0	92	12	3.0
21	202	22	12	100	8	2.2	84	12	2.7
22	192	11	5.7	100	7	1.9	73	16	3.2
23	217	23	13	114	13	4.0	69	28	5.2
24	216	14	8.2	110	22	6.5	62	29	4.9
25	199	8	4.3	108	10	2.9	69	25	4.7
26	194	8	4.2	106	19	5.4	61	22	3.6
27	179	10	4.8	107	10	2.9	50	22	3.0
28	168	14	6.4	98	10	2.6	46	25	3.1
29	173	10	4.7	117	12	3.8	45	44	5.3
30	175	8	3.8	137	15	5.5	44	46	5.5
31	---	---	---	169	39	18	---	---	---
TOTAL	5,782	---	236.0	3,486	---	95.34	2,925	---	130.4
MEAN	193	15	7.9	112	9	3.1	98	18	4.3
MAX	217	30	17	169	39	18	183	46	18
MIN	168	8	3.8	76	4	.94	44	8	2.0

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1999 through September 2000 (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)
					2000				
		July			August			September	
1	46	48	6.0	26	24	1.7	46	18	2.2
2	57	26	4.0	25	25	1.7	51	20	2.8
3	82	23	5.1	25	27	1.8	57	22	3.4
4	101	27	7.4	28	30	2.3	72	25	4.9
5	91	27	6.6	29	31	2.4	85	27	6.2
6	75	25	5.1	29	32	2.5	96	27	7.0
7	66	24	4.3	30	32	2.6	95	25	6.4
8	60	24	3.9	29	33	2.6	93	25	6.3
9	55	24	3.6	29	33	2.6	91	25	6.1
10	49	24	3.2	29	33	2.6	95	26	6.7
11	46	24	3.0	33	31	2.8	102	26	7.2
12	42	24	2.7	35	27	2.6	103	23	6.4
13	35	26	2.5	35	24	2.3	102	16	4.4
14	33	26	2.3	36	23	2.2	99	12	3.2
15	31	27	2.3	35	24	2.3	98	12	3.2
16	31	27	2.3	34	25	2.3	100	14	3.8
17	31	35	2.9	36	26	2.5	101	17	4.6
18	28	42	3.2	37	26	2.6	102	22	6.1
19	27	32	2.3	37	25	2.5	105	24	6.8
20	28	25	1.9	37	25	2.5	105	20	5.7
21	27	21	1.5	38	26	2.7	114	16	4.9
22	26	17	1.2	38	25	2.6	114	15	4.6
23	26	16	1.1	37	26	2.6	115	15	4.7
24	26	21	1.5	38	26	2.7	118	15	4.8
25	25	25	1.7	37	26	2.6	123	16	5.3
26	24	27	1.7	39	26	2.7	127	16	5.5
27	25	28	1.9	37	23	2.3	130	16	5.6
28	28	28	2.1	40	21	2.3	138	16	6.0
29	26	28	2.0	43	19	2.2	131	16	5.7
30	26	27	1.9	45	19	2.3	131	16	5.7
31	27	25	1.8	45	19	2.3	---	---	---
TOTAL	1,300	---	93.0	1,071	---	74.7	3,039	---	156.2
MEAN	42	27	3.0	34	26	2.4	101	19	5.2
MAX	101	48	7.4	45	33	2.8	138	27	7.2
MIN	24	16	1.1	25	19	1.7	46	12	2.2

TOTAL FOR WATER YEAR 2000:
STREAMFLOW---56,928 ft^3/s
SEDIMENT DISCHARGE---2,356.24 tons

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1999 through September 2000

[Abbreviations: ft^3/s, cubic feet per second; e, estimated; 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)
				1999					
	October			November			December		
1	697	5	9.4	883	12	29	889	8	19
2	712	5	9.6	861	10	23	874	7	17
3	719	6	12	842	10	23	851	6	14
4	718	6	12	864	9	21	778	6	13
5	719	6	12	862	8	19	676	5	9.1
6	731	8	16	853	8	18	760	6	12
7	746	10	20	862	8	19	859	7	16
8	748	12	24	862	8	19	828	6	13
9	783	14	30	857	8	19	e750	5	10
10	775	14	29	844	8	18	786	6	13
11	801	14	30	837	9	20	807	8	17
12	811	14	31	831	10	22	827	9	20
13	823	14	31	852	10	23	848	8	18
14	811	13	28	833	10	22	809	8	17
15	804	12	26	829	9	20	785	7	15
16	818	11	24	819	9	20	832	6	13
17	828	10	22	824	6	13	854	6	14
18	837	10	23	844	4	9.1	865	7	16
19	841	9	20	847	4	9.1	869	6	14
20	830	9	20	836	5	11	850	7	16
21	821	9	20	846	6	14	843	7	16
22	811	9	20	818	5	11	838	6	14
23	801	8	17	796	4	8.6	766	4	8.3
24	804	8	17	767	5	10	689	2	3.7
25	804	8	17	851	8	18	634	2	3.4
26	816	8	18	978	13	34	575	2	3.1
27	844	10	23	1,030	15	42	528	2	2.9
28	920	16	40	957	11	28	e440	3	3.6
29	958	18	47	898	8	19	e420	3	3.4
30	934	16	40	884	8	19	436	4	4.7
31	904	14	34	---	---	---	e450	5	6.1
TOTAL	24,969	---	722.0	25,767	---	580.8	23,016	---	365.3
MEAN	805	11	23	859	8	19	742	6	12
MAX	958	18	47	1,030	15	42	889	9	20
MIN	697	5	9.4	767	4	8.6	420	2	2.9

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1999 through September 2000 (Continued)

Day	January: Mean streamflow (ft^3/s)	January: Suspended sediment Mean concentration (mg/L)	January: Suspended sediment Discharge (ton/d)	February: Mean streamflow (ft^3/s)	February: Suspended sediment Mean concentration (mg/L)	February: Suspended sediment Discharge (ton/d)	March: Mean streamflow (ft^3/s)	March: Suspended sediment Mean concentration (mg/L)	March: Suspended sediment Discharge (ton/d)
	2000								
1	e650	10	18	540	6	8.7	984	24	64
2	784	10	21	812	29	64	954	18	46
3	743	10	20	1,130	54	165	936	16	40
4	702	9	17	955	27	70	950	16	41
5	763	8	16	838	11	25	977	18	47
6	747	8	16	846	9	21	982	22	58
7	721	7	14	837	13	29	961	18	47
8	774	6	13	841	23	52	947	14	36
9	788	5	11	871	30	71	927	15	38
10	745	5	10	896	27	65	883	15	36
11	723	4	7.8	836	20	45	868	14	33
12	728	4	7.9	775	14	29	857	12	28
13	677	4	7.3	825	11	25	833	12	27
14	661	4	7.1	817	11	24	827	9	20
15	818	10	22	817	10	22	812	9	20
16	811	8	18	801	10	22	797	7	15
17	814	10	22	754	10	20	798	8	17
18	776	8	17	708	9	17	788	8	17
19	734	5	9.9	684	10	18	792	9	19
20	743	4	8.0	669	11	20	790	7	15
21	776	4	8.4	728	12	24	765	7	14
22	796	4	8.6	800	14	30	756	6	12
23	785	4	8.5	869	14	33	782	10	21
24	781	5	11	922	15	37	799	10	22
25	752	5	10	880	16	38	773	9	19
26	788	4	8.5	824	13	29	770	10	21
27	779	5	11	802	12	26	802	13	28
28	762	7	14	930	14	35	879	17	40
29	685	7	13	1,070	32	92	953	17	44
30	581	6	9.4	---	---	---	893	11	27
31	509	5	6.9	---	---	---	843	10	23
TOTAL	22,896	---	392.3	24,077	---	1,156.7	26,678	---	935
MEAN	739	6	13	830	17	40	861	13	30
MAX	818	10	22	1,130	54	165	984	24	64
MIN	509	4	6.9	540	6	8.7	756	6	12

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1999 through September 2000 (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)
				2000					
		April			May			June	
1	836	12	27	1,120	12	36	1,460	18	71
2	838	12	27	1,150	15	47	1,320	14	50
3	846	11	25	1,200	14	45	1,190	11	35
4	833	13	29	1,240	16	54	1,130	8	24
5	907	16	39	1,280	17	59	1,120	9	27
6	978	21	55	1,240	12	40	1,130	10	31
7	942	15	38	1,180	12	38	1,110	10	30
8	890	14	34	1,110	9	27	1,100	12	36
9	873	15	35	1,100	8	24	1,090	10	29
10	884	15	36	1,080	8	23	1,070	9	26
11	917	17	42	1,070	23	66	1,070	11	32
12	944	18	46	1,010	7	19	1,050	9	26
13	1,020	26	72	952	5	13	1,040	9	25
14	1,150	33	102	910	5	12	1,030	7	19
15	1,170	29	92	893	5	12	1,010	6	16
16	1,130	22	67	897	5	12	1,040	7	20
17	1,120	22	67	930	7	18	1,020	7	19
18	1,120	22	67	968	8	21	975	6	16
19	1,160	24	75	1,000	8	22	921	7	17
20	1,190	24	77	1,060	10	29	904	6	15
21	1,220	26	86	1,080	12	35	869	4	9.4
22	1,260	28	95	1,150	14	43	819	4	8.8
23	1,330	29	104	1,260	22	75	775	4	8.4
24	1,340	27	98	1,280	19	66	738	5	10
25	1,250	22	74	1,220	13	43	711	5	9.6
26	1,190	16	51	1,190	12	39	679	5	9.2
27	1,140	17	52	1,180	12	38	661	6	11
28	1,120	16	48	1,200	13	42	642	6	10
29	1,220	17	56	1,350	18	66	622	5	8.4
30	1,190	12	39	1,280	12	41	591	6	9.6
31	---	---	---	1,330	14	50	---	---	---
TOTAL	32,008	---	1,755	34,910	---	1,155	28,887	---	658.4
MEAN	1,067	20	58	1,126	12	37	963	8	22
MAX	1,340	33	104	1,350	23	75	1,460	18	71
MIN	833	11	25	893	5	12	591	4	8.4

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1999 through September 2000 (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)
				2000					
	July			August			September		
1	568	5	7.7	271	5	3.7	282	4	3.0
2	570	5	7.7	264	5	3.6	309	4	3.3
3	580	6	9.4	258	5	3.5	318	4	3.4
4	597	6	9.7	258	5	3.5	324	4	3.5
5	623	6	10	260	5	3.5	338	5	4.6
6	632	7	12	261	5	3.5	372	7	7.0
7	623	7	12	258	5	3.5	389	9	9.5
8	602	7	11	255	5	3.4	393	10	11
9	596	7	11	253	5	3.4	398	10	11
10	575	8	12	257	5	3.5	401	10	11
11	542	8	12	264	5	3.6	428	10	12
12	525	9	13	265	5	3.6	437	9	11
13	535	9	13	264	5	3.6	434	9	11
14	537	9	13	259	5	3.5	428	9	10
15	511	9	12	257	4	2.8	417	9	10
16	490	9	12	253	4	2.7	410	9	10
17	480	8	10	254	3	2.1	416	9	10
18	470	8	10	263	2	1.4	415	8	9.0
19	463	8	10	266	2	1.4	414	8	8.9
20	457	8	9.9	270	2	1.5	422	7	8.0
21	450	8	9.7	273	3	2.2	453	7	8.6
22	436	8	9.4	276	4	3.0	468	7	8.8
23	419	8	9.1	291	4	3.1	488	8	11
24	401	7	7.6	299	5	4.0	498	8	11
25	384	7	7.3	314	5	4.2	501	9	12
26	365	6	5.9	312	5	4.2	504	9	12
27	351	6	5.7	300	4	3.2	499	9	12
28	335	6	5.4	286	4	3.1	497	10	13
29	319	6	5.2	284	4	3.1	499	11	15
30	305	6	4.9	280	3	2.3	520	12	17
31	284	6	4.6	280	4	3.0	---	---	---
TOTAL	15,025	---	292.2	8,405	---	96.7	12,672	---	287.6
MEAN	485	7	9.4	271	4	3.1	422	8	9.6
MAX	632	9	13	314	5	4.2	520	12	17
MIN	284	5	4.6	253	2	1.4	282	4	3.0

TOTAL FOR WATER YEAR 2000:

STREAMFLOW---279,310 ft^3/s
SEDIMENT DISCHARGE---8,397.0 tons

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1999 through September 2000

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

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)
				1999					
	October			November			December		
1	1,320	4	14	1,510	3	12	1,530	5	21
2	1,350	4	15	1,510	3	12	1,540	4	17
3	1,350	4	15	1,480	3	12	1,490	3	12
4	1,380	4	15	1,520	3	12	1,400	2	7.6
5	1,350	4	15	1,490	3	12	1,230	2	6.6
6	1,340	4	14	1,500	3	12	1,360	3	11
7	1,380	4	15	1,490	3	12	1,450	6	23
8	1,360	4	15	1,490	4	16	1,420	6	23
9	1,410	4	15	1,480	4	16	1,330	5	18
10	1,410	4	15	1,460	4	16	1,330	4	14
11	1,450	4	16	1,440	4	16	1,370	4	15
12	1,430	4	15	1,430	4	15	1,390	4	15
13	1,440	2	7.8	1,410	4	15	1,420	4	15
14	1,440	2	7.8	1,410	4	15	1,390	4	15
15	1,410	2	7.6	1,400	4	15	1,360	3	11
16	1,410	2	7.6	1,400	4	15	1,420	3	12
17	1,440	3	12	1,390	4	15	1,450	3	12
18	1,450	3	12	1,440	5	19	1,460	3	12
19	1,440	3	12	1,440	5	19	1,460	3	12
20	1,430	3	12	1,420	5	19	1,430	3	12
21	1,430	4	15	1,440	4	16	1,420	3	12
22	1,400	4	15	1,410	4	15	1,400	3	11
23	1,400	4	15	1,380	4	15	1,360	2	7.3
24	1,380	4	15	1,320	4	14	1,280	1	3.5
25	1,420	3	12	1,450	4	16	1,220	1	3.3
26	1,400	3	11	1,710	6	28	1,090	2	5.9
27	1,450	3	12	1,860	6	30	e1,000	2	5.4
28	1,520	4	16	1,770	5	24	952	2	5.1
29	1,600	6	26	1,650	5	22	905	2	4.9
30	1,580	6	26	1,560	5	21	880	2	4.8
31	1,550	4	17	---	---	---	990	2	5.3
TOTAL	44,120	---	437.8	44,660	---	496	40,727	---	352.7
MEAN	1,423	4	14	1,489	4	17	1,314	3	11
MAX	1,600	6	26	1,860	6	30	1,540	6	23
MIN	1,320	2	7.6	1,320	3	12	880	1	3.3

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1999 through September 2000 (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)
				2000					
	January			**February**			**March**		
1	1,190	2	6.4	1,100	2	5.9	1,490	11	44
2	1,360	3	11	1,340	4	14	1,500	9	36
3	1,340	3	11	1,640	5	22	1,470	7	28
4	1,230	3	10	1,450	6	23	1,530	7	29
5	1,280	3	10	1,380	5	19	1,570	7	30
6	1,260	3	10	1,380	6	22	1,620	8	35
7	1,220	3	9.9	1,380	6	22	1,620	8	35
8	1,300	3	11	1,370	6	22	1,620	8	35
9	1,310	3	11	1,390	6	23	1,610	8	35
10	1,260	3	10	1,410	6	23	1,540	8	33
11	1,210	3	9.8	1,330	5	18	1,510	7	29
12	1,210	3	9.8	1,270	5	17	1,500	6	24
13	1,100	2	5.9	1,340	4	14	1,470	7	28
14	1,150	2	6.2	1,330	4	14	1,460	7	28
15	1,330	2	7.2	1,340	4	14	1,460	4	16
16	1,320	2	7.1	1,330	4	14	1,410	4	15
17	1,340	2	7.2	1,230	4	13	1,460	5	20
18	1,260	2	6.8	1,180	4	13	1,390	6	23
19	1,230	2	6.6	1,140	4	12	1,480	9	36
20	1,190	2	6.4	1,090	4	12	1,420	8	31
21	1,240	2	6.7	1,230	4	13	1,450	7	27
22	1,320	2	7.1	1,340	4	14	1,400	8	30
23	1,310	2	7.1	1,370	5	18	1,470	8	32
24	1,280	2	6.9	1,440	6	23	1,550	8	33
25	1,230	2	6.6	1,390	6	23	1,530	6	25
26	1,280	2	6.9	1,330	6	22	1,560	7	29
27	1,280	2	6.9	1,300	7	25	1,650	8	36
28	1,260	2	6.8	1,410	9	34	1,840	8	40
29	1,210	2	6.5	1,580	10	43	2,080	12	67
30	1,070	2	5.8	---	---	---	1,960	11	58
31	e850	2	4.6	---	---	---	1,880	9	46
TOTAL	38,420	---	245.2	38,810	---	551.9	48,500	---	1,013
MEAN	1,239	2	7.9	1,338	5	19	1,565	8	33
MAX	1,360	3	11	1,640	10	43	2,080	12	67
MIN	850	2	4.6	1,090	2	5.9	1,390	4	15

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1999 through September 2000 (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)
	2000								
	April			May			June		
1	1,860	9	45	4,760	12	154	5,050	12	164
2	1,930	10	52	5,070	15	205	4,660	12	151
3	2,020	9	49	5,660	20	306	4,270	12	138
4	1,970	8	43	5,940	25	401	4,170	8	90
5	2,180	10	59	6,030	25	407	4,210	7	80
6	2,380	10	64	5,790	22	344	4,280	6	69
7	2,430	8	52	5,470	18	266	4,420	9	107
8	2,370	8	51	5,100	14	193	4,500	11	134
9	2,270	9	55	4,940	12	160	4,630	10	125
10	2,390	8	52	4,850	12	157	4,470	9	109
11	2,590	10	70	4,680	11	139	4,280	8	92
12	2,770	12	90	4,370	9	106	3,960	7	75
13	3,360	16	145	4,120	9	100	3,830	8	83
14	4,280	23	266	3,830	8	83	3,810	8	82
15	4,390	21	249	3,650	8	79	3,880	8	84
16	4,310	19	221	3,650	7	69	4,650	13	163
17	4,200	17	193	3,800	10	103	4,430	10	120
18	4,310	18	209	4,130	9	100	4,100	6	66
19	4,770	22	283	4,500	9	109	3,820	8	83
20	5,170	24	335	4,720	12	153	3,660	9	89
21	5,500	25	371	4,780	12	155	3,450	8	75
22	5,900	24	382	4,990	10	135	3,170	7	60
23	6,240	26	438	5,350	13	188	3,030	5	41
24	6,180	24	400	5,540	13	194	2,870	6	46
25	5,700	21	323	5,370	12	174	2,720	6	44
26	5,270	15	213	5,270	13	185	2,620	5	35
27	4,810	15	195	5,170	12	168	2,530	4	27
28	4,660	14	176	5,030	14	190	2,320	5	31
29	4,820	14	182	5,180	13	182	2,250	4	24
30	4,840	12	157	5,010	13	176	2,130	4	23
31	---	---	---	5,020	12	163	---	---	---
TOTAL	115,870	---	5,420	151,770	---	5,544	112,170	---	2,510
MEAN	3,862	15	181	4,896	13	179	3,739	8	84
MAX	6,240	26	438	6,030	25	407	5,050	13	164
MIN	1,860	8	43	3,650	7	69	2,130	4	23

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1999 through September 2000 (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)
				2000					
	July			August			September		
1	2,080	5	28	863	4	9.3	718	1	1.9
2	1,920	5	26	819	4	8.8	754	1	2.0
3	1,960	4	21	811	4	8.8	805	1	2.2
4	1,930	4	21	798	5	11	814	2	4.4
5	1,900	3	15	791	5	11	836	2	4.5
6	1,900	4	21	817	5	11	866	4	9.4
7	1,860	4	20	790	5	11	887	4	9.6
8	1,780	4	19	768	5	10	877	4	9.5
9	1,750	4	19	766	4	8.3	884	4	9.5
10	1,690	4	18	772	4	8.3	888	4	9.6
11	1,670	4	18	774	4	8.4	979	4	11
12	1,560	4	17	785	4	8.5	959	4	10
13	1,530	4	17	785	4	8.5	950	4	10
14	1,480	5	20	770	4	8.3	938	4	10
15	1,440	5	19	767	4	8.3	913	4	9.9
16	1,370	5	18	753	4	8.1	878	3	7.1
17	1,340	5	18	740	4	8.0	870	3	7.0
18	1,310	4	14	719	4	7.8	893	4	9.6
19	1,280	4	14	733	4	7.9	859	4	9.3
20	1,250	5	17	751	4	8.1	870	5	12
21	1,230	4	13	725	4	7.8	930	5	13
22	1,210	4	13	732	4	7.9	925	5	12
23	1,140	4	12	753	2	4.1	967	5	13
24	1,130	5	15	767	1	2.1	952	5	13
25	1,090	5	15	759	1	2.0	1,010	5	14
26	1,040	5	14	763	1	2.1	969	4	10
27	1,010	4	11	756	2	4.1	969	4	10
28	984	3	8.0	735	2	4.0	975	4	11
29	907	3	7.3	734	2	4.0	949	4	10
30	905	3	7.3	737	2	4.0	982	4	11
31	895	3	7.2	739	2	4.0	---	---	---
TOTAL	44,541	---	502.8	23,772	---	225.5	27,066	---	275.5
MEAN	1,437	4	16	767	3	7.3	902	4	9.2
MAX	2,080	5	28	863	5	11	1,010	5	14
MIN	895	3	7.2	719	1	2.0	718	1	1.9

TOTAL FOR WATER YEAR 2000:

STREAMFLOW---730,426 ft^3/s
SEDIMENT DISCHARGE---17,574.4 tons

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

[Abbreviations: E, estimated; 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)	Arsenic, dissolved (µg/L)
12323230	Blacktail Creek at Harrison Avenue, at Butte	04-04-00	1045	110	31	7.5	E2	2
		04-04-00	1050	110	31	7.6	3	2
12323250	Silver Bow Creek below Blacktail Creek, at Butte	06-04-00	1545	170	47	12	10	9
		06-04-00	1550	170	48	12	10	9
12323770	Warm Springs Creek at Warm Springs	07-21-00	1015	270	83	14	12	9
		07-21-00	1020	280	86	15	11	9
12324200	Clark Fork at Deer Lodge	03-06-00	1715	230	66	14	10	8
		03-06-00	1720	230	66	14	10	8
12331800	Clark Fork near Drummond	09-05-00	1515	280	80	19	11	11
		09-05-00	1520	300	84	22	11	11
12334550	Clark Fork at Turah Bridge, near Bonner	05-10-00	1040	100	29	7.7	3	4
		05-10-00	1045	100	29	7.7	4	3
12340500	Clark Fork above Missoula	05-23-00	1545	79	21	6.6	E2	1
		05-23-00	1550	83	22	7.0	E2	1

Station number	Date	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)
12323230	04-04-00	<0.1	<0.1	3	2	340	120	<1
	04-04-00	<.1	<.1	3	2	350	120	<1
12323250	06-04-00	.9	.7	27	16	240	20	2
	06-04-00	1.0	.7	27	16	240	20	2
12323770	07-21-00	<.1	<.1	8	4	40	<10	<1
	07-21-00	<.1	<.1	8	5	40	<10	<1
12324200	03-06-00	E.1	<.1	17	5	270	<10	2
	03-06-00	E.1	<.1	18	6	280	<10	2
12331800	09-05-00	E.1	<.1	8	8	90	<10	<1
	09-05-00	<.1	<.1	8	4	100	<10	1
12334550	05-10-00	<.1	<.1	4	2	100	<10	<1
	05-10-00	<.1	<.1	4	2	100	<10	<1
12340500	05-23-00	<.1	<.1	4	2	170	20	<1
	05-23-00	<.1	<.1	4	2	170	10	<1

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 (µg/L)	Sediment, suspended, diameter, percent finer than 0.062 mm
12323230	04-04-00	<1	36	32	3	2	4	86
	04-04-00	<1	38	33	3	4	4	84
12323250	06-04-00	E1	268	246	178	155	4	89
	06-04-00	<1	267	249	179	160	4	87
12323770	07-21-00	<1	79	61	2	2	4	83
	07-21-00	<1	76	62	2	2	--	--
12324200	03-06-00	<1	63	30	23	10	13	70
	03-06-00	<1	66	30	23	10	13	74
12331800	09-05-00	<1	36	7	11	4	25	44
	09-05-00	<1	38	7	11	4	21	45
12334550	05-10-00	<1	13	4	6	3	5	78
	05-10-00	<1	15	4	7	3	6	77
12340500	05-23-00	<1	20	8	6	3	15	89
	05-23-00	<1	19	8	6	4	15	89

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]

Constituent and reporting unit	Number of replicate pairs	Standard deviation, in units (+/-)	Relative standard deviation, in percent (+/-)
Calcium, dissolved, mg/L	7	1.4	2.7
Magnesium, dissolved, mg/L	7	.85	7.2
Arsenic, total recoverable, µg/L	7	.46	6.4
Arsenic, dissolved, µg/L	7	.27	4.3
Cadmium, total recoverable, µg/L	7	.03	14
Cadmium, dissolved, µg/L	7	.0	.0
Copper, total recoverable, µg/L	7	.27	2.6
Copper, dissolved, µg/L	7	1.1	21
Iron, total recoverable, µg/L	7	4.6	2.6
Iron, dissolved, µg/L	7	2.7	11
Lead, total recoverable, µg/L	7	.13	14
Lead, dissolved, µg/L	7	.0	.0
Manganese, total recoverable, µg/L	7	1.5	2.0
Manganese, dissolved, µg/L	7	.89	1.6
Zinc, total recoverable, µg/L	7	.38	1.2
Zinc, dissolved, µg/L	7	1.5	5.6
Sediment, suspended, mg/L	6	1.2	11
Sediment, suspended, percent finer than 0.062 mm	6	1.5	1.9

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,[1] in units (+/-)	Relative standard deviation, in percent (+/-)	Within limits of data-quality objective
Calcium, dissolved, mg/L	8	0.40	1.2	Yes
Magnesium, dissolved, mg/L	8	.13	1.4	Yes
Arsenic, total recoverable, µg/L	8	.23	6.0	Yes
Arsenic, dissolved, µg/L	8	.12	3.4	Yes
Cadmium, total recoverable, µg/L	8	.02	178	Yes[2]
Cadmium, dissolved, µg/L	8	.01	6.6	Yes
Copper, total recoverable, µg/L	8	.12	3.8	Yes
Copper, dissolved, µg/L	8	.22	14	Yes
Iron, total recoverable, µg/L	8	6.9	2.1	Yes
Iron, dissolved, µg/L	8	5.3	8.5	Yes
Lead, total recoverable, µg/L	8	.04	4.7	Yes
Lead, dissolved, µg/L	8	.10	114	Yes[2]
Manganese, total recoverable, µg/L	8	.57	1.2	Yes
Manganese, dissolved, µg/L	8	.35	1.1	Yes
Zinc, total recoverable, µg/L	8	.37	8.6	Yes
Zinc, dissolved, µg/L	8	.25	9.2	Yes

[1]Statistics calculated using laboratory reporting level for censored values less than the detection capability of the instrument.

[2]Exceedance of data-quality objective results from a statistical artifact of calculating differences between paired values that are predominantly less than the laboratory reporting level. Because such differences are not fully quantified at very low concentrations. the precision estimate may not be representative of analytical performance at detectable concentrations.

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	5	95.1-108	101.4	Yes
Arsenic, dissolved, µg/L	5	95.3-108	101.6	Yes
Cadmium, total recoverable, µg/L	5	96.0-114	105.0	Yes
Cadmium, dissolved, µg/L	5	97.3-110	103.8	Yes
Copper, total recoverable, µg/L	5	92.4-108	100.3	Yes
Copper, dissolved, µg/L	5	96.0-112	104.0	Yes
Iron, total recoverable, µg/L	5	92.3-102	97.4	Yes
Iron, dissolved, µg/L	5	89.2-112	100.6	Yes
Lead, total recoverable, µg/L	5	97.3-108	102.6	Yes
Lead, dissolved, µg/L	5	88.9-108	98.3	Yes
Manganese, total recoverable, µg/L	5	93.3-108	100.8	Yes
Manganese, dissolved, µg/L	5	96.8-110	103.2	Yes
Zinc, total recoverable, µg/L	5	90.0-115	102.6	Yes
Zinc, dissolved, µg/L	5	95.8-120	107.8	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	5	87.8-110	98.9	Yes
Arsenic, dissolved, µg/L	5	97.5-108	102.5	Yes
Cadmium, total recoverable, µg/L	5	88.9-107	98.1	Yes
Cadmium, dissolved, µg/L	5	100-108	104.2	Yes
Copper, total recoverable, µg/L	5	87.7-102	94.6	Yes
Copper, dissolved, µg/L	5	97.3-106	101.6	Yes
Iron, total recoverable, µg/L	5	88.0-105	96.5	Yes
Iron, dissolved, µg/L	5	88.3-108	98.0	Yes
Lead, total recoverable, µg/L	5	103-108	105.3	Yes
Lead, dissolved, µg/L	5	97.3-106	101.4	Yes
Manganese, total recoverable, µg/L	5	83.3-111	97.3	Yes
Manganese, dissolved, µg/L	5	91.4-112	101.7	Yes
Zinc, total recoverable, µg/L	5	91.1-104	97.8	Yes
Zinc, dissolved, µg/L	5	90.9-112	101.5	Yes

Table 13. Chemical analyses of field blanks for water samples

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

Date	Time	Specific conduct-ance, onsite (µS/cm)	pH, onsite (standard units)	Calcium, dissolved (mg/L)	Magne-sium, dissolved (mg/L)	Arsenic, total recov-erable (µg/L)	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)
NOV 1999										
16...	0630	2	5.7	0.04	E0.01	<3	<2.0	<0.1	<0.1	<1
MAR 2000										
06...	0900	2	5.6	<.02	.02	<3	<.9	<.1	<.1	<1
APR										
05...	1330	2	5.7	<.02	<.01	<3	<.9	<.1	<.1	<1
MAY										
10...	0700	2	5.7	<.02	<.01	<3	<.9	<.1	<.1	<1
23...	0600	2	5.5	<.02	<.01	<3	<.9	<.1	<.1	<1
JUN										
05...	0600	2	5.6	E.01	<.01	<3	<.9	<.1	<.1	1
JUL										
24...	0900	2	5.6	<.02	<.01	<3	<.9	<.1	<.1	
SEP										<1
01...	1600	2	5.6	<.02	<.01	<3	<.9	<.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)	Manga-nese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)
NOV 1999									
16...	<1	<20	<10	<1	<1	<3	<1	<31	<1
MAR 2000									
06...	E1	<20	<10	<1	<1	<3	<1	3	<1
APR									
05...	<1	<20	<10	<1	<1	<3	<1	3	<1
MAY									
10...	<1	<20	<10	<1	<1	<3	<1	<1	<1
23...	<1	<20	<10	<1	<1	<3	<1	<1	2
JUN									
05...	<1	<20	<10	<1	<1	<3	<1	<1	3
JUL									
24...	<1	<20	<10	<1	<1	<3	<1	<1	<1
SEP									
01...	<1	<20	<10	<1	<1	<3	<1	1	<1

Table 14. Trace-element analyses of fine-grained bed sediment, upper Clark Fork basin, Montana, September 2000

[Fine-grained sediment is material less than 0.064 millimeter in diameter. Reported 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	52.9	16.7	4,830	28,200	563	9,220	15.5	13.1	13,400
12323750	Silver Bow Creek at Warm Springs	3	9.7	17.5	272	18,100	63	14,700	15.4	<3.8	1,090
12323800	Clark Fork near Galen	3	9.3	19.1	1,110	23,600	128	8,470	15.4	5.7	1,090
461415112450801	Clark Fork below Lost Creek, near Galen	3	10.5	26.0	1,650	32,800	200	5,750	16.5	7.8	1,490
461559112443301	Clark Fork near Racetrack	3	8.6	19.1	933	24,700	128	4,120	12.7	5.1	1,170
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	3	10.3	16.0	1,110	22,000	130	6,400	10.7	5.1	1,370
12324200	Clark Fork at Deer Lodge	3	10.0	23.0	1,200	25,300	145	3,200	13.1	5.1	1,340
12324680	Clark Fork at Goldcreek	3	8.1	24.9	748	24,400	105	1,850	14.1	3.6	1,090
12331500	Flint Creek near Drummond	3	6.3	22.1	63	23,100	168	4,180	11.7	6.9	588
12331800	Clark Fork near Drummond	3	6.1	23.7	391	19,400	82	1,660	11.8	2.7	948
12334550	Clark Fork at Turah Bridge, near Bonner	3	4.5	16.8	277	15,400	56	842	9.3	<1.9	786
12340000	Blackfoot River near Bonner	3	2.0	15.1	18	15,400	13	683	9.4	<1.9	35
12340500	Clark Fork above Missoula	3	4.2	19.0	166	18,100	37	477	11.8	<1.9	438
12353000	Clark Fork below Missoula[1]	3	2.8	12.3	87	13,400	25	446	8.9	<1.9	252

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

Table 15. Trace-element analyses of bulk bed sediment, upper Clark Fork basin, Montana, September 2000

[Bulk bed sediment collected in this study generally is material smaller than about 10 millimeters in diameter. Reported concentrations are the mean of all analyses for replicate aliquots of 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	2	20.6	12.0	1,660	19,000	278	5,480	8.7	7.4	5,690
12323750	Silver Bow Creek at Warm Springs	2	<1.9	5.9	20	7,590	12	2,100	5.6	<1.9	98
12323800	Clark Fork near Galen	2	8.2	23.7	902	25,700	113	9,490	15.2	5.2	1,140
461415112450801	Clark Fork below Lost Creek, near Galen	2	3.3	10.8	305	16,000	58	1,440	5.3	<1.9	417
461559112443301	Clark Fork near Racetrack	2	6.6	19.1	603	25,900	86	1,710	9.1	2.7	781
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	2	9.2	21.1	1,000	24,900	115	4,930	10.8	4.4	1,240
12324200	Clark Fork at Deer Lodge	2	7.8	20.6	906	22,800	112	2,530	11.8	3.9	1,060
12324680	Clark Fork at Goldcreek	2	7.6	21.4	709	21,500	92	2,930	13.0	3.2	986
12331500	Flint Creek near Drummond	2	<1.9	5.1	16	11,700	56	1,690	4.9	2.5	178
12331800	Clark Fork near Drummond	2	2.5	6.9	114	12,100	32	979	7.8	<1.9	397
12334550	Clark Fork at Turah Bridge, near Bonner	2	3.3	10.3	186	12,600	39	932	8.3	<1.9	501
1234000	Blackfoot River near Bonner	2	<1.9	12.5	18	14,600	11	652	9.3	<1.9	35
12340500	Clark Fork above Missoula	2	3.4	15.0	128	16,800	28	570	11.1	<1.9	336
12353000	Clark Fork below Missoula[1]	2	<1.9	4.8	32	9,800	11	364	5.6	<1.9	134

[1]Samples collected about 30 miles downstream from streamflow-gaging 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]

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	6	1:5	0.4	--	--
Chromium	6	1:5	130	72.2	70.3-74.0
Copper	6	1:5	35	91.8	90.0-93.7
Iron	6	1:5	35,000	91.5	90.8-92.2
Lead	6	1:5	19	83.1	81.8-84.4
Manganese	6	1:5	538	93.1	91.7-94.5
Nickel	6	1:5	88	86.3	84.8-87.9
Silver	6	1:5	.4	--	--
Zinc	6	1:5	106	80.2	73.4-87.1
			SRM sample 2711		
Cadmium	7	1:10	41.7	107.6	107-108
Chromium	7	1:10	47.0	50.7	47.1-54.3
Copper	7	1:10	114	96.6	95.4-97.9
Iron	7	1:10	28,900	87.3	84.3-90.3
Lead	7	1:10	1,160	101.1	100-102
Manganese	7	1:10	638	82.7	79.7-85.6
Nickel	7	1:10	20.6	83.8	82.1-85.4
Silver	7	1:10	4.6	99.5	95.7-103
Zinc	7	1:10	350	84.4	79.4-89.4

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]

Station number	Station name	Dilution ratio	Trace-element concentration, in μg/mL								
			Cad-mium	Chro-mium	Cop-per	Iron	Lead	Manga-nese	Nickel	Silver	Zinc
12323600	Silver Bow Creek at Opportunity	1:10	<0.01	<0.003	<0.002	<0.02	<0.002	<0.036	<0.001	<0.01	<0.042
12323750	Silver Bow Creek at Warm Springs	1:10	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12323800	Clark Fork near Galen	1:10	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
461415112450801	Clark Fork below Lost Creek, near Galen	1:10	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
461559112443301	Clark Fork near Racetrack	1:10	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:10	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12324200	Clark Fork at Deer Lodge	1:10	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12324680	Clark Fork at Goldcreek	1:5	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12331500	Flint Creek near Drummond	1:5	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12331800	Clark Fork near Drummond	1:5	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12334550	Clark Fork at Turah Bridge, near Bonner	1:5	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12340000	Blackfoot River near Bonner	1:5	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12340500	Clark Fork above Missoula	1:5	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042
12353000	Clark Fork below Missoula	1:5	<.01	<.003	<.002	<.02	<.002	<.036	<.001	<.01	<.042

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, September 2000

[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
12323600 Silver Bow Creek at Opportunity									
Brachycentrus spp.	1	8.4	5.9	235	469	13.7	666	1.6	815
Hydropsyche spp.	1	5.0	4.6	352	1,430	36.5	1,040	2.2	1,090
12323750 Silver Bow Creek at Warm Springs									
Hydropsyche cockerelli	1	.4	.6	29.9	825	2.5	2,520	1.2	167
Hydropsyche occidentalis	3	.4	.9	31.4	1,010	2.8	3,080	1.5	180
12323800 Clark Fork near Galen									
Hydropsyche cockerelli	6	1.0	2.1	122	1,950	9.3	2,450	1.7	242
Hydropsyche occidentalis	1	1.2	2.6	94.9	1,530	10.1	6,170	2.0	286
461415112450801 Clark Fork below Lost Creek, near Galen									
Hydropsyche cockerelli	3	1.5	2.5	97.2	1,220	9.8	3,050	1.4	240
Claassenia sabulosa	1	.3	2.0	70.1	189	1.3	238	.2	245
461559112443301 Clark Fork near Racetrack									
Hydropsyche cockerelli	1	1.0	1.0	82.6	981	6.1	1,960	1.2	198
Hydropsyche occidentalis	1	1.2	1.4	124	1,760	10.3	2,050	1.9	255
Hydropsyche spp.	1	1.5	1.7	85.2	1,200	7.4	1,600	1.4	208
Claassenia sabulosa	1	.4	.2	40.3	113	.8	172	.2	213
461903112440701 Clark Fork at Dempsey Creek diversion, near Racetrack									
Hydropsyche cockerelli	2	.7	1.6	64.6	927	8.4	1,160	1.0	174
Hydropsyche occidentalis	3	1.2	2.6	91.8	1,440	12.1	1,540	1.6	238
12324200 Clark Fork at Deer Lodge									
Hydropsyche cockerelli	3	.7	1.9	84.6	1,120	11.0	1,290	.9	197
Hydropsyche occidentalis	3	1.1	2.3	144	1,600	13.6	1,700	1.7	267
12324680 Clark Fork at Goldcreek									
Arctopsyche grandis	1	1.1	1.2	31.5	673	6.6	1,580	1.1	216
Claassenia sabulosa	2	.5	.4	54.3	123	.9	154	.3	342
Hydropsyche cockerelli	1	1.1	2.3	65.1	1,610	13.2	1,670	1.8	249
Hydropsyche occidentalis	1	1.3	2.0	58.3	1,360	13.3	2,210	1.9	277
12331500 Flint Creek near Drummond									
Arctopsyche grandis	2	.2	1.6	16.3	1,390	13.3	2,080	1.5	205
Hydropsyche cockerelli	1	.3	3.2	16.8	3,390	28.4	2,460	2.3	208
Hydropsyche occidentalis	1	.2	3.6	27.3	2,990	29.8	4,790	2.3	205
12331800 Clark Fork near Drummond									
Arctopsyche grandis	3	.6	.9	27.3	600	5.4	1,020	.8	198
Claassenia sabulosa	3	.3	.4	50.4	156	1.2	211	.3	264
Hydropsyche cockerelli	4	.8	1.7	51.5	1,330	10.3	1,650	1.5	245
Hydropsyche occidentalis	1	.9	2.4	57.4	1,810	12.8	1,390	2.0	293

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, September 2000 (Continued)

Taxon	Number of composite samples	Concentration, in µg/g							
		Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
		12334550 Clark Fork at Turah Bridge, near Bonner							
Arctopsyche grandis	4	.8	1.8	43.1	1,180	6.8	701	2.4	242
Claassenia sabulosa	1	.4	<.1	50.8	61	<.7	37	<.1	214
Hydropsyche cockerelli	3	.5	1.7	44.4	1,320	6.5	688	1.6	199
Hydropsyche occidentalis	2	.8	2.7	63.1	1,830	11.2	1,260	2.5	326
		12340000 Blackfoot River near Bonner							
Arctopsyche grandis	1	.4	.8	12.9	525	.5	286	1.0	138
Claassenia sabulosa	2	<.1	.3	42.6	52	.1	33	.1	258
		12340500 Clark Fork above Missoula							
Arctopsyche grandis	1	.6	1.9	27.8	1,410	3.9	1,210	1.8	224
Claassenia sabulosa	2	.2	.8	57.5	340	1.2	477	.5	362
Hydropsyche cockerelli	2	.4	2.0	31.5	1,460	4.3	1,190	1.5	170
Hydropsyche occidentalis	2	.4	2.2	31.2	1,470	4.1	1,560	1.6	202
		12353000 Clark Fork below Missoula[1]							
Arctopsyche grandis	2	.2	.9	16.7	533	1.2	803	.9	163
Claassenia sabulosa	3	.1	.3	45.1	98	.2	130	.1	270
Hydropsyche cockerelli	2	.3	1.1	16.7	645	1.3	1,120	.7	121
Hydropsyche occidentalis	2	.3	1.1	16.1	814	1.5	966	.9	457

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

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

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

Constituent	Number of measurements	Certified concentration (µg/g)	Mean SRM recovery (percent)	95-percent confidence interval for SRM recovery (percent)
		<u>SRM sample TORT-2</u>		
Cadmium	11	26.7	103	102-104
Chromium	11	.77	163	163-164
Copper	11	106	88.5	85.9-91.2
Iron	11	105	94.4	91.0-97.7
Lead	[1]0	.35	--	--
Manganese	11	13.6	95.9	95.5-96.2
Nickel	11	2.5	88.3	88.2-88.4
Zinc	11	180	94.6	87.2-102

[1]Certified lead concentration in SRM was below the analytical detection limit.

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
12323600	Silver Bow Creek at Opportunity	1:1	<0.002	<0.01	<0.02	<0.10	<0.01	<0.02	<0.002	<0.02
12323750	Silver Bow Creek at Warm Springs	1:1	<.002	<.01	<.02	<.10	<.01	<.02	<.002	<.02
12323800	Clark Fork near Galen	1:1	<.002	<.01	<.02	<.10	<.01	<.02	<.002	<.02
461415112450801	Clark Fork below Lost Creek, near Galen	1:1	<.002	.02	<.02	<.10	<.01	<.02	<.002	<.02
461559112443301	Clark Fork near Racetrack	1:1	<.002	<.01	<.02	<.10	<.01	<.02	<.002	<.02
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:1	<.002	.02	<.02	<.10	<.01	<.02	<.002	<.02
12324200	Clark Fork at Deer Lodge	1:1	<.002	<.01	<.02	<.10	<.01	<.02	<.002	<.02
12324680	Clark Fork at Goldcreek	1:1	<.002	.02	<.02	<.10	<.01	<.02	<.002	<.02
12331500	Flint Creek near Drummond	1:1	<.002	<.01	<.02	<.10	<.01	<.02	<.002	<.02
12331800	Clark Fork near Drummond	1:1	<.002	.02	<.02	<.10	<.01	<.02	<.002	<.02
12334550	Clark Fork at Turah Bridge, near Bonner	1:1	<.002	.02	<.02	<.10	<.01	<.02	<.002	<.02
12340000	Blackfoot River near Bonner	1:1	<.002	<.01	<.02	<.10	<.01	<.02	<.002	<.02
12340500	Clark Fork above Missoula	1:1	<.002	<.02	<.02	<.10	<.01	<.02	<.002	<.02
12353000	Clark Fork below Missoula	1:1	<.002	.01	<.02	<.10	<.01	<.02	<.002	<.02

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000

[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 laboratory 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
12323230--BLACKTAIL CREEK AT HARRISON AVENUE, AT BUTTE, MONT.					
Period of record for water-quality data: March 1993-August 1995, December 1996-September 2000					
Streamflow, instantaneous (ft^3/s)	59	156	2.4	17	8.4
Specific conductance, onsite (μS/cm)	59	412	116	257	259
Temperature, water (°C)	59	17.5	2.0	8.2	8.0
pH, onsite (standard units)	59	8.2	7.3	7.8	7.8
Hardness, total (mg/L as $CaCO_3$)	59	140	38	102	100
Calcium, dissolved (mg/L)	59	40	11	29	30
Magnesium, dissolved (mg/L)	59	11	2.7	7.1	7.1
Arsenic, total recoverable (μg/L)	59	18	2	6	5
Arsenic, dissolved (μg/L)	59	13	1	4	3
Cadmium, total recoverable (μg/L)	59	<1	<.1	--	<1
Cadmium, dissolved (μg/L)	59	.5	<.1	--	<.1
Copper, total recoverable (μg/L)	59	52	2	8	6
Copper, dissolved (μg/L)	59	10	<1	[2]4	3
Iron, total recoverable (μg/L)	59	4,200	139	788	590
Iron, dissolved (μg/L)	59	480	23	182	170
Lead, total recoverable (μg/L)	59	47	<1	[2]3	1
Lead, dissolved (μg/L)	59	1	<.5	[2].3	<.5
Manganese, total recoverable (μg/L)	59	240	30	62	60
Manganese, dissolved (μg/L)	59	100	17	42	39
Zinc, total recoverable (μg/L)	59	130	<10	[2]12	<40
Zinc, dissolved (μg/L)	59	11	<3	[2]4	2
Sediment, suspended concentration (mg/L)	59	139	2	17	7
Sediment, suspended discharge (ton/d)	59	59	.02	1.9	.18
Sediment, suspended (percent finer than 0.062 mm)	59	97	50	84	86

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323250--SILVER BOW CREEK BELOW BLACKTAIL CREEK, AT BUTTE, MONT.					
Period of record for water-quality data: March 1993-August 1995, December 1996-September 2000					
Streamflow, instantaneous (ft^3/s)	59	134	13	33	26
Specific conductance, onsite (μS/cm)	59	691	226	459	470
Temperature, water (°C)	59	20.0	1.5	10.2	9.0
pH, onsite (standard units)	59	8.1	7.2	7.6	7.6
Hardness, total (mg/L as $CaCO_3$)	59	180	66	146	150
Calcium, dissolved (mg/L)	59	52	19	42	43
Magnesium, dissolved (mg/L)	59	13	4.5	10	11
Arsenic, total recoverable (μg/L)	59	45	7	15	13
Arsenic, dissolved (μg/L)	59	13	4	7	7
Cadmium, total recoverable (μg/L)	59	6	.7	2.6	2
Cadmium, dissolved (μg/L)	59	6.2	.2	1.9	1.5
Copper, total recoverable (μg/L)	59	550	16	152	130
Copper, dissolved (μg/L)	59	300	7	65	51
Iron, total recoverable (μg/L)	59	7,400	92	1,340	820
Iron, dissolved (μg/L)	59	270	18	97	84
Lead, total recoverable (μg/L)	59	250	1	24	11
Lead, dissolved (μg/L)	59	2.4	<.5	[2].8	<1
Manganese, total recoverable (μg/L)	59	1,600	176	637	630
Manganese, dissolved (μg/L)	59	1,700	161	578	580
Zinc, total recoverable (μg/L)	59	2,200	178	778	700
Zinc, dissolved (μg/L)	59	2,200	118	637	540
Sediment, suspended concentration (mg/L)	58	405	3	36	14
Sediment, suspended discharge (ton/d)	58	70	.14	4.6	1.2
Sediment, suspended (percent finer than 0.062 mm)	58	98	42	83	86

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for water-quality data: March 1993-August 1995, December 1996-September 2000					
Streamflow, instantaneous (ft^3/s)	62	361	15	86	57
Specific conductance, onsite (μS/cm)	61	616	202	384	370
Temperature, water (°C)	61	22.5	0.0	9.1	9.5
pH, onsite (standard units)	61	9.5	7.2	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	61	210	60	137	130
Calcium, dissolved (mg/L)	61	62	18	40	40
Magnesium, dissolved (mg/L)	61	15	3.4	8.7	8.4
Arsenic, total recoverable (μg/L)	61	240	11	32	18
Arsenic, dissolved (μg/L)	61	34	1	10	9
Cadmium, total recoverable (μg/L)	61	49	.6	3.0	2.0
Cadmium, dissolved (μg/L)	61	41	.1	1.8	1.1
Copper, total recoverable (μg/L)	61	3,900	62	293	140
Copper, dissolved (μg/L)	61	450	19	61	47
Iron, total recoverable (μg/L)	61	24,000	276	2,010	910
Iron, dissolved (μg/L)	61	310	3	53	27
Lead, total recoverable (μg/L)	61	650	7	51	17
Lead, dissolved (μg/L)	61	5.1	<.5	[2].8	<1
Manganese, total recoverable (μg/L)	61	10,000	174	748	570
Manganese, dissolved (μg/L)	61	9,300	68	615	470
Zinc, total recoverable (μg/L)	61	15,000	144	789	500
Zinc, dissolved (μg/L)	61	13,000	27	480	260
Sediment, suspended concentration (mg/L)	62	801	6	68	20
Sediment, suspended discharge (ton/d)	62	781	.28	32	3.2
Sediment, suspended (percent finer than 0.062 mm)	62	95	37	77	80

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (Continued)

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 2000**					
Streamflow, instantaneous (ft^3/s)	68	662	16	166	118
Specific conductance, onsite (μS/cm)	66	682	249	445	431
Temperature, water (°C)	67	22.0	.5	11.0	12.0
pH, onsite (standard units)	66	9.3	8.0	8.8	8.8
Hardness, total (mg/L as $CaCO_3$)	66	290	97	184	180
Calcium, dissolved (mg/L)	66	85	28	54	52
Magnesium, dissolved (mg/L)	66	19	5.9	12	12
Arsenic, total recoverable (μg/L)	66	94	12	26	24
Arsenic, dissolved (μg/L)	66	60	8	21	21
Cadmium, total recoverable (μg/L)	66	.1	<.1	--	<1
Cadmium, dissolved (μg/L)	66	.3	<.1	[2].1	<.1
Copper, total recoverable (μg/L)	66	80	5	22	19
Copper, dissolved (μg/L)	66	40	3	11	10
Iron, total recoverable (μg/L)	66	3,000	72	403	300
Iron, dissolved (μg/L)	66	93	<5	[2]18	15
Lead, total recoverable (μg/L)	66	15	<1	[2]3	2
Lead, dissolved (μg/L)	66	1.0	<.5	--	<.5
Manganese, total recoverable (μg/L)	66	600	60	191	160
Manganese, dissolved (μg/L)	66	530	12	120	96
Zinc, total recoverable (μg/L)	66	180	<10	[2]49	30
Zinc, dissolved (μg/L)	66	73	<3	[2]12	7
Sediment, suspended concentration (mg/L)	68	229	1	14	7
Sediment, suspended discharge (ton/d)	68	279	.11	11	2.0
Sediment, suspended (percent finer than 0.062 mm)	67	97	43	82	85

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	46	420	2.8	112	72
Specific conductance, onsite (μS/cm)	45	795	139	303	267
Temperature, water (°C)	46	18	.5	9.1	9.2
pH, onsite (standard units)	45	8.7	7.4	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	45	420	66	147	130
Calcium, dissolved (mg/L)	45	130	20	45	40
Magnesium, dissolved (mg/L)	45	22	3.6	8.5	7.3
Arsenic, total recoverable (μg/L)	45	27	3	8	6
Arsenic, dissolved (μg/L)	45	14	2	5	4
Cadmium, total recoverable (μg/L)	45	.2	<.1	--	<1
Cadmium, dissolved (μg/L)	45	<.1	<.1	--	<.1
Copper, total recoverable (μg/L)	45	97	2	23	11
Copper, dissolved (μg/L)	45	16	1	4	3
Iron, total recoverable (μg/L)	45	1,700	40	372	160
Iron, dissolved (μg/L)	45	30	<5	11	9
Lead, total recoverable (μg/L)	45	14	<1	[2]2	1
Lead, dissolved (μg/L)	45	1.8	<.5	--	<.5
Manganese, total recoverable (μg/L)	45	1,400	80	252	204
Manganese, dissolved (μg/L)	45	570	41	152	110
Zinc, total recoverable (μg/L)	45	60	<10	[2]13	2
Zinc, dissolved (μg/L)	45	10	<1	[2]3	<10
Sediment, suspended concentration (mg/L)	46	100	2	22	10
Sediment, suspended discharge (ton/d)	45	87	.05	12	1.6
Sediment, suspended (percent finer than 0.062 mm)	46	88	55	75	75

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	109	1,050	14	224	136
Specific conductance, onsite (μS/cm)	97	720	197	426	435
Temperature, water (°C)	108	22.5	0.0	9.7	10.0
pH, onsite (standard units)	96	9.0	7.5	8.5	8.5
Hardness, total (mg/L as $CaCO_3$)	95	370	81	187	190
Calcium, dissolved (mg/L)	95	110	24	55	55
Magnesium, dissolved (mg/L)	95	22	5.1	12	12
Arsenic, total recoverable (μg/L)	95	78	3	20	16
Arsenic, dissolved (μg/L)	95	53	4	15	13
Cadmium, total recoverable (μg/L)	95	3	<.1	[2].2	<1
Cadmium, dissolved (μg/L)	95	1	<.1	[2].05	<.1
Copper, total recoverable (μg/L)	94	240	5	35	21
Copper, dissolved (μg/L)	95	50	3	10	9
Iron, total recoverable (μg/L)	95	9,200	79	608	320
Iron, dissolved (μg/L)	95	110	<3	[2]17	12
Lead, total recoverable (μg/L)	95	28	<1	[2]4	2
Lead, dissolved (μg/L)	95	3	<.5	[2].3	<.5
Manganese, total recoverable (μg/L)	95	1,400	80	270	200
Manganese, dissolved (μg/L)	95	380	31	120	89
Zinc, total recoverable (μg/L)	95	360	<10	[2]55	40
Zinc, dissolved (μg/L)	95	110	<3	[2]14	9
Sediment, suspended concentration (mg/L)	109	338	2	22	9
Sediment, suspended discharge (ton/d)	109	459	.12	26	2.5
Sediment, suspended (percent finer than 0.062 mm)	108	97	41	78	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	161	1,920	23	304	227
Specific conductance, onsite (µS/cm)	144	642	234	487	506
Temperature, water (°C)	160	23.0	0.0	9.6	10.0
pH, onsite (standard units)	109	8.9	7.4	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	101	270	95	204	210
Calcium, dissolved (mg/L)	101	81	28	60	62
Magnesium, dissolved (mg/L)	101	18	5.9	13	14
Arsenic, total recoverable (µg/L)	111	220	8	27	18
Arsenic, dissolved (µg/L)	111	39	7	14	13
Cadmium, total recoverable (µg/L)	111	5	<.1	[2].5	<1
Cadmium, dissolved (µg/L)	111	2	<.1	[2].06	<.1
Copper, total recoverable (µg/L)	110	1,500	10	103	46
Copper, dissolved (µg/L)	111	120	4	13	9
Iron, total recoverable (µg/L)	111	29,000	60	2,010	710
Iron, dissolved (µg/L)	111	190	<3	[2]16	9
Lead, total recoverable (µg/L)	111	200	<1	[2]13	5
Lead, dissolved (µg/L)	111	6	<.5	[2].5	<.6
Manganese, total recoverable (µg/L)	111	4,600	30	303	170
Manganese, dissolved (µg/L)	111	400	1	45	32
Zinc, total recoverable (µg/L)	111	1,700	10	117	60
Zinc, dissolved (µg/L)	111	230	<10	[2]16	11
Sediment, suspended concentration (mg/L)	161	2,250	2	85	24
Sediment, suspended discharge (ton/d)	161	8,690	.29	195	12
Sediment, suspended (percent finer than 0.062 mm)	152	99	40	71	71

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	90	2,080	15	296	178
Specific conductance, onsite (µS/cm)	78	338	120	227	220
Temperature, water (°C)	89	22	0.0	8.3	9.0
pH, onsite (standard units)	77	8.5	7.0	8.1	8.1
Hardness, total (mg/L as $CaCO_3$)	72	160	51	104	100
Calcium, dissolved (mg/L)	72	47	14	30	30
Magnesium, dissolved (mg/L)	72	10	3.3	7.0	7.0
Arsenic, total recoverable (µg/L)	77	17	4	7	6
Arsenic, dissolved (µg/L)	77	7	3	5	5
Cadmium, total recoverable (µg/L)	77	2	<.1	[2].3	<1
Cadmium, dissolved (µg/L)	77	1	<.1	--	<.1
Copper, total recoverable (µg/L)	76	45	<1	[2]5	3
Copper, dissolved (µg/L)	77	7	<1	[2]2	2
Iron, total recoverable (µg/L)	77	25,000	20	1,240	260
Iron, dissolved (µg/L)	77	120	<3	[2]35	23
Lead, total recoverable (µg/L)	77	25	<1	[2]3	<5
Lead, dissolved (µg/L)	76	6	<.5	[2].4	<1
Manganese, total recoverable (µg/L)	77	1,100	<10	[2]74	30
Manganese, dissolved (µg/L)	77	30	1	9	8
Zinc, total recoverable (µg/L)	77	140	<1	[2]13	<31
Zinc, dissolved (µg/L)	77	24	<1	[2]4	<20
Sediment, suspended concentration (mg/L)	90	1,410	1	54	9
Sediment, suspended discharge (ton/d)	90	7,920	.08	152	4.0
Sediment, suspended (percent finer than 0.062 mm)	90	97	32	75	79

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	67	3,920	87	825	562
Specific conductance, onsite (μS/cm)	66	510	207	368	386
Temperature, water (°C)	67	21.5	0.0	9.5	9.5
pH, onsite (standard units)	66	8.8	7.9	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	66	230	86	161	170
Calcium, dissolved (mg/L)	66	68	26	47	50
Magnesium, dissolved (mg/L)	66	15	5.1	10	11
Arsenic, total recoverable (μg/L)	66	75	8	17	14
Arsenic, dissolved (μg/L)	66	20	6	10	10
Cadmium, total recoverable (μg/L)	66	2	<.1	[2].1	<1
Cadmium, dissolved (μg/L)	66	.2	<.1	--	<.1
Copper, total recoverable (μg/L)	65	440	8	51	34
Copper, dissolved (μg/L)	65	36	3	8	6
Iron, total recoverable (μg/L)	66	12,000	60	1,100	530
Iron, dissolved (μg/L)	66	100	<3	[2]19	13
Lead, total recoverable (μg/L)	65	73	<1	[2]7	4
Lead, dissolved (μg/L)	65	.8	<.5	--	<.5
Manganese, total recoverable (μg/L)	66	1,100	30	147	100
Manganese, dissolved (μg/L)	66	43	7	20	20
Zinc, total recoverable (μg/L)	66	510	8	60	40
Zinc, dissolved (μg/L)	66	26	<3	[2]8	5
Sediment, suspended concentration (mg/L)	67	752	2	64	24
Sediment, suspended discharge (ton/d)	67	7,960	.94	318	38
Sediment, suspended (percent finer than 0.062 mm)	67	93	43	75	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	116	892	2.8	193	122
Specific conductance, onsite (μS/cm)	105	529	134	297	299
Temperature, water (°C)	114	21.0	0.0	8.9	9.2
pH, onsite (standard units)	102	8.8	7.5	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	95	260	59	139	140
Calcium, dissolved (mg/L)	95	73	16	38	38
Magnesium, dissolved (mg/L)	95	20	4.3	11	11
Arsenic, total recoverable (μg/L)	102	57	7	18	14
Arsenic, dissolved (μg/L)	102	20	5	9	8
Cadmium, total recoverable (μg/L)	102	3	<.1	[2].2	<1
Cadmium, dissolved (μg/L)	102	.1	<.1	--	<.1
Copper, total recoverable (μg/L)	101	32	1	7	5
Copper, dissolved (μg/L)	102	7	<1	[2]2	2
Iron, total recoverable (μg/L)	102	7,200	69	947	520
Iron, dissolved (μg/L)	102	240	3	40	26
Lead, total recoverable (μg/L)	102	87	<1	[2]12	7
Lead, dissolved (μg/L)	102	7	<.5	[2].7	<1
Manganese, total recoverable (μg/L)	102	1,600	50	216	136
Manganese, dissolved (μg/L)	102	120	14	40	34
Zinc, total recoverable (μg/L)	102	290	<10	[2]40	30
Zinc, dissolved (μg/L)	102	27	<3	[2]6	3
Sediment, suspended concentration (mg/L)	116	556	3	52	28
Sediment, suspended discharge (ton/d)	113	904	.02	48	8.8
Sediment, suspended (percent finer than 0.062 mm)	116	98	28	80	84

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	67	3,860	149	1,150	842
Specific conductance, onsite (μS/cm)	66	630	189	400	429
Temperature, water (°C)	67	22.5	.5	10.5	11.0
pH, onsite (standard units)	66	8.5	7.8	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	66	300	74	180	190
Calcium, dissolved (mg/L)	66	83	21	52	55
Magnesium, dissolved (mg/L)	66	22	5.2	12	13
Arsenic, total recoverable (μg/L)	66	62	8	18	14
Arsenic, dissolved (μg/L)	66	20	7	11	10
Cadmium, total recoverable (μg/L)	66	2	<.1	[2].2	<1
Cadmium, dissolved (μg/L)	66	.2	<.1	--	<.1
Copper, total recoverable (μg/L)	64	360	5	51	26
Copper, dissolved (μg/L)	64	21	1	7	6
Iron, total recoverable (μg/L)	66	8,800	50	1,210	580
Iron, dissolved (μg/L)	66	150	<3	[2]21	9
Lead, total recoverable (μg/L)	62	56	<1	[2]9	4
Lead, dissolved (μg/L)	62	1.2	<.5	[2].3	<.5
Manganese, total recoverable (μg/L)	66	880	20	168	110
Manganese, dissolved (μg/L)	66	50	7	17	15
Zinc, total recoverable (μg/L)	66	490	9	76	41
Zinc, dissolved (μg/L)	66	21	<3	[2]8	6
Sediment, suspended concentration (mg/L)	67	530	2	76	30
Sediment, suspended discharge (ton/d)	67	4,720	1.9	420	66
Sediment, suspended (percent finer than 0.062 mm)	67	92	38	73	74

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	89	5,060	113	1,020	558
Specific conductance, onsite (µS/cm)	80	158	53	105	96
Temperature, water (°C)	89	18	0.0	8.1	8.5
pH, onsite (standard units)	79	8.8	6.9	7.9	7.9
Hardness, total (mg/L as $CaCO_3$)	71	90	22	49	49
Calcium, dissolved (mg/L)	71	23	5.9	13	13
Magnesium, dissolved (mg/L)	71	8.0	1.9	4.2	4.0
Arsenic, total recoverable (µg/L)	77	3	<1	[2].9	<1
Arsenic, dissolved (µg/L)	77	1	<1	[2].7	<1
Cadmium, total recoverable (µg/L)	77	3	<.1	[2].3	<1
Cadmium, dissolved (µg/L)	77	1	<.1	--	<.1
Copper, total recoverable (µg/L)	75	41	<1	[2]4	2
Copper, dissolved (µg/L)	76	6	<1	[2]1	<1
Iron, total recoverable (µg/L)	77	2,100	20	336	150
Iron, dissolved (µg/L)	77	160	5	37	33
Lead, total recoverable (µg/L)	75	19	<1	[2]2	<1
Lead, dissolved (µg/L)	75	5	<.5	[2].5	<1
Manganese, total recoverable (µg/L)	77	90	<1	[2]17	10
Manganese, dissolved (µg/L)	77	8	<3	[2]2	2
Zinc, total recoverable (µg/L)	77	60	<1	[2]8	<10
Zinc, dissolved (µg/L)	77	15	<1	[2]2	<3
Sediment, suspended concentration (mg/L)	89	223	1	23	6
Sediment, suspended discharge (ton/d)	89	3,050	.31	161	12
Sediment, suspended (percent finer than 0.062 mm)	89	95	35	69	70

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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: March 1985-September 2000					
Streamflow, instantaneous (ft^3/s)	164	9,560	296	1,900	1,120
Specific conductance, onsite (μS/cm)	139	483	140	306	327
Temperature, water (°C)	163	22.0	0.0	9.2	9.5
pH, onsite (standard units)	110	8.8	7.4	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	100	210	58	133	140
Calcium, dissolved (mg/L)	100	59	16	38	39
Magnesium, dissolved (mg/L)	100	14	3.9	9.5	9.5
Arsenic, total recoverable (μg/L)	109	110	3	11	8
Arsenic, dissolved (μg/L)	109	17	3	6	5
Cadmium, total recoverable (μg/L)	109	4	<.1	[2].3	<1
Cadmium, dissolved (μg/L)	109	1	<.1	--	<.1
Copper, total recoverable (μg/L)	107	500	3	43	21
Copper, dissolved (μg/L)	108	25	2	5	4
Iron, total recoverable (μg/L)	109	19,000	50	1,300	480
Iron, dissolved (μg/L)	109	190	<3	[2]26	14
Lead, total recoverable (μg/L)	105	100	<1	[2]9	5
Lead, dissolved (μg/L)	105	7	<.5	[2].4	<1
Manganese, total recoverable (μg/L)	109	2,000	10	151	80
Manganese, dissolved (μg/L)	109	37	1	8	7
Zinc, total recoverable (μg/L)	109	1,100	<10	[2]77	40
Zinc, dissolved (μg/L)	109	39	<3	[2]8	6
Sediment, suspended concentration (mg/L)	164	1,370	2	64	20
Sediment, suspended discharge (ton/d)	164	34,700	3.5	744	61
Sediment, suspended (percent finer than 0.062 mm)	153	98	27	72	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	120	13,400	344	2,770	1,320
Specific conductance, onsite (μS/cm)	97	294	130	205	203
Temperature, water (^{o}C)	120	21.0	0.0	9.1	9.2
pH, onsite (standard units)	80	8.7	7.5	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	73	140	55	101	95
Calcium, dissolved (mg/L)	73	37	14	26	24
Magnesium, dissolved (mg/L)	73	13	4.9	8.9	8.4
Arsenic, total recoverable (μg/L)	80	4	<1	[2]1	1
Arsenic, dissolved (μg/L)	80	2	<1	[2].9	.8
Cadmium, total recoverable (μg/L)	80	2	<.1	[2].4	<1
Cadmium, dissolved (μg/L)	80	1	<.1	--	<.1
Copper, total recoverable (μg/L)	77	34	<1	[2]7	4
Copper, dissolved (μg/L)	78	7	<1	[2]2	1
Iron, total recoverable (μg/L)	80	3,600	20	548	232
Iron, dissolved (μg/L)	80	100	<3	[2]19	12
Lead, total recoverable (μg/L)	76	25	<1	[2]4	1
Lead, dissolved (μg/L)	76	8	<.5	[2].9	<1
Manganese, total recoverable (μg/L)	80	180	<10	[2]36	20
Manganese, dissolved (μg/L)	80	11	<1	[2]3	2
Zinc, total recoverable (μg/L)	80	60	<1	[2]8	<10
Zinc, dissolved (μg/L)	80	15	<1	[2]3	<10
Sediment, suspended concentration (mg/L)	120	271	1	33	9
Sediment, suspended discharge (ton/d)	120	7,670	1.1	613	31
Sediment, suspended (percent finer than 0.062 mm)	118	98	42	79	81

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2000 (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 2000					
Streamflow, instantaneous (ft^3/s)	130	21,600	720	4,550	2,360
Specific conductance, onsite (µS/cm)	107	399	142	254	261
Temperature, water (°C)	127	20.0	0.0	9.2	8.5
pH, onsite (standard units)	87	8.7	7.9	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	87	170	61	117	120
Calcium, dissolved (mg/L)	87	46	14	32	32
Magnesium, dissolved (mg/L)	87	13	5.3	9.2	9.2
Arsenic, total recoverable (µg/L)	87	69	1	5	4
Arsenic, dissolved (µg/L)	87	9	1	3	3
Cadmium, total recoverable (µg/L)	87	5	<.1	--	<1
Cadmium, dissolved (µg/L)	87	.1	<.1	--	<.1
Copper, total recoverable (µg/L)	85	400	2	17	8
Copper, dissolved (µg/L)	86	11	.7	3	2
Iron, total recoverable (µg/L)	87	13,000	56	673	230
Iron, dissolved (µg/L)	87	200	<3	[2]23	16
Lead, total recoverable (µg/L)	82	78	<1	[2]4	2
Lead, dissolved (µg/L)	82	1	<.5	[2].6	<.5
Manganese, total recoverable (µg/L)	87	1,100	10	69	40
Manganese, dissolved (µg/L)	87	230	6	18	14
Zinc, total recoverable (µg/L)	87	1,100	<10	[2]34	20
Zinc, dissolved (µg/L)	87	16	<3	[2]5	3
Sediment, suspended concentration (mg/L)	130	824	2	39	10
Sediment, suspended discharge (ton/d)	130	21,900	6.1	1,070	62
Sediment, suspended (percent finer than 0.062 mm)	125	99	44	87	90

[1]Multiple less-than (<) values for an individual constituent are the result of changes in analytical laboratory reporting levels during the period of record.
[2]Value is estimated by using a log-probability regression to predict the values of data less than the laboratory 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 September 2000

[Fine-grained bed sediment is material less than 0.064 millimeter in diameter. Reported concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates 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]

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: 1992-2000				
Cadmium	9	42.0	23.7	31.5	29.3
Chromium	8	32.4	23.2	27.7	27.9
Copper	9	6,280	4,220	4,990	4,810
Iron	9	41,200	28,200	37,300	38,400
Lead	9	1,030	563	817	833
Manganese	9	9,220	1,680	3,280	2,460
Nickel	8	21.4	14.2	16.3	16.1
Silver	9	19.6	13.1	16.3	16.4
Zinc	9	13,400	6,660	8,660	8,010
	12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.				
	Period of record for fine-grained bed-sediment data: 1992-2000				
Cadmium	9	12.2	4.5	7.8	6.7
Chromium	8	34.1	12.8	22.1	23.2
Copper	9	769	223	416	344
Iron	9	27,200	18,100	21,600	20,800
Lead	9	100	58	75	73
Manganese	9	17,700	1,470	7,390	7,230
Nickel	8	19.1	12.5	15.5	15.6
Silver	9	2.1	.3	[1]1.4	[1]1.6
Zinc	9	2,220	620	1,150	840
	12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.				
	Period of record for fine-grained bed-sediment data: 1995, 1997, 1999				
Cadmium	3	3.9	1.3	2.6	2.6
Chromium	3	33.4	27.5	30.6	30.8
Copper	3	892	779	840	848
Iron	3	22,400	20,600	21,600	21,900
Lead	3	86	85	85	85
Manganese	3	8,790	2,020	5,610	6,030
Nickel	3	21.9	17.6	19.7	19.6
Silver	3	3.7	3.1	3.3	3.2
Zinc	3	421	372	396	396
	12323800--CLARK FORK NEAR GALEN, MONT.				
	Period of record for fine-grained bed-sediment data: 1987, 1991-2000				
Cadmium	11	20.1	4.0	10.3	9.3
Chromium	8	33.9	19.1	27.2	28.5
Copper	11	2,300	991	1,330	1,220
Iron	11	39,800	22,600	29,000	28,400
Lead	11	235	116	150	143
Manganese	11	15,600	2,780	8,460	8,470
Nickel	8	23.2	15.4	19.3	19.2
Silver	11	5.7	<3.2	[1]4.0	[1]3.7
Zinc	11	3,560	1,090	1,840	1,370

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2000					
Cadmium	5	10.5	6.5	8.2	8.4
Chromium	5	34.5	25.6	30.5	32.0
Copper	5	2,050	1,360	1,650	1,650
Iron	5	32.800	30.800	31,900	31,700
Lead	5	200	168	186	190
Manganese	5	5,900	3,540	4,830	5,000
Nickel	5	19.9	16.5	18.3	18.7
Silver	5	7.8	4.2	6.3	6.8
Zinc	5	1,680	1.280	1.480	1,490
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2000					
Cadmium	5	8.6	5.0	7.0	7.5
Chromium	5	33.3	19.1	27.5	30.0
Copper	5	1,610	933	1,250	1,370
Iron	5	31.700	24,700	28,800	29,000
Lead	5	186	128	151	153
Manganese	5	4,120	2,390	3,270	3,130
Nickel	5	18.4	12.7	16.2	16.7
Silver	5	6.1	<3.3	[1]4.7	[1]5.1
Zinc	5	1,550	1.030	1,270	1,190
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2000					
Cadmium	5	10.3	4.3	6.9	6.9
Chromium	5	34.1	16.0	27.3	28.3
Copper	5	1,550	766	1,110	1,110
Iron	5	33,700	22,000	28,500	28,300
Lead	5	152	115	133	130
Manganese	5	6,410	1,810	3,490	2,680
Nickel	5	16.9	10.7	15.1	15.8
Silver	5	6.2	2.7	4.8	5.1
Zinc	5	1,570	900	1,200	1,260
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1990-2000					
Cadmium	13	10.0	4.4	7.0	7.4
Chromium	8	43.9	19.5	31.9	33.9
Copper	13	4,180	837	1,490	1,200
Iron	13	35,300	22,600	28,500	29,400
Lead	13	242	121	160	155
Manganese	13	6,020	1,460	2,850	2,440
Nickel	8	21.1	13.1	17.2	17.2
Silver	13	7.9	2.4	4.8	4.6
Zinc	13	1,730	977	1,340	1,340

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1994, 1998					
Cadmium	4	1.5	.2	.8	.8
Chromium	2	52.9	22.1	37.5	--
Copper	4	85	38	60	59
Iron	4	30,700	16,100	24,200	25,100
Lead	4	53	36	41	38
Manganese	4	2,700	905	1,390	974
Nickel	2	21.9	13.6	17.8	--
Silver	4	.9	<.5	[1].6	[1].6
Zinc	4	204	161	179	175
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for fine-grained bed-sediment data: 1992-2000					
Cadmium	9	8.1	3.5	5.7	5.8
Chromium	8	48.9	24.9	34.5	33.2
Copper	9	1,080	653	823	780
Iron	9	30,600	20,500	25,700	25,300
Lead	9	152	88	113	118
Manganese	9	2,610	1,180	1,930	1,840
Nickel	8	18.6	14.1	16.5	16.7
Silver	9	4.8	2.3	3.5	3.6
Zinc	9	1,320	1,070	1,150	1,120
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1989, 1992-2000					
Cadmium	11	6.3	<.2	[1]2.7	[1]2.4
Chromium	8	29.2	20.4	24.4	24.1
Copper	11	73	55	62	63
Iron	11	28,100	21,100	24,000	23,500
Lead	11	240	150	179	174
Manganese	11	5,510	2,370	3,830	3,910
Nickel	8	14.9	11.7	12.9	12.6
Silver	10	7.8	5.0	6.3	6.5
Zinc	11	777	577	659	650
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991-2000					
Cadmium	12	6.1	2.6	4.5	4.6
Chromium	8	35.4	17.0	29.2	31.3
Copper	12	747	391	546	551
Iron	12	27,000	16,500	22,600	23,500
Lead	12	135	82	99	98
Manganese	12	2,790	1,220	1,840	1,810
Nickel	8	16.8	11.8	15.1	15.7
Silver	12	4.7	<3.2	[1]2.9	[1]2.8
Zinc	12	1,230	939	1,070	1,070

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1989, 1991-99					
Cadmium	12	<1.5	<.2	[1]--	[1]<.8
Chromium	7	27.9	16.5	22.6	21.4
Copper	12	16	3	12	14
Iron	12	21,400	13,100	18,100	18,500
Lead	12	16	<3	[1]8	[1]8
Manganese	12	724	126	405	403
Nickel	7	14.8	10.8	12.9	13.0
Silver	11	.8	<.3	[1].4	[1]<.5
Zinc	12	58	36	48	48
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1991-2000					
Cadmium	11	5.2	3.1	3.9	3.9
Chromium	8	34.7	15.3	25.2	27.2
Copper	11	635	277	407	356
Iron	11	24,400	15,100	19,900	21,700
Lead	11	115	49	78	74
Manganese	11	2,270	671	1,230	1,130
Nickel	8	19.1	9.3	14.6	16.0
Silver	11	3.9	<1.9	[1]2.1	[1]2.1
Zinc	11	1,160	775	927	909
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991, 1993-96, 1998-2000					
Cadmium	10	2.0	<.2	[1].7	[1]<1.2
Chromium	7	25.8	15.1	19.9	21.6
Copper	10	27	16	21	21
Iron	10	20,200	12,400	16,900	16,900
Lead	10	20	<13	[1]13	[1]12
Manganese	10	683	298	518	516
Nickel	7	14.3	9.4	12.5	12.7
Silver	10	1.0	<.3	[1].4	[1]<.3
Zinc	10	73	35	61	62
12340500--CLARK FORK ABOVE MISSOULA, MONT.					
Period of record for fine-grained bed-sediment data: 1997-2000					
Cadmium	4	4.2	1.5	2.9	3.0
Chromium	4	30.6	19.0	24.7	24.6
Copper	4	516	166	296	251
Iron	4	24,300	18,100	21,100	21,100
Lead	4	63	37	52	53
Manganese	4	1,370	480	1,070	1,230
Nickel	4	15.8	11.8	14.3	14.8
Silver	4	2.9	<3.2	[1]1.6	[1]1.3
Zinc	4	924	438	651	622

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (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, 1990-2000					
Cadmium	12	2.8	1.1	1.8	1.8
Chromium	8	27.6	12.3	21.0	21.2
Copper	12	293	87	156	140
Iron	12	21,100	13,400	18,200	19,000
Lead	12	58	12	37	36
Manganese	12	2,530	446	1,360	1,270
Nickel	8	14.1	8.9	12.5	13.1
Silver	12	2.1	.4	[1]1.2	[1]1.2
Zinc	12	675	252	415	423

[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 streamflow-gaging 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 September 2000

[Bulk bed sediment is material smaller than about 10 millimeters in diameter. Reported concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates 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]

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for bulk bed-sediment data: 1993-95, 1997-2000					
Cadmium	7	20.6	4.2	9.0	6.7
Chromium	7	16.2	9.6	12.7	12.1
Copper	7	1,660	670	1,050	902
Iron	7	29,300	18,300	21,900	19,700
Lead	7	300	198	248	248
Manganese	7	5,480	504	1,510	745
Nickel	7	8.9	6.0	7.0	6.5
Silver	7	7.4	3.2	4.3	3.9
Zinc	7	5,690	1,720	2,660	2,050
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1993, 1995-2000					
Cadmium	7	1.7	<.9	[1]1.0	[1]1.0
Chromium	7	11.8	5.9	9.7	9.9
Copper	7	111	20	54	42
Iron	7	12,300	7,200	9,730	9,600
Lead	7	33	<10	[1]15	[1]11
Manganese	7	2,100	209	899	830
Nickel	7	9.2	4.8	6.3	5.5
Silver	7	1.3	<.3	[1].7	[1].8
Zinc	7	303	93	165	137
12327700--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1995, 1997, 1999					
Cadmium	3	1.0	<.8	[1].6	[1]<.9
Chromium	3	12.0	9.7	11.2	11.8
Copper	3	238	203	215	205
Iron	3	12,700	8,980	10,900	10,900
Lead	3	38	18	30	34
Manganese	3	2,650	1,220	2,100	2,440
Nickel	3	8.5	5.7	7.3	7.8
Silver	3	1.1	<.8	[1].8	[1].9
Zinc	3	275	146	190	148

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through September 2000 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for bulk bed-sediment data: 1993-2000					
Cadmium	8	8.2	<.9	[1]3.7	[1]3.3
Chromium	8	23.7	4.2	14.9	14.9
Copper	8	902	223	455	363
Iron	8	31,300	9,930	21,100	21,500
Lead	8	158	41	80	72
Manganese	8	9.490	900	2,940	1,710
Nickel	8	15.2	4.9	8.7	7.9
Silver	8	5.2	.7	[1]1.8	[1]1.6
Zinc	8	1,280	417	730	665
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT					
Period of record for bulk bed-sediment data: 1996-2000					
Cadmium	5	3.3	<.9	[1]2.3	[1]2.5
Chromium	5	17.5	9.3	12.5	12.0
Copper	5	763	238	432	398
Iron	5	21,000	12,600	16,600	16,000
Lead	5	104	41	71	72
Manganese	5	1,740	1.260	1,420	1,390
Nickel	5	8.2	4.2	6.4	6.7
Silver	5	2.8	<3.4	[1]1.7	[1]1.7
Zinc	5	787	365	545	522
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-2000					
Cadmium	5	6.6	<.9	[1]2.9	[1]2.1
Chromium	5	19.1	12.4	15.0	14.7
Copper	5	603	361	475	440
Iron	5	25,900	16,200	19,600	18,200
Lead	5	87	66	78	78
Manganese	5	1,710	759	1,390	1,500
Nickel	5	9.9	5.5	7.7	7.3
Silver	5	2.7	<3.2	[1]2.0	[1]1.9
Zinc	5	781	472	631	626
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-2000					
Cadmium	5	9.2	1.5	3.9	3.0
Chromium	5	21.1	13.0	17.7	17.3
Copper	5	1,000	244	580	577
Iron	5	25,400	16,400	21,600	20,900
Lead	5	115	47	79	88
Manganese	5	4.930	825	2,090	1,850
Nickel	5	12.8	5.5	9.1	10.0
Silver	5	4.4	<.8	[1]2.2	[1]2.0
Zinc	5	1,240	368	693	604
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for bulk bed-sediment data: 1993-2000					
Cadmium	8	7.8	1.0	2.9	2.2
Chromium	8	24.5	12.1	17.8	17.9
Copper	8	906	281	485	412
Iron	8	25,000	13,200	19,200	19,000
Lead	8	112	45	76	78
Manganese	8	2,530	653	1,270	1,040
Nickel	8	12.3	7.7	9.9	10.1
Silver	8	3.9	<.7	[1]1.8	[1]1.6
Zinc	8	1,060	456	626	564

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through September 2000 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for bulk bed-sediment data: 1994, 1998					
Cadmium	2	.7	<1.2	[1].6	--
Chromium	2	33.2	14.7	23.9	--
Copper	2	20	19	20	--
Iron	2	21,000	15,600	18,300	--
Lead	2	18	12	15	--
Manganese	2	420	308	364	--
Nickel	2	15.2	8.6	11.9	--
Silver	2	<1.6	<.7	[1]--	--
Zinc	2	86	73	79	--
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for bulk bed-sediment data: 1993-2000					
Cadmium	8	7.6	1.1	3.5	2.9
Chromium	8	33.2	17.6	23.1	21.2
Copper	8	858	243	495	421
Iron	8	24,900	15,500	19,700	19,100
Lead	8	92	46	68	72
Manganese	8	2,930	554	1,440	1,220
Nickel	8	15.9	9.1	12.2	12.2
Silver	8	3.7	<.7	[1]2.0	[1]1.6
Zinc	8	1,020	525	750	686
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-2000					
Cadmium	8	3.2	<.2	[1]1.2	[1].9
Chromium	8	13.9	4.9	9.2	10.5
Copper	8	40	16	25	22
Iron	8	15,700	8,630	12,800	13,400
Lead	8	120	51	79	80
Manganese	8	3,200	1,150	2,160	2,220
Nickel	8	8.0	4.5	5.9	5.9
Silver	8	5.8	2.5	4.2	4.0
Zinc	8	429	178	287	304
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-2000					
Cadmium	8	3.9	<1.6	[1]2.1	[1]1.8
Chromium	8	29.5	6.9	19.2	18.5
Copper	8	605	114	289	229
Iron	8	21,800	12,100	16,600	16,100
Lead	8	78	32	51	49
Manganese	8	1,510	711	1,090	1,060
Nickel	8	14.2	7.8	10.7	10.1
Silver	8	3.5	.5	[1]1.6	[1]1.4
Zinc	8	939	397	615	559

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through September 2000 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for bulk bed-sediment data: 1993-99					
Cadmium	7	<1.5	<.2	[1]--	[1]<.8
Chromium	7	14.3	6.4	9.1	8.8
Copper	7	7	3	5	5
Iron	7	11,100	5,290	8,040	7,410
Lead	7	<13	<3	[1]5	[1]5
Manganese	7	265	72	170	186
Nickel	7	8.2	3.6	5.5	5.1
Silver	7	<1.6	.1	[1].3	[1].3
Zinc	7	29	10	18	17
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-2000					
Cadmium	8	3.3	.4	[1]1.7	[1]1.6
Chromium	8	23.8	6.9	14.5	12.9
Copper	8	336	75	189	184
Iron	8	19,100	9,270	13,300	12,900
Lead	8	67	21	38	36
Manganese	8	1,470	234	690	451
Nickel	8	14.0	6.4	9.2	8.6
Silver	8	2.9	<.3	[1]1.0	[1].7
Zinc	8	769	271	478	504
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-94, 1999-2000					
Cadmium	4	<1.9	<.2	[1].5	[1]<.5
Chromium	4	17.7	6.7	11.4	10.6
Copper	4	19	12	16	16
Iron	4	16,600	10,300	13,200	13,100
Lead	4	11	6	9	9
Manganese	4	650	179	340	256
Nickel	4	9.8	7.5	8.6	8.5
Silver	4	<1.9	<.4	[1]--	[1]<.5
Zinc	4	58	33	40	34
12340500--CLARK FORK ABOVE MISSOULA, MONT.					
Period of record for bulk bed-sediment data: 1997-2000					
Cadmium	4	3.4	<.8	[1]1.2	[1].6
Chromium	4	18.2	9.7	13.3	12.6
Copper	4	130	43	93	100
Iron	4	16,800	11,500	14,500	14,900
Lead	4	30	7	21	23
Manganese	4	810	228	540	562
Nickel	4	11.1	8.2	9.7	9.8
Silver	4	<3.3	<.4	[1].8	[1].8
Zinc	4	387	145	283	300

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through September 2000 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for bulk bed-sediment data: 1993-2000					
Cadmium	8	1.0	<.2	[1].5	[1]<1.2
Chromium	8	12.6	4.4	7.1	6.4
Copper	8	77	16	39	31
Iron	8	11,300	5,830	8,430	8,630
Lead	8	19	<10	[1]9	[1]7
Manganese	8	444	150	336	366
Nickel	8	7.1	3.5	5.2	5.1
Silver	8	<1.9	<.3	[1].5	[1].4
Zinc	8	172	58	115	111

[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 streamflow-gaging station to conform to previous sampling location.

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000

[Concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates either too few samples (less than three) 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. Insects were depurated prior to analysis during 1986-98; depuration was discontinued in 1999]

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for biological data: 1992, 1994-95, 1997-2000					
***Brachycentrus* spp.**					
Cadmium	4	12.5	5.8	9.6	10.0
Chromium	4	5.9	.7	2.1	.9
Copper	4	846	235	565	589
Iron	4	730	335	474	416
Lead	4	17.9	7.4	11.7	10.8
Manganese	4	666	231	439	430
Nickel	4	1.9	<.1	[1]1.2	[1]1.3
Zinc	4	888	629	755	751
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* spp.**					
Cadmium	1	--	--	5.0	--
Chromium	1	--	--	4.7	--
Copper	1	--	--	352	--
Iron	1	--	--	1,430	--
Lead	1	--	--	36.5	--
Manganese	1	--	--	1,040	--
Nickel	1	--	--	2.2	--
Zinc	1	--	--	1,090	--
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: 1992-2000					
Hydropsyche cockerelli					
Cadmium	22	2.1	.2	.8	.6
Chromium	22	1.3	.5	.8	.8
Copper	22	96.9	22.4	44.7	41.8
Iron	22	1,240	351	697	733
Lead	22	5.7	.3	3.2	3.0
Manganese	22	2,520	491	1,050	829
Nickel	22	1.8	.3	.8	.8
Zinc	22	276	115	183	174

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (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: 1992-2000					
Hydropsyche occidentalis					
Cadmium	12	1.1	.2	.5	.4
Chromium	12	1.7	.3	.9	.9
Copper	12	46.5	22.8	32.2	30.3
Iron	12	1,050	372	811	805
Lead	12	4.3	<2.3	[1]3.2	[1]3.2
Manganese	12	3,200	1,200	2,090	1,810
Nickel	12	1.8	.7	1.2	1.1
Zinc	12	202	149	176	177
Hydropsyche spp.					
Cadmium	4	2.3	.4	1.1	.9
Chromium	4	1.4	.5	.8	1.2
Copper	4	47.6	34.9	40.9	40.6
Iron	4	773	561	680	693
Lead	4	5.1	1.9	2.9	4.7
Manganese	4	1,100	443	725	678
Nickel	4	1.9	<.4	[1].8	[1].5
Zinc	4	285	141	195	177
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for biological data: 1995, 1997, 1999					
Arctopsyche grandis					
Cadmium	3	2.4	1.9	2.2	2.1
Chromium	3	2.9	1.4	2.0	1.8
Copper	3	102	95.6	98.9	98.8
Iron	3	1,040	684	866	872
Lead	3	5.6	<6.3	[1]4.4	<8.7
Manganese	3	2,280	1,340	1,810	1,800
Nickel	3	<7.0	1.8	[1]2.5	2.3
Zinc	3	222	180	200	197
Hydropsyche occidentalis					
Cadmium	2	.8	.7	.8	--
Chromium	2	3.2	3.2	3.2	--
Copper	2	183	181	182	--
Iron	2	2,070	1,950	2,010	--
Lead	2	8.2	6.7	7.4	--
Manganese	2	2,480	2,400	2,440	--
Nickel	2	3.3	3.0	3.2	--
Zinc	2	172	166	169	--
Hydropsyche spp.					
Cadmium	1	--	--	<9.3	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	94.8	--
Iron	1	--	--	1,150	--
Lead	1	--	--	<16.7	--
Manganese	1	--	--	956	--
Nickel	1	--	--	2.0	--
Zinc	1	--	--	129	--
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for biological data: 1987, 1991-2000					
Hydropsyche cockerelli					
Cadmium	20	2.7	.9	1.5	1.5
Chromium	20	3.3	.8	1.7	1.6
Copper	20	181	48.7	102	100
Iron	20	2,460	816	1,410	1,280
Lead	20	11.7	1.2	7.7	7.9
Manganese	20	2,950	1,070	2,080	2,140
Nickel	20	3.1	.9	1.6	1.6
Zinc	20	299	136	219	222

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.--Continued					
Period of record for biological data: 1987, 1991-2000					
***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
Hydropsyche occidentalis					
Cadmium	29	1.7	.6	1.1	1.0
Chromium	29	6.6	.7	1.7	1.4
Copper	29	106	49.2	78.1	75.5
Iron	29	1,920	642	1,190	1,160
Lead	29	13.5	1.6	6.6	6.3
Manganese	29	6,170	1,220	2,470	2,240
Nickel	29	3.5	.8	1.5	1.4
Zinc	29	286	168	200	195
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: 1996-2000					
Claassenia sabulosa					
Cadmium	1	--	--	.3	--
Chromium	1	--	--	1.9	--
Copper	1	--	--	70.1	--
Iron	1	--	--	189	--
Lead	1	--	--	1.2	--
Manganese	1	--	--	238	--
Nickel	1	--	--	.2	--
Zinc	1	--	--	245	--
Hydropsyche cockerelli					
Cadmium	8	2.8	2.2	2.1	2.2
Chromium	8	2.6	1.0	2.1	2.2
Copper	8	147	48.8	112	109
Iron	8	1,900	706	1,420	1,420
Lead	8	14.8	12.1	11.6	12.1
Manganese	8	3,160	1,230	2,090	1,760
Nickel	8	1.9	1.1	1.5	1.4
Zinc	8	250	151	226	235

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (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: 1996-2000					
Hydropsyche occidentalis					
Cadmium	14	1.8	.9	1.3	1.6
Chromium	14	3.3	1.3	1.9	1.9
Copper	14	157	52.1	102	120
Iron	14	1,920	963	1,400	1,520
Lead	14	12.4	6.6	9.7	11.5
Manganese	14	3,440	1,270	2,280	1,850
Nickel	14	1.7	.9	1.3	1.5
Zinc	14	283	174	230	231
***Hydropsyche* spp.**					
Cadmium	4	1.8	1.2	1.4	1.4
Chromium	4	2.4	.9	1.6	1.6
Copper	4	122	45.1	89.0	94.3
Iron	4	1,410	533	1,120	1,270
Lead	4	20.5	4.1	10.4	8.5
Manganese	4	1,980	799	1,490	1,590
Nickel	4	2.8	1.4	1.9	1.4
Zinc	4	225	143	183	183
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for biological data: 1996-2000					
Claassenia sabulosa					
Cadmium	1	--	--	.4	--
Chromium	1	--	--	.3	--
Copper	1	--	--	40.3	--
Iron	1	--	--	113	--
Lead	1	--	--	.8	--
Manganese	1	--	--	172	--
Nickel	1	--	--	.2	--
Zinc	1	--	--	213	--
Hydropsyche cockerelli					
Cadmium	7	1.9	1.1	1.4	1.4
Chromium	7	2.7	.7	1.7	1.4
Copper	7	109	50.0	78.9	82.6
Iron	7	1,370	846	1,050	981
Lead	7	10.5	6.1	7.9	7.7
Manganese	7	1,960	646	1,220	1,050
Nickel	7	1.4	1.0	1.2	1.2
Zinc	7	199	139	176	179
Hydropsyche occidentalis					
Cadmium	12	2.2	.7	1.3	1.3
Chromium	12	2.6	1.1	1.9	1.9
Copper	12	160	59.5	104	100
Iron	12	1,880	1,030	1,500	1,480
Lead	12	11.7	4.3	9.6	9.9
Manganese	12	3,480	1,090	2,030	2,070
Nickel	12	1.9	1.1	1.3	1.3
Zinc	12	255	181	228	229
***Hydropsyche* spp.**					
Cadmium	2	1.5	1.0	1.2	--
Chromium	2	1.7	.7	1.2	--
Copper	2	85.2	82.9	84.0	--
Iron	2	1,200	1,140	1,170	--
Lead	2	7.4	5.7	6.6	--
Manganese	2	1,600	910	1,260	--
Nickel	2	1.4	1.1	1.2	--
Zinc	2	208	151	180	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for biological data: 1996-2000					
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	4	1.6	.7	1.0	.8
Chromium	4	1.7	1.0	1.4	1.4
Copper	4	143	62.7	90.1	77.1
Iron	4	1,290	831	995	927
Lead	4	8.9	6.8	8.0	8.2
Manganese	4	1,190	487	878	918
Nickel	4	1.9	.9	1.4	1.3
Zinc	4	180	162	172	174
Hydropsyche occidentalis					
Cadmium	15	1.7	.7	1.1	1.0
Chromium	15	2.8	1.2	1.9	1.9
Copper	15	163	74.9	96.9	89.0
Iron	15	1,660	1,100	1,470	1,500
Lead	15	13.8	9.7	11.5	11.4
Manganese	15	3,990	826	2,470	2,290
Nickel	15	2.4	1.2	1.5	1.5
Zinc	15	292	222	248	236
Hydropsyche spp.					
Cadmium	2	1.7	1.6	1.6	--
Chromium	2	2.1	1.4	1.8	--
Copper	2	140	104	122	--
Iron	2	1,610	1,070	1,340	--
Lead	2	13.2	10.5	11.8	--
Manganese	2	1,150	638	892	--
Nickel	2	1.6	1.6	1.6	--
Zinc	2	212	191	202	--
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for biological data: 1986-87, 1990-2000					
Arctopsyche grandis					
Cadmium	2	2.4	<4.2	[1]2.2	--
Chromium	2	1.0	<1.3	[1].8	--
Copper	2	69.1	34.9	52.0	--
Iron	2	676	537	606	--
Lead	2	<7.8	3.8	[1]3.8	--
Manganese	2	727	380	554	--
Nickel	2	<1.7	<1.3	[1]--	--
Zinc	2	178	140	159	--
Hydropsyche cockerelli					
Cadmium	21	2.3	.6	1.3	1.3
Chromium	21	3.2	.4	1.7	1.8
Copper	21	136	54.7	93.2	87.3
Iron	21	3,340	490	1,160	1,050
Lead	21	18.2	4.3	9.7	8.9
Manganese	21	1,490	396	790	700
Nickel	21	2.4	.3	1.2	1.1
Zinc	21	391	132	185	184

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT.--Continued					
Period of record for biological data: 1986-87, 1990-2000					
Hydropsyche occidentalis					
Cadmium	33	2.7	.8	1.3	1.3
Chromium	33	3.6	.6	1.9	1.9
Copper	33	162	49.5	114	112
Iron	33	2,060	558	1,440	1,430
Lead	33	18.6	3.5	11.1	10.8
Manganese	33	2,840	649	1,650	1,710
Nickel	33	12.9	1.0	1.9	1.5
Zinc	33	329	166	236	229
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, 1998					
Arctopsyche grandis					
Cadmium	10	.5	.2	.3	.3
Chromium	10	1.6	.6	.8	.8
Copper	10	14.0	9.1	11.4	11.5
Iron	10	654	177	284	235
Lead	10	1.3	.5	.8	.8
Manganese	10	596	318	479	496
Nickel	10	.6	.4	.5	.5
Zinc	10	179	113	149	145
Claassenia sabulosa					
Cadmium	5	.5	.1	.3	.2
Chromium	5	.9	.7	.8	.8
Copper	5	36.1	20.0	29.5	31.4
Iron	5	319	98	174	144
Lead	5	<1.2	<.4	[1]--	[1]<.6
Manganese	5	71.0	46.7	57.8	56.7
Nickel	5	.7	.5	.6	.5
Zinc	5	233	191	205	202
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	--
Hydropsyche occidentalis					
Cadmium	2	<.7	.3	.3	--
Chromium	2	2.3	1.3	1.8	--
Copper	2	15.2	15.1	15.2	--
Iron	2	1,340	426	883	--
Lead	2	2.3	<3.7	2.1	--
Manganese	2	554	434	494	--
Nickel	2	1.1	.8	1.0	--
Zinc	2	137	110	124	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
	12324680--CLARK FORK AT GOLDCREEK, MONT.				
	Period of record for biological data: 1992-2000				
	Arctopsyche grandis				
Cadmium	22	6.6	1.1	2.7	2.4
Chromium	22	3.3	.8	1.4	1.1
Copper	22	129	28.8	56.7	54.9
Iron	22	2,360	339	811	617
Lead	22	10.9	2.3	4.6	3.7
Manganese	22	1,580	592	877	851
Nickel	22	1.8	.2	.8	.7
Zinc	22	326	165	217	193
	Claassenia sabulosa				
Cadmium	17	3.5	.5	1.4	1.0
Chromium	17	1.6	.3	.7	.6
Copper	17	81.7	33.0	55.5	55.6
Iron	17	296	63.0	168	171
Lead	17	1.7	.5	1.0	1.0
Manganese	17	184	50.6	107	92.5
Nickel	17	.7	.2	.3	.3
Zinc	17	351	166	258	258
	Hydropsyche cockerelli				
Cadmium	15	2.6	.6	1.7	1.7
Chromium	15	4.7	.7	2.5	2.0
Copper	15	188	33.5	90.9	66.6
Iron	15	3,250	589	1,400	1,340
Lead	15	16.2	4.5	8.6	6.9
Manganese	15	1,670	538	782	687
Nickel	15	2.3	.6	1.4	1.3
Zinc	15	249	137	198	206
	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	15	1.7	.7	1.3	1.3
Chromium	15	3.9	.4	1.6	1.6
Copper	15	156	26.4	64.4	58.3
Iron	15	2,720	466	1,140	1,040
Lead	15	15.7	2.9	7.3	6.0
Manganese	15	2,210	530	1,170	1,030
Nickel	15	2.5	.8	1.3	1.1
Zinc	15	277	97	195	192
	12331500--FLINT CREEK NEAR DRUMMOND, MONT.				
	Period of record for biological data: 1986, 1992-2000				
	Arctopsyche grandis				
Cadmium	37	.8	.1	.4	.3
Chromium	37	4.7	.6	1.9	1.7
Copper	37	21.7	8.7	15.0	15.2
Iron	37	2,460	606	1,370	1,330
Lead	37	17.5	3.7	9.0	8.4
Manganese	37	2,480	679	1,510	1,360
Nickel	37	2.7	.6	1.4	1.3
Zinc	37	275	141	199	193

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12331500--FLINT CREEK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1992-2000					
Hydropsyche cockerelli					
Cadmium	9	.7	.1	.4	.4
Chromium	9	4.0	.9	1.9	1.8
Copper	9	28.3	9.5	17.9	18.0
Iron	9	3,390	996	1,960	1,870
Lead	9	28.4	3.1	13.2	12.9
Manganese	9	2,460	401	1,180	1,190
Nickel	9	2.3	.9	1.9	2.2
Zinc	9	208	85	163	181
Hydropsyche occidentalis					
Cadmium	7	1.1	.2	.6	.6
Chromium	7	17.6	.7	4.5	2.1
Copper	7	27.3	15.1	20.6	18.6
Iron	7	2,990	912	1,900	1,870
Lead	7	29.8	5.8	19.4	24.0
Manganese	7	4,790	1,400	2,270	1,780
Nickel	7	6.9	.8	3.0	2.4
Zinc	7	243	128	185	188
Hydropsyche spp.					
Cadmium	1	--	--	<.3	--
Chromium	1	--	--	1.4	--
Copper	1	--	--	12.5	--
Iron	1	--	--	1,440	--
Lead	1	--	--	4.5	--
Manganese	1	--	--	1,320	--
Nickel	1	--	--	1.3	--
Zinc	1	--	--	130	--
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, 1991-2000					
Arctopsyche grandis					
Cadmium	27	3.8	.5	1.6	1.5
Chromium	27	2.5	.2	1.0	1.0
Copper	27	89.2	18.2	37.4	32.0
Iron	27	1,660	240	659	650
Lead	27	11.8	2.1	5.0	4.3
Manganese	27	2,010	462	900	754
Nickel	27	1.9	.2	.7	.7
Zinc	27	308	142	197	190
Claassenia sabulosa					
Cadmium	30	2.8	.3	1.3	1.3
Chromium	30	3.3	.3	.8	.6
Copper	30	130	18.0	65.1	56.9
Iron	30	381	76.0	160	133
Lead	30	2.9	.2	1.0	.9
Manganese	30	410	45.9	162	148
Nickel	30	1.1	.1	.3	.2
Zinc	30	469	140	270	251

Table 24. Statistical summary of biological data for the upper Clark Fork basin. Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1991-2000					
Hydropsyche cockerelli					
Cadmium	22	2.3	.7	1.4	1.4
Chromium	22	3.5	.4	1.9	1.7
Copper	22	156	37.2	70.1	54.5
Iron	22	2,500	506	1,310	1,280
Lead	22	15.0	5.1	9.4	9.1
Manganese	22	1,680	549	924	784
Nickel	22	2.0	.5	1.3	1.2
Zinc	22	248	134	201	198
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	15	2.0	.7	1.2	1.2
Chromium	15	8.1	.4	2.4	2.2
Copper	15	118	13.3	57.0	56.3
Iron	15	2,060	424	1,283	1,420
Lead	15	13.5	2.9	9.1	9.1
Manganese	15	2,920	619	1,500	1,220
Nickel	15	2.4	.5	1.5	1.7
Zinc	15	293	157	226	223
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	--
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for biological data: 1987, 1991-99					
Arctopsyche grandis					
Cadmium	32	.4	.06	.2	.2
Chromium	32	2.9	.5	1.2	1.0
Copper	32	15.7	4.7	8.6	8.3
Iron	32	991	191	517	464
Lead	32	<2.9	.1	[1].4	[1].4
Manganese	32	454	113	249	226
Nickel	32	1.6	.2	.8	.9
Zinc	32	189	84	127	124
Claassenia sabulosa					
Cadmium	16	.3	.05	.2	.1
Chromium	16	1.8	.4	.8	.6
Copper	16	40.7	18.1	29.8	30.0
Iron	16	129	49.8	90.7	93.1
Lead	16	1.0	.1	.3	.3
Manganese	16	76.3	15.7	35.0	33.6
Nickel	16	.9	.1	.3	.3
Zinc	16	264	164	205	207

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.--Continued					
Period of record for biological data: 1987, 1991-99					
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
***Hydropsyche* spp.**					
Cadmium	3	.3	<.5	[1].2	.2
Chromium	3	2.1	1.1	1.6	1.7
Copper	3	16.2	11.6	14.3	15.0
Iron	3	1,140	837	1,000	1,030
Lead	3	<3.1	<1.8	[1]--	<2.9
Manganese	3	462	299	399	437
Nickel	3	1.3	.8	1.1	1.1
Zinc	3	135	117	126	126
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for biological data: 1986, 1991-2000					
Arctopsyche grandis					
Cadmium	36	2.7	.6	1.4	1.4
Chromium	36	4.1	.6	1.8	1.7
Copper	36	125	20.1	42.3	35.8
Iron	36	2,870	420	1,070	942
Lead	36	13.2	2.1	4.8	4.0
Manganese	36	893	351	634	637
Nickel	36	2.6	.4	1.2	1.0
Zinc	36	276	152	206	202
Claassenia sabulosa					
Cadmium	24	2.5	.3	1.2	.9
Chromium	24	2.0	.4	.7	.6
Copper	24	79.2	38.3	56.7	53.9
Iron	24	181	58.6	103	101
Lead	24	1.6	.2	.6	.6
Manganese	24	139	37.2	76.4	68.5
Nickel	24	.6	.1	.2	.1
Zinc	24	283	144	221	226
Hydropsyche cockerelli					
Cadmium	24	1.7	.5	.9	.8
Chromium	24	8.0	1.0	2.2	1.8
Copper	24	118	26.4	51.0	43.9
Iron	24	2,530	688	1,280	1,100
Lead	24	12.1	2.2	5.5	5.2
Manganese	24	788	426	597	570
Nickel	24	2.6	.6	1.3	1.2
Zinc	24	228	148	188	184

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.--Continued					
Period of record for biological data: 1986, 1991-2000					
Hydropsyche morosa group					
Cadmium	2	1.3	1.1	1.2	--
Chromium	2	4.6	2.4	3.5	--
Copper	2	84.1	26.8	55.4	--
Iron	2	1,800	986	1,390	--
Lead	2	6.6	<7.8	5.2	--
Manganese	2	1,320	537	928	--
Nickel	2	1.7	1.3	1.5	--
Zinc	2	231	171	201	--
Hydropsyche occidentalis					
Cadmium	18	1.8	.3	.9	.9
Chromium	18	3.2	.6	1.9	1.8
Copper	18	102	34.1	51.1	43.7
Iron	18	2,310	472	1,220	1,090
Lead	18	14.2	3.0	6.7	5.7
Manganese	18	1,600	454	812	688
Nickel	18	3.2	.6	1.2	1.0
Zinc	18	416	145	207	188
Hydropsyche spp.					
Cadmium	1	--	--	1.3	--
Chromium	1	--	--	2.4	--
Copper	1	--	--	84.1	--
Iron	1	--	--	1,800	--
Lead	1	--	--	<7.8	--
Manganese	1	--	--	537	--
Nickel	1	--	--	1.3	--
Zinc	1	--	--	171	--
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for biological data: 1986-87, 1991, 1993, 1996, 1998, 2000					
Arctopsyche grandis					
Cadmium	10	.4	<.1	[1].2	[1].2
Chromium	4	1.8	.8	1.3	1.2
Copper	10	13.4	9.9	11.9	12.0
Iron	10	1,230	108	588	609
Lead	10	2.1	.5	1.1	.8
Manganese	4	517	286	398	393
Nickel	4	1.2	.8	1.0	.9
Zinc	10	143	123	135	136
Claassenia sabulosa					
Cadmium	11	.2	.1	.1	.1
Chromium	5	.9	.3	.5	.5
Copper	11	88.5	19.0	45.2	44.0
Iron	11	199	46.2	100	99.0
Lead	11	.6	.4	.3	.4
Manganese	5	127	26.3	57.1	44.7
Nickel	5	.3	.1	.2	.2
Zinc	11	329	117	209	194
Hydropsyche occidentalis					
Cadmium	12	.5	.1	.2	.2
Chromium	12	2.7	.8	1.8	1.7
Copper	12	20.6	12.0	14.6	14.4
Iron	12	1,930	1,060	1,410	1,380
Lead	12	1.9	.8	1.3	1.2
Manganese	12	527	414	472	460
Nickel	12	1.8	.9	1.3	1.2
Zinc	12	150	117	134	130

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.--Continued					
Period of record for biological data: 1986-87, 1991, 1993, 1996, 1998, 2000					
***Hydropsyche* spp.**					
Cadmium	1	--	--	.6	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	13.9	--
Iron	1	--	--	1,140	--
Lead	1	--	--	2.9	--
Manganese	1	--	--	525	--
Nickel	1	--	--	2.8	--
Zinc	1	--	--	132	--
12340500--CLARK FORK ABOVE MISSOULA, MONT.					
Period of record for biological data: 1997-2000					
Arctopsyche grandis					
Cadmium	12	1.8	.5	.9	.8
Chromium	12	3.0	1.3	1.7	1.7
Copper	12	77.6	22.3	36.1	32.8
Iron	12	2,340	708	1,180	1,100
Lead	12	6.8	1.2	3.4	3.3
Manganese	12	1,210	476	815	846
Nickel	12	2.0	.7	1.2	1.3
Zinc	12	235	155	190	187
Claassenia sabulosa					
Cadmium	6	2.0	.2	.9	.8
Chromium	6	1.1	.4	.8	.8
Copper	6	71.7	37.8	51.1	47.1
Iron	6	402	95.0	225	218
Lead	6	3.1	.5	[1]1.2	[1]1.0
Manganese	6	683	75.2	230	123
Nickel	6	<1.3	<.3	[1].4	[1]<.4
Zinc	6	363	191	287	290
Hydropsyche cockerelli					
Cadmium	8	1.3	.4	.9	1.0
Chromium	8	4.1	1.9	2.9	3.2
Copper	8	96.1	29.9	57.8	45.9
Iron	8	3,590	1,400	2,200	2,060
Lead	8	6.3	4.2	5.4	5.5
Manganese	8	1,250	781	996	967
Nickel	8	2.4	1.4	1.8	1.8
Zinc	8	226	156	192	192
Hydropsyche occidentalis					
Cadmium	6	1.1	.4	.7	.7
Chromium	6	3.2	2.1	2.7	2.9
Copper	6	76.5	30.3	48.5	48.2
Iron	6	2,400	1,450	1,970	2,110
Lead	6	7.7	4.0	5.7	5.5
Manganese	6	2,460	939	1,810	1,810
Nickel	6	2.3	1.6	2.0	2.0
Zinc	6	232	192	218	221
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for biological data: 1986, 1990-2000					
Arctopsyche grandis					
Cadmium	22	1.5	.2	.7	.7
Chromium	22	2.7	.5	1.4	1.4
Copper	22	38.0	9.4	21.5	21.2
Iron	22	1,500	343	785	783
Lead	22	3.2	.9	1.8	1.8
Manganese	22	1,090	511	722	712
Nickel	22	1.6	.4	.9	.9
Zinc	22	217	106	155	150

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2000 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]--Continued					
Period of record for biological data: 1986, 1990-2000					
Claassenia sabulosa					
Cadmium	34	1.3	.1	.5	.4
Chromium	34	1.2	.05	.5	.5
Copper	34	66.4	31.1	47.3	46.4
Iron	34	240	66.6	108	98
Lead	34	1.3	.1	.4	.3
Manganese	34	168	48.9	103	101
Nickel	34	.3	.1	.2	.2
Zinc	34	286	146	214	204
Hydropsyche cockerelli					
Cadmium	30	1.1	.2	.5	.6
Chromium	30	3.4	.8	1.9	1.9
Copper	30	45.7	12.4	29.6	32.0
Iron	30	2,000	584	1,250	1,270
Lead	30	3.6	1.2	2.2	2.3
Manganese	30	1,210	353	749	664
Nickel	30	1.7	.5	1.2	1.3
Zinc	30	172	77.4	145	154
Hydropsyche occidentalis					
Cadmium	15	1.1	.2	.5	.4
Chromium	15	3.5	.2	1.4	1.5
Copper	15	38.2	16.0	24.7	22.2
Iron	15	1,420	482	938	907
Lead	15	4.2	.7	2.1	1.9
Manganese	15	1,460	575	874	834
Nickel	15	2.2	.5	1.0	.9
Zinc	15	193	112	144	149
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 and 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 streamflow-gaging station to conform to previous sampling location.

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