

Streamflow and Water-Quality Data for Bear Butte Creek Downstream of Sturgis, South Dakota, 1998-2000

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ABSTRACT

This report presents miscellaneous streamflow and water-quality data that were collected from June 1998 through May 2000 for the Bear Butte Creek Water Quality Study. This study was completed in cooperation with the South Dakota Department of Environment and Natural Resources with the objective of collecting baseline data along the lower reach of Bear Butte Creek.

Miscellaneous discharge and stage data are presented for four sites along Bear Butte Creek—one immediately below the City of Sturgis, one below inflows from Cottle Creek, another below inflows from Spring Creek, and the last just upstream from the confluence with the Belle Fourche River. Continuous stage is presented for the first site. Discharge was measured at all sites during monthly site visits as well as during four storm events.

Results from water-quality data analyzed by the South Dakota State Health Laboratory, as well as results from quality assurance/quality control samples, are presented. Samples were collected at the same time that discharge measurements were made. Beneficial-use designations and water-quality criteria for selected segments of Bear Butte Creek are presented.

INTRODUCTION

The City of Sturgis operates a municipal wastewater lagoon facility adjacent to Bear Butte Creek.

Treated effluent from the facility occasionally is used for irrigation purposes on nearby land. In 1996, with significantly higher inflows, limited evaporation, and no need for the treated water for irrigation purposes, the lagoons were full and in order to protect the lagoon system, the City of Sturgis discharged treated water to Bear Butte Creek. Following the discharge, the South Dakota Department of Environment and Natural Resources (DENR) required the City of Sturgis to develop a plan to ensure that a similar situation did not reoccur. One of the options that was considered by the City was to apply for a discharge permit. DENR found that very little water-quality data existed for Bear Butte Creek near and below the City of Sturgis from which discharge limits could be based. In addition to this, Bear Butte Creek was included on the State 303D list for establishment of total maximum daily loads (TMDL). DENR approached the U.S. Geological Survey (USGS) to assist in streamflow characterization and the collection of water-quality samples.

The general objectives of the study were to:

- (1) establish one continuous and three miscellaneous streamflow-gaging sites on Bear Butte Creek; and
- (2) determine existing baseline water-quality conditions in Bear Butte Creek so that the State can begin to determine temporal variations in streamflow and variations in water quality in relation to streamflow quantity.

Data collection and analysis completed for the study provide the information needed by DENR to begin to assess the hydrologic conditions in this area. The information obtained will provide data for developing technically based TMDL's within a basin where only limited streamflow and water-quality data previously existed.

Purpose and Scope

This report presents selected discharge and water-quality data collected in the Bear Butte Creek Basin downstream from the City of Sturgis. Miscellaneous measurements from four gaging stations are presented. Continuous discharge is published in the annual Water Resources Data Report for South Dakota (U.S. Geological Survey, 1999, 2000). Results from water-quality samples analyzed by the South Dakota State Health Laboratory (SHL) are included herein, as well as the quality-assurance/quality-control samples (QA/QC) analyzed by the SHL and the USGS National Water Quality Laboratory (NWQL). Hydrographs, scatter plots, boxplots, and trilinear diagrams are used for comparing changes in flow and concentration levels within the basin.

Description of Bear Butte Creek Basin

Bear Butte Creek originates south of Deadwood, South Dakota, and drains the area between Whitewood Creek on the north and Elk Creek and Alkali Creek on the south (fig. 1). Tributaries in the upper reach include Strawberry Creek, Park Creek, Two Bit Creek, and Boulder Creek. For most months of the year, Bear Butte Creek loses all or most of its flow as it crosses the Madison Limestone and Minnelusa Formation outcrops. The streambed generally is dry from about 3 miles west of Sturgis to the east edge of Sturgis. Springs and well discharges generally maintain some perennial flow in Bear Butte Creek for the area near the eastern edge of Sturgis to upstream of the Sturgis wastewater lagoon facility. Cottle Creek and Spring Creek provide tributary inflows within the lower reach of Bear Butte Creek.

The upper part of Bear Butte Creek is representative of a mountain-type stream with a rock/cobble bottom and higher gradients. Historical mining, primarily for gold, in this part of the basin has

impacted stream quality. This is evident on Strawberry Creek below the Gilt Edge mine, which currently is proposed as a superfund site. Bear Butte Creek below Sturgis is more representative of a prairie-type stream with meanders and a mud bottom. Land use adjacent to the stream and tributaries is predominantly agricultural. Sturgis and close-by housing developments probably provide some urban land-use influence.

DESCRIPTION OF STREAMFLOW DATA

This section presents the miscellaneous discharge measurements collected along Bear Butte Creek downstream of the City of Sturgis. Four sites were established within the basin from immediately upstream from the City's Wastewater Treatment Facility to just above the confluence with the Belle Fourche River. Table 1 presents site information, and figure 2 displays the location of the sites within the basin. For simplification, sites may be referenced by a site identification number (site 1, site 2, etc.) within this text and on related figures. Site 2, Bear Butte Creek below Sturgis, and site 3, Bear Butte Creek near Sturgis, were located immediately downstream from inflows from Cottle Creek and Spring Creek, respectively. Cottle Creek drains the area south of Bear Butte Creek and Spring Creek drains an area north of Bear Butte Creek.

Miscellaneous discharge measurements were obtained monthly at each of the four sites and during storm events (table 2, fig. 3). Flows generally increased between site 1 and site 2 (Cottle Creek inflows) and between site 2 and site 3 (Spring Creek inflows). With the exception of storm events, flow between site 3 and site 4 did not vary considerably. No flow occurred at site 4 in September 1998. During the first storm event (June 18, 1998), flows decreased from site 1 to site 2, which probably resulted from attenuation in filling the stream channel and alluvial storage, and then increased from site 2 to site 3 and from site 3 to site 4.

Table 1. Site information for selected streamflow-gaging stations and water-quality sampling sites

Site number	Site identification	Site name	Latitude (degrees, minutes, seconds)	Longitude	Elevation (feet)
06437400	1	Bear Butte Creek at Sturgis, SD	44 24 44	103 29 10	3,320.00
442811103205000	2	Bear Butte Creek below Sturgis, SD	44 28 11	103 20 50	2,930.00
06437500	3	Bear Butte Creek near Sturgis, SD	44 28 53	103 16 31	2,779.91
443048103091400	4	Bear Butte Creek near mouth, near Vale, SD	44 30 48	103 09 14	2,590.00

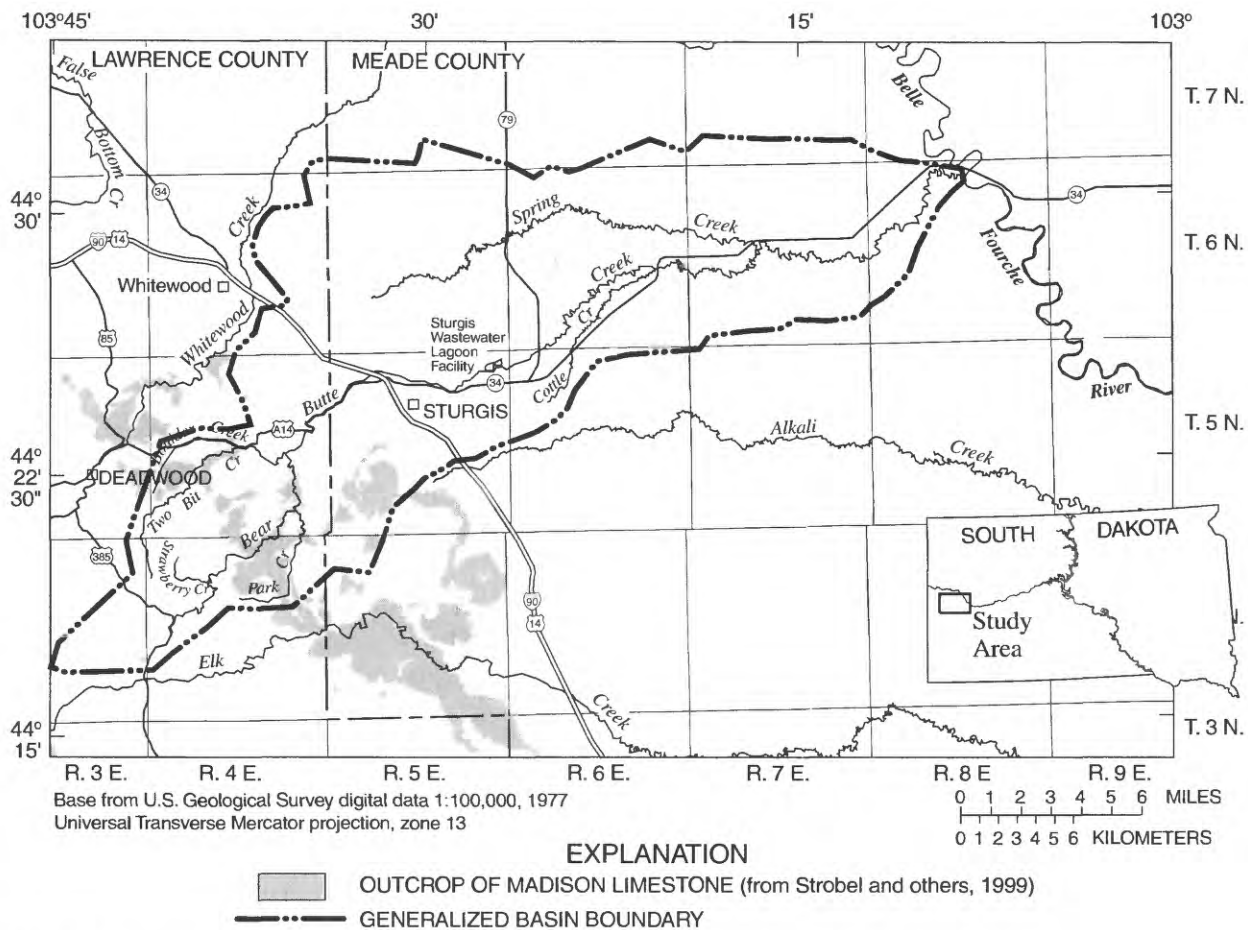


Figure 1. Location of Bear Butte Creek Basin.

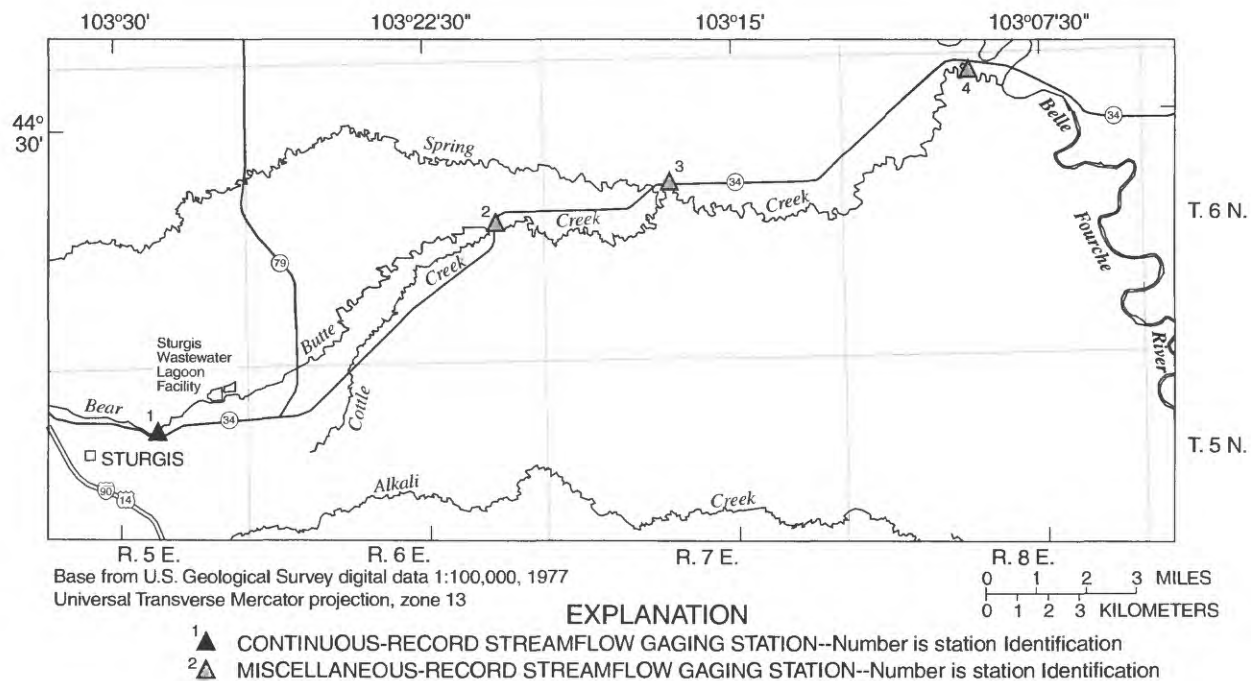


Figure 2. Locations of selected gaging stations and water-quality sampling sites.

Table 2. Miscellaneous discharge measurements for selected streamflow-gaging stations[--, no data; ft³/s, cubic feet per second]

Date	Time	Bear Butte Creek at Sturgis 06437400 (site 1) (ft ³ /s)	Time	Bear Butte Creek below Sturgis 442811103205000 (site 2) (ft ³ /s)	Time	Bear Butte Creek near Sturgis 06437500 (site 3) (ft ³ /s)	Time	Bear Butte Creek near mouth, near Vale 443048103091400 (site 4) (ft ³ /s)
06-16-1998	1000	3.8	1145	4.2	1315	7.5	1455	7.3
06-18-1998	1300	349	1405	52	1532	299	1745	529
06-19-1998	1020	149	--	--	--	--	--	--
06-20-1998	1230	83	--	--	--	--	--	--
06-22-1998	0950	42	--	--	--	--	--	--
06-25-1998	1057	19	--	--	--	--	--	--
06-30-1998	1100	5.8	--	--	--	--	--	--
07-07-1998	0915	4.7	1100	6.2	1240	12	1415	12
08-11-1998	1015	4.4	1215	3.8	1340	3.5	1450	3.1
09-16-1998	0855	3.5	1100	1.1	1230	1.1	1245	0
10-06-1998	1040	7.3	1345	17	--	--	--	--
10-07-1998	--	--	--	--	1035	48	1330	56
11-17-1998	0930	14	1130	22	1250	51	1420	62
12-15-1998	0930	6.5	1115	10	1250	20	1430	22
01-25-1999	1125	4.8	1300	8.4	--	--	--	--
01-26-1999	--	--	--	--	0855	15	1125	14
02-10-1999	0915	4.3	1055	6.6	1230	18	1405	21
03-09-1999	0915	3.8	1105	6.3	1245	18	1435	20
04-06-1999	0900	4.3	1055	20	1220	69	1400	107
04-21-1999	1110	4.7	1200	15	1255	29	1350	42
05-10-1999	0900	6.6	1130	16	1310	32	1445	37
06-09-1999	0915	7.4	1100	17	1245	80	1430	119
06-15-1999	0845	92	1027	122	1225	190	1456	265
07-19-1999	0735	9.9	0925	14	1050	31	1210	32
08-16-1999	0840	7.4	1025	6.8	1145	12	1255	12
09-14-1999	0910	6.2	1100	5.2	1245	9.6	1430	7.9
10-26-1999	0910	4.2	1050	5.6	1220	10	1345	12
11-16-1999	0850	3.8	1025	5.7	1155	10	1325	11
12-07-1999	0900	3.9	1050	5.5	1205	12	1340	16
01-18-2000	0905	3.5	1105	4.6	1255	9.4	1425	11
02-22-2000	0845	2.9	1030	4.5	1200	9.4	1330	13
03-28-2000	0900	3.2	1130	7.5	1405	19	--	--
03-29-2000	--	--	--	--	--	--	1000	20
04-04-2000	0855	3.0	1035	6.3	1200	14	1330	13
05-09-2000	0900	4.6	1030	16	1215	36	1345	53
05-18-2000	0900	7.7	1100	19	1230	33	1400	37

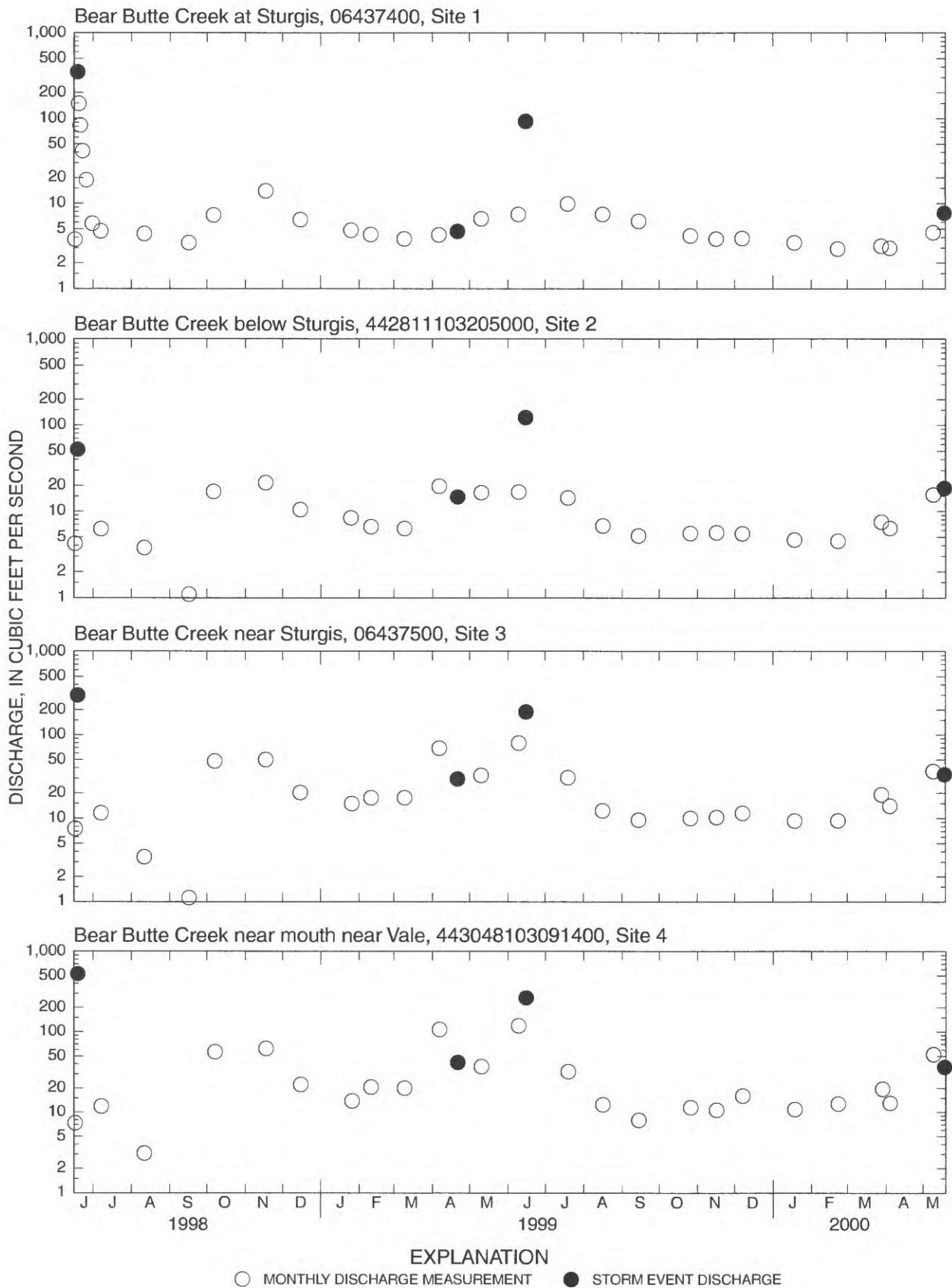


Figure 3. Miscellaneous discharge measurements for selected streamflow gaging stations, May 1998 to May 2000.

Continuous stage was recorded at site 1, Bear Butte Creek at Sturgis (fig. 4). Daily discharge was calculated based on measured discharge and continuous stage recordings and is published annually by water year (October to September) in the Water Resources Data Report for South Dakota (U.S. Geological Survey, 1999, 2000). Flow data collected from October 1999 through September 2000 will be published in the water year 2000 Annual Data Report. For storm events, an effort was made to determine discharge and collect water-quality samples during either the first flush (rise of the hydrograph) or near the peak of the event (fig. 4).

Figure 5 presents a comparison of the discharge measurements from this study at site 3, Bear Butte Creek near Sturgis, with the long-term statistical range

of flows during 1945-72. This site has numerous periods of zero flow so the minimum line on the plot corresponds with the x-axis as does the 25th percentile for much of the late summer and fall. All measurements in 1998-2000 except one exceed the 1945-72 median and most approach or exceed the 75th percentile.

DESCRIPTION OF WATER-QUALITY DATA

This section presents the water-quality data from samples collected at the same time as the monthly and storm-event discharge measurements. A discussion of QA/QC sampling, as well as beneficial-use and water-quality criteria are presented.

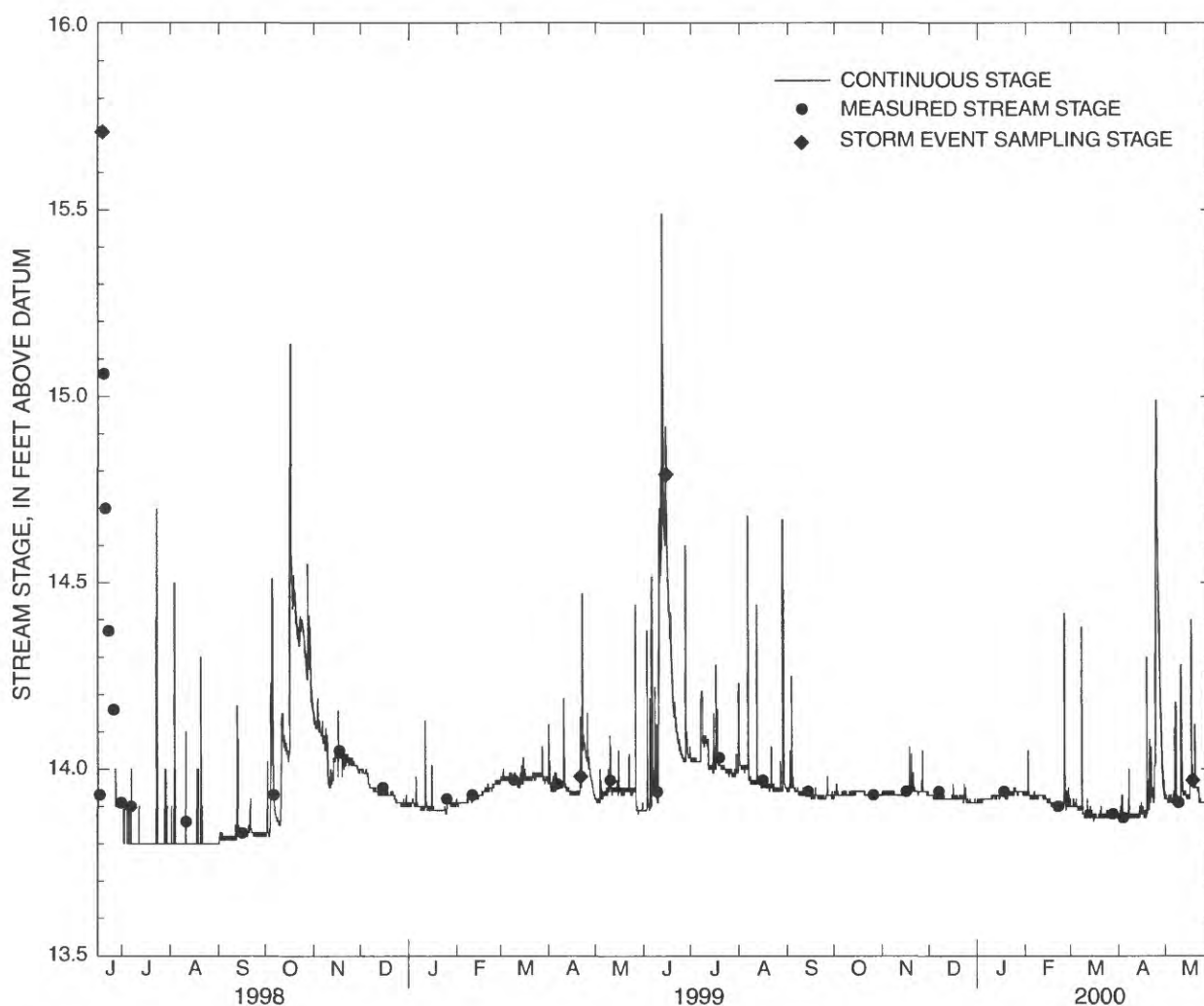


Figure 4. Continuous stage recordings, stage at miscellaneous measurements, and storm-event stage at Bear Butte Creek at Sturgis, 06437400.

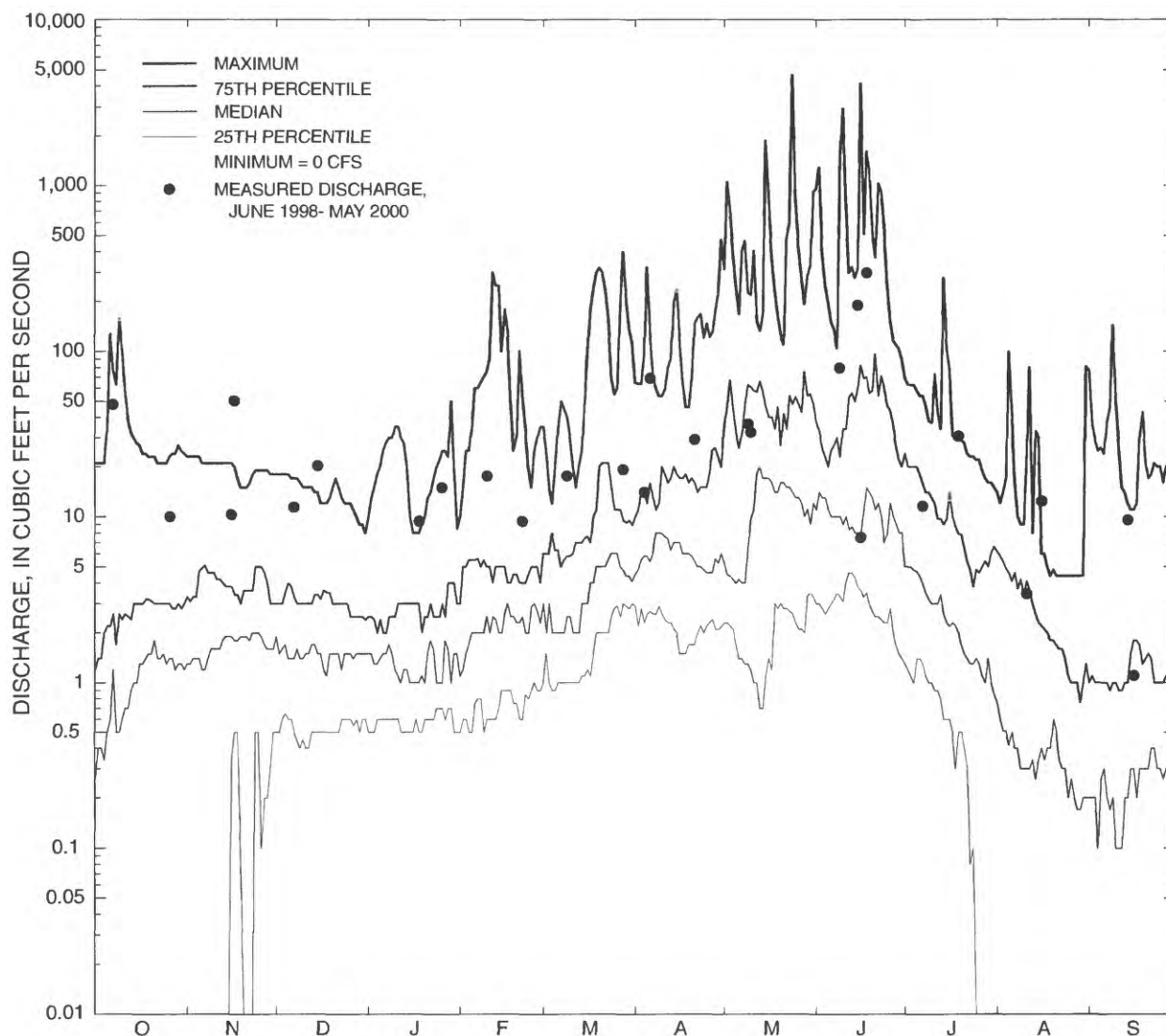


Figure 5. Comparison of miscellaneous discharge measurements during water years 1998-2000 to hydrographs of long-term statistical range of flows (1945-72) at Bear Butte Creek near Sturgis, 06437500

Water-Quality Results

Water-quality results are presented in table 6 in the Supplemental Information section at the end of the report and include data analyzed by the SHL as well as QA/QC data analyzed by both the SHL and NWQL. Discharge and field measurements followed standard USGS methods (Rantz and others, 1982). Sampling methods and criteria for water-quality sampling followed DENR's Water Quality 106 Quality Assurance Project Plan (1988). An additional 10 percent of samples were collected for QA/QC. Included in the

QA/QC were samples collected using standard USGS techniques (Horowitz and others, 1994) and sent to the NWQL for analysis.

Trace-element results from the first two analyses at each site should be used with caution due to contamination (see following section for details). Ion analyses were switched from total to dissolved concentrations in December 1998. Boxplots and trilinear diagrams are presented to provide indications of changes in water quality within the basin below the City of Sturgis (figs. 6 and 7).

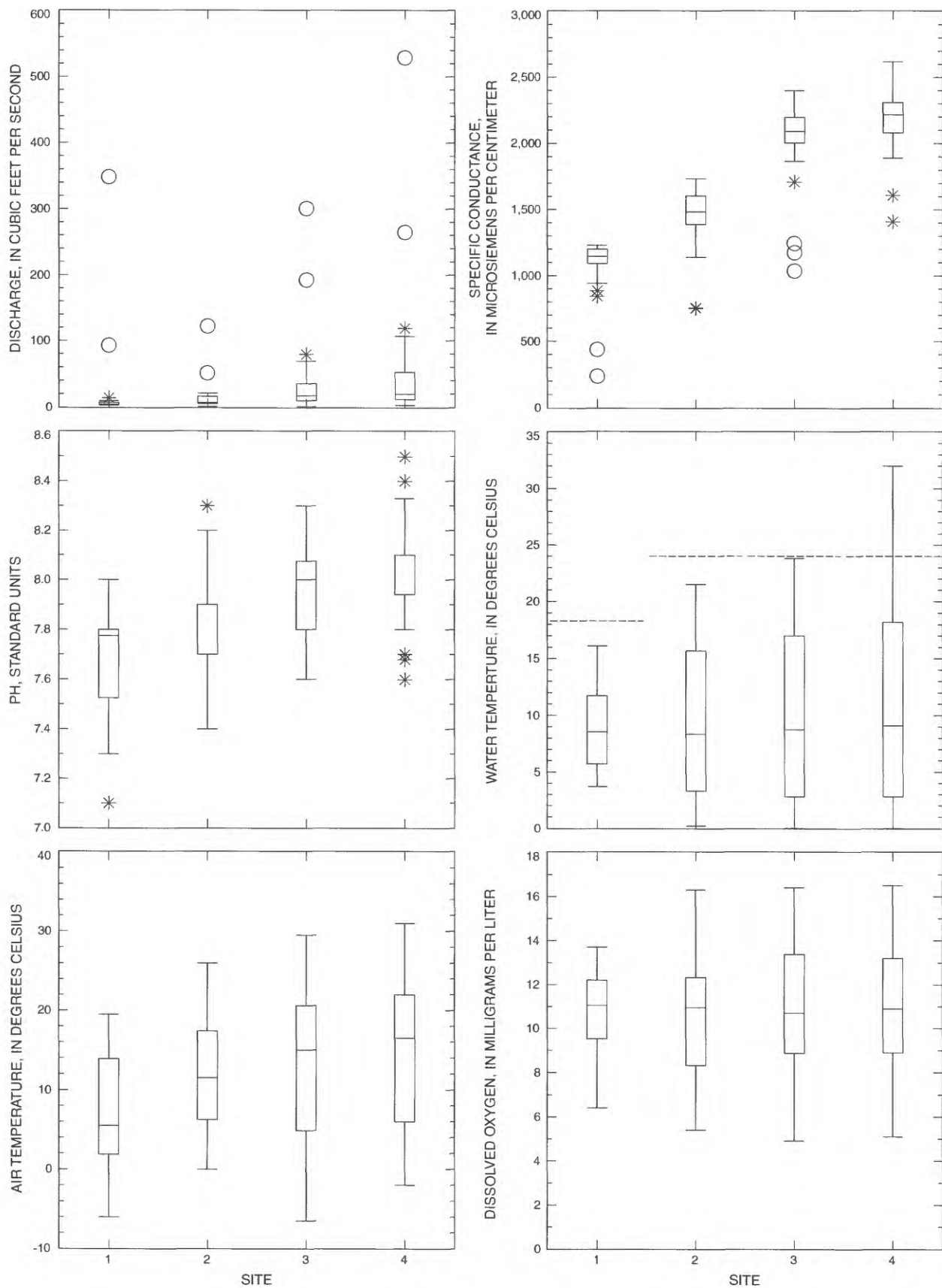


Figure 6. Boxplots by site for selected constituents for Bear Butte Creek from June 1998 to May 2000.

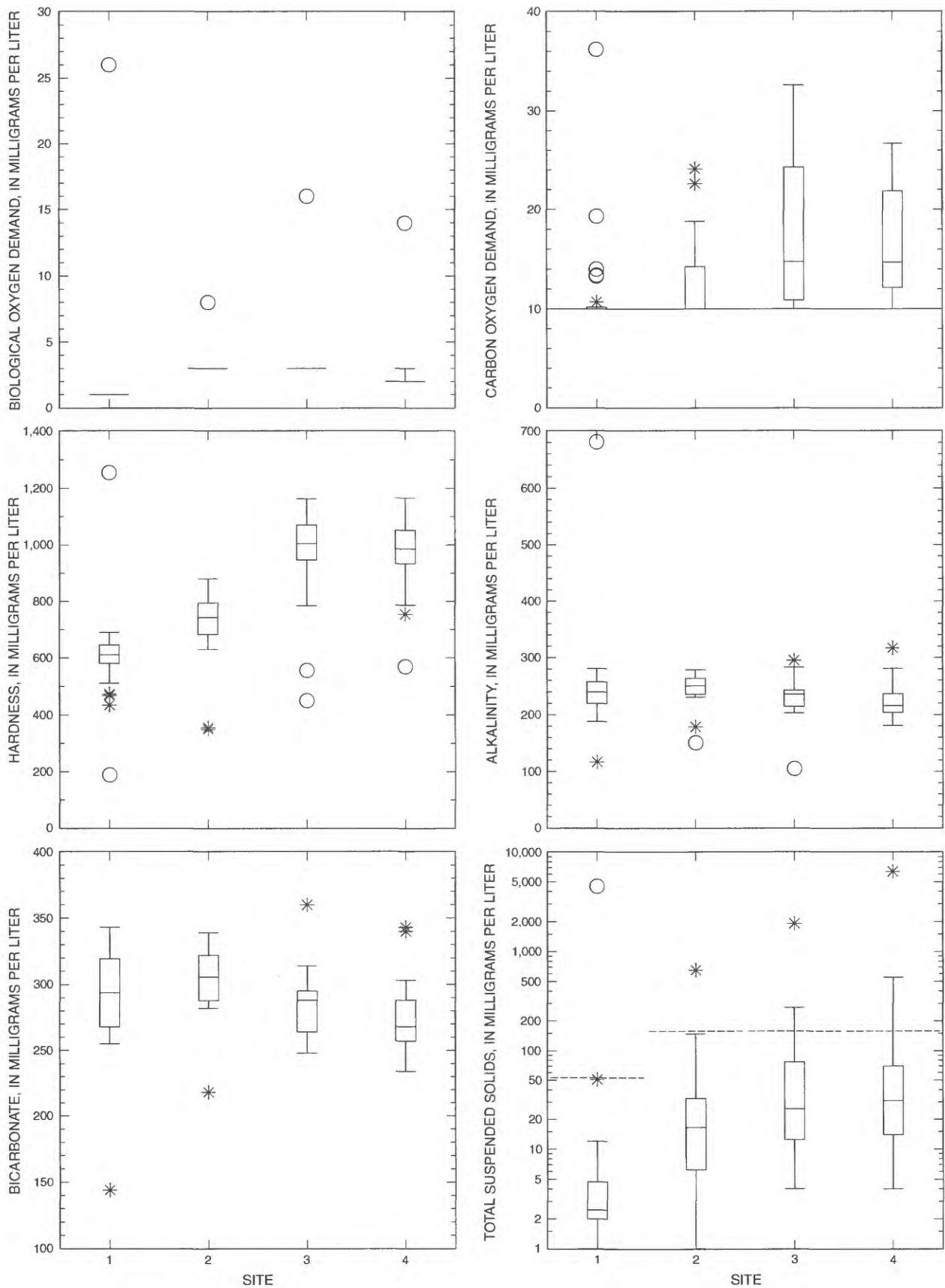


Figure 6. Boxplots by site for selected constituents for Bear Butte Creek from June 1998 to May 2000.--Continued

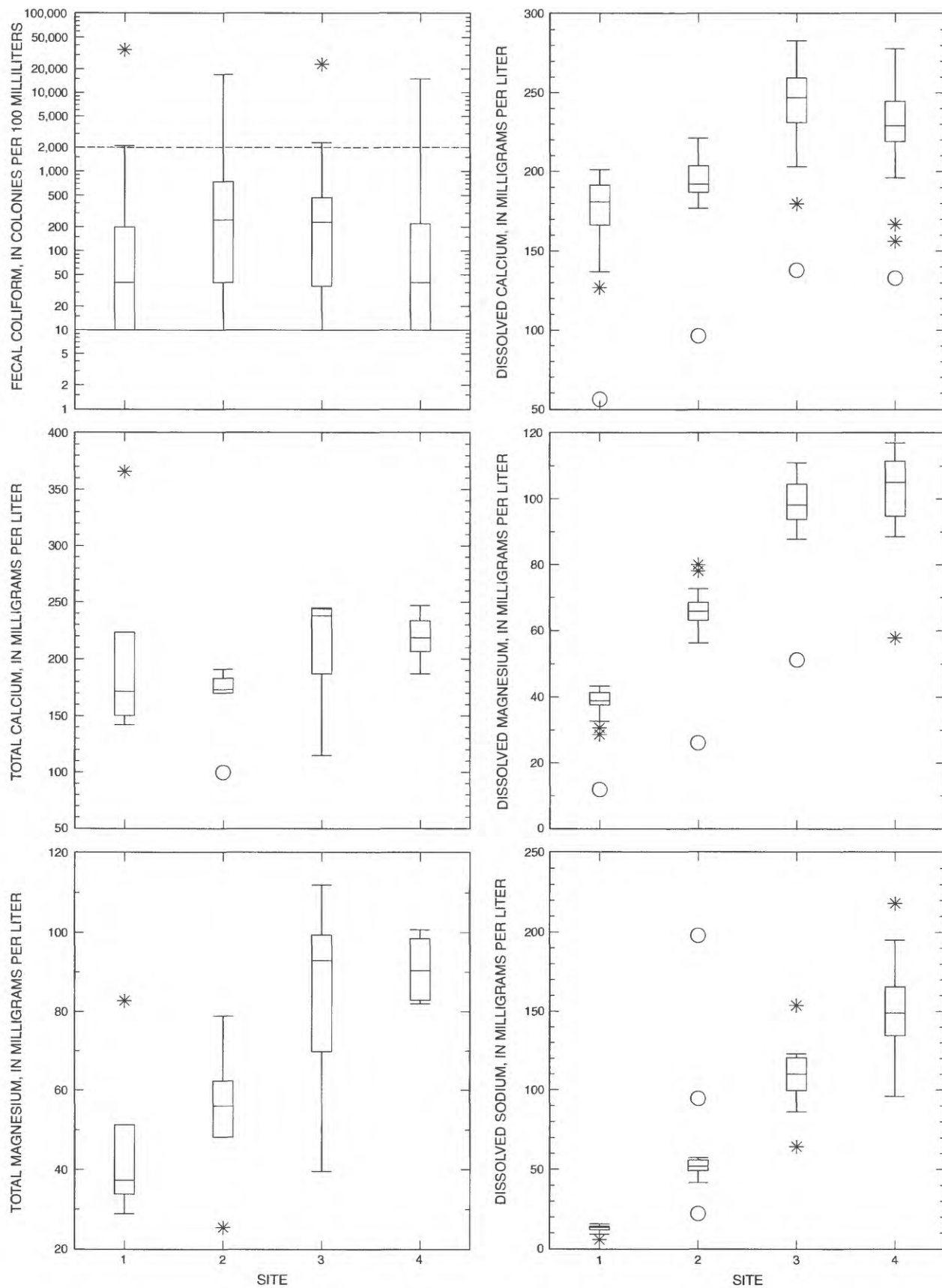


Figure 6. Boxplots by site for selected constituents for Bear Butte Creek from June 1998 to May 2000.--Continued

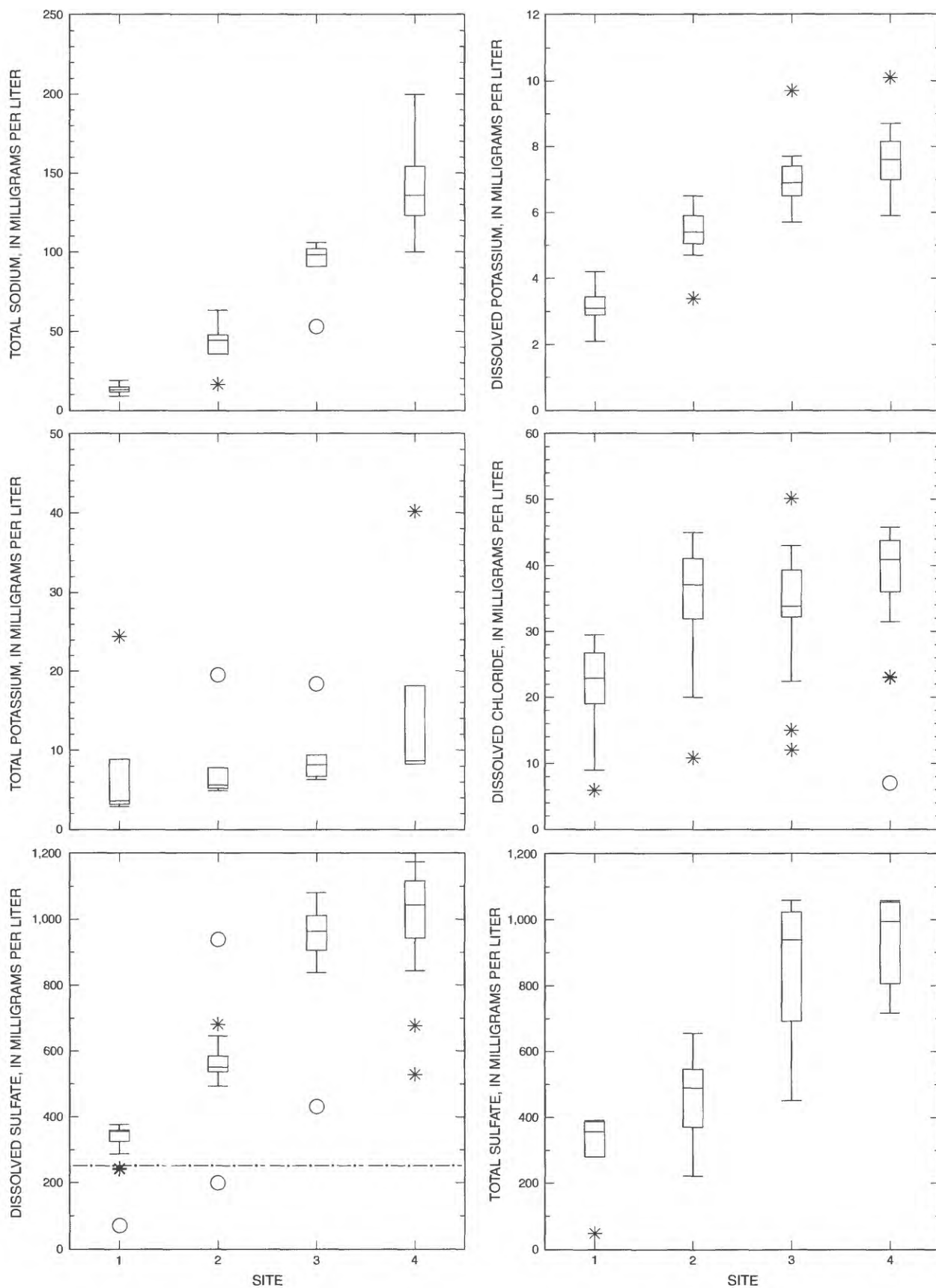


Figure 6. Boxplots by site for selected constituents for Bear Butte Creek from June 1998 to May 2000.--Continued

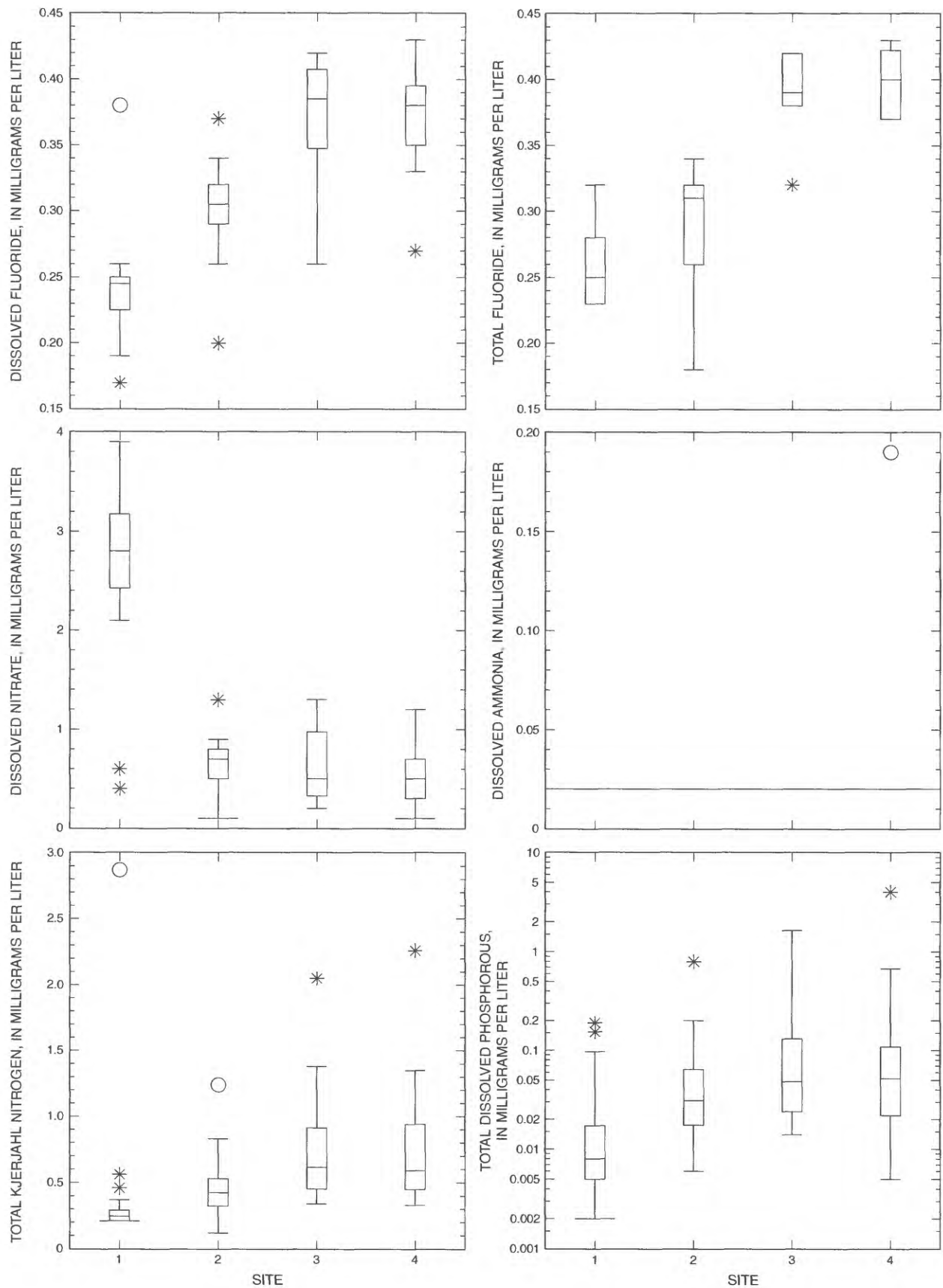


Figure 6. Boxplots by site for selected constituents for Bear Butte Creek from June 1998 to May 2000.--Continued

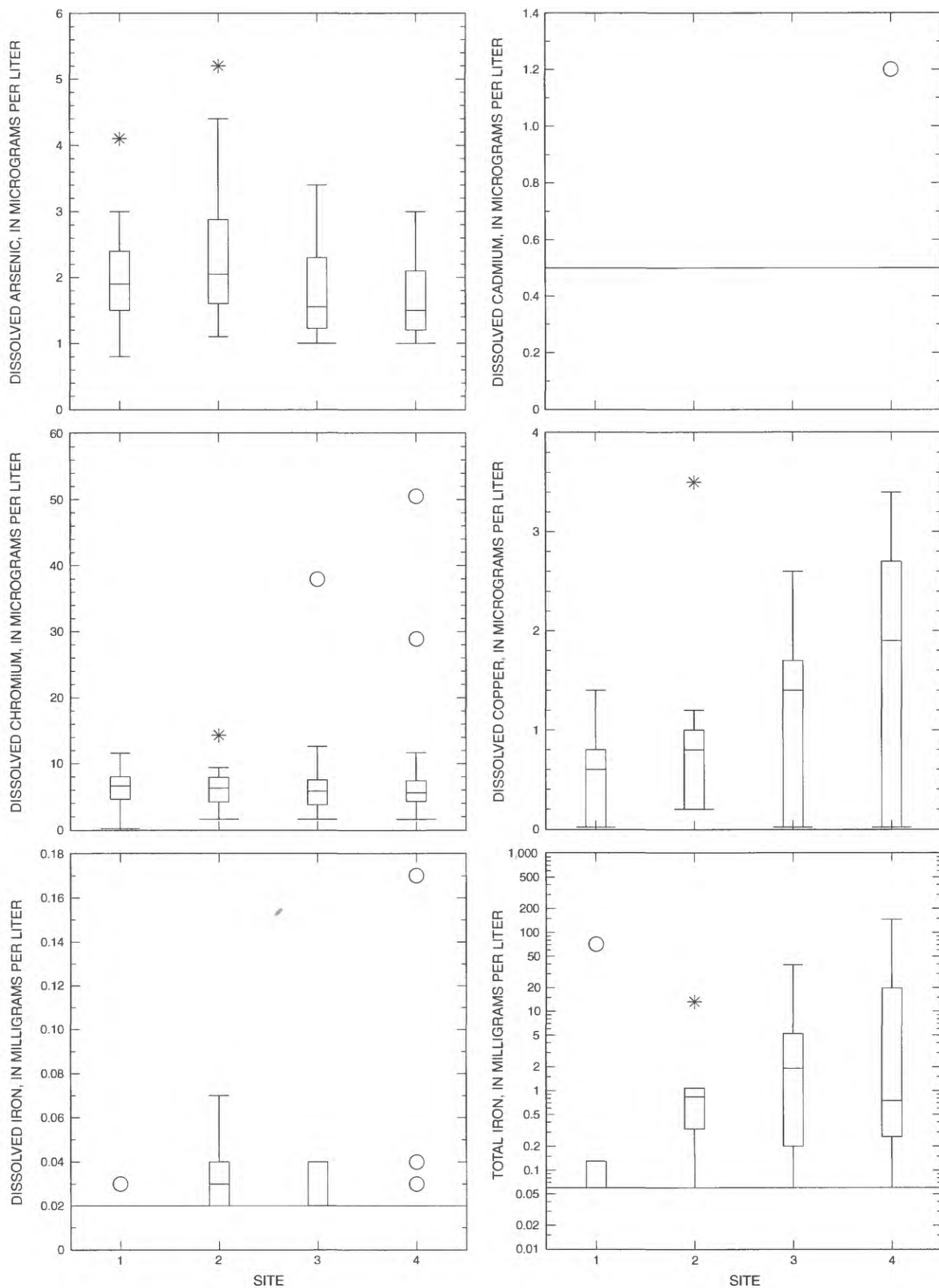


Figure 6. Boxplots by site for selected constituents for Bear Butte Creek from June 1998 to May 2000.--Continued

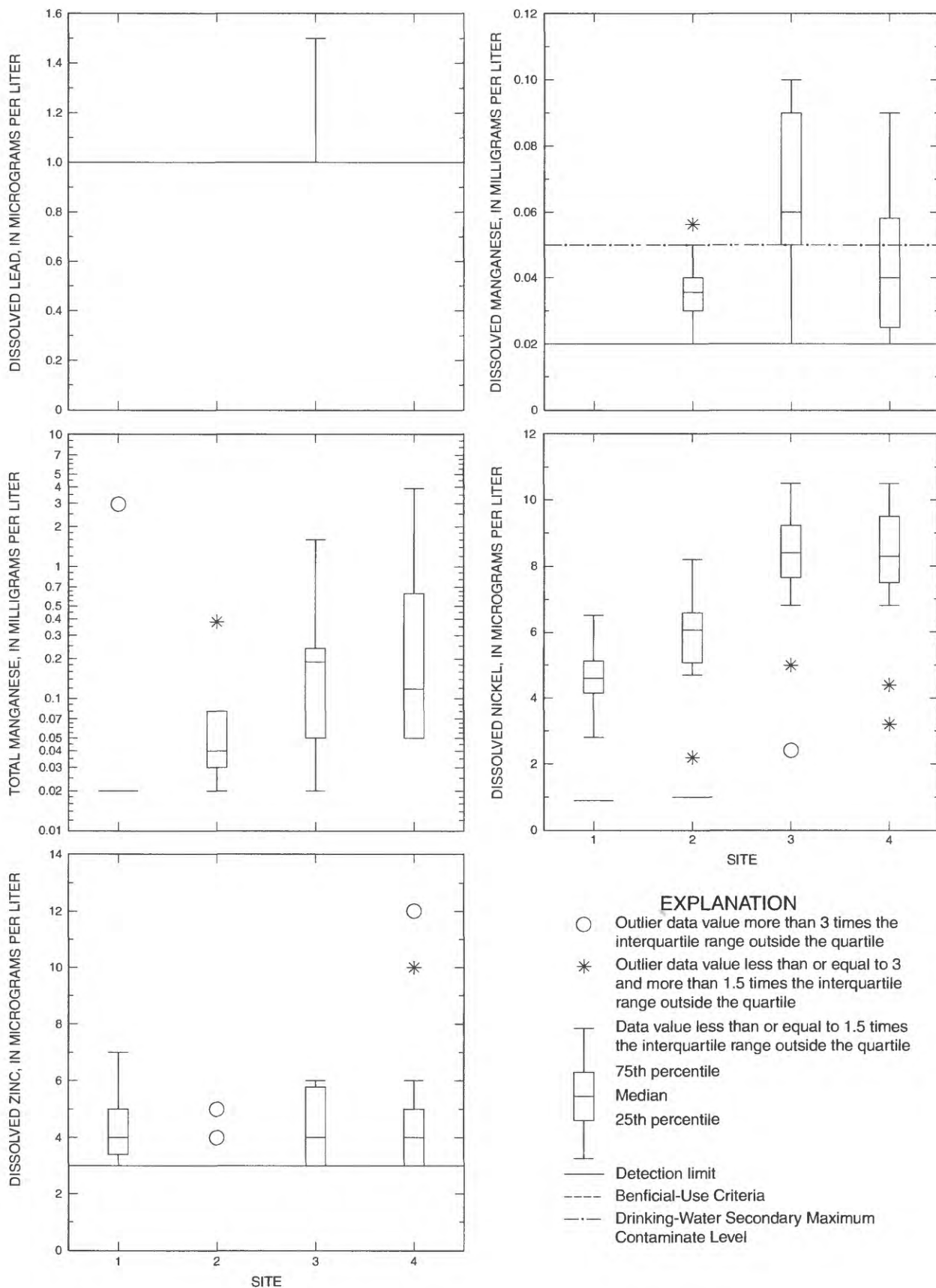
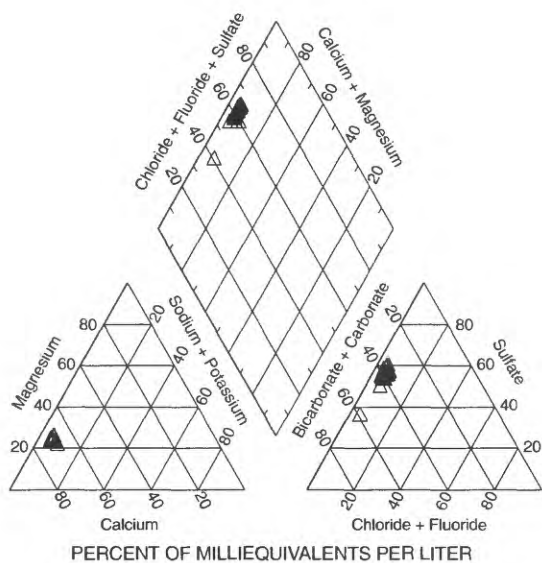
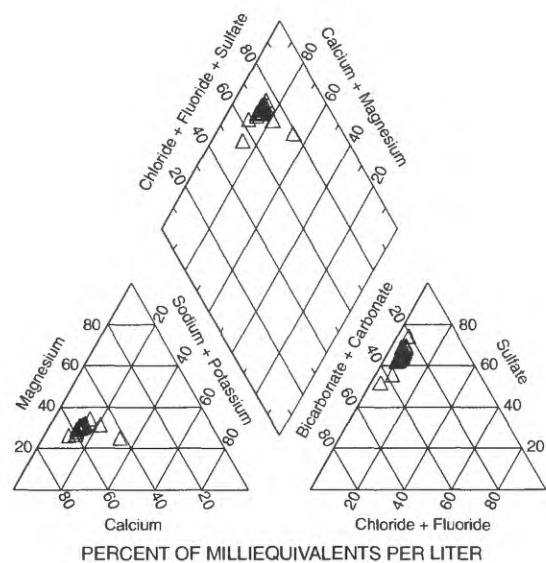


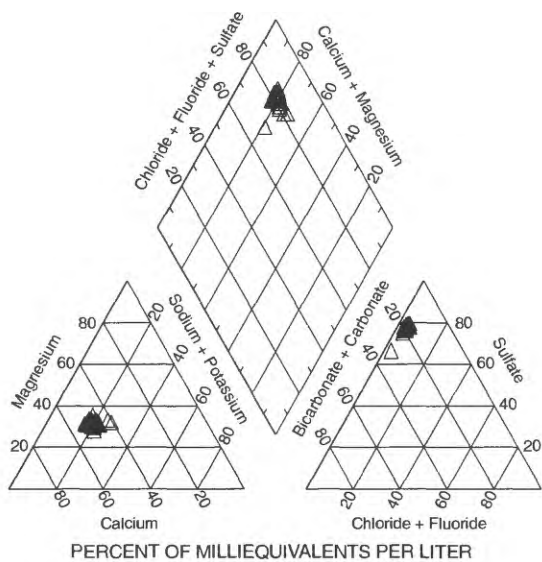
Figure 6. Boxplots by site for selected constituents for Bear Butte Creek from June 1998 to May 2000.--Continued



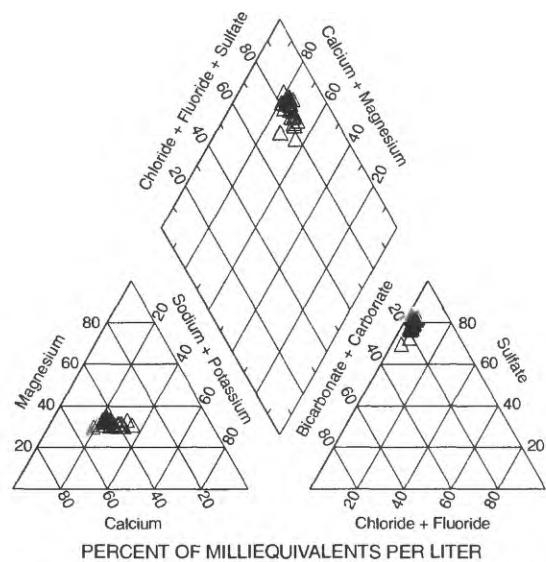
Bear Butte Creek at Sturgis, SD,
06437400, Site 1



Bear Butte Creek below Sturgis, SD,
44281103205000, Site 2



Bear Butte Creek near Sturgis, SD,
06437500, Site 3



Bear Butte Creek near mouth, near Vale, SD,
443048103091400, Site 4

Figure 7. Trilinear diagrams (Piper, 1944) showing proportional concentrations of major ions for select sites.

Quality-Assurance/Quality-Control Results

An additional 10 percent of the water-quality samples were collected to examine QA/QC. QA/QC samples included splits and blanks and were sent for analysis at both the SHL and NWQL (table 3).

Following the analysis of the first two sample sets, the SHL had concerns about the cleaning method used for the dissolved trace-element analysis. Bottles were cleaned using chromic acid and contamination of chromium was suspected. New sample bottles were used for subsequent sampling. In an effort to obtain indications of possible contamination levels, two blank samples were analyzed (site 1 and site 2, Oct. 6, 1998) using the chromic-acid cleaned bottles. Results from the blanks indicated that contamination was probably taking place for arsenic, chromium, nickel, and zinc. Therefore, trace-element results from the first two analyses at each site should be used with caution.

Splits analyzed by the SHL were very similar with percent difference less than 5 percent for most constituents (table 6). Those with over 5-percent difference were generally at or near the laboratory reporting limit.

Splits analyzed at the NWQL showed the most variability from SHL data for fecal coliform and alkalinity at site 1 on October 6, 1998. Some constituents can vary a great deal with slight changes in location, and differences may be related to sampling methods. Nutrient concentrations generally were smaller in the NWQL results, again possibly due to sampling methods.

For the March 28, 2000, sampling, rather significant differences were noted for chromium and nickel in the NWQL and SHL splits (sites 2 and 3), with results from NWQL at or near the laboratory reporting limits and SHL results ranging from 5 to 8 µg/L (micrograms per liter) higher. In an effort to eliminate sampling method, bottles, and preservation methods as the cause of difference, a split was sent to

Table 3. Description of quality-assurance/quality-control samples

[SHL, South Dakota State Health Laboratory; NWQL, U.S. Geological Survey National Water Quality Laboratory]

Date	Time	Site	Type of sample
10-06-1998	1041	06437400	SHL, blank to test chromium contamination in bottles, monthly site sample at 1040
10-06-1998	1048	06437400	NWQL, split of 1040 monthly sample
10-06-1998	1345	442811103205000	SHL, blank to test chromium contamination in bottles, monthly site sample at 1346
10-06-1998	1350	442811103205000	NWQL, split of 1346 monthly sample
10-07-1998	1036	06437500	SHL, split of 1035 monthly sample
10-07-1998	1331	443048103091400	SHL, split of 1330 monthly sample
03-28-2000	1135	442811103205000	NWQL, split of 1130 monthly sample
03-28-2000	1402	06437500	SHL, split of 1400 monthly sample
03-28-2000	1405	06437500	NWQL, split of 1400 monthly sample
05-18-2000	0905	06437400	SHL, split of 0900 storm-event sample
05-18-2000	0908	06437400	SHL, split of 0900 storm-event sample using USGS analysis bottle and acid to address differenced in chromium and nickel between NWQL and SHL

the SHL to look at within-laboratory variability and a third sample was analyzed just for trace elements. The third sample was collected using USGS methods, bottles, and preservation methods, but analyzed at the SHL. Slight variability between the 3 samples was noted for chromium, with concentrations ranging from 9.8 to 11.9 µg/L, but differences were not of the same magnitude as the March 28 sample results. Laboratory digestion procedures and methods of analysis are the most likely cause of the concentration differences. Values for alkalinity can vary due to holding times and storage conditions as well.

Beneficial-Use Designations and Water-Quality Criteria

General information is provided in this section to enable the reader to compare water-quality criteria to constituent concentrations measured in the lower reach of Bear Butte Creek from June 1998 to May 2000. Tables 4 and 5 present the beneficial use designations and water-quality standards for select sections of Bear Butte Creek. Figure 8 presents the relation between hardness and freshwater aquatic-life standards of selected trace elements.

Table 4. Beneficial-use designations for segments of Bear Butte Creek

Stream segment	Beneficial-use designation
All of Bear Butte Creek	Limited contact recreation waters; irrigation waters; wildlife propagation and stock-watering waters
From Belle Fourche River to Highway 79	Coldwater marginal fish life propagation waters
Highway 79 to Deadman Creek	Coldwater permanent fish life propagation waters
Deadman Creek to Section 2, Township 4N, Range 4E	Coldwater marginal fish life propagation waters
Section 2, Township 4N, Range 4E to Section 22, Township 4N, Range 3E	Coldwater permanent fish life propagation waters

Table 5. Water-quality standards for selected physical properties and constituents

[All concentrations in milligrams per liter unless otherwise noted; MCL, maximum contaminate level; SMCL, secondary maximum contaminate level; $\mu\text{S}/\text{cm}$, microsiemens per centimeter at 25°C; mg/L, milligrams per liter; $\mu\text{g}/\text{L}$, micrograms per liter; mL, milliliter; °C, degrees Celsius; --, not applicable or no data available]

Property or constituent	U.S. Environmental Protection Agency drinking-water standards		Beneficial-use criteria					Aquatic-life value for fisheries (acute/chronic) $\mu\text{g}/\text{L}$ ²
	Drinking water MCL ¹	Drinking water SMCL ¹	Coldwater permanent fish life propagation waters ²	Coldwater marginal fish life propagation waters ²	Limited contact recreation waters ²	Wildlife propagation and stock-watering waters ²	Irrigation waters ²	
Specific conductance ($\mu\text{S}/\text{cm}$)	--	--	--	--	--	4,000/ ³ 7,000	2,500/ ³ 4,375	--
pH range (standard units)	--	6.5-8.5	6.6/8.6	6.5-8.8	--	6.0-9.5	--	--
Temperature (°C)	--	--	18.3	24	--	--	--	--
Dissolved oxygen (minimum concentration)	--	--	6.0	5.0	5.0	--	--	--
Total alkalinity (as CaCO_3)	--	--				750/ ³ 1,313		
Total suspended solids	--	--	30/ ³ 53	90/ ³ 158	--	--	--	--
Chloride	--	250	100/ ³ 175	--	--	--	--	--
Fluoride	4	2	--	--	--	--	--	--
Sulfate	--	250	--	--	--	--	--	--
Nitrate	10	--	--	--	--	50/ ³ 88	--	--
Cyanide	0.2	--	220	220	--	--	--	22/5.2
Arsenic	0.05	--	--	--	--	--	--	360/190
Cadmium	0.005	--	--	--	--	--	--	⁴ 3.7/ ⁴ 1.0
Copper	--	1.0	--	--	--	--	--	⁴ 17/ ⁴ 11
Iron	--	0.3	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	⁴ 65/ ⁴ 2.5
Manganese	--	0.05	--	--	--	--	--	--
Mercury	0.002	--	--	--	--	--	--	2.1/ ⁵ 0.012
Nickel	--	--	--	--	--	--	--	⁴ 1,400/ ⁴ 610
Silver	--	0.1	--	--	--	--	--	⁴ 3.4/--
Zinc	--	5.0	--	--	--	--	--	⁴ 110/ ⁴ 100
Fecal coliform, per 100 mL (mean/single sample)	--	--	--	--	1,000/ ³ 2,000	--	--	--

¹U.S. Environmental Protection Agency, 2000.

²South Dakota Department of Environment and Natural Resources, 1998.

³30-day average/daily maximum.

⁴Hardness-dependent criteria, value given is an example based on CaCO_3 concentration of 100 mg/L.

⁵Chronic criteria based on total recoverable concentration.

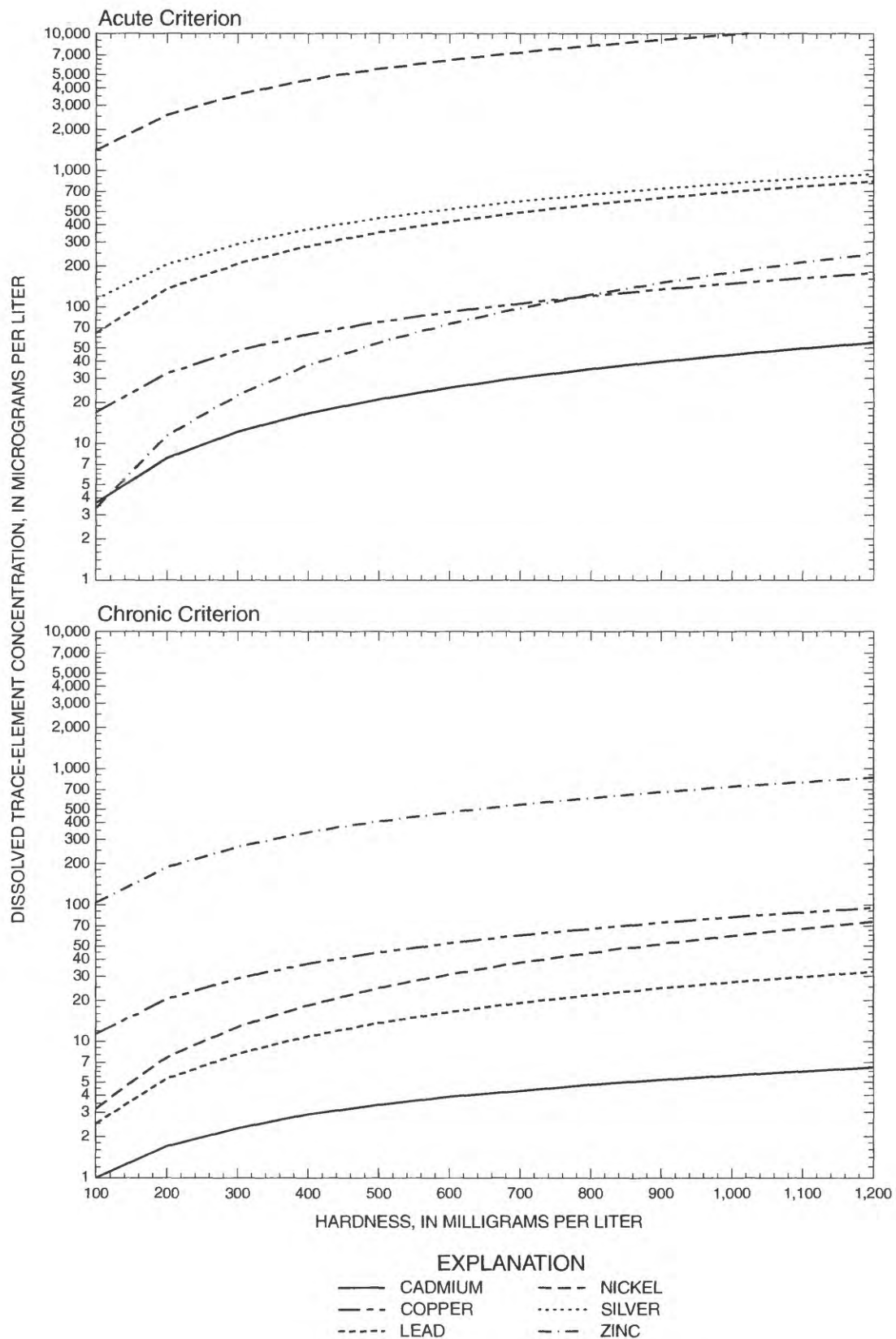


Figure 8. Relation between water hardness and freshwater aquatic-life standards for acute and chronic toxicity of selected trace elements (South Dakota Department of Environment and Natural Resources, 1998).

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SUPPLEMENTAL DATA

Table 6. Water-quality data for selected sites along Bear Butte Creek

[ft³/s, cubic feet per second; μ S/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; μ g/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-charge (ft ³ /s)	Specific conduc- tance (μ S/cm)	pH (standard units)	Water tempera- ture (deg C)	Air tempera- ture (deg C)	Dis- solved oxygen (mg/L)	Bio- logical oxygen demand (mg/L)	Carbon oxygen demand (mg/L)	Hardness as CaCO ₃ (mg/L)	Labora- tory alkalinity (mg/L)
Site 1 - 06437400 Bear Butte Creek at Sturgis, SD											
06-16-1998	0930	3.8	1,130	7.8	11.5	13.5	11.9	<1	7.4	640	241
06-18-1998	1300	349	239	7.8	11.0	11.0	9.6	26	36.2	1,255	681
07-07-1998	0915	4.7	1,120	7.8	13.5	19.0	11.4	<1	19.3	588	239
08-11-1998	1015	4.4	1,150	7.9	16.0	18.5	11.1	<1	13.4	599	239
09-16-1998	0855	3.5	1,200	7.8	13.5	14.0	9.5	<1	4.41	610	245
10-06-1998	1040	7.3	1,090	7.6	10.0	8.0	10.1	<1	1.79	528	196
¹ 10-06-1998	1041	7.3	1,090	7.6	10.0	8.0	10.1	--	--	--	--
² 10-06-1998	1048	7.3	1,090	7.6	10.0	8.0	10.1	--	--	--	253
11-17-1998	0930	14	941	7.4	6.5	3.0	11.9	<1	<20	473	209
12-15-1998	0930	6.5	1,120	7.3	6.0	-3.0	12.3	<1	<20	601	260
01-25-1999	1125	4.8	1,160	7.8	4.5	.0	12.5	<1	<10	605	245
02-10-1999	0915	4.3	1,160	7.8	5.5	3.0	13.7	<1	<10	--	262
03-09-1999	0915	3.8	1,150	7.7	3.5	-1.5	13.3	<1	<10	580	221
04-06-1999	0900	4.3	1,130	7.8	5.5	1.5	12.3	<1	<10	596	236
04-21-1999	1040	4.7	1,010	7.9	9.0	8.0	11.0	<1	<10	511	219
05-10-1999	0900	6.6	843	7.3	8.0	7.0	7.9	<1	10.7	435	188
06-09-1999	0915	7.4	1,090	8.0	12.0	14.5	9.3	<1	<10	580	235
06-15-1999	0755	92	438	7.8	12.0	15.0	6.4	<1	<10	189	118
07-19-1999	0735	9.9	1,200	7.3	14.0	19.5	8.5	<1	13.3	640	267
08-16-1999	0840	7.4	1,210	7.5	14.0	17.5	9.0	<1	<10	690	272
09-14-1999	0910	6.2	1,230	7.4	11.5	5.0	8.9	<1	<10	670	250
10-26-1999	0910	4.2	1,220	7.6	9.5	6.0	9.7	<1	<10	658	248
11-16-1999	0850	3.8	1,200	7.7	8.5	3.0	11.2	<1	<10	653	281
12-07-1999	0900	3.9	1,210	7.1	6.5	-.5	11.8	<1	<10	641	248
01-18-2000	0905	3.5	1,200	7.9	4.0	-6.0	10.0	<1	<10	644	268
02-22-2000	0845	2.9	1,200	7.8	5.5	4.5	11.0	<1	<10	624	230
03-28-2000	0900	3.2	1,190	7.7	6.0	4.0	12.2	<1	<10	645	232
04-04-2000	0855	3.0	1,190	7.6	5.0	.0	10.7	<1	<10	649	251
05-09-2000	0900	4.6	1,120	8.0	8.5	10.0	12.2	<1	<10	611	220
05-18-2000	0900	7.7	885	8.0	8.0	4.0	12.8	<1	14	468	215
³ 05-18-2000	0905	7.7	885	8.0	8.0	4.0	12.8	<1	<10	475	213
³ 05-18-2000	0908	7.7	885	8.0	8.0	4.0	12.8	--	--	--	--

Bicar- bonate as CaCO ₃ (mg/L)	Total sus- pended solids (mg/L)	Fecal coliform (cols/ 100 mL)	Dis- solved calcium (mg/L)	Total calcium (mg/L)	Dis- solved magne- sium (mg/L)	Total magne- sium (mg/L)	Dis- solved sodium (mg/L)	Total sodium (mg/L)	Dis- solved potas- sium (mg/L)	Total potas- sium (mg/L)	Dis- solved chloride (mg/L)
--	12	140	--	--	--	--	--	--	--	--	22
--	4,500	35,000	--	366	--	82.8	--	8.9	--	24.4	9
--	7	150	--	176	--	36	--	13.4	--	3.3	16
--	1	1,900	--	176	--	38.7	--	12.5	--	3.6	20
--	<1	90	--	167	--	40.7	--	13.2	--	3.6	19
--	2	250	--	153	--	35.5	--	12.9	--	3.7	17
--	--	--	--	--	--	--	--	--	--	--	--
--	<1	111	170	--	37.0	--	13	--	3.5	--	16
255	2	20	--	142	--	28.9	--	18.9	--	2.9	15
317	4	<10	178	--	38.0	--	15.1	--	3.5	--	19
299	2	<10	179	--	38.5	--	13.4	--	3.2	--	22.7
--	<1	<10	179	--	37.3	--	13.6	--	2.9	--	22.5
270	2	<10	164	--	38.1	--	13.6	--	2.8	--	23.1
288	2	<10	174	--	38.9	--	13.1	--	3.1	--	24.7
267	7	<10	151	--	32.7	--	11.4	--	3.1	--	21.3
--	7	90	127	--	28.7	--	9.2	--	2.6	--	16.8
--	4	2,100	169	--	38.3	--	11.7	--	3.1	--	24
144	51	1,900	56.2	--	11.9	--	5.8	--	2.1	--	6
326	2	110	190	--	40.2	--	13.8	--	4.2	--	26.2
332	4	220	201	--	43.2	--	14.4	--	3.9	--	29.1
--	<1	80	197	--	43.3	--	14.3	--	3.4	--	28.7
303	<1	<10	195	--	41.6	--	15.7	--	3.5	--	26.9
343	2	10	192	--	42.1	--	14.7	--	3.7	--	25.6
303	3	12	190	--	40.5	--	13.5	--	3.4	--	24.3
327	2	<2	191	--	40.7	--	14.1	--	3.3	--	26.4
281	3	2	184	--	40.1	--	14.2	--	2.9	--	26.9
283	<1	<10	190	--	41.5	--	13	--	2.9	--	27.7
306	3	10	192	--	41.3	--	12.9	--	3.1	--	29.5
268	5	120	181	--	38.6	--	12.4	--	3.1	--	27.3
262	3	540	137	--	30.7	--	9.8	--	2.5	--	20.4
260	4	360	140	--	30.5	--	10.1	--	2.4	--	20.6
--	--	--	137	--	30.5	--	9.7	--	2.4	--	--

Table 6. Water-quality data for selected sites along Bear Butte Creek—Continued

[ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-solved sulfate (mg/L)	Total sulfate (mg/L)	Dis-solved fluoride (mg/L)	Total fluoride (mg/L)	Nitrate as nitro-gen (mg/L)	Nitrogen ammonia (mg/L)	Total kjeldahl nitrogen (mg/L)	Total dissolved phos-phorus (mg/L)	Dis-solved cyanide (mg/L)	Dis-solved arsenic (µg/L)
Site 1 - 06437400 Bear Butte Creek at Sturgis, SD—Continued											
06-16-1998	0930	--	360	--	0.26	2.6	<0.02	<0.1	0.022	<0.01	--
06-18-1998	1300	--	48.7	--	.28	.4	< .02	2.87	.19	< .01	3
07-07-1998	0915	--	356	--	.24	2.8	< .02	.29	.008	< .01	2.3
08-11-1998	1015	--	391	--	.25	2.5	< .02	.46	.018	< .01	4.1
09-16-1998	0855	--	387	--	.23	2.5	< .02	.19	.004	< .01	2.3
10-06-1998	1040	--	331	--	.23	2.4	< .02	.26	.097	< .01	2.6
¹ 10-06-1998	1041	--	--	--	--	--	--	--	--	--	4
² 10-06-1998	1048	320	--	0.17	--	2.74	.021	.12	< .05	--	2
11-17-1998	0930	--	280	--	.32	2.1	< .02	.26	.013	< .01	2
12-15-1998	0930	340	--	--	--	3.1	< .02	.37	.007	< .01	2.9
01-25-1999	1125	346	--	.25	--	3	< .02	< .1	.012	< .01	2.2
02-10-1999	0915	356	--	.24	--	2.9	< .02	.28	.007	< .01	1.9
03-09-1999	0915	344	--	.25	--	2.8	< .02	.18	.005	< .01	1.7
04-06-1999	0900	330	--	.26	--	2.6	< .02	.24	.004	< .01	2.4
04-21-1999	1040	287	--	.22	--	2.2	< .02	.34	.01	< .01	2.1
05-10-1999	0900	243	--	.19	--	2.1	< .02	.26	.072	< .01	.8
06-09-1999	0915	333	--	--	--	2.7	< .02	.19	.018	< .01	1.2
06-15-1999	0755	71.1	--	--	--	.6	< .02	.56	.154	< .01	2.7
07-19-1999	0735	374	--	--	--	3.9	< .02	.19	.013	< .01	2.6
08-16-1999	0840	358	--	--	--	3.6	< .02	.25	.006	< .01	2
09-14-1999	0910	377	--	.17	--	3.4	< .02	.18	.005	< .01	1.5
10-26-1999	0910	359	--	.24	--	3.3	< .02	< .14	.002	< .01	1.4
11-16-1999	0850	359	--	.38	--	3.4	< .02	.15	.002	< .01	1.3
12-07-1999	0900	360	--	.24	--	3.4	< .02	.2	.008	< .01	1.9
01-18-2000	0905	360	--	.25	--	3.2	< .02	< .2	.006	< .01	1.5
02-22-2000	0845	363	--	.24	--	2.9	< .02	< .21	.008	< .01	1.6
03-28-2000	0900	359	--	.26	--	2.8	< .02	< .21	.005	< .01	1.5
04-04-2000	0855	356	--	.25	--	2.9	< .02	.27	< .002	< .01	1.5
05-09-2000	0900	321	--	.25	--	2.8	< .02	.29	.009	< .01	1.5
05-18-2000	0900	240	--	.22	--	2.1	< .02	.3	.015	< .01	1.5
³ 05-18-2000	0905	243	--	.23	--	2.2	< .02	.28	.014	< .01	1.3
³ 05-18-2000	0908	--	--	--	--	--	--	--	--	< .01	1.4

Dis-solved cadmium (µg/L)	Dis-solved chromium (µg/L)	Dis-solved copper (µg/L)	Dis-solved iron (mg/L)	Total iron (mg/L)	Dis-solved lead (µg/L)	Dis-solved manganese (mg/L)	Total manganese (mg/L)	Dis-solved mercury (µg/L)	Dis-solved nickel (µg/L)	Dis-solved silver (µg/L)	Dis-solved zinc (µg/L)
--	--	--	--	0.13	--	--	<0.02	--	--	--	--
<0.5	11.6	<0.02	--	71	<0.8	--	2.96	<0.2	<0.9	<0.5	<50
<.1	3.3	<.02	--	<.06	<.8	--	<.02	<.13	4.2	<.2	<50
<.1	6.8	<.02	--	<.06	<.8	--	<.02	<.2	5.3	<.2	3.7
<.1	8	<.02	--	<.06	<1	--	.02	<.2	4.4	<.2	4.3
<.1	4.6	<.02	--	<.06	<1	--	<.02	<.2	--	<1	<3
<.1	17.6	<.02	--	--	<1	--	--	<.2	4.1	<1	15.2
<1	2	.0016	<0.01	--	<1	0.0042		<.1	1.9	<1	5.2
<.2	<.2	<.02	--	<.06	<.8	--	<.02	<.2	3.3	<.2	6.1
<.2	3.8	<.02	<.02	--	<.1	.02	--	<.1	5	<.2	4
<.2	7	<.02	<.02	--	<.8	.02	--	<.1	5	<.2	<40
<.2	4.7	.7	.02	--	<.1	<.02	--	<.1	6.5	<.2	5
<.2	4.1	.6	--	--	<.1	--	--	<.1	3.8	<.2	3
<.2	8.6	.5	--	--	<.1	--	--	<.1	4.3	<.2	<3
<.2	6	1	--	--	<.1	--	--	<.1	5	<.2	7
<.2	6.7	.8	.03	--	<.1	<.02	--	<.1	4	<.2	4
<.2	6.7	<.02	<.02	--	<.1	.02	--	<.1	4.3	<.2	5
<.2	3.2	1.4	--	--	<.1	--	--	<.1	2.8	<.2	6
<.2	7.1	1.2	--	--	<.1	--	--	<.1	4.4	<.2	4
<.2	10	.9	<.02	--	<.1	.02	--	<.1	4.5	<.2	4.6
<.2	6.2	1	<.02	--	.1	<.02	--	<.1	5.5	<.2	5.8
.4	5.6	.8	<.02	--	<.1	<.02	--	<.1	4.8	<.2	5
<.2	3.6	.6	<.02	--	<.1	<.02	--	<.1	4.7	<.2	5
<.2	7.9	.7	<.02	--	<.1	<.02	--	<.1	4.5	<.2	4
<.2	4.7	.6	.02	--	<.1	<.02	--	<.1	5	<.2	4
<.2	6.6	.6	<.02	--	<.1	<.02	--	<.1	5.4	<.2	4
<.2	5.8	.9	<.02	--	<.1	.0031	--	<.1	5.2	<.2	<3
<.2	8.3	.7	<.02	--	<.1	.0033	--	<.1	5.3	<.2	<3
<.2	10.5	.7	<.02	--	.1	<.02	--	<.1	5.1	.4	4.1
<.2	9.8	.6	<.02	--	<.1	<.02	--	<.1	3.9	<.2	3.3
<.2	11.7	.6	.02	--	<.1	.02	--	<.1	3.6	<.2	<3
<.2	11.9	.6	.02	--	<.1	.02	--	<.1	3.6	<.2	3.3

Table 6. Water-quality data for selected sites along Bear Butte Creek—Continued

[ft³/s, cubic feet per second; μ S/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; μ g/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-charge (ft ³ /s)	Specific conduc- tance (μ S/cm)	pH (standard units)	Water tempera- ture (deg C)	Air tempera- ture (deg C)	Dis- solved oxygen (mg/L)	Bio- logical oxygen demand (mg/L)	Carbon oxygen demand (mg/L)	Hardness as CaCO ₃ (mg/L)	Labora- tory alkalinity (mg/L)
Site 2 - 442811103205000 Bear Butte Creek below Sturgis, SD											
06-16-1998	1145	4.2	1,440	7.8	16.5	20.5	9.0	<1	0.54	713	252
06-18-1998	1405	52	1,140	7.9	12.5	13.0	8.5	8	14.8	655	264
07-07-1998	1100	6.2	1,370	7.9	21.5	25.0	8.3	<1	8	662	239
08-11-1998	1215	3.8	1,410	8.0	21.0	22.5	8.4	<1	18.8	674	236
09-16-1998	1100	1.1	1,670	7.9	17.5	24.0	8.2	<3	22.6	820	246
¹ 10-06-1998	1345	--	--	--	--	--	11.2	--	--	--	--
10-06-1998	1346	17	751	7.9	7.0	11.0	11.2	<1	14.1	355	151
² 10-06-1998	1350	17	751	7.9	7.0	11.0	11.2	--	--	--	146
11-17-1998	1130	22	1,250	7.9	5.5	6.0	13.3	<1	<20	629	231
12-15-1998	1115	10	1,360	7.6	2.0	8.0	15.2	<1	<20	679	249
01-25-1999	1300	8.4	1,580	7.8	.0	9.0	12.4	<1	<10	800	279
02-10-1999	1055	6.6	1,490	7.9	3.0	7.0	14.5	<1	<10	728	269
03-09-1999	1105	6.3	1,530	7.7	1.5	5.0	16.3	<1	<10	750	247
04-06-1999	1055	20	1,730	8.0	5.5	6.0	11.2	<2	14.8	881	278
04-21-1999	1144	15	1,530	7.8	10.0	7.5	10.1	<1	<10	748	252
05-10-1999	1130	16	1,470	7.9	8.5	4.0	5.4	<1	17.9	732	254
06-09-1999	1100	17	1,730	8.1	16.5	18.0	8.2	<1	11.8	801	274
06-15-1999	0940	123	755	8.0	13.5	15.0	7.8	<2	<10	349	179
07-19-1999	0925	14	1,380	7.7	19.5	26.0	6.9	<1	10.8	694	263
08-16-1999	1025	6.8	1,430	7.7	18.5	19.5	8.2	<1	<10	742	247
09-14-1999	1100	5.2	1,470	7.5	11.0	12.0	11.3	<1	<10	744	231
10-26-1999	1050	5.6	1,530	7.7	8.0	15.0	10.9	<1	<10	772	252
11-16-1999	1025	5.7	1,510	7.7	5.5	6.0	11.7	<1	<10	775	266
12-07-1999	1050	5.5	1,570	7.4	1.0	4.0	14.0	<1	<10	778	249
01-18-2000	1105	4.6	1,660	7.9	.0	.0	12.1	<1	<10	822	275
02-22-2000	1030	4.5	1,610	7.9	1.5	12.0	12.7	<1	<10	774	234
03-28-2000	1130	7.5	1,650	7.9	6.5	12.0	10.6	<2	<10	839	235
² 03-28-2000	1135	7.5	1,650	7.9	6.5	12.0	10.6	--	--	800	259
04-04-2000	1035	6.3	1,620	7.9	4.5	10.0	11.0	<1	<10	811	256
05-09-2000	1030	16	1,460	8.2	11.0	15.5	11.3	<1	<10	743	236
05-18-2000	1100	19	1,440	8.3	10.0	9.0	10.5	<1	24.1	733	255

Bicar- bonate as CaCO ₃ (mg/L)	Total sus- pended solids (mg/L)	Fecal coliform (cols/ 100 mL)	Dis- solved calcium (mg/L)	Total calcium (mg/L)	Dis- solved magne- sium (mg/L)	Total magne- sium (mg/L)	Dis- solved sodium (mg/L)	Total sodium (mg/L)	Dis- solved potas- sium (mg/L)	Total potas- sium (mg/L)	Dis- solved chloride (mg/L)
--	40	120	--	183	--	62.3	--	46.9	--	5.6	40
--	652	17,000	--	183	--	48.2	--	35.6	--	19.5	22
--	38	480	--	173	--	56	--	44.4	--	5.5	32
--	30	770	--	170	--	60.8	--	47.8	--	6.2	37
--	18	350	--	191	--	78.9	--	63.4	--	7.8	45
--	--	--	--	--	--	--	--	--	--	--	--
--	52	3,200	--	100	--	25.5	--	16.4	--	4.9	20
--	47	K2,840	95	--	26	--	18	--	4.6	--	18
282	10	170	--	170	--	49.7	--	40.8	--	5.2	26
304	5	40	177	--	57.6	--	43.6	--	5.1	--	31
--	3	30	203	--	66.3	--	49.6	--	5.3	--	38.5
328	6	40	188	--	62.9	--	51.3	--	5	--	36.9
301	3	10	182	--	66.6	--	52.9	--	4.9	--	37.6
339	32	540	221	--	80	--	198	--	6.5	--	41.7
307	17	<10	191	--	65.8	--	55.9	--	5.4	--	34.4
--	17	1,400	186	--	64.9	--	51.4	--	5.3	--	33.3
--	46	4,300	192	--	78.1	--	94.5	--	5.9	--	29.7
218	148	2,100	96.4	--	26.2	--	22.2	--	3.4	--	10.9
321	21	430	185	--	56.3	--	41.7	--	6	--	33.2
301	25	380	192	--	63.9	--	46.4	--	6.1	--	37.2
--	16	190	191	--	64.8	--	48.4	--	5.9	--	38.3
307	11	10	199	--	66.9	--	55.2	--	5.4	--	41
325	7	50	200	--	67	--	51.7	--	6	--	41.1
304	6	100	204	--	65.2	--	50.5	--	5.5	--	41.4
336	1	4	214	--	69.8	--	56.1	--	5.5	--	43.3
285	5	10	199	--	67.4	--	54.8	--	5	--	41.2
287	14	240	216	--	72.7	--	56.7	--	5.4	--	40.7
--	13	--	203.7	--	79.3	--	59.5	--	5.76	--	39.9
312	9	1,100	210	--	69.7	--	57.5	--	5.2	--	42.2
288	15	250	193	--	63.4	--	53.7	--	5.3	--	31.9
311	33	650	192	--	61.7	--	52	--	4.7	--	36

Table 6. Water-quality data for selected sites along Bear Butte Creek—Continued

[ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-solved sulfate (mg/L)	Total sulfate (mg/L)	Dis-solved fluoride (mg/L)	Total fluoride (mg/L)	Nitrate as nitro-gen (mg/L)	Nitrogen ammonia (mg/L)	Total kjeldahl nitrogen (mg/L)	Total dissolved phos-phorus (mg/L)	Dis-solved cyanide (mg/L)	Dis-sovled arsenic (µg/L)
Site 2 - 442811103205000 Bear Butte Creek below Sturgis, SD—Continued											
06-16-1998	1145	--	527	--	0.32	0.4	<0.02	0.3	0.075	<0.01	3.9
06-18-1998	1405	--	370	--	.31	.3	<.02	1.24	.8	<.01	4.4
07-07-1998	1100	--	489	--	.31	.4	<.02	.36	.069	<.01	3.5
08-11-1998	1215	--	546	--	.31	.2	<.02	.67	.071	<.01	5.2
09-16-1998	1100	--	656	--	.34	<.1	<.02	.6	.052	<.01	2.8
¹ 10-06-1998	1345	--	--	--	--	--	--	--	--	--	3.7
10-06-1998	1346	--	221	--	.18	.6	<.02	.63	.108	<.01	3
² 10-06-1998	1350	210	--	0.11	--	.603	.025	.18	.068	--	2
11-17-1998	1130	--	431	--	.26	.7	<.02	.38	.023	<.01	1.7
12-15-1998	1115	493	--	--	--	.9	<.02	.38	.009	<.01	2.6
01-25-1999	1300	548	--	.34	--	.9	<.02	.12	.015	<.01	1.9
02-10-1999	1055	539	--	.3	--	.7	<.02	.41	.019	<.01	1.3
03-09-1999	1105	563	--	.3	--	.7	<.02	.39	.017	<.01	2.1
04-06-1999	1055	938	--	.37	--	.4	<.02	.48	.045	<.01	2.2
04-21-1999	1144	551	--	.32	--	.6	<.02	.47	.021	<.01	2.7
05-10-1999	1130	538	--	.32	--	.8	<.02	.44	.031	<.01	1.6
06-09-1999	1100	682	--	--	--	.8	<.02	.71	.08	<.01	2.9
06-15-1999	0940	200	--	--	--	.6	<.02	.83	.2	<.01	3.4
07-19-1999	0925	496	--	--	--	1.3	<.02	.37	.042	<.01	2.8
08-16-1999	1025	519	--	--	--	.9	<.02	.5	.037	<.01	2.7
09-14-1999	1100	546	--	.2	--	.8	<.02	.29	.02	<.01	1.9
10-26-1999	1050	550	--	.26	--	.6	<.02	.27	.021	<.01	1.8
11-16-1999	1025	567	--	.31	--	.7	<.02	.26	.014	<.01	1.3
12-07-1999	1050	562	--	.29	--	.9	<.02	.24	.009	<.01	1.6
01-18-2000	1105	586	--	.31	--	.9	<.02	.32	.006	<.01	1.2
02-22-2000	1030	583	--	.29	--	.7	<.02	.33	.01	<.01	1.1
03-28-2000	1130	646	--	.32	--	.5	<.02	.45	.032	<.01	1.5
² 03-28-2000	1135	652	--	.25	--	.488	<.02	.3	.05	<.01	1.6
04-04-2000	1035	615	--	.29	--	.5	<.02	.44	.02	<.01	1.5
05-09-2000	1030	560	--	.32	--	.7	<.02	.48	.031	<.01	2
05-18-2000	1100	535	--	.29	--	.7	<.02	.54	.037	<.01	1.9

Dis-solved cadmium (µg/L)	Dis-solved chromium (µg/L)	Dis-solved copper (µg/L)	Dis-solved iron (mg/L)	Total iron (mg/L)	Dis-solved lead (µg/L)	Dis-solved manganese (mg/L)	Total manganese (mg/L)	Dis-solved mercury (µg/L)	Dis-solved nickel (µg/L)	Dis-solved silver (µg/L)	Dis-solved zinc (µg/L)
<0.5	9.4	<0.02	--	0.84	<0.8	--	0.06	--	<0.9	<0.5	<50
<.5	5.4	<.02	--	13.3	<.8	--	.38	<0.2	2.2	<.5	<50
<.1	7.9	<.02	--	1	<.8	--	.08	<.13	5	<.2	<50
<.1	6	<.02	--	.36	<.8	--	.02	<.2	5.5	<.2	<3
<.1	7.3	<.02	--	.33	<1	--	.04	<.2	5.3	<.2	<3
<.1	15.3	<.02	--	--	<1	--	--	<.2	<1	<1	<3
<.1	<1	<.2	--	1.08	<1	--	.03	<.2	<1	<1	<3
<1	1.4	.0013	0.0054	--	<1	.012	--	<.1	1.8	<1	1.4
<.2	4.1	<.02	--	<.06	<.8	--	.04	<.2	4.7	<.2	2.9
<.2	3.6	<.02	--	--	.1	--	--	<.1	6.78	<.2	3
<.2	7.5	<.02	.04	--	<.8	.04	--	<.1	6.2	.4	<40
<.2	3.4	1.2	.04	--	.1	.05	--	.1	8.2	<.2	4
<.2	5.5	1	--	--	<.1	--	--	<.1	4.9	<.2	<3
<.2	9.4	1	--	--	<.1	--	--	<.1	7	<.2	<3
<.2	6.6	1.1	--	--	.2	--	--	<.1	6.6	<.2	3
<.2	7.9	1	.05	--	.2	.05	--	.1	6	<.2	3
<.2	<1.6	<.02	.02	--	<.1	.04	--	<.1	6.3	<.2	4
<.2	3.7	3.5	--	--	<.1	--	--	<.1	5.7	<.2	5
<.2	6.8	.8	--	--	.1	--	--	<.1	5	.2	3
<.2	8.7	<.9	<.02	--	<.1	.03	--	<.1	5.9	<.2	3
<.2	5.2	.8	.03	--	<.1	.03	--	<.1	6.1	<.2	<3
<.2	5.6	1	.03	--	.1	<.02	--	.2	6.4	.2	5
<.2	3.9	.7	.03	--	<.1	.02	--	<.1	5.8	<.2	<3
<.2	7.8	.7	.02	--	<.1	.02	--	<.1	5.8	.2	3
<.2	4.9	1	.04	--	<.1	.03	--	<.1	6.2	<.2	3
<.2	6.6	1	.02	--	<.1	.03	--	<.1	6.3	<.2	<3
<.2	8.1	1	.03	--	<.1	.06	--	<.1	7.3	<.2	<3
<1	<1	1.18	.021	--	<1	.06	--	<.23	<1	<1	2.52
<.2	8	1.1	.03	--	<.1	.04	--	<.1	7.1	<.2	<3
<.2	4.4	1	.03	--	.1	.04	--	<.1	6.6	<.2	<3
<.2	14.3	.8	.07	--	.2	.04	--	<.1	6.5	<.2	<3

Table 6. Water-quality data for selected sites along Bear Butte Creek—Continued

[ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-charge (ft ³ /s)	Specific conduc- tance (µS/cm)	pH (standard units)	Water tempera- ture (deg C)	Air tempera- ture (deg C)	Dis- solved oxygen (mg/L)	Bio- logical oxygen demand (mg/L)	Carbon oxygen demand (mg/L)	Hardness as CaCO ₃ (mg/L)	Labora- tory alkalinity (mg/L)
Site 3 - 06437500 Bear Butte Creek near Sturgis, SD											
06-16-1998	1315	7.5	2,040	7.7	17.5	23.0	8.3	<1	5.2	1,014	241
06-18-1998	1532	301	1,170	7.8	12.0	15.0	9.1	16	16.4	862	260
07-07-1998	1240	12	2,080	8.0	24.0	25.0	9.2	<3	10.2	992	236
08-11-1998	1340	3.5	2,050	8.1	23.5	28.5	10.2	<2	23.9	1,078	209
09-16-1998	1230	1.1	2,240	8.0	19.0	26.0	8.8	<2	32.6	980	234
10-07-1998	1035	48	1,040	7.6	5.5	9.0	12.4	<2	26.2	450	105
³ 10-07-1998	1036	48	1,040	7.6	5.5	9.0	12.4	<3	21.3	450	105
11-17-1998	1250	51	1,710	7.9	4.0	3.5	14.1	<1	<20	784	203
12-15-1998	1250	20	2,000	7.7	1.5	4.5	16.4	<2	<20	1,002	251
01-26-1999	0855	15	2,160	7.7	.0	-6.5	12.1	<1	10.5	1,100	283
02-10-1999	1230	18	2,090	8.0	2.5	4.1	13.8	<1	16.8	991	214
03-09-1999	1245	18	2,200	7.9	2.0	.0	14.3	<1	10.9	1,070	238
04-06-1999	1220	69	2,110	8.0	6.5	8.5	10.7	<3	25.7	914	219
04-21-1999	1235	29	2,140	8.1	11.0	8.0	10.6	<1	12.9	1,011	238
05-10-1999	1310	32	2,020	8.0	9.0	4.0	4.9	<1	20.4	976	243
06-09-1999	1245	80	1,870	8.1	18.5	21.0	7.5	<3	25.8	811	214
06-15-1999	1105	193	1,240	7.8	16.0	16.8	7.3	<2	18.4	556	203
07-19-1999	1050	30	2,000	7.8	21.5	29.5	6.0	<1	25.4	1,007	213
08-16-1999	1145	12	2,090	7.9	20.0	23.0	8.7	<1	12.4	1,080	216
09-14-1999	1245	9.6	2,170	7.8	12.0	16.5	10.7	<1	14.8	1,056	225
10-26-1999	1220	10	2,240	8.0	8.0	19.5	11.7	<1	10.8	1,100	237
11-16-1999	1155	10	2,180	7.9	5.0	8.5	13.5	<1	13.4	1,091	257
12-07-1999	1205	12	2,220	7.6	.0	6.0	14.5	<1	<10	1,059	243
01-18-2000	1255	9.4	2,400	8.0	.0	3.0	13.0	<1	14.7	1,163	295
02-22-2000	1200	9.4	2,210	8.1	2.0	17.0	13.6	<2	<10	1,030	225
03-28-2000	1400	19	2,130	8.2	8.5	15.5	10.8	<2	14.7	998	232
³ 03-28-2000	1402	19	2,130	8.2	8.5	15.5	10.8	<2	14.4	989	227
² 03-28-2000	1405	19	2,130	8.2	8.5	15.5	10.8	--	--	980	234
04-04-2000	1200	14	2,200	8.0	5.5	15.0	12.2	<1	11.5	1,070	242
05-09-2000	1215	36	2,020	8.3	13.5	18.0	10.4	<2	15.8	954	236
05-18-2000	1230	33	2,010	8.3	12.0	12.0	10.4	<2	26.4	944	236

Bicar- bonate as CaCO ₃ (mg/L)	Total sus- pended solids (mg/L)	Fecal coliform (cols/ 100 mL)	Dis- solved calcium (mg/L)	Total calcium (mg/L)	Dis- solved magne- sium (mg/L)	Total magne- sium (mg/L)	Dis- solved sodium (mg/L)	Total sodium (mg/L)	Dis- solved potas- sium (mg/L)	Total potas- sium (mg/L)	Dis- solved chloride (mg/L)
--	79	170	--	245	--	97.8	--	91.6	--	7.1	43
--	1,930	23,000	--	230	--	69.8	--	98.3	--	18.4	33
--	70	430	--	244	--	92.9	--	106	--	8.2	34
--	26	130	--	238	--	99.4	--	90.9	--	6.7	40
--	14	--	--	239	--	112	--	102	--	6.3	50
--	200	2,300	--	115	--	39.5	--	53.1	--	9.4	12
--	196	3,600	--	114	--	40.1	--	53.7	--	9.5	13
248	24	50	--	187	--	77	--	102	--	8.2	24
306	10	60	247	--	93.5	--	98.7	--	6.5	--	32
--	4	230	271	--	96.9	--	98.7	--	6.5	--	36.5
261	9	100	245	--	92.1	--	109	--	6	--	33
290	8	10	244	--	103	--	117	--	6.2	--	35.6
267	130	660	203	--	98.9	--	154	--	7.5	--	29
290	25	<10	243	--	98.2	--	116	--	7.7	--	32.9
--	28	1,100	235	--	94.7	--	99.7	--	6.7	--	32.7
--	256	1,200	180	--	87.8	--	123	--	9.7	--	22.4
248	274	900	138	--	51.3	--	64.6	--	6.9	--	15
260	34	460	252	--	91.7	--	86.1	--	7.4	--	30.9
264	31	260	261	--	104	--	99.5	--	7.4	--	37.2
275	21	70	250	--	105	--	108	--	7	--	39
289	9	30	261	--	109	--	117	--	6.5	--	40.1
314	9	280	259	--	108	--	110	--	7.1	--	39.5
296	14	270	260	--	99.5	--	107	--	6.6	--	39.4
360	12	36	283	--	111	--	114	--	6.6	--	40.9
275	16	<2	251	--	97.2	--	106	--	5.7	--	38.3
283	41	<10	237	--	98.8	--	121	--	7.2	--	33.6
277	40	10	234	--	98.3	--	120	--	7.1	--	33.5
--	39	--	232.45	--	97.95	--	124.4	--	7.23	--	36.62
295	23	30	248	--	109	--	120	--	6.9	--	38.7
288	102	470	227	--	94.1	--	121	--	7.7	--	33
288	63	380	223	--	94.1	--	121	--	7.1	--	33.5

Table 6. Water-quality data for selected sites along Bear Butte Creek—Continued

[ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-solved sulfate (mg/L)	Total sulfate (mg/L)	Dis-solved fluoride (mg/L)	Total fluoride (mg/L)	Nitrate as nitro-gen (mg/L)	Nitrogen ammonia (mg/L)	Total kjeldahl nitrogen (mg/L)	Total dissolved phosphorus (mg/L)	Dis-solved cyanide (mg/L)	Dis-solved arsenic (µg/L)
Site 3 - 06437500 Bear Butte Creek near Sturgis, SD—Continued											
06-16-1998	1315	--	938	--	0.39	0.4	<0.02	0.41	0.125	<0.01	3
06-18-1998	1532	--	692	--	.42	.4	< .02	2.05	1.64	< .01	1.6
07-07-1998	1240	--	948	--	.41	.3	< .02	1.19	.144	< .01	2.3
08-11-1998	1340	--	1,023	--	.39	.3	< .02	.86	.066	< .01	3.4
09-16-1998	1230	--	1,059	--	.38	.2	< .02	.66	.039	< .01	1.5
10-07-1998	1035	--	450	--	.32	.3	< .02	1.38	.358	< .01	1.7
³ 10-07-1998	1036	--	449	--	.32	.4	< .02	1.09	.353	< .01	2.1
11-17-1998	1250	--	752	--	.42	.5	< .02	.67	.058	< .01	1.3
12-15-1998	1250	923	--	--	--	1.1	< .02	.56	.024	< .01	2.7
01-26-1999	0855	964	--	0.41	--	1.3	< .02	.34	.018	< .01	1.6
02-10-1999	1230	947	--	.38	--	1	< .02	.46	.024	< .01	1.4
03-09-1999	1245	1,022	--	.37	--	.8	< .02	.48	.026	< .01	1.2
04-06-1999	1220	955	--	.39	--	.2	< .02	1.05	.174	< .01	2.3
04-21-1999	1235	946	--	.4	--	.4	< .02	.67	.049	< .01	2
05-10-1999	1310	898	--	.38	--	.7	< .02	.55	.014	< .01	.7
06-09-1999	1245	838	--	--	--	.3	< .02	1.1	.424	< .01	2.4
06-15-1999	1105	431	--	--	--	.5	< .02	1.31	.372	< .01	2.9
07-19-1999	1050	898	--	--	--	.9	< .02	.75	.062	< .01	2.4
08-16-1999	1145	974	--	--	--	.8	< .02	.65	.048	< .01	2
09-14-1999	1245	1,059	--	.26	--	1	< .02	.51	.026	< .01	1.4
10-26-1999	1220	1,057	--	.34	--	.7	< .02	.36	.02	< .01	<1
11-16-1999	1155	1,036	--	.26	--	.8	< .02	.45	.014	< .01	<1
12-07-1999	1205	963	--	.34	--	1.1	< .02	.39	.018	< .01	1.3
01-18-2000	1255	1,081	--	.41	--	1.3	< .02	.44	.016	< .01	<1
02-22-2000	1200	991	--	.37	--	1.1	< .02	.44	.024	< .01	1.3
03-28-2000	1400	974	--	.42	--	.3	< .02	.58	.074	< .01	1.2
³ 03-28-2000	1402	970	--	.43	--	.3	< .02	.5	.07	< .01	1.2
² 03-28-2000	1405	1,016.1	--	.346	--	.307	< .2	.414	.058	< .01	1.29
04-04-2000	1200	1,000	--	.39	--	.5	< .02	.58	.041	< .01	1
05-09-2000	1215	905	--	.41	--	.4	< .02	.74	.133	< .01	1.7
05-18-2000	1230	906	--	.4	--	.5	< .02	.93	.104	< .01	1.4

Dis-solved cadmium (µg/L)	Dis-solved chromium (µg/L)	Dis-solved copper (µg/L)	Dis-solved iron (mg/L)	Total iron (mg/L)	Dis-solved lead (µg/L)	Dis-solved manganese (mg/L)	Total manganese (mg/L)	Dis-solved mercury (µg/L)	Dis-solved nickel (µg/L)	Dis-solved silver (µg/L)	Dis-solved zinc (µg/L)
<0.5	8.7	<0.02	--	2.22	1.5	--	0.19	<0.2	7.4	<0.5	<50
< .2	37.9	< .02	--	39	< .8	--	1.6	< .2	2.4	< .5	<50
< .1	7.8	< .02	--	1.92	< .8	--	.2	< .13	7.9	< .2	<50
< .1	3	< .02	--	.45	< .8	--	.05	< .2	8.4	< .2	<3
< .1	7.2	< .02	--	.2	<1	--	.02	< .2	7.6	< .2	<3
< .1	<1	< .02	--	5.2	<1	--	.24	< .2	5	<1	<3
< .1	<1	< .02	--	5.26	<1	--	.24	< .2	4.8	<1	<3
< .2	4	< .02	--	< .06	< .8	--	.08	< .2	8.6	< .2	5.1
< .2	3.7	< .02	--	--	< .1	--	--	< .1	9.9	< .2	4
< .2	5.4	< .02	0.04	--	< .8	0.08	--	< .1	9	< .2	<40
< .2	3.5	1.8	.02	--	< .1	.09	--	< .1	10.5	< .2	6
< .2	6	1.5	--	--	< .1	--	--	< .1	7.5	< .2	4
< .2	7.1	2	--	--	< .1	--	--	< .1	7.6	< .2	<3
< .2	5.7	1.8	--	--	< .1	--	--	< .1	9.3	< .2	6
< .2	8.2	1.5	.03	--	< .1	.09	--	< .1	9	< .2	5
< .2	<1.6	< .02	< .02	--	< .1	.05	--	< .1	9	< .2	4
< .2	4.4	1.7	--	--	< .1	--	--	< .1	6.8	< .2	<3
< .2	7	1.6	--	--	.1	--	--	.1	7.8	2.4	6
< .2	6.7	2.6	< .02	--	< .1	.05	--	< .1	7.9	< .2	6
< .2	4.8	1.3	.04	--	< .1	.03	--	< .1	9.3	< .2	6
< .2	4.8	1.4	< .02	--	< .1	< .02	--	.1	8.2	< .2	5
< .2	3.6	1.1	.03	--	< .1	.05	--	< .1	8.2	< .2	5
< .2	8	1.1	< .02	--	< .1	.05	--	< .1	8.2	< .2	6
< .2	5.9	1.5	.04	--	< .1	.06	--	< .1	8.4	< .2	4
< .2	7.6	1.4	< .02	--	< .1	.05	--	< .1	9.6	< .2	4
< .2	5	2	.03	--	< .1	.1	--	< .1	9.9	< .2	<3
< .2	6.2	1.9	.03	--	< .1	.1	--	< .1	9.2	< .2	<3
<1	<1	2.08	< .03	--	<1	.104	--	< .23	1.23	<1	39
< .2	7.2	2	.02	--	< .1	.0926	--	< .1	9.5	< .2	<3
< .2	2.9	1.7	.02	--	< .1	.07	--	< .1	8.9	< .2	3
< .2	12.6	1.6	.04	--	< .1	.06	--	< .1	8.8	< .2	3

Table 6. Water-quality data for selected sites along Bear Butte Creek—Continued

[ft³/s, cubic feet per second; μ S/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; μ g/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-charge (ft ³ /s)	Specific conduc- tance (μ S/cm)	pH (standard units)	Water tempera- ture (deg C)	Air tempera- ture (deg C)	Dis- solved oxygen (mg/L)	Bio- logical oxygen demand (mg/L)	Carbon oxygen demand (mg/L)	Hardness as CaCO ₃ (mg/L)	Labora- tory alkalinity (mg/L)
Site 4 - 443048103091400 Bear Butte Creek near mouth, near Vale, SD											
06-16-1998	1455	7.3	2,170	7.9	20.0	25.5	10.9	<1	13.2	986	195
06-18-1998	1745	529	1,610	7.7	13.0	16.5	7.4	14	22.7	881	317
07-07-1998	1415	12	2,140	8.1	27.5	31.0	9.1	3	19	937	195
08-11-1998	1450	3.1	2,140	8.1	32.0	27.5	8.6	<2	18.7	934	181
09-16-1998	1245	--	--	--	--	--	--	--	--	--	--
10-07-1998	1330	56	1,980	7.6	8.0	19.5	12.3	<2	21.7	970	193
³ 10-07-1998	1331	56	1,980	7.6	8.0	19.5	12.3	<2	19.8	968	192
11-17-1998	1420	62.0	1,890	8.0	4.0	3.5	13.6	<1	<20	809	207
12-15-1998	1430	22.0	2,080	7.8	.0	5.5	16.5	<1	<20	990	244
01-26-1999	1125	14	2,360	8.0	.0	-2.0	13.5	<1	13.6	1,122	279
02-10-1999	1405	21	2,220	8.1	.0	2.5	12.4	<1	21.1	942	216
03-09-1999	1435	20	2,310	8.0	3.0	3.5	14.2	<1	11.6	1,000	218
04-06-1999	1400	107	2,150	8.1	8.5	16.0	9.6	3	23.3	786	212
04-21-1999	1333	42	2,620	8.1	11.0	7.0	10.8	<1	22	1,024	248
05-10-1999	1445	37	2,410	8.1	9.0	5.0	5.3	<1	22.2	1,004	244
06-09-1999	1430	119	1,930	8.2	21.0	22.0	8.2	3	26.7	754	215
06-15-1999	1350	265	1,410	8.3	18.0	21.0	5.1	<2	19.4	570	211
07-19-1999	1210	32	2,070	7.9	23.5	30.5	6.1	<1	14.7	955	204
08-16-1999	1255	12	2,090	8.0	23.0	26.0	8.9	<1	13.7	1,040	192
09-14-1999	1430	7.9	2,250	7.7	15.5	18.5	9.0	<1	12.7	1,052	199
10-26-1999	1345	12	2,350	8.1	9.0	23.0	11.6	<1	<10	1,079	214
11-16-1999	1325	11	2,300	8.1	5.5	12.0	11.9	<1	13.2	1,090	235
12-07-1999	1340	16	2,400	7.7	.5	6.0	13.2	<1	<10	1,092	236
01-18-2000	1425	11	2,540	8.1	.0	7.5	14.2	<1	13.5	1,166	281
02-22-2000	1330	13	2,280	8.2	.5	20.0	14.5	<1	<10	971	211
03-29-2000	1000	20	2,240	8.2	7.5	7.0	11.2	<1	11.6	1,010	221
04-04-2000	1330	13	2,300	8.1	8.0	20.0	11.4	<1	<10	1,060	220
05-09-2000	1345	53	2,120	8.4	14.5	18.5	10.4	<2	21.2	879	234
05-18-2000	1400	37	2,220	8.5	14.5	14.0	10.6	<2	23.5	950	237

Bicar- bonate as CaCO ₃ (mg/L)	Total sus- pended solids (mg/L)	Fecal coliform (cols/ 100 mL)	Dis- solved calcium (mg/L)	Total calcium (mg/L)	Dis- solved magne- sium (mg/L)	Total magne- sium (mg/L)	Dis- solved sodium (mg/L)	Total sodium (mg/L)	Dis- solved potas- sium (mg/L)	Total potas- sium (mg/L)	Dis- solved chloride (mg/L)
--	46	20	--	229	--	100.7	--	131	--	8.3	44
--	6,440	15,000	--	218	--	82	--	200	--	40.2	7
--	29	80	--	219	--	94.8	--	136	--	8.8	36
--	23	100	--	213	--	97.7	--	136	--	8.3	44
--	--	--	--	--	--	--	--	--	--	--	--
--	384	2,000	--	247	--	86	--	100	--	10.8	23
--	392	2,000	--	245	--	86.5	--	102	--	11.1	23
253	40	110	--	187	--	83.2	--	139	--	8.6	33
298	14	<10	240	--	94.9	--	133	--	6.9	--	42
340	12	<10	278	--	104.2	--	131	--	7.2	--	39.6
263	30	40	224	--	93.1	--	149	--	6.5	--	39.7
266	15	<10	230	--	105	--	157	--	6.3	--	41.8
258	416	780	167	--	89.7	--	195	--	8.4	--	43.9
303	54	<10	229	--	110	--	218	--	8.5	--	44.4
--	52	220	224	--	108	--	189	--	7.6	--	40.9
--	440	400	156	--	88.6	--	157	--	10.1	--	31.5
257	552	1,100	133	--	57.9	--	95.9	--	7.9	--	23.1
249	42	150	224	--	96.1	--	119	--	7.9	--	35.8
234	36	40	241	--	106	--	127	--	8.3	--	40.2
--	24	60	235	--	113	--	136	--	6.9	--	40.7
261	6	<10	246	--	113	--	148	--	7.7	--	43.5
287	4	<10	247	--	115	--	143	--	7.6	--	43.8
288	14	26	251	--	113	--	148	--	7.7	--	43.8
343	6	12	274	--	117	--	151	--	7.1	--	45.8
257	18	<2	228	--	97.7	--	136	--	5.9	--	41.1
270	31	<10	229	--	107	--	149	--	7.6	--	36.6
268	12	<10	243	--	110	--	152	--	7.3	--	41.8
285	118	600	196	--	94.7	--	174	--	8.7	--	40.9
287	70	160	214	--	101	--	175	--	8	--	39.5

Table 6. Water-quality data for selected sites along Bear Butte Creek—Continued

[ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; deg C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; cols, colonies; mL, milliliters; K, non-ideal colony count; <, less than; --, no data available]

Date	Time	Dis-solved sulfate (mg/L)	Total sulfate (mg/L)	Dis-solved fluoride (mg/L)	Total fluoride (mg/L)	Nitrate as nitro-gen (mg/L)	Nitrogen ammonia (mg/L)	Total kjeldahl nitrogen (mg/L)	Total dissolved phosphorus (mg/L)	Dis-solved cyanide (mg/L)	Dis-solved arsenic (µg/L)
Site 4 - 443048103091400 Bear Butte Creek near mouth, near Vale, SD—Continued											
06-16-1998	1455	--	1,052	--	0.37	<0.1	<0.02	0.64	0.072	<0.01	3
06-18-1998	1745	--	717	--	.43	.5	.19	2.26	4.04	<.01	2
07-07-1998	1415	--	992	--	.38	<.1	<.02	1.08	.072	<.01	1.7
08-11-1998	1450	--	1,058	--	.37	<.1	<.02	.83	.051	<.01	2.4
09-16-1998	1245	--	--	--	--	--	--	--	--	--	--
10-07-1998	1330	--	996	--	.42	.3	<.02	1.35	.554	<.01	2
³ 10-07-1998	1331	--	992	--	.42	.3	<.02	1.4	.559	<.01	1.8
11-17-1998	1420	--	836	--	.42	.5	<.02	.73	.086	<.01	1.2
12-15-1998	1430	931	--	0.37	--	1	<.02	.53	.021	<.01	2.3
01-26-1999	1125	1,082	--	.43	--	1.2	<.02	.48	.025	<.01	1.7
02-10-1999	1405	969	--	.37	--	.8	<.02	.5	.057	<.01	1.3
03-09-1999	1435	1,044	--	.39	--	.6	<.02	.56	.029	<.01	1.5
04-06-1999	1400	679	--	.33	--	.3	<.02	.96	.317	<.01	2.6
04-21-1999	1333	1,175	--	.41	--	.4	<.02	.66	.069	<.01	1.9
05-10-1999	1445	1,123	--	.4	--	.6	<.02	.59	.051	<.01	1
06-09-1999	1430	844	--	--	--	.2	<.02	1.17	.576	<.01	2.2
06-15-1999	1350	529	--	--	--	.6	<.02	1.25	.676	<.01	2.2
07-19-1999	1210	954	--	--	--	.7	<.02	.4	.059	<.01	2.1
08-16-1999	1255	1,001	--	--	--	.5	<.02	.54	.052	<.01	1.5
09-14-1999	1430	1,103	--	.27	--	.6	<.02	.41	.028	<.01	1.4
10-26-1999	1345	1,145	--	.33	--	.5	<.02	.38	.011	<.01	<1
11-16-1999	1325	1,126	--	.36	--	.6	<.02	.39	.009	<.01	1
12-07-1999	1340	1,111	--	.34	--	.8	<.02	.41	.02	<.01	1.2
01-18-2000	1425	1,165	--	.39	--	1.1	<.02	.45	.005	<.01	<1
02-22-2000	1330	1,020	--	.36	--	.9	<.02	.33	.022	<.01	1.1
03-29-2000	1000	1,045	--	.39	--	.1	<.02	.66	.042	<.01	1.2
04-04-2000	1330	1,110	--	.38	--	.2	<.02	.52	.022	<.01	1
05-09-2000	1345	923	--	.38	--	.3	<.02	.94	.187	<.01	1.9
05-18-2000	1400	1,020	--	.41	--	.4	<.02	.9	.109	<.01	1.5

¹Quality-assurance/quality-control blank sample analyzed at South Dakota State Health Laboratory.

²Quality-assurance/quality-control split sample analyzed at U.S. Geological Survey National Water Quality Laboratory.

³Quality-assurance/quality-control split sample analyzed at South Dakota State Health Laboratory.

Dis-solved cadmium (µg/L)	Dis-solved chromium (µg/L)	Dis-solved copper (µg/L)	Dis-solved iron (mg/L)	Total iron (mg/L)	Dis-solved lead (µg/L)	Dis-solved manganese (mg/L)	Total manganese (mg/L)	Dis-solved mercury (µg/L)	Dis-solved nickel (µg/L)	Dis-solved silver (µg/L)	Dis-solved zinc (µg/L)
<0.5	50.5	<0.02	--	0.96	<0.8	--	0.1	0.2	3.2	<0.5	<50
< .5	28.9	< .02	--	146	< .8	--	3.9	< .2	4.4	< .5	<50
< .1	6.7	< .02	--	.58	< .8	--	.14	< .13	7.9	< .2	<50
< .1	5.3	< .02	--	.43	< .8	--	.05	< .2	7.6	< .2	<3
--	--	--	--	--	--	--	--	--	--	--	--
< .1	< .1	< .02	--	10.1	<1	--	.34	< .2	8	<1	<3
< .1	<1	< .02	--	9.8	<1	--	.34	< .2	7.7	<1	<3
< .2	2.6	< .02	--	< .06	< .8	--	.05	< .2	7.4	< .2	3.9
< .2	3.7	< .02	0.17	--	< .1	0.03	--	< .1	9.7	< .2	4
< .2	7	< .02	.02	--	< .8	.08	--	< .1	10	< .2	<40
< .2	4.6	2.7	.04	--	< .1	.09	--	< .1	10.2	< .2	5
< .2	5.2	2.1	--	--	< .1	--	--	< .1	7.5	< .2	12
< .2	7	3.1	--	--	< .1	--	--	.2	7.1	.3	<3
< .2	11.6	3.4	--	--	< .1	--	--	< .1	9.8	< .2	4
< .2	7.5	2.7	.02	--	< .1	.06	--	< .1	9.1	< .2	6
< .2	6.1	< .02	.02	--	< .1	< .02	--	< .1	8.7	< .2	<1
< .2	<1.6	< .02	< .02	--	< .1	< .02	--	.1	6.8	.3	<3
< .2	5.6	2	--	--	< .1	--	--	< .1	7.5	< .2	4
< .2	6.6	2.1	< .02	--	< .1	.03	--	< .1	7.6	< .2	5
1.2	4.2	1.9	.02	--	.2	.04	--	< .1	9.1	< .2	10
< .2	4.3	1.9	.02	--	< .1	.04	--	.1	7.8	< .2	4
< .2	<1	1.4	< .02	--	< .1	.04	--	< .1	8.2	< .2	4
< .2	7.4	1.5	.02	--	< .1	.05	--	< .1	8.3	< .2	4
< .2	4.5	2.3	.03	--	< .1	.05	--	.1	10.5	.3	4
< .2	5.6	1.9	< .02	--	< .1	.08	--	< .1	9.5	< .2	5
< .2	5	2.7	< .02	--	< .1	.0563	--	< .1	9.6	< .2	<3
< .2	7.1	2.7	.02	--	< .1	.0513	--	< .1	9.5	< .2	<3
< .2	8.2	2.9	< .02	--	< .1	.02	--	< .1	8.5	.2	<3
< .2	11.7	2.4	.02	--	< .1	.02	--	< .1	9.3	< .2	3.1