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The Nature of Flow and Sediment Movement in Little Granite Creek Near Bondurant, Wyoming

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Abstract

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Sediment and flow measurements were made during the course of 13 runoff seasons between 1982 and 1997 on a gravel-bed stream near Bondurant, Wyoming. The data for Little Granite Creek, compiled through the efforts of the U.S. Geological Survey and USDA Forest Service, is one of the most comprehensive databases on transport processes for an individual site available as of this writing. Bedload, moved by flows ranging from 0.05 times to nearly twice the bankfull discharge, was measured with an original Helley-Smith bedload sampler while wading, while suspended from a bridge, or from a temporary sampling platform. Samples of suspended load were collected using depth-integrating samplers. Laboratory analyses were conducted in accordance with standard U.S. Geological Survey methods. Hydraulic data were taken from summaries of discharge measurements maintained by the U.S. Geological Survey and by supplemental measurements made by Forest Service personnel in 1997. All data on rates of bedload transport, particle-size distribution of individual samples, suspended sediment load, measurements of hydraulic geometry, and channel surveys are presented in tables and graphs.

Keywords: gravel-bed channels, bedload transport, suspended sediment, hydraulic geometry

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The Nature of Flow and Sediment Movement in Little Granite Creek Near Bondurant, Wyoming

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Introduction

Measurements of bedload transport provide invaluable information on the nature of flow and sedimentation processes in stream systems. This information may be used to test models and quantify instream flow requirements, as well as provide a general understanding of how flow and sediment interact in creating and maintaining channel form. Measuring rates of bedload transport in coarse-grained channels can be particularly difficult because flows necessary for transporting larger particles are typically fast, turbid, and turbulent, making it difficult to directly measure or observe particle motion. Bedload movement is usually sampled using a hand-held or a suspended version of one of several types of pressure-difference bedload samplers (for example, Childers 1999; Emmett 1980; Hubbell and others 1985; Ryan and Porth 1999; Zhian and Gangyan 1992). Because such measurements are time and labor intensive and, therefore, expensive, relatively few are usually obtained. Yet, numerous samples are needed to derive a suitable measure of mean transport rates in light of the exceptionally high variability associated with bedload movement (Edwards and Glysson 1998; Emmett 1980; Troendle and others 1996). Because of these difficulties and limitations, relatively few databases on bedload transport have been collected over long periods (10 or more years) and over a range of discharges from low flow to greater than bankfull. Nonetheless, databases of this nature are essential for understanding the behavior of bedload transport, defining transport rates of different grain sizes, and testing theoretical transport relationships (Wohl 2000).

Through the combined efforts of personnel from the U.S. Geological Survey (USGS) and the USDA Forest Service (USFS), a relatively long-term database of bedload and suspended sediment measurements has been compiled for a 4th-order channel (based on 1:24,000 topographic maps) in western Wyoming. The sampling program began in 1982 as part of environmental monitoring in conjunction with planned exploration and extraction of fossil fuels in the upper basin of Little Granite Creek. Though the exploratory effort was eventually abandoned, sediment monitoring was continued by the USGS through 1993. The database was expanded when additional bedload samples were collected by the USFS during high flow in 1997. This paper reports on more than 450 measurements of sediment transport (bedload and suspended sediment) at flows ranging from about 0.05 bankfull (approximately 10 cubic feet per second [cfs]) to nearly twice the bankfull discharge (400 cfs).

Objectives

The primary objective of this paper is to characterize the morphology and hydrology of Little Granite Creek and the nature of bedload and suspended material transported in this gravel-bed channel. To facilitate further analysis, all data on flow, sediment, and grain size measurements are provided in appendices and graphs; planimetric maps and cross-sections provide details on the configuration of the channel.

Site Description

Little Granite Creek, an upland contributor to the Snake River system, drains 21.1 square miles of the Gros Ventre range near Bondurant, Wyoming, south of Jackson, Wyoming. The geology underlying the basin is varied but is composed primarily of sedimentary rocks of Cretaceous and Tertiary age, including: the Hoback formation (interbedded grayish sandstone and claystone), the Sohare formation (gray and brown sandstone), the Ankaren formation (red and maroon slate and purple limestone), and the Gannett group (red mudstone, sandstone, and conglomerate) (Love and Christiansen 1985). The upper portion of the basin was glaciated and is mantled by till and glacial outwash, likely correlative of Bull Lake and Pinedale aged deposits (as generalized in Leopold and Emmett 1997). Basin elevation ranges from 10,921 ft at an unnamed high point on a ridge near Pinnacle Peak to 6,390 ft at the confluence of Little Granite and Granite Creeks; the sampling site is located roughly 175 ft upstream of the confluence (fig. 1).

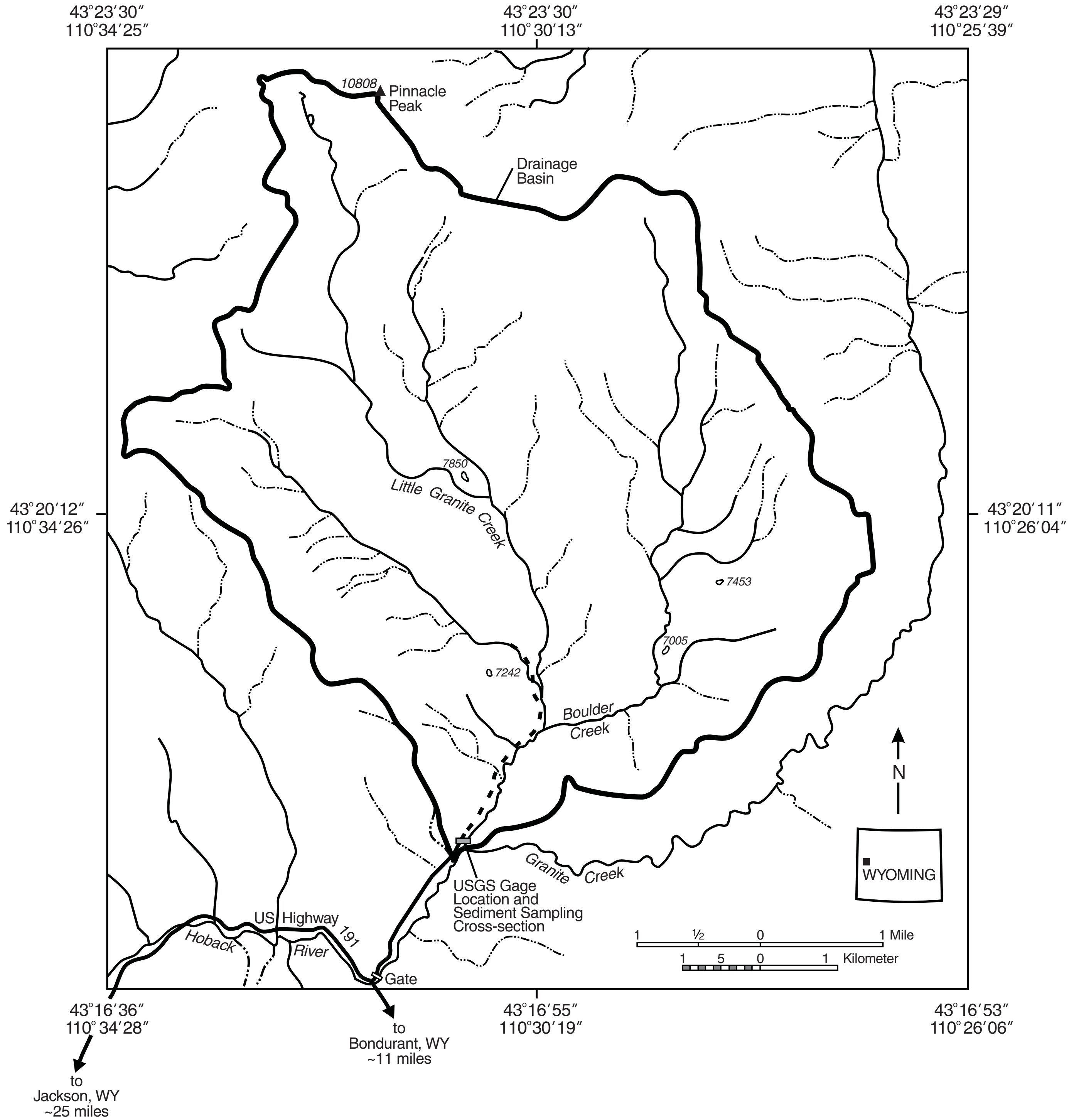

Figure 1—Map of the watershed drained by Little Granite Creek. Medium solid line indicates primary road access. Dashed line indicates location of Forest Service road (30505) leading to an old mining camp, cattle grazing area, and trailhead.

The channel in the vicinity of the cross-section is single thread with slight sinuosity and a moderately steep slope (fig. 2); mean water surface slope at low flow is about 0.020 ft per ft. Bed material at the surface ranges primarily from gravel to small boulders, with a small amount of sand-sized grains at the channel margins and in small patches in the lee of larger particles. Median grain size is in the coarse gravel to small cobble range. The channel type may be described as plane-bed (as defined by Montgomery and Buffington 1997), because no clear undulating pattern exists and there are only a few, poorly defined cobble steps. Banks are composed of sand, gravel, and cobbles overlain by fine sand and organic matter; they are largely stable and densely vegetated primarily by willows (*Salex* sp.) and lodgepole pine (*Pinus contorta*).

Upland uses include grazing for a few months in late summer and dispersed recreation (camping, hiking, horseback riding, and hunting); 74 percent of the watershed has wilderness designation. Forest Service road 30505 parallels the stream for about 1.5 miles in the lower end of the watershed. Former land uses include coal extraction and a mining camp above the confluence with Boulder Creek (fig. 1). These former and present uses are small in scale, and their influence on sediment delivered to the channel is relatively nominal. Primary sources of sediment are from mass wasting, including active earthflows from unstable hillslopes, slumping from undercut terraces and road cuts, and scour from the channel bed and banks. The area is administered by the USFS, Bridger-Teton National Forest, Jackson Ranger District.

Runoff in Little Granite Creek is generated primarily by snowmelt, with peak flows occurring between mid-May and mid-June (fig. 3). While thunderstorms are common in the summer, they produce only minimal rises in the hydrograph. The timing of seasonal high flow is slightly earlier than some nearby streams due to the south-to-southwest facing aspect of the upper basin. Mean annual temperature is 33.3 °F and mean annual precipitation is 20.53 inches at a nearby climate station in the vicinity of Bondurant (elevation 6,504 ft) (Western Regional Climate Center [WRCC], National Climate Data Center [NCDC] Normals, 1961–1990). Mean daily temperature in January is 9.4 °F and mean daily temperature in July is 56.9 °F (fig. 4) (WRCC, NCDC Normals, 1961–1990). Most of the precipitation falls as snow between November and March; the average annual snowfall measured at Bondurant between 1948 and 1999 is 134 inches (standard deviation is 48.9 inches) (WRCC, Monthly Total Snowfall).

Figure 2—Downstream view of Little Granite Creek with location of discontinued U.S. Geological Survey gaging station and bedload-sampling cross-section indicated by light colored lines (photograph by W.W. Emmett, July 1994).

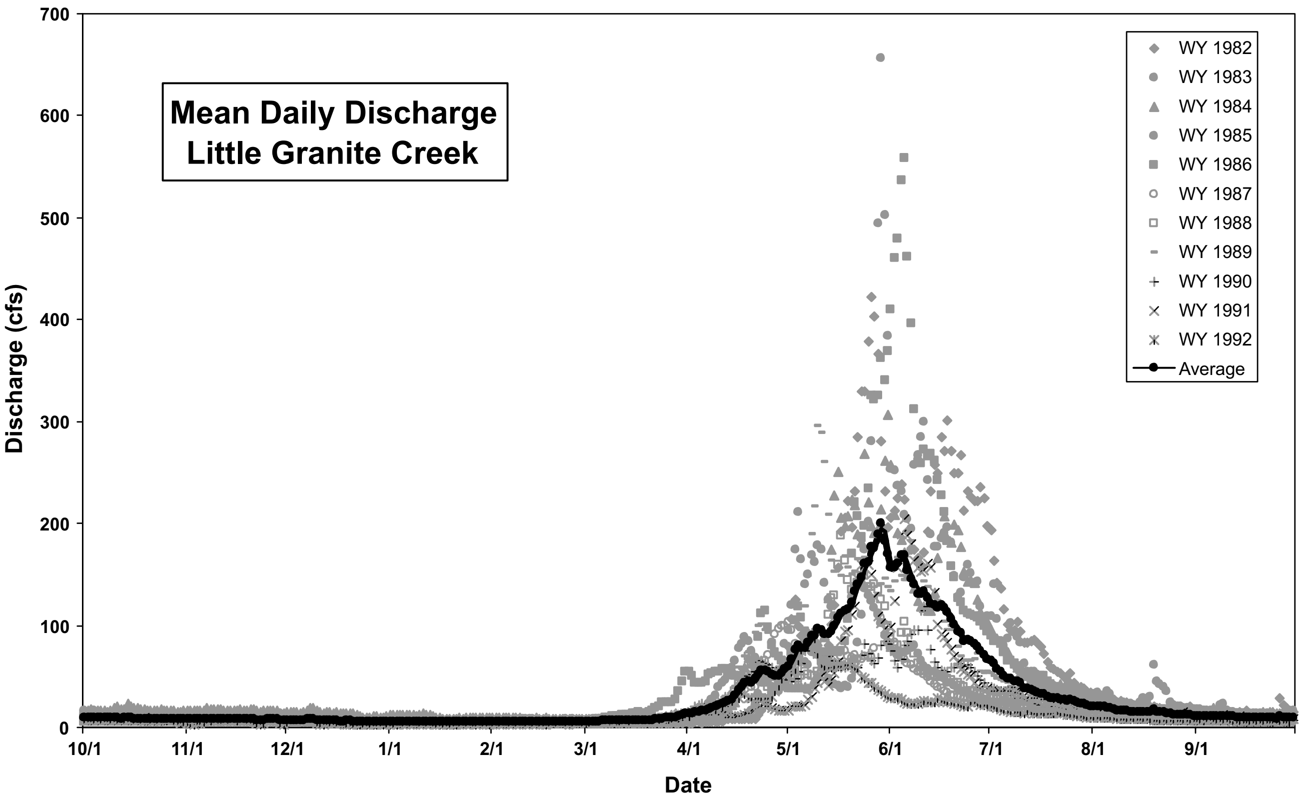

Figure 3—Daily mean flows from USGS gage (13019438) on Little Granite Creek for water years 1982 through 1992. The black line represents the mean of values for a given day.

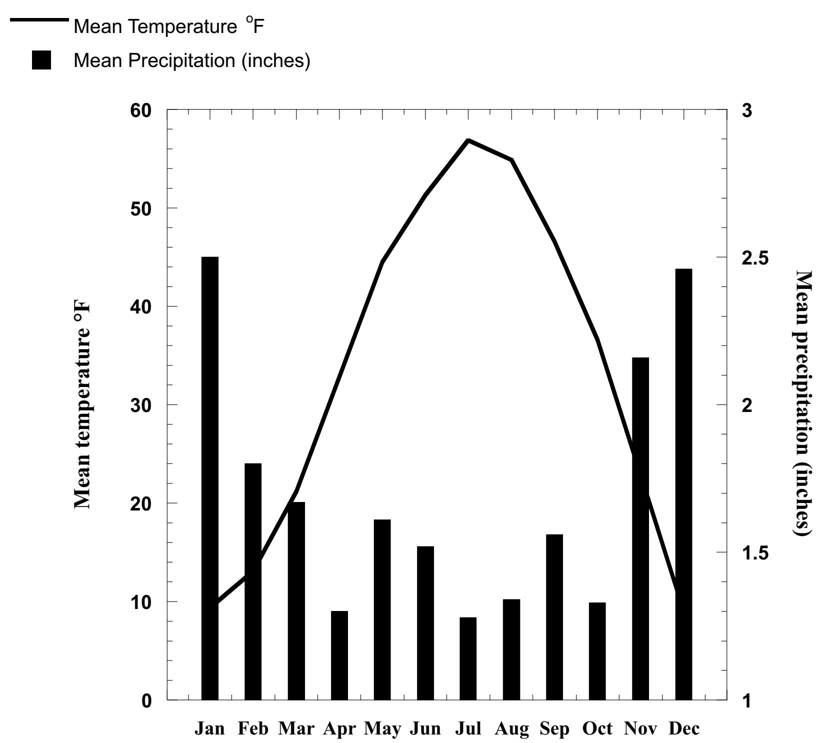

Figure 4—Climagraph showing mean monthly temperature and precipitation from a climate station at Bondurant, WY, the closest long-term station to the Little Granite Creek study site.

Methods

Discharge Measurements

A USGS gaging station, Little Granite Creek near Bondurant (13019438), was established in 1982 and discontinued in 1992. The discharge records for these years are published in two annual USGS Reports, *Water Resources Data for Wyoming* and *Water Resources Data for Idaho* for the years 1982 through 1992. Because the gage was located in the upper Snake River, installation and measurements were done by the Idaho District of the USGS and the data were published in the Idaho Report. Since the station is located in Wyoming, the Wyoming District of the USGS also published the data to complete its report. The gage house was removed in 1992, though the staff plate installed with the station remains intact. Discharge at the time the sediment samples were collected was obtained from the stage-discharge rating curves developed from USGS discharge measurements and by supplemental measurements made in 1993 and 1997. All measurements of discharge were taken in accordance with standard USGS practices (Buchanan and Somers 1969; Nolan and Shields 2000).

Bedload Measurements

Bedload samples were collected with an original version of the Helley-Smith sampler (Helley and Smith 1971). The wall of the sampler is $^{1}/_{4}$-inch thick, the body has an expansion ratio of 3.22, and the orifice through which bedload passes is 3 by 3 inches so the upper limit to the catch is about 76 mm (very coarse gravel). The sampler is fitted with a catch bag with 0.25-mm mesh. Samples were collected during 1982–1993 with a hand-held version of the sampler while wading at flows less than about 200 cfs. At higher flows, samples were collected from the vehicle bridge downstream of the cross-section using a weighted sampler that was cable-suspended from a truck crane. A temporary platform (Martinez and Ryan 2000) was constructed in 1997 at the wading cross-section and bedload was collected from this platform with the hand-held sampler fitted with an 8-ft handle.

Samples were collected at about 20 equidistant positions (or verticals) on the cross-section, about 1 ft apart; each vertical was sampled for 30 or 60 seconds. Generally, two traverses of the channel width were made during each visit. A bedload sample is a composite of sediments collected at all verticals on a traverse and, thus, represents a spatially and temporally averaged transport rate measured over a period of time ranging from about 30 to 60 minutes. This procedure is referred to as the Single Equal Width Increment (SEWI) method (Edwards and Glysson 1999). Rates of bedload transport rates averaged over the channel width are reported for each sample collected between 1982 and 1997, along with date, discharge, and percentage of total measured load (appendix, table 1). Bedload samples were ovendried and sieved using standard sedimentological methods for grain size analysis (Folk 1968). Full phi-interval sieves, ranging from 0.25 to 64 mm, were used to separate bedload samples into 10 grain-size classes. These particle-size data are reported in table 2 (appendix) as the weight of bedload retained on individual sieves and in table 3 (appendix) as the percentage finer than each sieve size. Computed percentiles or D-values are reported in table 4 (appendix). The D-values were determined by interpolating between values of phi on either side of the D-value being sought. Data from individual samples are then summarized by year in tables 5, 6, and 7 (appendix).

Suspended Sediment Measurements

Samples of suspended sediment load were usually collected during the same visit when bedload was measured in years 1982–1993; no measurements of suspended sediment were made in 1997. Suspended sediment was collected just before or after the bedload sample was obtained; for all practical purposes, the measurements are considered concurrent. Samples were collected at several points in the cross-section with a DH-48, D-74, or DH-81 depth integrating sampler following the Equal Width Increment (EWI) method described in Edwards and Glysson (1999). These data are reported in table 1 (appendix) along with bedload discharge and percentage of total measured load. Percentages of the suspended load in the silt- and sand-size classes are reported for most suspended sediment samples. Laboratory analyses of concentrations and percentages at the silt-sand break (0.0625 mm) were conducted by the USGS in accordance with guidelines in Guy (1969). The results provide an index to the amount of material moved in suspension relative to that amount moved as bedload.

Hydraulic Geometry Measurements

Measurements of width, mean depth, and mean velocity obtained while making discharge measurements were extracted from the "summary of discharge measurements" maintained by the USGS and from field notes kept by USFS personnel in 1997. Only those measurements made at or near the cross-section where transport was measured are included in the analysis of hydraulic geometry. However, all measurements are reported in table 8 (appendix). Low flow measurements at narrower than typical sections and high flow measurements made from the narrow bridge crossing near the confluence are identifiable by width criteria and were not used in the analysis of hydraulic geometry. Specifically, measurements were not used when the value of the width departed visually from the trend generated from known measurements at the primary cross-section.

Channel Surveys

Planimetry of the channel and profiles of the floodplain, water surface, and streambed elevations were surveyed in 1986 and 1994. A more complete survey of the area was done in 1997 using an automatic level and total station surveying equipment. Surfaces inundated during high flow (approximately 400 cfs) and at flows near bankfull were marked with pin flags during runoff and these points of high water were included in the survey. Several cross-sections were measured over a 300-ft reach of channel above and below the sampling cross-section. Maps were generated from the survey using RiverCAD (Boss International 1997) and the area of flow inundation for discharges with return frequencies of 1.5, 5, 10, 25, and 50 years were modeled using HEC-RAS (U.S. Army Corp of Engineers 1997) calibrated to our field observations.

Surface and Subsurface Grain Size Sampling

The particle size distribution of bed materials in Little Granite Creek was assessed using pebble counts (Wolman 1954). One count was made in July 1994 using 300 particles in the vicinity of the former gage house and the sampling cross-section. A second count was made in July 1997 in the same area using 200 particles. A third pebble count, also using 200 particles, was made in August 2000.

During the third count, a "barrel sampler" was used to collect surface and subsurface materials near the sampling cross-section. Specifically, a barrel sampler consists of a 55-gallon drum with the top, bottom, and bottom rim removed. The barrel is driven into the bed of the channel by hand and reduces the loss of fine grains to the passing flow. All surface grains are removed, leaving the subsurface exposed. Smaller grains are taken from the surface first so that they are not mistaken for part of the subsurface once the larger particles are removed. The subsurface is excavated using a scoop and the sediment is transferred into cotton duck bags to permit drainage while retaining the majority of smaller grains. Approximately 20 lbs of subsurface materials are collected per barrel sample. This material is later dried and sieved for grain size analysis, using methods described previously. The distribution of particle sizes for both surface and subsurface measures are reported in table 9 (appendix).

Results

Flow Frequency Calculations and the Bankfull Discharge

Estimates of flow frequency were calculated using Log Pearson III analysis (U.S. Interagency Advisory Committee on Water Data 1982) on the annual maximum series for the period 1982–1992 (fig. 5). The confidence bands on the estimates are relatively wide due to uncertainty associated with a limited record of flow (Linsley and others 1975). The calculated 1.5-year return interval flow was 210 cfs, with 95 percent confidence limits ranging from 133 to 302 cfs. The area inundated by this level of flow is nearly identical to the bankfull stage as pinned in the field and delineated on maps in 1997. To corroborate further, we looked at the bankfull stage that was field-determined using profiles from the 1994 survey and the corresponding staff gage elevation and rating curve. This estimate of the bankfull discharge, 229 cfs, corresponds to the floodplain elevation at the gage location (Emmett 1999). Note that there is less than 10 percent difference between the estimates of the bankfull discharge, which represents less than 0.1 ft difference in stage. Hence, we conclude that the 1.5-year flow using Log Pearson III analysis approximates the level of flow that just fills the channel as determined in the field. The highest discharge at which bedload was measured (400 cfs) has a calculated return frequency of about 3.1 years (95 percent confidence limits between 1.8 and 7 years).

Hydraulic Geometry and Areal Extent of Flow at Varying Discharge

The hydraulic geometry of Little Granite Creek, defined as the relationships between channel width, mean depth, and mean velocity over varying levels of flow, were fit with power functions using least-squares regression; the data and equations are presented on the commonly used log-log scaled plot (fig. 6). At the 1.5-year return interval flow (210 cfs), channel width at the sampling cross-section is about 32 ft, mean depth is 1.4 ft, and mean velocity is 4.5 ft s^{-1} (fps). At 400 cfs, the channel width is about 37 ft, mean depth is 1.7 ft, and mean velocity is 6.2 fps. There was no sharp break in the fitted relationships that would suggest a threshold at which flow reaches bankfull and spills onto the floodplain. This is probably because variations in channel width, as well as a narrow and often incremental floodplain, make bankfull identification on plots of hydraulic geometry difficult.

The channel near the sampling section on Little Granite Creek is confined within a relatively narrow valley bottom, with a steep hillslope to the west of the

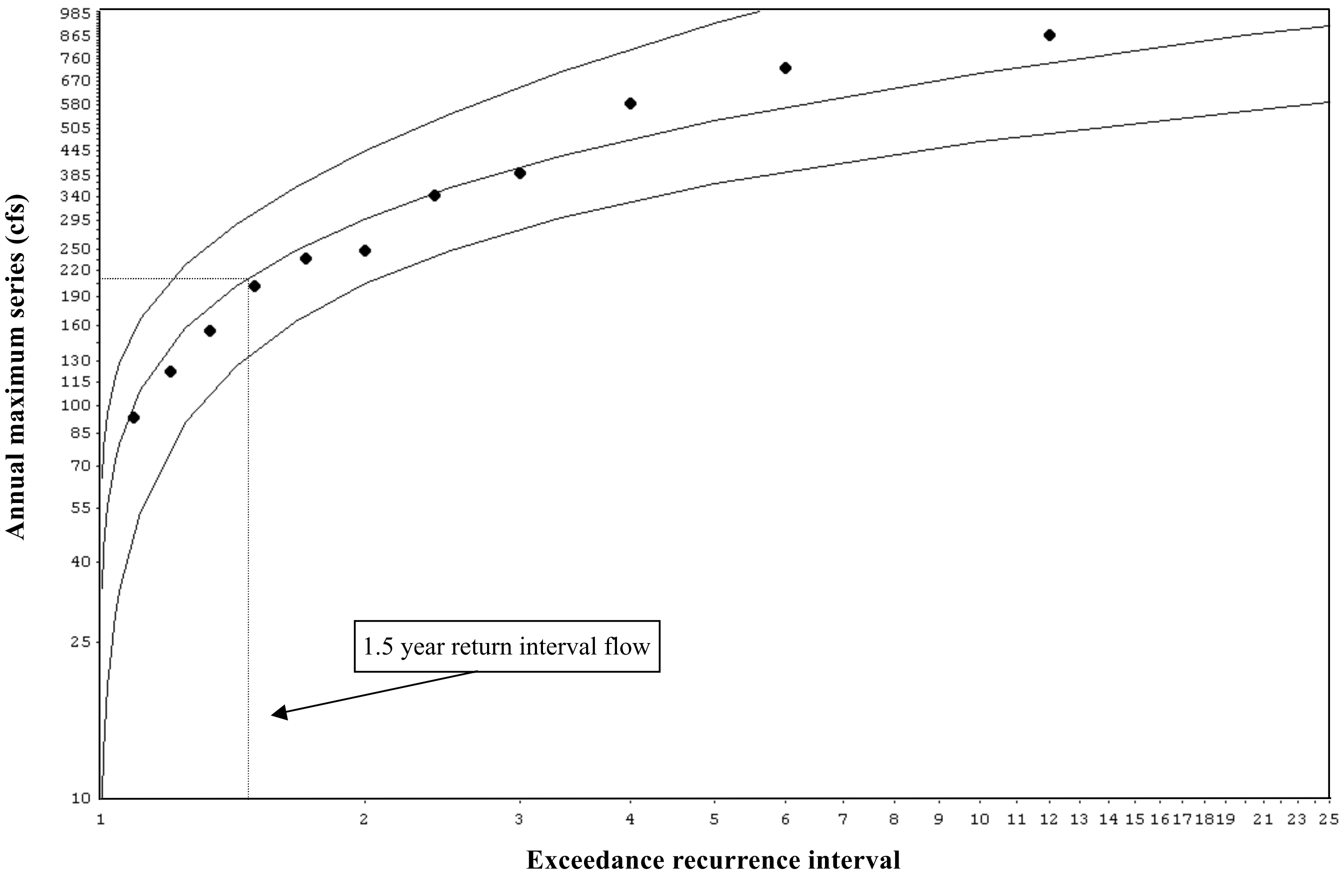

Figure 5—Flow frequency calculations using Log Pearson III distribution. Upper and lower lines are the 95 percent confidence bands on the estimates of streamflow (1982–1992).

channel and the remnants of glacial deposition to the east (fig. 7). The floodplain is narrow and discontinuous, as observed on a series of cross-sectional plots (fig. 8); there is a low terrace at the downstream end of the area on the left side. Of the estimates of bankfull flow described in the previous section, only the surveyed line that was marked in the field using pin flags is shown. Differences between this line and the 1.5-year discharge determined using Log Pearson III are on the order of the line width on the cross-sectional plots. The "high water line" on the map is the highest flow at which bedload was measured in 1997 and is slightly less than the 5-year flood line from the HEC-RAS model (shown only on cross-section plots); at this level, flow covers about a 2–3 ft portion of the floodplain occupied by willows, grasses, and sedges (fig. 2). Estimates of the 10-, 25-, and 50-year stages were generated using the HEC-RAS model. The 50-year flood covers the small floodplain but is largely contained within the constrained valley bottom and terraces.

Water surface profiles, used in estimating area inundation, were generated using a one-dimensional flow model calibrated to field observations (fig. 9). Numbers on the mid-channel elevation line refer to measured cross-sections, except point 0, which is an arbitrarily selected cutoff above the vehicle bridge. Elevations at points 3.4 and 3.8 were added to model the flow adequately through a steeper segment of the channel; they are based on elevations from the longitudinal profile surveyed in the field. Profiles indicate the presence of a control on the flow downstream from the sampling cross-section where there is an increase in the slope accompanied by a contraction in the channel width. Mean water surface slope through the reach decreases from 0.020 at the 1.5-year flow to 0.018 at the 50-year flood, all in accord with field-mapped slopes averaged at 0.019 by Emmett (1998).

Bed Material

The grain size distribution of the channel bed sampled in 1994 varied considerably from that observed in 1997 and 2000 (fig. 10). The median particle size (D_{50}) from pebble counts made in 1994 was 55 mm, which is in the very coarse gravel range; D_{84}, the 84th percentile on a percent finer than scale, was 140 mm (large cobble). Pebble counts from 1997 depict a

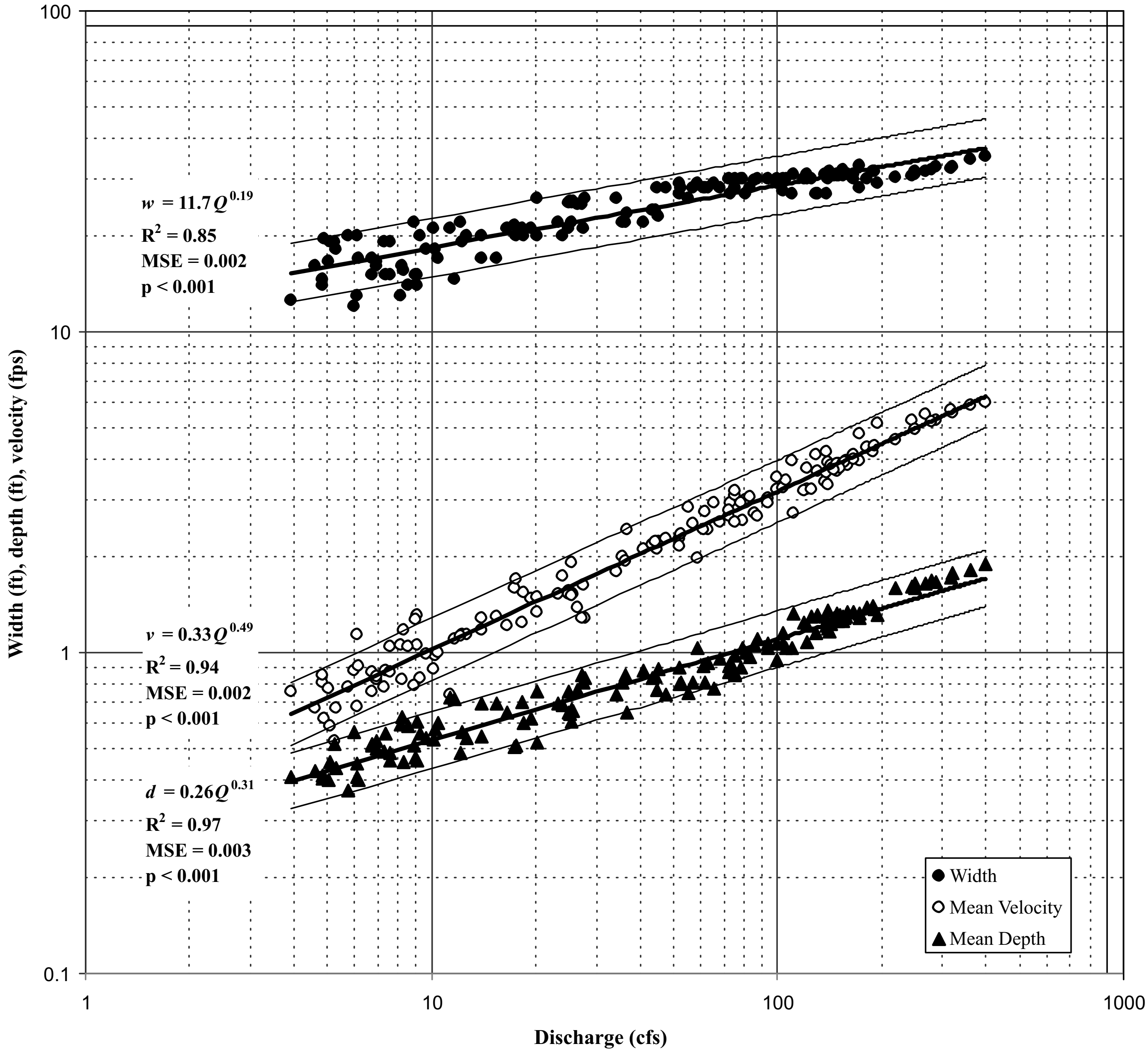

Figure 6—Relationship between width, hydraulic mean depth, and mean velocity over varying ranges of flow with 95 percent confidence bands (thin lines). Plots only include cases when flow was measured at or near the cross-section where sediment was sampled.

substantially coarser bed with a D_{50} of 100 mm and a D_{84} of 220 mm, both of which are well into the cobble-size range. Pebble counts made in 2000 were intermediate with a D_{50} of 89 mm and a D_{84} of 207 mm, both within the cobble range. The biggest difference in the sets of data is a near absence of sand and small gravel in the 1997 count. While the differences could be attributable to variation in operator technique, there was a notable absence of small gravel on the channel surface observed after the extended high runoff in 1997. Gravel was limited to small patches behind cobble clusters or in narrow zones along channel margins and in small pools. Speculatively, we surmise that the sustained high flows of 1997 preferentially transported the smaller sized particles and this diminished their presence in the study reach. The pebble count from August 2000 indicates the presence of more gravel in the bed, though apparently not to the 1994 level.

As is typical for gravel-bed channels, the subsurface of the bed of Little Granite Creek is considerably finer than the surface. While the distribution of grain sizes

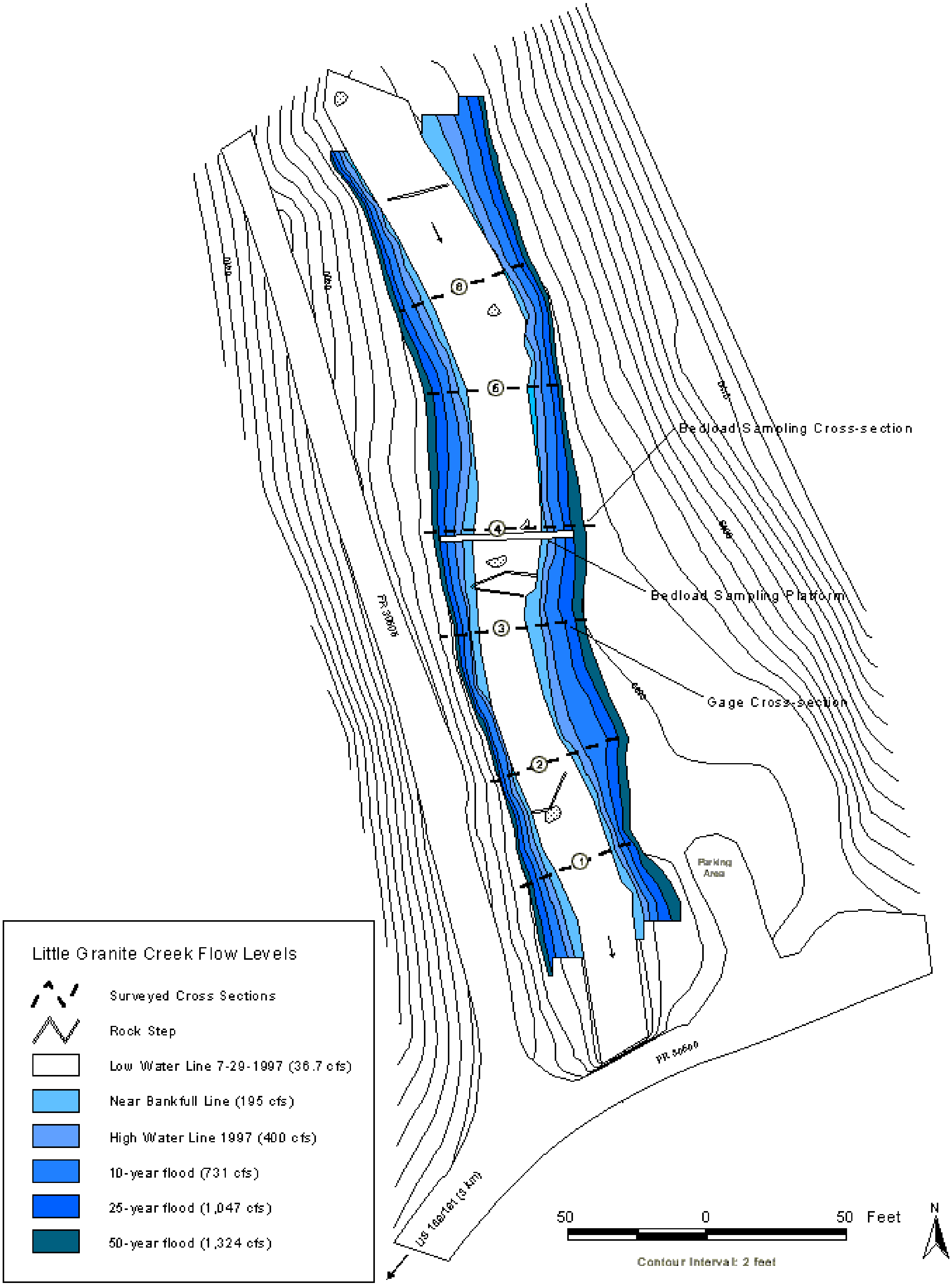

Figure 7—Planimetric map of study site and areal inundation of flows with varying recurrence intervals. Channel near vehicle-bridge was not mapped in detail and so flow lines do not extend to this area. Elevation is relative to arbitrary datum above confluence.

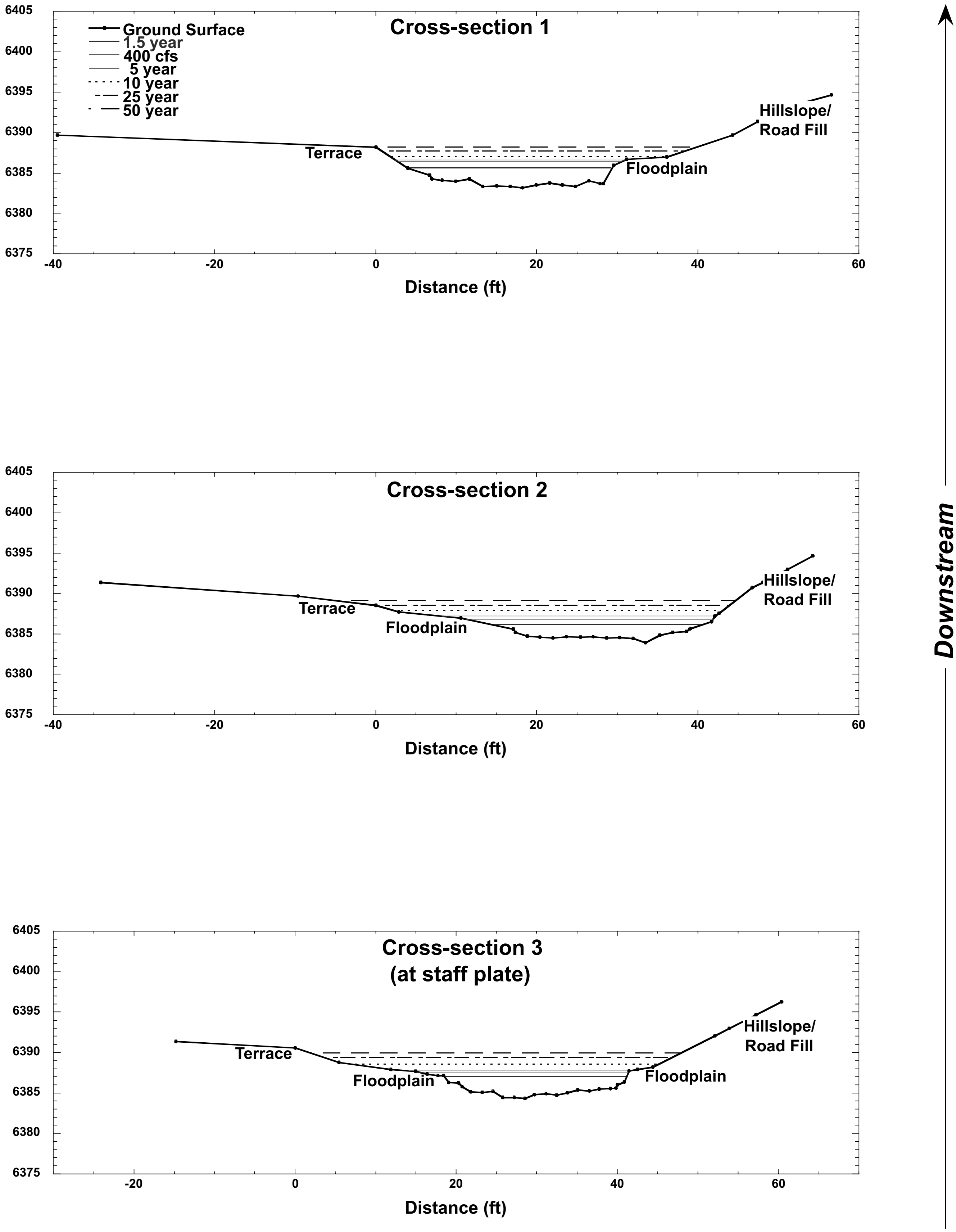

Figure 8—Plots of cross-sections surveyed at study site in Little Granite Creek. Cross-section numbers also referenced on figures 7 and 9. View at each cross-section is downstream. Vertical exaggeration is 1:1.

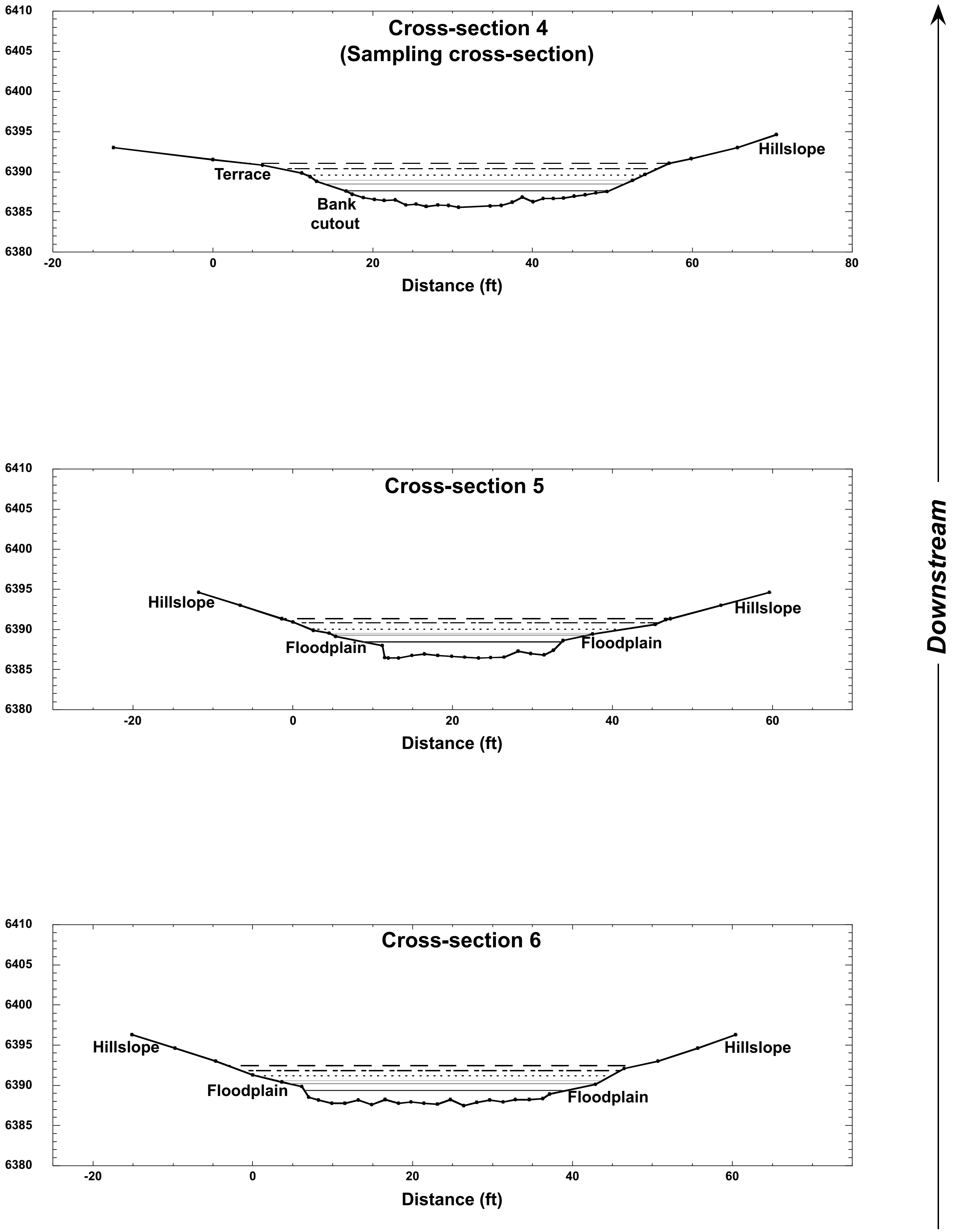
Cross-section 4
(Sampling cross-section)
Terrace
Bank
cutout
Hillslope
6410
6405
6400
6395
6390
6385
6380
-20
0
20
40
60
80
Distance (ft)
Cross-section 5
Hillslope
Floodplain
Floodplain
Hillslope
6410
6405
6400
6395
6390
6385
6380
-20
0
20
40
60
Distance (ft)
Cross-section 6
Hillslope
Floodplain
Floodplain
Hillslope
6410
6405
6400
6395
6390
6385
6380
-20
0
20
40
60
Distance (ft)
Downstream

Figure 8 (Con.)

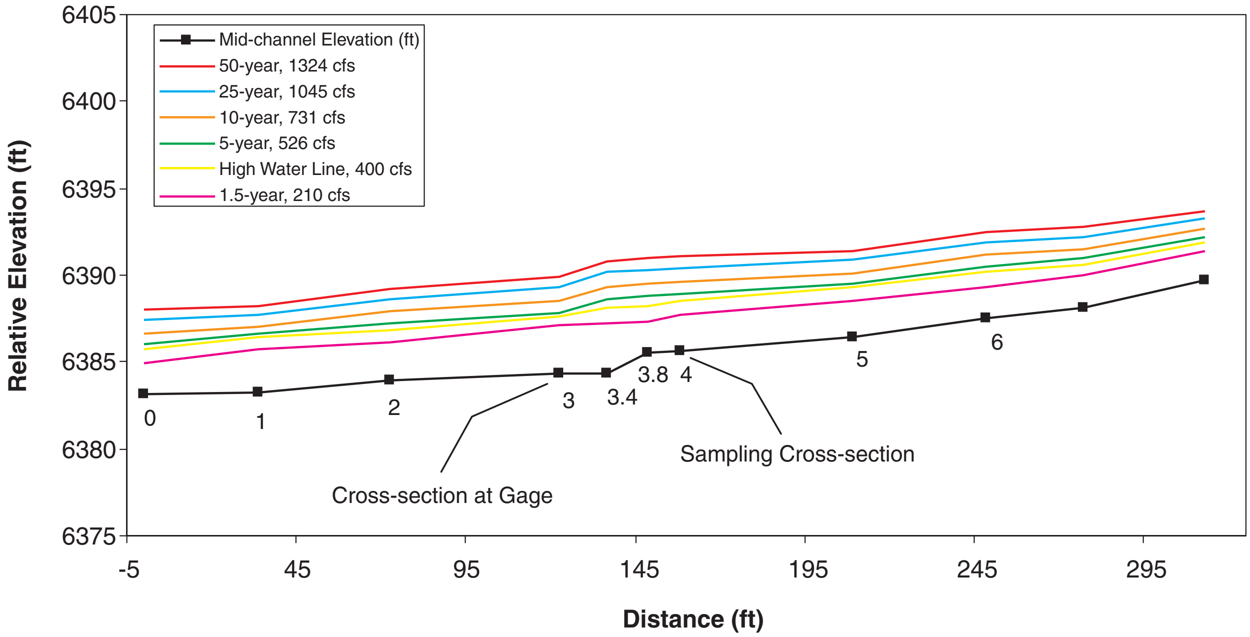

Figure 9—Water surface profiles determined for flows with 1.5-, 5-, 10-, 25-, and 50-year return frequencies. Mapped height of high water line is included for reference. Vertical exaggeration is 5 times.

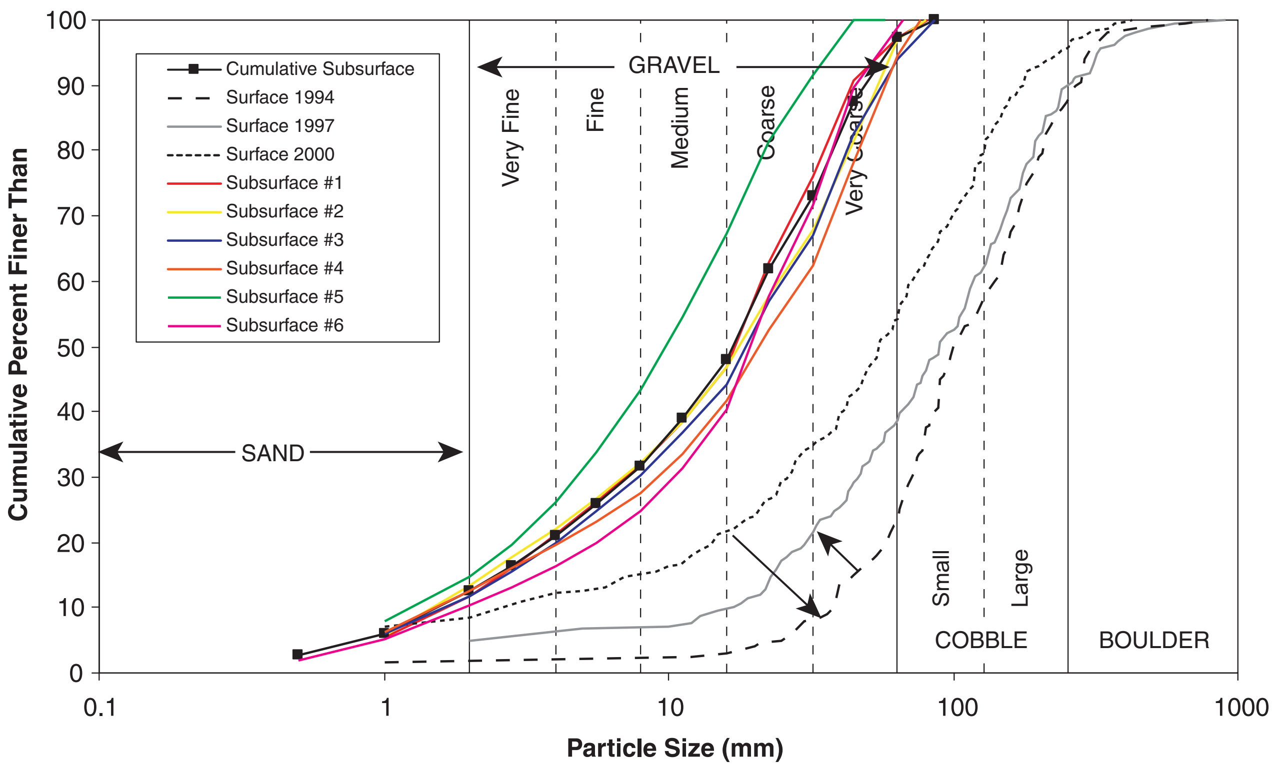

Figure 10—Particle size distribution of channel surface and subsurface in vicinity of sampling cross-section and former USGS gaging site. Distribution of the surface sampled using Wolman (1954) pebble counts in 1994, 1997, and 2000; small arrows indicate the temporal sequence of these observations. Classification of sand, gravel, cobble, and boulder based on Guy 1969.

on the surface is spatially variable, the distribution of the subsurface is more consistent, as indicated by near overlap of five of the six subsurface distributions shown on figure 10. The D_{50} of all subsurface samples (and standard deviations) is 17.4 mm (±3.9) and D_{84} is 42 mm (±9.6). The D_{50} of the surface, based on pebble counts in 2000, was 89 mm; hence, the median grain size of the surface is about five times larger than that of the subsurface. This ratio typically has a value between 1.5 to 3 in gravel-bed channels (Thorne and Hey 1983). The relatively large ratio for Little Granite Creek suggests that the bed is well armored. The composite D_{50} of the subsurface is approximately equal to the D_{10} of the surface.

Rates of Bedload Transport

Total Transport—Sediment rating curves, which characterize the rate of transport relative to discharge, were fitted to the bedload dataset; an arithmetic plot is used to express the range and variability of samples collected at higher discharges (fig. 11). Several models, including linear, power, and piecewise regression, were applied to determine best fit. A piecewise linear regression model fits one or more linear functions to different ranges of data (Neter and others 1989); the model applied to bedload data is described in Ryan and others (submitted). *Breakpoints* are values on the x-axis where a change in the slope of the different linear relationships can be defined. While the regression functions so determined may be discontinuous, the model can be written in such a way that the function is continuous at all points, including the breakpoint. We assume that, given what is understood about the nature of bedload movement in natural channels, the function should be continuous. The breakpoint may be used as an indicator of flows at which a substantial change in the rate and nature of coarse-grained transport occurs (Ryan and others, submitted) and is useful for defining phases of transport (for example, Ashworth and Ferguson 1989; Jackson and Beschta 1982; Ryan and Troendle 1996; Warburton 1992).

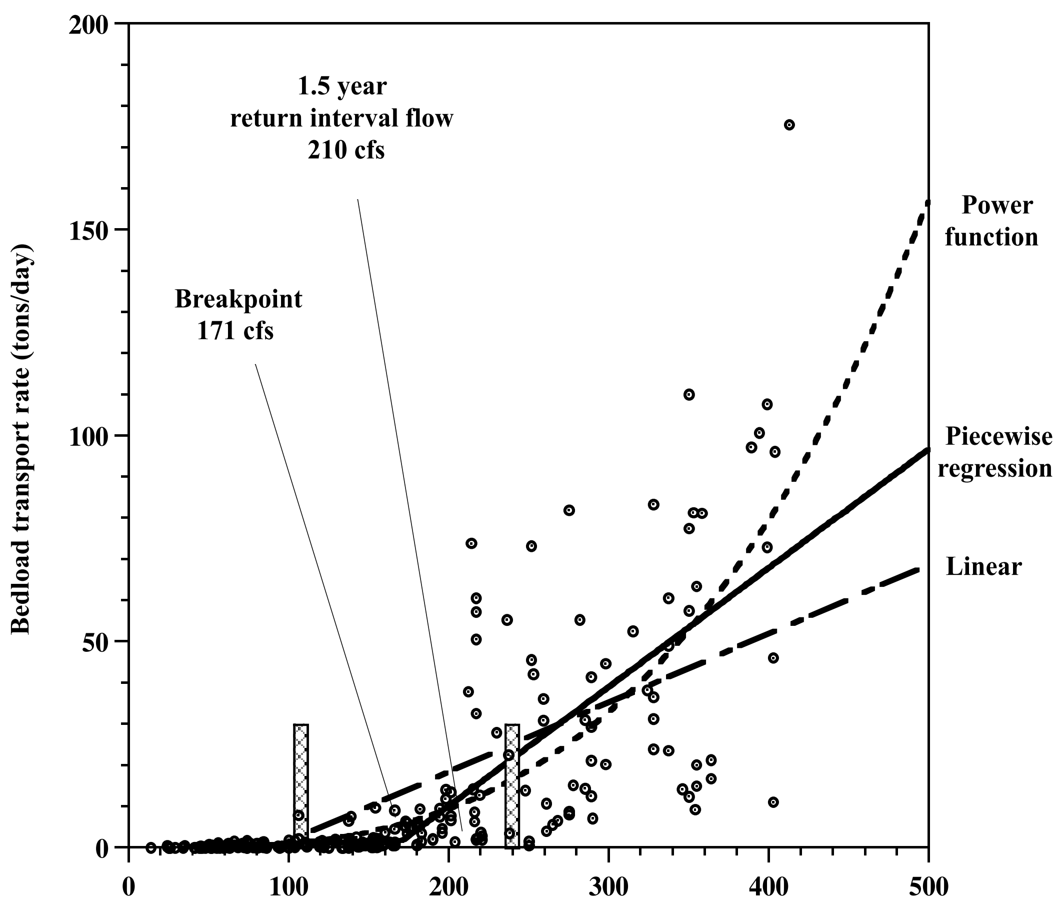

Figure 11—Three fits (linear, power, and piecewise linear) to bedload transport data on arithmetic scale. Bars represent the 95 percent confidence limits on the estimate of the breakpoint; bar height is arbitrary.

One of the common difficulties encountered when fitting regression models to bedload data is the non-normality and heterogeneous variance of model results. When this occurs, the standard errors of the estimates for each of the parameters are suspect (Ryan and others, submitted). Hence, a bootstrapping procedure was used to obtain nonparametric estimates of the standard errors and confidence intervals for the model parameters (Efron and Tibshirani 1993). Bootstrapping assumes the sample data represents the distribution of the population and involves resampling from the original dataset with replacement, meaning a datapoint may be selected more than once, in order to obtain a secondary dataset. The model is then fit to this secondary dataset and the parameters from the bootstrap estimates are retained. This procedure is repeated a large number of times; we used 1,000 iterations, generating 1,000 secondary datasets. Standard errors can then be calculated as the standard deviation of the bootstrap estimates for each parameter (Efron and Tibshirani 1993).

Of the three fits, the linear fit was the poorest, as may be expected, explaining about 50 percent of the variance ($R^2 = 0.49$). The linear model, where Q is discharge (in cfs) and G_b is the expected rate of bedload transport (in tons per day) is:

$$G_b = -15.1 + 0.165Q \qquad [1]$$

The form of the power model is:

$$G_b = -0.219 + 8.89\text{E}{-07}Q^{3.05} \qquad [2]$$

The power and piecewise regression models gave fits that were nearly identical at discharges less than 400 cfs and both accounted for about 60 percent of the variance. However, the power fit increases at a much higher rate and so extrapolation from this model will predict substantially higher rates of transport for flows greater than 400 cfs compared to the piecewise regression. Bedload transported in Little Granite Creek, as characterized by piecewise regression model, has the form:

$$G_b = -0.351 + 0.0117Q \qquad \text{for } Q \leq 171 \qquad [3]$$

$$G_b = -46.6 + 0.282Q \qquad \text{for } Q > 171 \qquad [4]$$

The rate of bedload transport is relatively low until about 171 cfs (81 percent of the 1.5-year discharge, 210 cfs); the 95 percent confidence limits on the estimate of the breakpoint are 107 to 235 cfs (51 to 112 percent of the 1.5-year discharge).

For flows less than the breakpoint, bedload can never be <0, so when $G_b \rightarrow 0$:

$$G_b = -0.351 + 0.0117Q$$

$$0.351 = 0.0117Q$$

$$Q = 30.0$$

Hence, an approximation for first or incipient motion would be around 30 cfs. The slope of the line for flows less than the breakpoint was 0.0117, indicating that increasing flow produces only a small commensurate increase in sediment. As flow approaches bankfull, the rate of bedload transport increases substantially; the slope of the line above the breakpoint was 0.282, representing a 25 times increase in the rate of change in bedload with increasing discharge. Conceptually, there could be a second breakpoint at higher discharges indicative of the "leveling off" of shear stress (and hence, sediment movement) in the channel as flow moves onto the floodplain (for example, Ferguson 1994). However, there was no apparent leveling of the rate of transport at flows between 220 and 400 to indicate the presence of a second breakpoint. This may be because there are no data above 400 cfs, and the few data that exist for the highest flows are so variable that the model is unable to improve the error reduction by adding a third segment.

Emmett (1999) describes a similar analysis for the data at Little Granite Creek, using the term "explosion" to characterize the rapid increase in transport rate. Using visual indicators for the flow, which produces the rapid rise in transport rates, Emmett suggested that the explosion occurs at about 220 cfs, which is considerably greater than the estimate of 171 cfs from the piecewise regression procedure. The visual cue can be seen in figure 11 using several especially large rates of transport at about 220 cfs. Yet, while there is a discrepancy between the explosion and breakpoint estimates, Emmett's estimate of 220 cfs is within the confidence limits of the breakpoint estimate from the piecewise regression procedure. In short, both estimates indicate that a substantial increase in the amount of bedload in transport begins at flows approaching bankfull, or about the 1.5-year discharge.

Transport by Size Fractions—Fractional transport rates, in tons per day (t/d), were determined from the size-distribution data in table 2 (appendix). The transport rates for several grain size classes are plotted against discharge in figure 12; a similar analysis of fractional transport rates appears in Emmett (1999). The discharge at the breakpoint and its confidence limits are indicated on this plot, separating fractional transport rates by flows greater or less than the breakpoint. The primary constituent of all bedload samples was sand that ranged from 100 percent of the total sample weight at the lowest flows to 20 percent at high flows. The presence or predominance of sand in bedload is typical for channels with very coarse beds (Leopold 1992; Lisle 1995). Bedload measured at flows less than the breakpoint (30–172 cfs) consisted primarily of sand (80 percent on average) and some small gravel (20 percent on average); D_{50} for these samples

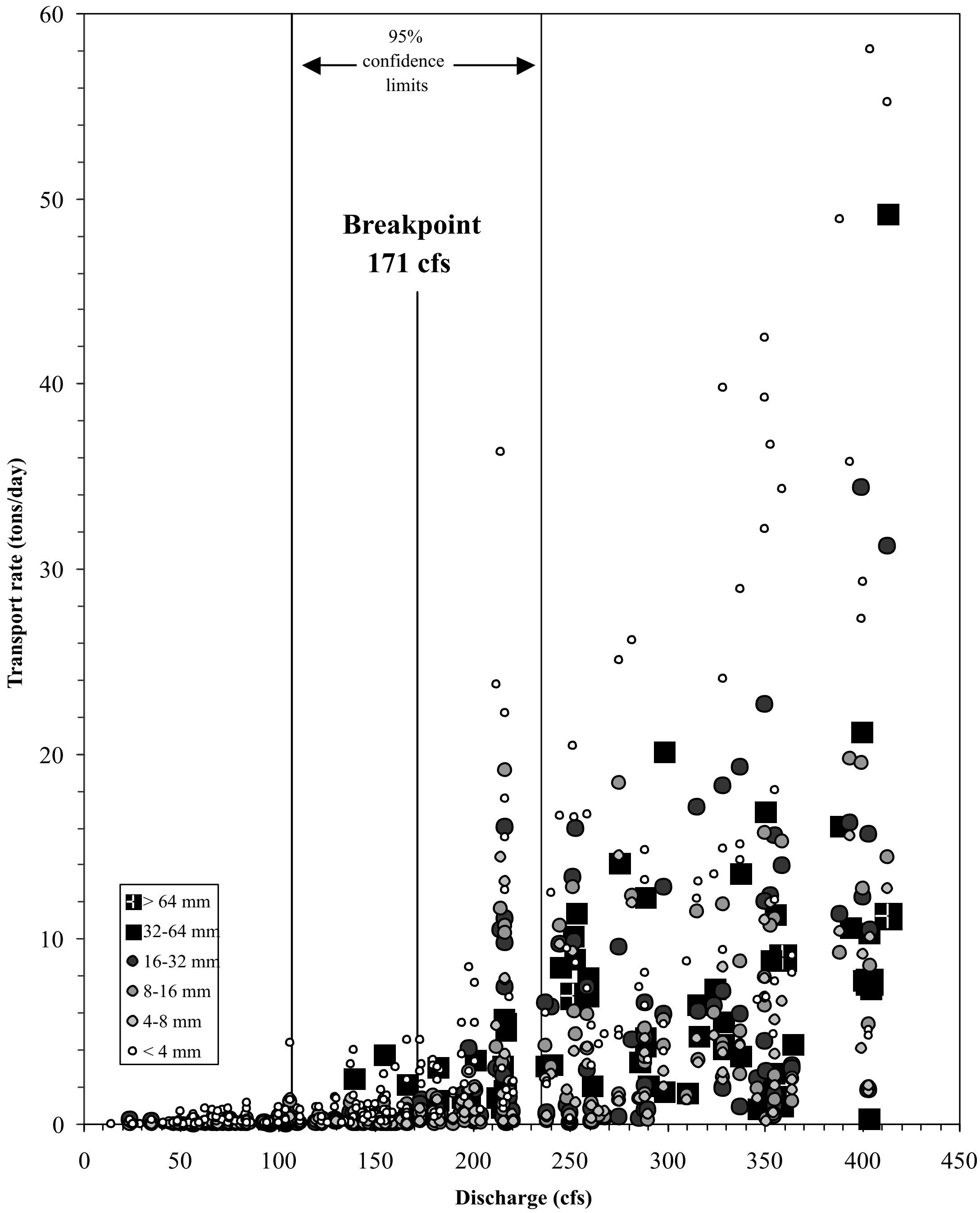

Figure 12—Fractional rates of transport measured over a wide range of discharges. Lines indicate values of the breakpoint discharge and the 95 percent confidence limits on the breakpoint estimate.

was in the 1–4 mm range. Samples from flows less than 30 cfs (estimated incipient motion) were typically too small to sieve, but were most likely 100 percent fine sand, perhaps entering the sampler as suspended load rather than bedload.

There was a general tendency for bedload samples from Little Granite Creek to become coarser with increasing discharge; the D_{50} of samples measured at flows greater than the breakpoint were in the 2–32 mm range. Coarse gravel (>32 mm) was rarely trapped at flows less than the breakpoint; only 2 percent of the samples collected at lower flows contained coarse material and these were from flows close to the breakpoint. This indicates that coarse gravel movement over this range of flows is essentially negligible. The source of sand and small gravel is likely from relatively mobile patches on the channel surface. By comparison, coarse gravel was common in samples collected at flows greater than the breakpoint where 60 percent of the samples contained particles larger than 32 mm and 90 percent of the samples contained gravel larger than 16 mm. Because particles in this range approach the limits of the Helley-Smith sampler (Emmett 1980), it is likely that they are underrepresented in the samples. Nonetheless, the *persistence* of coarse gravel in bedload samples provides good evidence that conditions suitable for transporting gravel and larger grains have been reached. This does not imply that the entire bed surface is in motion, but rather that representatives from a number of size classes are mobile at flows greater than the breakpoint. Particles 32 mm in diameter represent the 35th percentile of the bed measured in 1994, the 8th percentile as measured in 1997, and the 22nd percentile as measured in 2000.

Suspended Sediment

Streams draining unstable Tertiary and Cretaceous sedimentary formations in the area are typically muddy and turbid during high runoff, due to high concentrations of materials carried by the flows. Much more material is moved in suspension than as bedload at Little Granite Creek, though the differences are temporally variable. General trends in discharge for both suspended sediment load and bedload are shown in figure 13. The data are plotted on a log-log scale so that comparisons over the full range of flows are

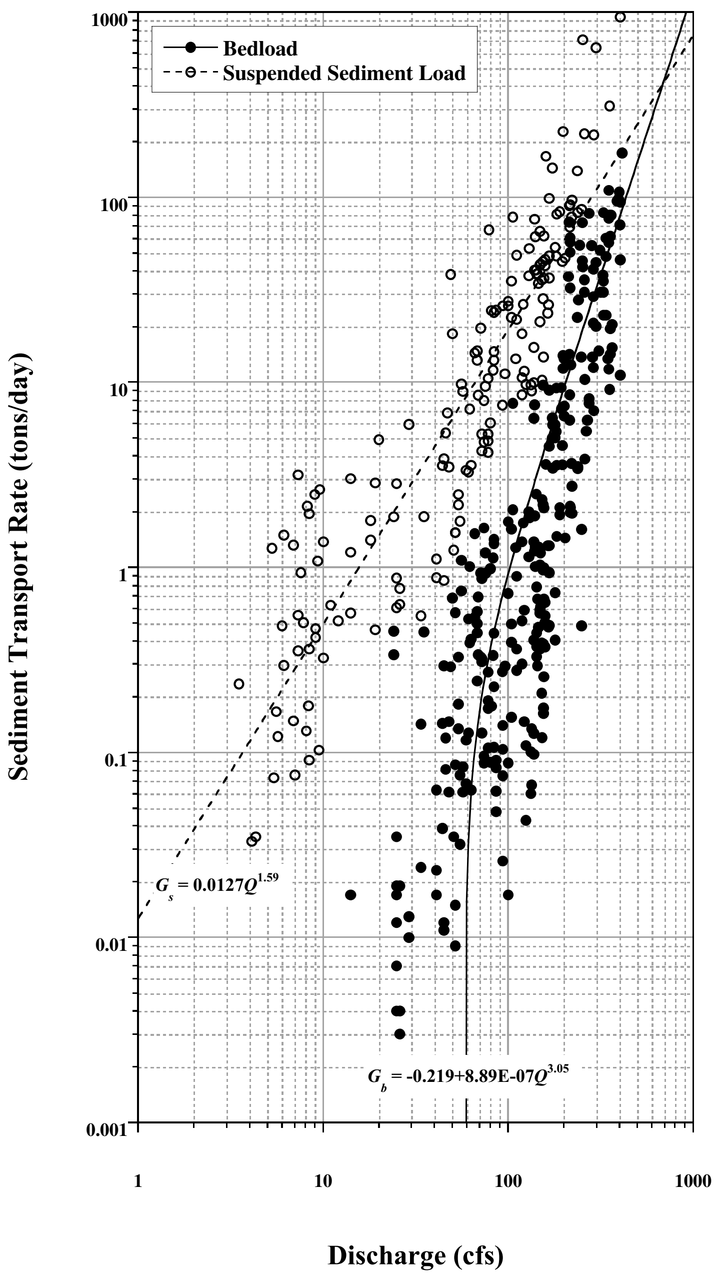

Figure 13—Comparison between suspended load and bedload measured at Little Granite Creek over the period 1982 through 1997.

readily discerned. The function fit to the bedload data is the same as presented previously (equation 2). The trendline for suspended sediment load (G_s) uses a power function with the form:

$$G_s = 0.0127Q^{1.59} \qquad [5]$$

For years that suspended sediment samples were collected (1982–1993), total suspended load was about 15 times greater than total bedload (see also: Leopold 1994:206). At low to moderate discharges, suspended loads are about 100 times greater than bedload. The rate of bedload transport increases more rapidly with discharge so that at flows approaching bankfull, the measured rates of bedload transport are within an order of magnitude of that carried in suspension. Similar conclusions were drawn in Leopold (1994) using the suspended and bedload data measured between 1982–1988; additional data collected since then (Emmett 1998) support these earlier results.

Summary

Little Granite Creek is a relatively steep, coarse-grained channel draining a 21.1 square mile area of the Gros Ventre range near Bondurant, Wyoming. Runoff is produced largely by the melting of snow so there is a strong seasonal component to the flow regime. Bankfull flows, estimated using a number of methods, have about a 1.5-year return frequency. At higher discharges, flow moves out onto a small, discontinuous, densely vegetated floodplain. Flows with return frequencies as high as 50 years are confined to the narrow valley bottom within 3–5 ft terraces.

Sediment transport was measured at flows ranging from 0.05 times to almost 2 times the bankfull discharge, making the database from Little Granite Creek one of the most comprehensive available. From a land management perspective, knowledge of the range of flows needed to move different sized particles in streams will help in determining discharges required to maintain the form and function of the channel and aquatic habitat. Rates of bedload transport in Little Granite Creek are quite low at flows up to 80 percent of bankfull and the bedload consists primarily of sand and small gravel. A significant increase in the rate of transport occurs and the bedload becomes substantially coarser as flow reaches bankfull and greater discharges. The persistence of coarse gravel in the bedload samples at these higher flows indicates that conditions suitable for the transport of larger grains have been reached. While coarse particles are moved during high flows occurring most years in Little Granite Creek, overall, much more sediment is moved in suspension than as bedload. At lower flows, the differences between bedload and suspended load are on the order of one to two orders of magnitude. Rates of bedload and suspended sediment transport tend to converge at higher discharges because of the increase in the rate at which material is moved as bedload.

All data collected by the authors on sediment, flow, and hydraulic geometry are presented in the tables in the appendices. The data are also available electronically by request from the first author.

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Appendix

Table 1—Sediment load data, Little Granite Creek, Wyoming, 1982–1993 and 1997.

Water year	Date	Water discharge	Temp.	Suspended load: Conc.	Suspended load: (G_S) Discharge	Suspended load: Percentage silt	Suspended load: Percentage sand	Bedload: Traverse	Bedload: (G_B) Discharge	Bedload: Percentage sand	Bedload: Percentage gravel	Bedload: D_{50}	Bedload: D_{84}	(G_T) Total load	Percent G_B/G_T
		cfs	*°C*	*mg/l*	*t/d*			*#*	*t/d*			- - - - *mm*	- - - -	*t/d*	
82	12/16/1981	5.7	0.0	8	0.123	—	—	—	—	—	—	—	—	—	—
82	01/11/1982	4.3	.0	3	.035	—	—	—	—	—	—	—	—	—	—
82	02/10/1982	7.3	.0	18	.355	—	—	—	—	—	—	—	—	—	—
82	03/18/1982	4.1	.5	3	.033	—	—	—	—	—	—	—	—	—	—
82	04/14/1982	7.8	3.5	24	.505	—	—	—	—	—	—	—	—	—	—
82	05/11/1982	78.	2.0	50	10.5	66	34	—	—	—	—	—	—	—	—
82	05/27/1982	354.	—	326	312.	60	40	1	9.18	44	56	3.24	36.5	321.	2.86
82	06/02/1982	204.	—	85	46.8	58	42	1	1.44	39	61	3.41	18.4	48.2	2.99
82	06/09/1982	165.	3.0	59	26.3	60	40	1	.477	76	24	1.05	2.51	26.8	1.78
82	06/18/1982	290.	—	278	218.	59	41	1	7.05	38	62	4.27	36.3	225.	3.13
82	06/24/1982	237.	—	217	139.	61	39	1	22.5	17	83	12.6	30.3	162.	13.93
82	06/29/1982	215.	—	156	90.6	53	47	1	14.2	14	86	13.3	34.4	105.	13.55
82	07/07/1982	96.	—	43	11.1	38	62	1	.293	49	51	2.07	7.76	11.4	2.57
82	07/13/1982	78.	7.5	20	4.21	—	—	1	.191	60	40	1.37	5.71	4.40	4.34
82	08/18/1982	19.	12.0	9	.462	47	53	—	—	—	—	—	—	—	—
82	09/14/1982	14.	6.5	15	.567	56	44	—	—	—	—	—	—	—	—
83	10/20/1982	9.3	.0	43	1.08	—	—	—	—	—	—	—	—	—	—
83	11/17/1982	10.	.0	12	.324	—	—	—	—	—	—	—	—	—	—
83	12/16/1982	8.1	.5	6	.131	—	—	—	—	—	—	—	—	—	—
83	01/18/1983	5.6	.0	11	.166	23	77	—	—	—	—	—	—	—	—
83	02/16/1983	6.1	.0	18	.296	60	40	—	—	—	—	—	—	—	—
83	03/17/1983	8.3	.0	8	.179	—	—	—	—	—	—	—	—	—	—
83	04/13/1983	9.1	2.5	19	.467	54	46	—	—	—	—	—	—	—	—
83	05/17/1983	35.	6.5	20	1.89	68	32	1	.450	48	52	2.65	19.2	2.34	19.23
83	05/25/1983	160.	7.5	386	167.	69	31	1	3.61	78	22	.60	3.78	171.	2.21
83	06/01/1983	259.	6.0	316	221.	61	39	1	30.9	14	86	7.40	17.2	252.	12.27
83	06/08/1983	220.	—	132	78.4	63	37	1	3.65	47	53	2.31	16.5	82.1	4.45
83	06/18/1983	163.	6.5	54	23.8	63	37	1	1.31	50	50	1.99	5.38	25.1	5.22
83	06/22/1983	119.	8.5	33	10.6	63	37	1	1.38	43	57	2.52	9.07	12.0	11.52
83	06/28/1983	119.	—	27	8.60	71	29	—	—	—	—	—	—	—	—
83	06/29/1983	93.	13.5	30	7.53	—	—	1	.273	32	68	9.12	18.6	7.80	3.50
83	07/06/1983	78.	10.0	23	4.84	—	—	1	.272	48	52	2.23	8.79	5.11	5.32
83	07/13/1983	54.	7.0	15	2.19	—	—	1	.135	58	42	1.57	4.20	2.33	5.81
83	08/24/1983	24.	6.5	29	1.88	—	—	—	—	—	—	—	—	—	—
84	10/12/1983	18.	2.5	37	1.80	—	—	—	—	—	—	—	—	—	—
84	11/14/1983	19.	1.0	56	2.87	—	—	—	—	—	—	—	—	—	—
84	12/15/1983	14.	.0	32	1.21	—	—	—	—	—	—	—	—	—	—
84	01/26/1984	11.	.0	21	.624	—	—	—	—	—	—	—	—	—	—
84	02/14/1984	9.1	.0	17	.418	—	—	—	—	—	—	—	—	—	—
84	03/14/1984	9.0	1.0	102	2.48	86	14	—	—	—	—	—	—	—	—
84	04/18/1984	49.	2.0	290	38.4	93	7	1	.290	72	28	.86	2.95	38.7	.75

(con.)

Table 1 (Con.)

				Suspended load				Bedload						(GT)	
Water year	Date	Water discharge	Temp.	Conc.	(G_S) Discharge	Percentage silt	Percentage sand	Traverse	(G_B) Discharge	Percentage sand	Percentage gravel	D_{50}	D_{84}	Total load	Percent G_B/G_T
		cfs	*°C*	*mg/l*	*t/d*		*sand*	*#*	*t/d*			- - - - *mm* - - - -		*t/d*	
84	05/10/1984	50.	—	136	18.4	84	16	1	.685	79	21	1.13	2.22	19.1	3.59
84	05/17/1984	198.	6.0	422	226.	71	29	1	11.9	17	83	13.3	26.3	238.	5.00
84	05/22/1984	166.	—	220	98.6	75	25	1	9.11	38	62	3.93	34.9	108.	8.46
84	05/30/1984	253.	—	1040	710.	72	28	1	42.1	18	82	21.0	35.8	752.	5.60
84	06/07/1984	142.	—	106	40.6	—	—	1	2.49	29	71	5.60	16.5	43.1	5.78
84	06/13/1984	111.	6.0	73	21.9	—	—	1	.278	48	52	2.16	7.46	22.2	1.25
84	06/21/1984	121.	—	81	26.5	—	—	1	1.74	37	63	3.35	8.87	28.2	6.16
84	06/28/1984	110.	—	45	13.4	—	—	1	1.28	40	60	2.67	8.01	14.7	8.72
84	07/06/1984	74.	—	24	4.80	—	—	1	.088	47	53	2.15	5.89	4.89	1.80
84	07/11/1984	51.	—	9	1.24	—	—	1	.035	43	57	3.66	8.37	1.28	2.75
84	07/18/1984	41.	7.0	8	.886	56	44	1	.017	76	23	.87	2.38	.903	1.88
84	08/15/1984	18.	8.5	29	1.41	79	21	—	—	—	—	—	—	—	—
84	09/11/1984	12.	6.0	16	.518	—	—	—	—	—	—	—	—	—	—
85	10/24/1984	9.6	—	102	2.64	53	47	—	—	—	—	—	—	—	—
85	11/14/1984	8.2	—	97	2.15	77	23	—	—	—	—	—	—	—	—
85	12/12/1984	6.9	—	71	1.32	86	14	—	—	—	—	—	—	—	—
85	01/08/1985	7.6	—	46	.944	71	29	—	—	—	—	—	—	—	—
85	02/13/1985	6.0	—	30	.486	68	32	—	—	—	—	—	—	—	—
85	03/19/1985	7.3	—	161	3.17	94	6	—	—	—	—	—	—	—	—
85	04/17/1985	79.	—	314	67.0	80	20	—	—	—	—	—	—	—	
85	05/08/1985	139.	—	203	76.2	67	33	1	1.91	72	28	.76	5.32	78.1	2.45
85								2	7.57	38	62	3.52	37.0	83.8	9.04
85	05/15/1985	104.	—	125	35.1	74	26	1	.156	69	31	.92	8.19	35.3	.44
85								2	1.62	27	73	4.51	9.21	36.7	4.41
85	05/25/1985	129.	3.0	108	37.6	65	35	1	1.14	72	28	1.05	4.17	38.7	2.94
85								2	2.00	57	43	1.56	10.5	39.6	5.05
85	05/30/1985	100.	3.0	96	25.9	64	36	1	.726	57	43	1.65	6.60	26.6	2.73
85								2	1.77	31	69	3.96	9.01	27.7	6.40
85	06/05/1985	68.	7.0	72	13.2	62	38	1	.243	45	55	2.27	6.24	13.4	1.81
85								2	.443	43	57	2.31	4.83	13.6	3.25
85	06/13/1985	56.	—	65	9.83	75	25	1	1.09	27	73	3.89	8.73	10.9	9.98
85								2	.749	31	69	3.54	7.86	10.6	7.08
85	06/19/1985	44.	7.0	30	3.56	86	14	1	.144	62	38	1.55	3.04	3.70	3.89
85								2	.039	67	33	1.20	3.26	3.60	1.08
85	06/27/1985	29.	9.0	76	5.95	95	5	1	.010	73	27	.89	2.23	5.96	.17
85								2	.013	78	22	.84	2.15	5.96	.22
85	07/02/1985	25.	15.0	42	2.84	76	24	1	.017	58	42	1.52	2.43	2.86	.60
85								2	.019	100	0	.38	.61	2.86	.66
85	07/11/1985	24.	—	—	—	—	—	1	.454	31	69	5.93	19.6	—	—
85								2	.338	44	56	2.33	5.60	—	—
85	07/17/1985	14.	9.5	80	3.02	93	7	1	.017	76	24	1.05	2.18	3.04	.56
85	08/21/1985	10.	—	51	1.38	84	16	—	—	—	—	—	—	—	—
85	09/16/1985	7.3	—	28	.552	75	25	—	—	—	—	—	—	—	—

(con.)

Table 1 (Con.)

Water year	Date	Water discharge	Temp.	Suspended load Conc.	(G_S) Discharge	Percentage silt	Percentage sand	Bedload Traverse	(G_B) Discharge	Percentage sand	Percentage gravel	D_{50}	D_{84}	(G_T) Total load	Percent G_B/G_T
		cfs	*°C*	*mg/l*	*t/d*			*#*	*t/d*			---- *mm* ----		*t/d*	
86	10/09/1985	6.1	5.0	91	1.50	71	29	—	—	—	—	—	—	—	—
86	05/08/1986	81.	—	112	24.5	74	26	1	.178	60	40	.88	5.74	24.7	.72
86	05/14/1986	71.	1.5	103	19.7	70	30	1	.328	36	64	2.98	7.18	20.0	1.64
86								2	.934	52	48	1.90	4.52	20.6	4.53
86	05/20/1986	130.	—	151	53.0	67	33	1	1.85	65	35	.88	8.22	54.9	3.37
86	05/28/1986	298.	—	801	644.	54	46	1	20.2	13	87	12.0	25.4	664.	3.04
86								2	44.6	8	92	28.7	39.4	688.	6.48
86	06/03/1986	403.	—	870	947.	53	47	1	46.0	8	92	25.9	64.7	993.	4.63
86								2	11.0	27	73	5.05	17.6	958.	1.15
86	06/12/1986	250.	—	128	86.4	67	33	1	.485	39	61	4.23	16.2	86.9	.56
86								2	1.61	16	84	11.7	19.0	88.0	1.83
86	06/18/1986	180.	—	111	53.9	76	24	1	.735	67	33	1.08	5.43	54.6	1.35
86								2	.407	77	23	.83	3.09	54.3	.75
86	06/26/1986	104.	—	80	22.5	84	16	1	.396	43	57	2.34	5.23	22.9	1.73
86								2	.494	26	74	3.92	8.72	23.0	2.15
86	07/02/1986	83.	—	52	11.7	78	22	1	1.13	25	75	4.10	10.8	12.8	8.81
86								2	.336	55	45	1.72	8.26	12.0	2.79
86	07/10/1986	57.	—	58	8.93	70	30	1	.084	58	42	1.59	7.46	9.01	.93
86								2	.061	41	59	3.05	8.85	8.99	.68
86	07/16/1986	46.	—	43	5.34	70	30	1	.081	31	69	2.99	6.03	5.42	1.49
86								2	.12	36	64	2.63	4.55	5.46	2.20
87	11/20/1986	8.4	.0	86	1.95	60	40	—	—	—	—	—	—	—	—
87	03/19/1987	8.4	.0	16	.363	58	42	—	—	—	—	—	—	—	—
87	05/07/1987	84.	7.0	65	14.7	81	19	1	1.35	47	53	2.26	8.54	16.1	8.41
87	05/13/1987	62.	8.0	43	7.20	84	16	1	1.01	64	36	1.43	3.80	8.21	12.30
87								2	.391	49	51	2.09	8.66	7.59	5.15
87	05/22/1987	66.	5.0	81	14.4	84	16	1	1.53	26	74	4.13	9.36	15.9	9.60
87								2	.541	47	53	2.20	7.07	14.9	3.62
87	05/28/1987	106.	5.0	274	78.4	92	8	1	7.76	38	62	3.17	13.9	86.2	9.01
87								2	2.05	47	53	2.26	8.07	80.5	2.55
87	06/03/1987	74.	7.0	40	7.99	87	13	1	1.63	29	71	3.88	9.34	9.62	16.94
87								2	.096	69	31	1.38	3.28	8.09	1.19
87	07/15/1987	20.	8.0	91	4.91	52	48	1	—	—	—	—	—	—	—
87	09/17/1987	8.4	11.0	4	.091	33	67	1	—	—	—	—	—	—	—
88	11/24/1987	5.3	.0	89	1.27	71	29	1	—	—	—	—	—	—	—
88	03/17/1988	5.4	.0	5	.073	68	32	1	—	—	—	—	—	—	—
88	05/04/1988	47.	4.5	54	6.85	80	20	—	—	—	—	—	—	—	—
88	05/12/1988	68.	5.0	81	14.9	73	27	1	.581	65	35	1.18	4.63	155.	3.75
88								2	.496	72	28	1.02	3.70	15.4	3.22
88	05/18/1988	156.	6.0	147	61.9	66	34	1	.998	71	29	.82	5.18	62.9	1.59
88								2	2.09	55	45	1.65	6.57	64.0	3.27

(con.)

Table 1 (Con.)

Water year	Date	Water discharge	Temp.	Suspended load Conc.	(G_S) Discharge	Percentage silt	Percentage sand	Bedload Traverse	(G_B) Discharge	Percentage sand	Percentage gravel	D_{50}	D_{84}	(G_T) Total load	Percent G_B/G_T
		cfs	*°C*	*mg/l*	*t/d*			#	*t/d*			- - - - *mm* - - - -		*t/d*	
88	05/27/1988	149.	10.0	53	21.3	70	30	1	1.03	37	63	4.18	18.1	22.3	4.61
88								2	1.02	78	22	.68	3.22	22.3	4.57
88	06/03/1988	75.	6.0	47	9.52	70	30	1	.93	22	78	9.07	17.4	10.5	8.90
88								2	1.20	16	84	5.98	12.7	10.7	11.19
88	06/10/1988	59.	6.0	21	3.35	75	25	1	.068	54	46	1.85	4.44	3.42	1.99
88								2	.117	54	46	1.74	4.37	3.47	3.37
88	06/15/1988	48.	11.0	27	3.50	64	36	1	.061	85	15	.68	1.92	3.56	1.71
88								2	.147	56	44	1.78	4.11	3.65	4.03
88	06/22/1988	41.	—	10	1.11	67	33	1	.023	59	41	1.64	2.42	1.13	2.03
88								2	.063	66	34	1.32	2.33	1.17	5.37
88	09/15/1988	7.0	6.0	4	.076	76	24	—	—	—	—	—	—	—	—
89	11/11/1988	3.5	.0	25	.236	69	31	1	—	—	—	—	—	—	—
89	05/05/1989	84.	3.0	58	13.2	80	20	1	.441	51	49	1.94	4.54	13.6	3.23
89								2	1.42	51	49	1.95	4.32	14.6	9.71
89	05/09/1989	173.	4.5	309	144.	63	37	1	5.03	51	49	1.91	32.1	149.	3.38
89								2	6.45	55	45	1.67	7.91	150.	4.29
89	05/18/1989	154.	6.5	68	28.3	72	28	1	9.67	13	87	12.1	38.3	38.0	25.50
89								2	2.19	43	57	2.64	8.40	30.5	7.18
89	05/25/1989	137.	3.0	42	15.5	71	29	1	6.42	27	73	3.99	12.2	21.9	29.30
89								2	1.37	100	0	—	—	16.9	8.12
89	06/02/1989	119.	—	57	18.3	88	12	1	.303	100	0	—	—	18.6	1.63
89								2	.518	100	0	—	—	18.8	2.75
89	06/07/1989	166.	8.0	82	36.8	78	22	1	4.51	36	64	3.47	13.1	41.3	10.90
89								2	1.31	56	44	1.55	17.2	38.1	3.44
89	06/15/1989	122.	5.5	35	11.5	75	25	1	.147	90	10	0.76	1.67	11.6	1.26
89								2	.587	54	46	1.72	18.6	12.1	4.86
89	06/21/1989	78.	6.5	25	5.27	74	26	1	.174	100	0	—	—	5.44	3.20
89								2	.106	100	0	—	—	5.38	1.97
89	06/29/1989	52.	11.0	11	1.54	60	40	1	.015	100	0	—	—	1.56	.96
89								2	.009	100	0	—	—	1.55	.58
89	07/05/1989	45.	11.0	7	.851	69	31	1	.012	100	0	—	—	0.863	1.39
89								2	.011	100	0	—	—	0.862	1.28
89	09/13/1989	9.5	9.0	4	.103	74	26	—	—	—	—	—	—	—	—
90	04/27/1990	54.	2.5	17	2.48	78	22	1	.184	100	0	—	—	2.66	6.91
90								2	.328	100	0	—	—	2.81	11.68
90	05/03/1990	45.	4.5	32	3.89	91	9	1	.295	100	0	—	—	4.19	7.05
90	05/10/1990	69.	7.5	46	8.57	77	23	1	.339	100	0	—	—	8.91	3.81
90								2	.696	77	23	1.17	2.40	9.27	7.51
90	05/18/1990	55.	5.0	12	1.78	63	37	1	.032	100	0	—	—	1.81	1.77
90								2	.076	100	0	—	—	1.86	4.09
90	05/25/1990	72.	8.0	22	4.28	73	27	1	.322	100	0	—	—	4.60	7.00
90								2	.128	100	0	—	—	4.41	2.90

(con.)

Table 1 (Con.)

Water year	Date	Water discharge	Temp.	Suspended load: Conc.	Suspended load: (G_S) Discharge	Suspended load: Percentage silt	Suspended load: Percentage sand	Bedload: Traverse	Bedload: (G_B) Discharge	Bedload: Percentage sand	Bedload: Percentage gravel	Bedload: D_{50}	Bedload: D_{84}	(G_T) Total load	Percent G_B/G_T
		cfs	*°C*	*mg/l*	*t/d*			*#*	*t/d*			- - - - *mm* - - - -		*t/d*	
90	05/31/1990	80.	7.5	28	6.05	69	31	1	.089	100	0	—	—	6.14	1.45
90								2	.985	100	0	—	—	7.04	14.00
90	06/05/1990	72.	6.0	27	5.25	71	29	1	.310	100	0	—	—	5.56	5.58
90								2	.877	100	0	—	—	6.13	14.31
90	06/14/1990	63.	10.0	21	3.57	68	32	1	.411	100	0	—	—	3.98	10.32
90								2	.063	100	0	—	—	3.63	1.73
90	06/20/1990	61.	12.0	20	3.29	66	34	1	.128	100	0	—	—	3.42	3.74
90								2	.527	100	0	—	—	3.82	13.82
90	06/28/1990	52.	15.5	11	1.54	61	39	1	.572	100	0	—	—	2.11	27.08
90								2	.086	100	0	—	—	1.63	5.29
90	07/05/1990	34.	9.0	6	.551	55	45	1	.024	100	0	—	—	0.575	4.17
90								2	.143	100	0	—	—	0.694	20.61
90	09/18/1990	6.9	21.0	8	.149	49	51	—	—	—	—	—	—	—	—
91	05/29/1991	100.	3.0	102	27.5	83	17	1	.017	78	22	.74	2.45	27.5	.06
91								2	.088	66	34	1.03	3.62	27.6	.32
91	05/21/1991	94.	5.0		25.9			1	.075	43	57	3.37	9.18	26.0	.29
91								2	.026	93	7	.53	1.43	25.9	.10
91	05/21/1991	94.	6.5		25.9			1	.140	95	5	.51	1.22	26.0	.54
91								2	.104	97	3	.46	1.06	26.0	.40
91	06/01/1991	86.	6.0	106	24.6	80	20	1	.062	91	9	.63	1.52	24.7	.25
91								2	.083	71	29	.79	4.10	24.7	.34
91	06/01/1991	86.	9.0		24.6			1	.048	91	9	.54	1.48	24.6	.19
91								2	.091	80	20	.85	2.82	24.7	.37
91	06/01/1991	84.	10.0		24.0			1	.227	95	5	.55	1.31	24.2	.94
91								2	.107	82	18	.79	3.24	24.1	.44
91	06/03/1991	111.	6.0	163	48.9	78	22	1	.363	92	8	.57	1.41	49.3	.74
91								2	.895	72	28	1.12	3.49	49.8	1.80
91	06/03/1991	149.	8.0		65.6			1	.569	90	10	.58	1.55	66.2	.86
91								2	.668	84	16	.67	2.00	66.3	1.01
91	06/03/1991	140.	9.0		61.6			1	1.29	77	23	.71	4.85	62.9	2.05
91								2	1.01	77	23	.76	3.63	62.6	1.61
91	06/04/1991	183.	6.0	164	81.0	70	30	1	3.57	66	34	1.33	4.34	84.6	4.22
91								2	1.47	40	60	5.06	19.2	82.5	1.78
91	06/04/1991	190.	9.0		84.1			1	1.93	69	31	1.21	4.00	86.0	2.24
91								2	2.11	69	31	1.09	4.01	86.2	2.45
91	06/11/1991	143.	6.0	100	38.6	71	29	1	.444	84	16	.83	2.00	39.0	1.14
91								2	.375	75	25	.95	3.71	39.0	.96
91	06/11/1991	143.	10.0		38.6			1	.787	61	39	1.58	5.66	39.4	2.00
91								2	.330	84	16	.91	2.04	38.9	.85
91	06/11/1991	144.	11.5		38.9			1	.674	60	40	1.36	8.13	39.6	1.70
91								2	.295	80	20	.90	2.6	39.2	.75
91	06/11/1991	158.	12.0		42.7			1	.374	68	32	1.06	17.3	43.1	.87
91								2	.504	93	7	.64	1.43	43.2	1.17

(con.)

Table 1 (Con.)

Water year	Date	Water discharge	Temp.	Suspended load Conc.	(G$_S$) Discharge	Percentage silt	Percentage sand	Bedload Traverse	(G$_B$) Discharge	Percentage sand	Percentage gravel	D$_{50}$	D$_{84}$	(G$_T$) Total load	Percent G$_B$/G$_T$
		cfs	*°C*	*mg/l*	*t/d*			*#*	*t/d*			- - - - *mm*	- - - -	*t/d*	
91	06/12/1991	150.	6.0	108	43.7	79	21	1	1.20	69	31	1.34	3.16	44.9	2.67
91								2	.617	69	31	1.28	4.11	44.3	1.39
91	06/12/1991	139.	8.5		40.5			1	1.23	28	72	12.1	19.7	41.7	2.95
91								2	.406	78	22	1.06	2.64	40.9	.99
91	06/12/1991	148.	11.0		43.2			1	.363	88	12	.77	1.76	43.6	.83
91								2	.589	73	27	1.13	3.14	43.8	1.35
91	06/12/1991	154.	12.0		44.9			1	.974	61	39	1.46	5.16	45.9	2.12
91								2	.389	87	13	.79	1.82	45.3	.86
91	06/12/1991	159.	12.5		46.4			1	.550	85	15	.80	1.93	47.0	1.17
91								2	.653	95	5	.67	1.38	47.1	1.39
91	06/12/1991	166.	11.5		48.4			1	.942	60	40	1.41	10.6	49.3	1.91
91								2	.487	89	11	.69	1.67	48.9	1.00
91	06/13/1991	156.	7.0	87	36.6	74	26	1	.257	83	17	.74	2.14	36.9	1.43
91								2	.676	75	25	1.04	3.24	37.3	1.81
91	06/13/1991	152.	9.0		35.7			1	.392	88	12	.77	1.72	36.1	1.09
91								2	.209	94	6	.60	1.37	35.9	.58
91	06/13/1991	146.	10.5		34.3			1	.475	84	16	.88	2.06	34.8	1.37
91								2	1.29	64	36	1.46	4.45	34.8	3.71
92	06/05/1992	26.	12.0	9	.632	70	30	1	.004	97	3	.68	1.28	.636	.63
92								2	.003	96	4	.41	.95	.635	.47
92	06/06/1992	26.	8.0	11	.772	74	26	1	.004	95	5	.65	1.31	.776	.53
92								2	.019	76	24	1.01	2.18	.791	2.40
92	06/07/1992	25.	10.0	13	.878	84	16	1	.035	87	13	.80	1.80	.913	3.83
92								2	.012	96	4	.68	1.33	.890	1.35
92	06/08/1992	25.	9.0	9	.608	71	29	1	.007	90	10	.53	1.51	.615	1.15
92								2	.004	100	0	.38	.97	.612	.65
93	05/26/1993	196.	8.0	85	45.0	75	25	1	3.59	32	68	7.71	19.7	48.6	7.39
93								2	4.57	36	64	4.69	17.6	49.6	9.21
93	05/26/1993	182.	8.0	98	48.2	74	26	1	9.33	21	79	8.96	37.2	57.5	16.23
93								2	5.42	32	68	6.20	35.0	53.6	10.11
93	05/27/1993	217.	5.0	156	91.4	75	25	1	2.15	82	18	.79	2.34	93.5	2.30
93								2	1.98	84	16	.75	1.98	93.4	2.12
93	05/27/1993	221.	7.0	162	96.7	67	33	1	2.76	69	31	1.25	4.19	99.5	2.77
93								2	1.96	74	26	.98	3.56	98.7	1.99
93	05/28/1993	216.	6.0	118	68.8	70	30	1	6.24	13	87	24.6	36.5	75.0	8.32
93								2	8.60	12	88	34.9	42.5	77.4	11.11
93	05/28/1993	238.	8.0	129	82.9	73	27	1	3.44	57	43	1.62	15.6	86.3	3.99
93								2	3.52	49	51	2.07	16.3	86.4	4.07
93	06/06/1993	155.	6.0	33	13.8	76	24	1	.175	63	37	1.44	2.37	14.0	1.25
93								2	.163	81	19	.82	2.17	14.0	1.16
93	06/07/1993	153.	5.0	25	10.3	78	22	1	.121	80	20	.52	2.10	10.4	1.16
93								2	2.33	52	48	1.93	4.26	12.6	18.49

(con.)

Table 1 (Con.)

Water year	Date	Water discharge	Temp.	Suspended load: Conc.	Suspended load: (G_S) Discharge	Suspended load: Percentage silt	Suspended load: Percentage sand	Bedload: Traverse	Bedload: (G_B) Discharge	Bedload: Percentage sand	Bedload: Percentage gravel	Bedload: D_{50}	Bedload: D_{84}	(G_T) Total load	Percent G_B/G_T
		cfs	*°C*	*mg/l*	*t/d*			*#*	*t/d*			- - - - *mm* - - - -		*t/d*	
93	06/08/1993	137.	6.0	27	9.99	72	28	1	.127	89	11	.85	1.70	10.1	1.26
93								2	.098	86	14	.68	1.88	10.1	.97
93	06/08/1993	134.	6.0	25	9.05	78	22	1	.067	91	9	.82	1.62	9.12	.73
93								2	.135	84	16	.90	2.00	9.18	1.47
93	06/09/1993	133.	7.0	27	9.70	79	21	1	.060	90	10	.59	1.61	9.76	.61
93								2	.101	80	20	1.17	2.30	9.80	1.03
93	06/09/1993	125.	6.0	29	9.79	81	19	1	.043	100	0	.52	.91	9.83	.44
93								2	.109	75	25	1.21	2.20	9.90	1.10
97	05/20/1997	275.	—	—	—	—	—	1	81.7	18	82	8.54	33.1	—	—
97		282.						2	55.0	27	73	4.45	13.3	—	—
97	05/21/1997	289.	—	—	—	—	—	1	29.0	34	66	3.74	28.7	—	—
97		289.						2	21.0	24	76	13.7	35.2	—	—
97	05/21/1997	337.	—	—	—	—	—	1	60.1	17	83	18.3	36.9	—	—
97		355.						2	61.7	20	80	13.2	33.7	—	—
97	05/22/1997	315.	—	—	—	—	—	1	51.9	16	84	14.4	30.3	—	—
97		289.						2	41.1	21	79	13.3	41.8	—	—
97	05/22/1997	324.	—	—	—	—	—	1	37.9	23	77	8.90	38.5	—	—
97		328.						2	30.7	33	67	4.50	34.9	—	—
97	05/28/1997	218.	—	—	—	—	—	1	2.11	60	40	1.24	12.6	—	—
97		219.						2	12.5	34	66	3.53	13.7	—	—
97	05/29/1997	240.	—	—	—	—	—	1	27.8	31	69	6.15	29.0	—	—
97		245.						2	55.3	17	83	8.94	31.4	—	—
97	05/29/1997	248.	—	—	—	—	—	1	13.7	51	49	1.96	8.99	—	—
97		252.						2	73.0	16	84	12.2	49.1	—	—
97	05/30/1997	268.	—	—	—	—	—	1	6.25	58	42	1.65	6.53	—	—
97		261.						2	3.85	67	33	1.16	4.94	—	—
97	05/30/1997	261.	—	—	—	—	—	1	10.4	38	62	3.83	33.2	—	—
97		265.						2	5.44	60	40	1.56	5.55	—	—
97	05/30/1997	310.	—	—	—	—	—	1	14.8	47	53	2.52	24.6	—	—
97		316.						2	30.7	30	70	6.77	31.7	—	—
97	05/31/1997	275.	—	—	—	—	—	1	8.19	40	60	2.87	9.78	—	—
97		275.						2	7.75	46	54	2.50	10.8	—	—
97	05/31/1997	285.	—	—	—	—	—	1	13.8	39	61	3.52	36.5	—	—
97		289.						2	12.0	44	56	2.49	10.3	—	—
97	05/31/1997	328.	—	—	—	—	—	1	23.0	32	68	7.49	27.6	—	—
97		337.						2	23.1	46	54	2.45	7.94	—	—
97	06/01/1997	364.	—	—	—	—	—	1	15.4	45	55	2.71	22.8	—	—
97		364.						2	20.5	29	71	7.36	34.4	—	—
97	06/01/1997	355.	—	—	—	—	—	1	14.2	40	60	3.42	24.5	—	—
97		355.						2	19.5	42	58	2.82	9.45	—	—
97	06/01/1997	346.	—	—	—	—	—	1	13.4	41	59	3.95	23.7	—	—
97		350.						2	11.8	55	45	1.52	30.8	—	—

(con.)

Table 1 (Con.)

				Suspended load				Bedload						(G_T)	
Water year	Date	Water discharge	Temp.	Conc.	(G_S) Discharge	Percentage silt	Percentage sand	Traverse	(G_B) Discharge	Percentage sand	Percentage gravel	D_{50}	D_{84}	Total load	Percent G_B/G_T
		cfs	*°C*	*mg/l*	*t/d*			#	*t/d*			- - - - *mm*	- - - -	*t/d*	
97	06/04/1997	394.	—	—	—	—	—	1	98.1	26	74	7.40	27.1	—	—
97		400.						2	71.2	31	69	6.75	27.3	—	—
97	06/05/1997	353.	—	—	—	—	—	1	80.6	31	69	5.20	26.8	—	—
97		350.						2	76.8	30	70	7.19	39.6	—	—
97	06/05/1997	350.	—	—	—	—	—	1	109.	29	71	8.45	31.6	—	—
97		358.						2	80.2	35	65	7.47	28.7	—	—
97	06/05/1997	389.	—	—	—	—	—	1	96.1	39	61	3.84	32.8	—	—
97		399.						2	107.	22	78	17.1	38.3	—	—
97	06/05/1997	413.	—	—	—	—	—	1	174.	24	76	18.4	53.2	—	—
97		404.						2	94.6	47	53	2.44	20.1	—	—
97	06/06/1997	350.	—	—	—	—	—	1	56.9	53	47	1.85	10.2	—	—
97		337.						2	47.8	50	50	2.06	21.4	—	—
97	06/06/1997	328.	—	—	—	—	—	1	35.3	57	43	1.49	19.0	—	—
97		328.						2	82.7	37	63	4.73	24.2	—	—
97	06/10/1997	252.	—	—	—	—	—	1	45.5	27	73	10.9	34.3	—	—
97		259.						2	35.9	35	65	5.18	37.3	—	—
97	06/11/1997	217.	—	—	—	—	—	1	60.5	17	83	8.68	20.4	—	—
97		217.						2	32.4	28	72	7.75	31.8	—	—
97	06/11/1997	217.	—	—	—	—	—	1	50.5	31	69	5.56	19.0	—	—
97		217.						2	57.3	19	81	10.5	28.3	—	—
97	06/11/1997	212.	—	—	—	—	—	1	37.3	43	57	2.73	13.0	—	—
97		214.						2	73.8	27	73	4.15	15.7	—	—
97	06/12/1997	201.	—	—	—	—	—	1	6.56	65	35	1.43	4.28	—	—
97		198.						2	14.0	42	58	2.84	14.0	—	—
97	06/12/1997	194.	—	—	—	—	—	1	9.36	43	57	2.90	15.6	—	—
97		194.						2	7.24	39	61	3.72	32.9	—	—
97	06/12/1997	201.	—	—	—	—	—	1	7.45	40	60	13.7	39.9	—	—
97		201.						2	13.4	39	61	3.19	14.7	—	—
97	06/13/1997	180.	—	—	—	—	—	1	5.05	51	49	1.96	11.2	—	—
97		180.						2	5.90	40	60	3.55	13.7	—	—
97	06/13/1997	174.	—	—	—	—	—	1	3.45	50	50	2.05	18.0	—	—
97		174.						2	5.91	41	59	3.33	18.0	—	—

Table 2—Bedload particle-size distribution, percent retained on sieve size, Little Granite Creek, Wyoming, 1982–1993 and 1997.

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Percent retained on sieve size (mm) Pan	0.25	0.5	1	2	4	8	16	32	64
	cfs		*t/d*										
05/27/1982	354	1	9.18	2.0	15.1	14.4	12.1	9.2	6.6	5.5	5.0	30.1	0.0
06/02/1982	204	1	1.44	1.5	9.7	12.0	15.6	14.6	12.1	3.3	31.2	.0	.0
06/09/1982	165	1	.477	2.7	20.3	24.7	28.5	18.2	5.6	.0	.0	.0	.0
06/18/1982	290	1	7.05	2.0	11.4	12.0	12.9	11.0	7.3	3.1	10.8	29.5	.0
06/24/1982	237	1	22.5	.7	4.0	4.7	7.5	9.8	11.1	18.8	29.2	14.2	.0
06/29/1982	215	1	14.2	.4	3.4	4.5	5.8	7.2	11.6	23.5	21.4	22.2	.0
07/07/1982	96	1	.293	2.5	15.2	15.9	15.6	15.9	19.7	11.6	3.6	.0	.0
07/13/1982	78	1	.191	6.3	17.4	18.2	17.8	14.0	17.4	8.9	.0	.0	.0
05/17/1983	35	1	.450	4.3	10.8	18.1	14.4	5.9	5.5	1.8	39.2	.0	.0
05/25/1983	160	1	3.61	10.2	34.0	21.8	12.3	6.3	6.2	6.6	2.6	.0	.0
06/01/1983	259	1	30.9	.4	2.3	3.9	7.8	9.4	10.6	19.2	24.0	22.4	.0
06/08/1983	220	1	3.65	1.4	15.3	15.4	14.9	14.4	13.8	6.6	18.2	.0	.0
06/18/1983	163	1	1.31	5.4	15.4	13.1	16.2	23.9	19.0	7.0	.0	.0	.0
06/22/1983	119	1	1.38	2.7	9.5	12.0	18.4	21.8	16.7	12.7	6.2	.0	.0
06/29/1983	93	1	.273	5.4	10.9	7.5	7.8	8.0	6.3	21.1	33.0	.0	.0
07/06/1983	78	1	.272	4.5	13.9	13.9	15.2	15.9	11.7	24.9	.0	.0	.0
07/13/1983	54	1	.135	5.0	13.4	17.4	21.9	22.4	19.9	.0	.0	.0	.0
04/18/1984	49	1	.290	11.7	24.7	17.3	18.5	18.5	6.6	2.7	.0	.0	.0
05/10/1984	50	1	.685	7.7	12.7	22.5	36.2	19.0	1.9	.0	.0	.0	.0
05/17/1984	198	1	11.9	1.5	4.8	5.2	5.7	6.5	9.1	23.7	34.3	9.2	.0
05/22/1984	166	1	9.11	4.0	12.7	10.3	11.0	12.3	9.5	11.5	4.6	24.1	.0
05/30/1984	253	1	42.1	2.5	6.3	5.0	4.1	2.8	2.7	11.5	37.9	27.2	.0
06/07/1984	142	1	2.49	3.2	8.2	8.1	9.3	12.7	17.5	22.6	18.4	.0	.0
06/13/1984	111	1	.278	4.3	13.4	14.6	15.5	19.1	18.7	14.4	.0	.0	.0
06/21/1984	121	1	1.74	4.5	10.3	9.7	12.6	17.4	19.4	26.1	.0	.0	.0
06/28/1984	110	1	1.28	3.6	7.1	10.5	18.4	24.7	19.8	11.6	4.3	.0	.0
07/06/1984	74	1	.088	4.6	9.0	13.5	20.3	24.1	19.5	9.0	.0	.0	.0
07/11/1984	51	1	.035	5.9	11.8	13.7	11.8	7.8	29.4	19.6	.0	.0	.0
07/18/1984	41	1	.017	15.5	19.2	19.2	23.1	19.2	3.8	.0	.0	.0	.0
05/08/1985	139	1	1.91	11.5	27.7	18.0	15.0	8.6	7.4	5.1	6.7	.0	.0
		2	7.57	3.6	10.2	9.9	14.1	15.0	9.0	4.5	1.2	32.5	.0
05/15/1985	104	1	.156	12.1	22.4	17.8	16.8	7.5	7.5	.9	15.0	.0	.0
		2	1.62	1.8	3.9	6.9	14.3	19.2	22.1	31.8	.0	.0	.0
05/25/1985	129	1	1.14	8.1	20.3	22.0	21.0	12.0	9.5	7.1	.0	.0	.0
		2	2.00	7.2	15.8	14.5	19.5	15.6	9.7	4.4	13.3	.0	.0
05/30/1985	100	1	.726	3.3	10.1	18.3	25.6	19.5	9.7	13.5	.0	.0	.0
		2	1.77	1.5	4.4	8.9	16.1	19.5	21.3	28.3	.0	.0	.0
06/05/1985	68	1	.243	3.1	10.1	13.9	18.3	24.0	20.5	10.1	.0	.0	.0
		2	.443	1.5	5.2	12.1	24.4	31.4	22.6	2.8	.0	.0	.0
06/13/1985	56	1	1.09	1.0	3.4	7.0	15.8	23.7	25.0	24.1	.0	.0	.0
		2	.749	1.2	4.2	8.7	16.3	23.8	30.5	12.8	2.5	.0	.0
06/19/1985	44	1	.144	1.4	8.6	20.6	31.1	31.1	7.2	.0	.0	.0	.0
		2	.039	6.6	15.2	21.7	23.9	21.7	10.9	.0	.0	.0	.0
06/27/1985	29	1	.010	13.3	20.0	20.0	20.0	26.7	.0	.0	.0	.0	.0
		2	.013	5.6	27.8	22.2	22.2	22.2	.0	.0	.0	.0	.0
07/02/1985	25	1	.017	3.9	19.2	15.4	19.2	42.3	.0	.0	.0	.0	.0
		2	.019	37.9	20.7	41.4	.0	.0	.0	.0	.0	.0	.0
07/11/1985	24	1	.454	2.1	4.1	9.4	15.3	13.2	10.4	1.2	44.3	.0	.0
		2	.338	2.7	8.1	12.9	20.4	26.1	23.1	6.7	.0	.0	.0
07/17/1985	14	1	.017	8.0	20.0	20.0	28.0	24.0	.0	.0	.0	.0	.0
05/08/1986	81	1	.178	15.5	25.1	11.5	7.4	16.3	14.1	10.1	.0	.0	.0
05/14/1986	71	1	.328	3.6	8.3	10.3	13.4	25.1	26.5	12.8	.0	.0	.0
		2	.934	2.4	10.1	15.3	24.1	26.8	18.7	2.6	.0	.0	.0
05/20/1986	130	1	1.85	10.8	27.1	14.8	12.7	9.3	9.0	8.7	7.6	.0	.0
05/28/1986	298	1	20.2	1.7	3.2	3.0	4.6	7.0	14.3	28.0	29.4	8.8	.0
		2	44.6	1.3	2.5	2.0	1.8	4.5	4.5	9.5	28.7	45.2	.0

(con.)

Table 2 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Pan	0.25	0.5	1	2	4	8	16	32	64
				Percent retained on sieve size (mm)									
	cfs		*t/d*										
06/03/1986	403	1	46.0	.9	2.7	2.1	2.5	2.8	3.9	11.8	34.1	22.5	16.7
		2	11.0	3.2	6.0	6.9	11.3	16.3	18.6	18.0	17.1	2.6	.0
06/12/1986	250	1	.485	6.7	16.0	8.1	8.2	10.1	11.0	23.3	16.6	.0	.0
		2	1.61	3.3	6.4	3.6	2.9	4.9	13.9	27.2	37.8	.0	.0
06/18/1986	180	1	.735	1.0	22.5	24.2	19.5	13.7	6.8	12.3	.0	.0	.0
		2	.407	1.5	28.5	27.9	18.7	11.2	10.1	2.1	.0	.0	.0
06/26/1986	104	1	.396	.6	7.1	13.2	22.0	30.0	21.8	5.3	.0	.0	.0
		2	.494	.5	5.9	7.5	11.9	25.0	34.0	15.2	.0	.0	.0
07/02/1986	83	1	1.13	.7	2.6	7.0	14.9	23.8	25.2	18.5	7.3	.0	.0
		2	.336	2.1	8.2	21.1	23.9	16.3	10.0	18.4	.0	.0	.0
07/10/1986	57	1	.084	1.6	12.2	21.1	22.8	12.2	15.5	14.6	.0	.0	.0
		2	.061	2.3	9.0	13.5	15.7	15.7	18.0	25.8	.0	.0	.0
07/16/1986	46	1	.081	1.5	5.2	6.7	17.2	33.6	28.3	7.5	.0	.0	.0
		2	.120	1.5	7.1	10.6	17.2	33.8	29.8	.0	.0	.0	.0
05/07/1987	84	1	1.35	5.7	8.8	13.2	19.4	16.4	14.9	21.6	.0	.0	.0
05/13/1987	62	1	1.01	5.1	9.8	19.9	29.6	20.9	12.5	2.2	.0	.0	.0
		2	.391	3.9	11.8	16.7	16.6	15.0	12.8	23.2	.0	.0	.0
05/22/1987	66	1	1.53	2.8	3.2	6.5	13.9	22.1	30.1	17.0	4.4	.0	.0
		2	.541	2.4	9.6	15.0	19.6	21.9	18.2	13.3	.0	.0	.0
05/28/1987	106	1	7.76	2.0	5.0	12.3	18.7	18.2	17.9	15.9	10.0	.0	.0
		2	2.05	4.3	8.6	14.0	19.8	18.7	18.1	16.5	.0	.0	.0
06/03/1987	74	1	1.63	2.4	4.4	7.5	14.9	21.8	26.4	19.4	3.2	.0	.0
		2	.096	4.2	9.7	19.4	35.8	19.4	7.9	3.6	.0	.0	.0
05/12/1988	68	1	.581	9.7	17.5	18.1	19.6	14.2	16.5	4.4	.0	.0	.0
		2	.496	9.9	20.1	19.2	22.5	13.7	7.6	7.0	.0	.0	.0
05/18/1988	156	1	.998	11.9	25.4	17.9	16.2	9.1	8.7	10.8	.0	.0	.0
		2	2.09	6.0	14.6	16.2	18.3	16.9	15.8	8.4	3.8	.0	.0
05/27/1988	149	1	1.03	4.2	8.6	10.4	13.4	12.8	9.2	12.8	28.6	.0	.0
		2	1.02	11.2	29.8	20.0	16.7	8.9	6.1	3.2	4.1	.0	.0
06/03/1988	75	1	.930	2.0	4.8	6.2	8.5	9.2	12.9	33.0	23.4	.0	.0
		2	1.20	1.3	2.6	3.6	8.3	16.0	31.6	27.5	9.1	.0	.0
06/10/1988	59	1	.068	4.0	7.1	14.1	28.3	20.2	26.3	.0	.0	.0	.0
		2	.117	3.6	11.2	18.3	21.3	21.3	24.3	.0	.0	.0	.0
06/15/1988	48	1	.061	7.6	29.0	30.1	18.3	7.5	7.5	.0	.0	.0	.0
		2	.147	1.9	5.6	16.4	31.9	26.3	17.9	.0	.0	.0	.0
06/22/1988	41	1	.023	2.9	11.8	14.7	29.4	41.2	.0	.0	.0	.0	.0
		2	.063	5.1	13.3	20.4	27.5	33.7	.0	.0	.0	.0	.0
05/05/1989	84	1	.441	2.0	8.9	13.1	27.4	25.7	21.3	1.6	.0	.0	.0
		2	1.42	3.7	5.6	13.2	28.6	29.7	17.1	2.1	.0	.0	.0
05/09/1989	173	1	5.03	3.0	20.2	16.2	11.4	5.3	3.6	3.1	21.1	16.1	.0
		2	6.45	2.7	17.0	17.4	17.5	16.3	13.4	9.8	5.9	.0	.0
05/18/1989	154	1	9.67	.6	.9	3.0	8.9	14.6	14.7	12.2	6.3	38.8	.0
		2	2.19	4.0	9.1	11.7	18.0	18.0	22.0	12.8	4.4	.0	.0
05/25/1989	137	1	6.42	.8	2.3	7.1	17.2	22.7	21.3	18.5	10.1	.0	.0
		2	—	—	—	—	—	—	—	—	—	—	—
06/02/1989	119	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/07/1989	166	1	4.51	2.5	6.8	10.5	16.0	17.9	17.5	16.8	12.0	.0	.0
		2	1.31	5.6	16.6	18.3	15.1	11.3	5.0	5.5	22.6	.0	.0
06/15/1989	122	1	.147	7.4	26.1	27.6	28.4	10.5	.0	.0	.0	.0	.0
		2	.587	5.8	15.3	15.8	16.8	8.4	2.9	1.9	33.1	.0	.0
06/21/1989	78	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/29/1989	52	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
07/05/1989	45	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—

(con.)

Table 2 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Percent retained on sieve size (mm) Pan	0.25	0.5	1	2	4	8	16	32	64
	cfs		*t/d*										
04/27/1990	54	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/03/1990	45	1	—	—	—	—	—	—	—	—	—	—	—
05/10/1990	69	1	.696	4.4	13.2	23.7	35.9	18.5	4.3	.0	.0	.0	.0
		2	—	—	—	—	—	—	—	—	—	—	—
05/18/1990	55	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/25/1990	72	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/31/1990	80	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/05/1990	72	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/14/1990	63	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/20/1990	61	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/28/1990	52	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
07/05/1990	34	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/29/1991	100	1	.017	12.5	25.0	21.9	18.8	15.6	6.2	.0	.0	.0	.0
		2	.088	7.6	23.5	18.2	16.7	20.4	13.6	.0	.0	.0	.0
05/29/1991	94	1	.075	5.5	11.0	9.2	17.4	9.2	16.5	31.2	.0	.0	.0
		2	.026	13.8	34.5	20.7	24.1	6.9	.0	.0	.0	.0	.0
05/29/1991	94	1	.140	9.9	40.1	27.2	17.8	5.0	.0	.0	.0	.0	.0
		2	.104	11.0	45.2	26.0	15.1	2.7	.0	.0	.0	.0	.0
06/01/1991	86	1	.062	6.5	34.8	26.1	23.9	6.5	2.2	.0	.0	.0	.0
		2	.083	6.4	30.7	19.4	14.5	11.3	17.7	.0	.0	.0	.0
06/01/1991	86	1	.048	8.9	38.2	23.5	20.6	8.8	.0	.0	.0	.0	.0
		2	.091	6.2	26.1	23.1	24.6	7.7	12.3	.0	.0	.0	.0
06/01/1991	84	1	.227	10.4	35.6	27.0	21.5	5.5	.0	.0	.0	.0	.0
		2	.107	7.3	27.2	23.5	23.5	3.7	14.8	.0	.0	.0	.0
06/03/1991	111	1	.363	9.1	35.6	28.0	19.4	6.8	1.1	.0	.0	.0	.0
		2	.895	5.3	20.6	19.8	26.1	14.7	8.2	5.3	.0	.0	.0
06/03/1991	149	1	.569	10.6	33.8	25.8	19.7	7.3	2.8	.0	.0	.0	.0
		2	.668	8.1	32.3	22.8	20.9	9.6	5.5	.8	.0	.0	.0
06/03/1991	140	1	1.29	9.0	29.4	22.7	16.2	5.9	3.2	3.8	9.8	.0	.0
		2	1.01	8.4	28.9	21.2	18.8	7.8	4.6	3.5	6.8	.0	.0
06/04/1991	183	1	3.57	3.2	13.6	21.7	27.9	15.6	12.8	5.2	.0	.0	.0
		2	1.47	4.3	14.2	11.5	10.2	6.6	9.4	4.7	39.1	.0	.0
06/04/1991	190	1	1.93	4.9	17.7	20.1	26.0	15.4	12.6	3.3	.0	.0	.0
		2	2.11	5.9	22.8	18.4	21.9	15.0	14.2	1.8	.0	.0	.0
06/11/1991	143	1	.444	6.1	23.1	29.1	25.8	11.1	4.8	.0	.0	.0	.0
		2	.357	6.7	23.0	23.8	21.2	10.4	11.5	3.4	.0	.0	.0
06/11/1991	143	1	.787	2.3	9.4	17.7	31.5	17.3	10.7	11.1	.0	.0	.0
		2	.330	4.8	19.9	27.3	31.6	11.7	4.7	.0	.0	.0	.0
06/11/1991	144	1	.674	4.6	18.3	19.3	17.7	10.2	12.8	17.1	.0	.0	.0
		2	.295	5.5	23.0	25.4	26.3	9.2	5.5	5.1	.0	.0	.0
06/11/1991	158	1	.374	5.4	19.9	23.1	19.1	6.5	3.3	.0	22.7	.0	.0
		2	.504	8.3	30.6	30.3	23.6	6.9	.3	.0	.0	.0	.0
06/12/1991	150	1	1.20	3.1	11.7	20.9	33.6	20.2	8.5	2.0	.0	.0	.0
		2	.617	4.3	14.3	20.6	30.0	14.1	13.5	3.2	.0	.0	.0
06/12/1991	139	1	1.23	1.9	6.6	9.6	10.1	5.9	9.7	10.4	45.8	.0	.0
		2	.406	5.7	17.9	23.8	30.2	13.7	5.2	3.5	.0	.0	.0
06/12/1991	148	1	.363	7.9	24.6	28.0	27.3	7.6	4.6	.0	.0	.0	.0
		2	.589	4.9	16.8	23.0	28.4	15.5	8.9	2.5	.0	.0	.0
06/12/1991	154	1	.974	3.5	13.4	20.2	23.8	16.3	15.3	7.5	.0	.0	.0
		2	.389	7.3	23.6	29.5	26.4	9.4	3.8	.0	.0	.0	.0

(con.)

Table 2 (Con.)

		Bedload		Percent retained on sieve size (mm)									
Date	Water discharge	Traverse number	Discharge	Pan	0.25	0.5	1	2	4	8	16	32	64
	cfs		*t/d*										
06/12/1991	159	1	.550	6.3	24.8	28.4	25.6	9.6	5.3	.0	.0	.0	.0
		2	.653	8.4	28.1	31.6	26.6	4.9	.4	.0	.0	.0	.0
06/12/1991	166	1	.942	5.7	16.8	18.1	18.9	9.6	9.7	11.3	9.9	.0	.0
		2	.487	8.5	27.9	29.3	22.9	8.8	2.6	.0	.0	.0	.0
06/13/1991	156	1	.257	7.6	26.6	27.7	21.2	8.7	8.2	.0	.0	.0	.0
		2	.676	5.3	19.1	25.6	24.8	12.6	8.3	4.3	.0	.0	.0
06/13/1991	152	1	.392	7.4	24.9	29.1	27.0	8.8	2.8	.0	.0	.0	.0
		2	.209	10.6	31.7	28.9	22.5	6.3	.0	.0	.0	.0	.0
06/13/1991	146	1	.475	6.5	21.1	27.5	28.4	11.2	5.3	.0	.0	.0	.0
		2	1.29	3.1	11.6	18.4	31.1	18.2	9.2	8.4	.0	.0	.0
06/05/1992	26	1	.004	12.5	20.7	37.2	26.4	3.2	.0	.0	.0	.0	.0
		2	.003	26.4	33.4	25.7	10.3	4.2	.0	.0	.0	.0	.0
06/06/1992	26	1	.004	12.8	23.3	35.3	24.0	4.6	.0	.0	.0	.0	.0
		2	.019	4.6	16.8	28.1	26.6	23.9	.0	.0	.0	.0	.0
06/07/1992	25	1	.035	5.7	20.5	36.2	24.6	9.1	3.9	.0	.0	.0	.0
		2	.012	9.7	24.7	35.5	25.6	4.5	.0	.0	.0	.0	.0
06/08/1992	25	1	.007	16.9	30.6	25.3	16.9	10.3	.0	.0	.0	.0	.0
		2	.004	26.0	39.4	19.4	15.2	.0	.0	.0	.0	.0	.0
05/26/1993	196	1	3.59	2.1	6.3	9.1	14.3	9.3	9.4	4.4	45.1	.0	.0
		2	4.57	2.4	8.0	11.6	14.4	10.3	14.2	14.0	25.1	.0	.0
05/26/1993	182	1	9.33	.8	2.5	5.4	12.4	12.1	14.3	15.1	4.0	33.4	.0
		2	5.42	1.9	6.3	9.0	14.5	11.8	10.3	8.0	13.9	24.3	.0
05/27/1993	217	1	2.15	8.0	25.1	25.6	22.9	9.4	3.1	1.3	4.6	.0	.0
		2	1.98	8.2	26.0	27.0	23.2	7.8	2.2	5.6	.0	.0	.0
05/27/1993	221	1	2.76	4.8	15.1	21.2	27.6	14.6	9.7	7.0	.0	.0	.0
		2	1.96	7.1	21.7	22.0	23.3	11.7	6.4	7.8	.0	.0	.0
05/28/1993	216	1	6.24	1.4	4.1	4.5	2.9	1.3	1.1	12.7	41.8	30.2	.0
		2	8.60	1.0	3.4	3.8	3.9	1.6	2.2	12.8	4.6	66.7	.0
05/28/1993	238	1	3.44	4.2	14.3	16.5	21.8	10.9	11.4	5.2	15.7	.0	.0
		2	3.52	3.4	11.8	15.0	19.2	12.3	13.2	7.6	17.5	.0	.0
06/06/1993	155	1	.175	1.5	13.2	20.6	27.9	36.8	.0	.0	.0	.0	.0
		2	.163	6.8	25.4	25.4	23.7	15.3	3.4	.0	.0	.0	.0
06/07/1993	153	1	.121	26.6	22.2	22.2	9.0	20.0	.0	.0	.0	.0	.0
		2	2.33	.9	4.3	11.0	36.0	28.4	18.5	.9	.0	.0	.0
06/07/1993	137	1	.127	4.3	23.4	29.8	31.9	10.6	.0	.0	.0	.0	.0
		2	.098	11.4	28.5	22.9	22.9	14.3	.0	.0	.0	.0	.0
06/08/1993	134	1	.067	8.7	26.1	21.7	34.8	8.7	.0	.0	.0	.0	.0
		2	.135	6.0	24.0	24.0	30.0	16.0	.0	.0	.0	.0	.0
06/08/1993	133	1	.060	10.0	35.0	20.0	25.0	10.0	.0	.0	.0	.0	.0
		2	.101	3.0	17.0	20.0	40.0	20.0	.0	.0	.0	.0	.0
06/09/1993	125	1	.043	6.0	19.0	25.0	38.0	12.0	.0	.0	.0	.0	.0
		2	.109	5.0	17.5	17.5	35.0	25.0	.0	.0	.0	.0	.0
05/20/1997	275	1	81.7	.9	3.7	4.8	8.2	13.0	17.8	22.5	11.7	17.3	.0
	282	2	55.0	1.6	5.6	7.2	12.9	20.2	21.7	22.4	8.3	.0	.0
05/21/1997	289	1	29.0	1.5	7.4	10.2	14.7	17.2	15.9	11.3	7.2	14.5	.0
	289	2	21.0	1.8	8.0	7.4	7.1	6.2	7.2	17.3	22.3	22.6	.0
05/21/1997	337	1	60.1	1.0	4.9	4.8	6.3	6.7	6.9	14.7	32.2	22.6	.0
	355	2	61.7	1.5	5.7	5.8	7.2	9.1	9.1	17.9	25.3	18.4	.0
05/22/1997	315	1	51.9	1.1	4.2	4.5	6.4	7.3	8.9	22.2	33.0	12.4	.0
	289	2	41.1	1.1	5.1	5.9	9.2	10.8	9.4	12.6	15.9	29.9	.0
05/22/1997	324	1	37.9	1.5	5.8	6.0	9.5	12.9	12.6	15.8	16.8	19.2	.0
	328	2	30.7	2.0	8.4	9.2	13.4	15.4	12.6	14.4	6.6	18.0	.0
05/28/1997	218	1	2.11	5.5	23.9	17.4	13.6	10.6	7.1	10.2	11.7	.0	.0
	219	2	12.5	1.4	7.0	10.0	15.8	20.6	18.7	14.8	11.7	.0	.0
05/29/1997	240	1	27.8	1.0	5.4	10.2	14.9	13.3	9.8	11.1	22.6	11.8	.0
	245	2	55.3	.7	2.5	4.7	8.7	13.5	17.5	19.4	17.6	15.3	.0
05/29/1997	248	1	13.7	2.3	13.4	16.4	18.7	18.5	13.4	10.0	7.2	.0	.0

(con.)

Table 2 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Pan	0.25	0.5	1	2	4	8	16	32	64
				Percent retained on sieve size (mm)									
	cfs		*t/d*										
	252	2	73.0	.7	2.7	4.7	8.1	11.8	12.8	17.5	18.3	13.9	9.5
05/30/1997	268	1	6.25	2.3	15.3	17.9	22.4	19.5	10.6	5.7	6.4	.0	.0
	261	2	3.85	4.2	22.0	20.6	20.5	14.8	8.6	4.8	4.7	.0	.0
05/30/1997	261	1	10.4	2.5	10.1	10.6	14.6	13.3	9.6	11.0	8.4	19.9	.0
	265	2	5.44	4.1	16.5	17.4	21.5	19.7	12.3	8.5	.0	.0	.0
05/30/1997	310	1	14.8	2.8	11.5	14.7	17.5	13.2	8.7	10.2	10.0	11.4	.0
	316	2	30.7	1.6	7.0	9.1	12.2	12.7	10.7	11.2	19.9	15.6	.0
05/31/1997	275	1	8.19	2.4	8.3	12.7	17.0	21.9	17.7	20.0	.0	.0	.0
	275	2	7.75	2.7	15.6	13.1	14.5	16.2	15.8	17.0	5.0	.0	.0
05/31/1997	285	1	13.8	2.2	11.7	11.4	14.0	14.0	10.0	9.9	2.3	24.5	.0
	289	2	12.0	2.3	10.8	10.7	20.5	23.7	12.2	13.5	6.4	.0	.0
05/31/1997	328	1	23.0	2.8	10.2	9.3	9.3	9.2	10.5	17.6	31.1	.0	.0
	337	2	23.1	3.4	13.9	12.7	15.5	19.9	18.8	11.7	4.0	.0	.0
06/01/1997	364	1	15.4	3.2	16.8	11.9	13.0	14.2	12.3	8.0	20.6	.0	.0
	364	2	20.5	2.4	10.5	7.2	8.6	11.4	11.8	12.2	14.8	21.1	.0
06/01/1997	355	1	14.2	3.2	15.0	11.0	10.7	14.1	14.4	9.4	11.4	10.6	.0
	355	2	19.5	2.7	14.0	11.2	13.7	20.5	19.6	13.3	5.1	.0	.0
06/01/1997	346	1	13.4	3.4	15.3	12.2	10.1	9.3	10.4	14.5	18.3	6.5	.0
	350	2	11.8	4.9	23.7	16.4	9.6	3.5	1.3	2.4	23.9	14.2	.0
06/04/1997	394	1	98.1	2.5	7.8	6.8	8.5	10.9	15.9	20.2	16.6	10.9	.0
	400	2	71.2	3.0	11.6	8.3	7.7	10.4	12.9	17.8	17.2	10.9	.0
06/05/1997	353	1	80.6	2.3	8.5	9.1	11.1	14.7	14.8	13.3	15.3	11.0	.0
	350	2	76.8	2.4	9.6	8.6	9.8	11.4	10.2	10.3	15.7	22.0	.0
06/05/1997	350	1	109.	2.2	8.3	8.6	9.8	10.2	10.2	14.5	20.9	15.5	.0
	358	2	80.2	2.9	13.1	10.3	9.0	7.6	8.3	19.1	17.4	1.2	11.2
06/05/1997	389	1	96.1	3.1	13.5	11.6	10.9	11.8	10.9	9.7	11.8	16.7	.0
	399	2	107.	2.2	8.7	7.0	4.4	3.3	3.8	18.3	32.3	19.9	.0
06/05/1997	413	1	174.	1.7	7.2	7.4	7.8	7.7	7.3	8.3	18.0	28.3	6.5
	404	2	94.6	3.2	14.5	14.5	14.6	14.6	10.7	9.1	11.1	7.8	.0
06/06/1997	350	1	56.9	3.7	18.3	14.3	16.2	16.4	12.0	11.2	7.8	.0	.0
	337	2	47.8	3.7	18.3	14.2	13.5	10.9	8.8	10.5	12.5	7.7	.0
06/06/1997	328	1	35.3	3.8	22.6	16.6	14.3	10.8	7.8	7.1	5.4	11.6	.0
	328	2	82.7	2.9	12.9	10.0	11.0	11.2	10.3	14.4	22.1	5.2	.0
06/10/1997	252	1	45.5	1.7	6.9	8.2	10.3	9.2	8.7	13.4	21.8	19.7	.0
	259	2	35.9	2.1	9.8	10.5	12.2	12.0	11.7	11.5	8.2	22.1	.0
06/11/1997	217	1	60.5	1.1	4.7	5.5	5.6	8.7	21.7	31.6	18.4	2.7	.0
	217	2	32.4	1.8	8.2	8.0	9.8	11.2	11.7	10.6	22.9	15.7	.0
06/11/1997	217	1	50.5	1.1	6.3	10.4	13.1	13.2	15.4	21.2	19.4	.0	.0
	217	2	57.3	.9	4.2	6.1	8.2	11.4	13.8	18.0	28.0	9.6	.0
06/11/1997	212	1	37.3	1.5	7.3	13.4	20.3	20.4	14.2	11.1	7.9	3.9	.0
	214	2	73.8	.7	3.0	6.6	16.2	22.7	19.5	15.8	14.2	1.2	.0
06/12/1997	201	1	6.56	2.6	13.7	22.1	26.8	18.1	10.3	4.6	1.8	.0	.0
	198	2	14.0	1.7	7.6	13.3	19.8	18.3	13.4	13.3	4.9	7.7	.0
06/12/1997	194	1	9.36	2.2	8.9	14.1	18.2	14.8	13.0	13.6	15.2	.0	.0
	194	2	7.24	1.7	7.3	12.6	17.4	12.7	6.2	13.8	7.5	20.7	.0
06/12/1997	201	1	7.45	2.0	11.1	14.1	12.5	6.4	2.3	2.4	2.7	46.6	.0
	201	2	13.4	1.5	7.4	12.4	18.2	17.7	14.2	15.0	13.6	.0	.0
06/13/1997	180	1	5.05	2.4	12.2	15.9	20.2	17.5	10.2	13.8	7.8	.0	.0
	180	2	5.90	1.7	10.7	13.1	14.3	13.2	12.4	26.2	8.5	.0	.0
06/13/1997	174	1	3.45	2.7	12.9	16.3	17.8	12.8	9.7	6.6	21.2	.0	.0
	174	2	5.91	1.1	7.6	13.7	18.6	13.4	9.8	13.4	22.3	.0	.0

Table 3—Bedload particle-size distribution, percent finer than sieve size, Little Granite Creek, Wyoming, 1982–1993 and 1997.

		Bedload		Percent finer than sieve size (mm)									
Date	Water discharge	Traverse number	Discharge	0.25	0.5	1	2	4	8	16	32	64	128
	cfs		*t/d*										
05/27/82	354	1	9.18	2.0	17.1	31.5	43.6	52.8	59.4	64.9	69.9	100.	100.
06/02/82	204	1	1.44	1.5	11.2	23.2	38.8	53.4	65.5	68.8	100.	100.	100.
06/09/82	165	1	.477	2.7	23.0	47.7	76.2	94.4	100.	100.	100.	100.	100.
06/18/82	290	1	7.05	2.0	13.4	25.4	38.3	49.3	56.6	59.7	70.5	100.	100.
06/24/82	237	1	22.5	.7	4.7	9.4	16.9	26.7	37.8	56.6	85.8	100.	100.
06/29/82	215	1	14.2	.4	3.8	8.3	14.1	21.3	32.9	56.4	77.8	100.	100.
07/07/82	96	1	.293	2.5	17.7	33.6	49.2	65.1	84.8	96.4	100.	100.	100.
07/13/82	78	1	.191	6.3	23.7	41.9	59.7	73.7	91.1	100.	100.	100.	100.
05/17/83	35	1	.450	4.3	15.1	33.2	47.6	53.5	59.0	60.8	100.	100.	100.
05/25/83	160	1	3.61	10.2	66.0	78.3	84.6	90.8	97.4	100.	100.	100.	100.
06/01/83	259	1	30.9	.4	6.6	14.4	23.8	34.4	53.6	77.6	77.6	100.	100.
06/08/83	220	1	3.65	1.4	32.1	47.0	61.4	75.2	81.8	100.	100.	100.	100.
06/18/83	163	1	1.31	5.4	33.9	50.1	74.	93.	100.	100.	100.	100.	100.
06/22/83	119	1	1.38	2.7	24.2	42.6	64.4	81.1	93.8	100.	100.	100.	100.
06/29/83	93	1	.273	5.4	23.8	31.6	39.6	45.9	67.0	100.	100.	100.	100.
07/06/83	78	1	.272	4.5	32.3	47.5	63.4	75.1	100.	100.	100.	100.	100.
07/13/83	54	1	.135	5.0	35.8	57.7	80.1	100.	100.	100.	100.	100.	100.
04/18/84	49	1	.290	11.7	36.4	53.7	72.2	90.7	97.3	100.	100.	100.	100.
05/10/84	50	1	.685	7.7	20.4	42.9	79.1	98.1	100.	100.	100.	100.	100.
05/17/84	198	1	11.9	1.5	6.3	11.5	17.2	23.7	32.8	56.5	90.8	100.	100.
05/22/84	166	1	9.11	4.0	16.7	27.0	38.0	50.3	59.8	71.3	75.9	100.	100.
05/30/84	253	1	42.1	2.5	8.8	13.8	17.9	20.7	23.4	34.9	72.8	100.	100.
06/07/84	142	1	2.49	3.2	11.4	19.5	28.8	41.5	59.0	81.6	100.	100.	100.
06/13/84	111	1	.278	4.3	17.7	32.3	47.8	66.9	85.6	100.	100.	100.	100.
06/21/84	121	1	1.74	4.5	14.8	24.5	37.1	54.5	73.9	100.	100.	100.	100.
06/28/84	110	1	1.28	3.6	10.7	21.2	39.6	64.3	84.1	95.7	100.	100.	100.
07/06/84	74	1	.088	4.6	13.6	27.1	47.4	71.5	91.0	100.	100.	100.	100.
07/11/84	51	1	.035	5.9	17.7	31.4	43.2	51.0	80.4	100.	100.	100.	100.
07/18/84	41	1	.017	15.5	34.7	53.9	77.0	96.2	100.	100.	100.	100.	100.
05/08/85	139	1	1.91	11.5	39.2	57.2	72.2	80.8	88.2	93.3	100.	100.	100.
		2	7.57	3.6	13.8	23.7	37.8	52.8	61.8	66.3	67.5	100.	100.
05/15/85	104	1	.156	12.1	34.5	52.3	69.1	76.6	84.1	85.	100.	100.	100.
		2	1.62	1.8	5.7	12.6	26.9	46.1	68.2	100.	100.	100.	100.
05/25/85	129	1	1.14	8.1	28.4	50.4	71.4	83.4	92.9	100.	100.	100.	100.
		2	2.00	7.2	23.0	37.5	57.0	72.6	82.3	86.7	100.	100.	100.
05/30/85	100	1	.726	3.3	13.4	31.7	57.3	76.8	86.5	100.	100.	100.	100.
		2	1.77	1.5	5.9	14.8	30.9	50.4	71.7	100.	100.	100.	100.
06/05/85	68	1	.243	3.1	13.2	27.1	45.4	69.4	89.9	100.	100.	100.	100.
		2	.443	1.5	6.7	18.8	43.2	74.6	97.2	100.	100.	100.	100.
06/13/85	56	1	1.09	1.0	4.4	11.4	27.2	50.9	75.9	100.	100.	100.	100.
		2	.749	1.2	5.4	14.1	30.4	54.2	84.7	97.5	100.	100.	100.
06/19/85	44	1	.144	1.4	10.0	30.6	61.7	92.8	100.	100.	100.	100.	100.
		2	.039	6.6	21.8	43.5	67.4	89.1	100.	100.	100.	100.	100.
06/27/85	29	1	.010	13.3	33.3	53.3	73.3	100.	100.	100.	100.	100.	100.
		2	.013	5.6	33.4	55.6	77.8	100.	100.	100.	100.	100.	100.
07/02/85	25	1	.017	3.9	23.1	38.5	57.7	100.	100.	100.	100.	100.	100.
		2	.019	37.9	58.6	100.	100.	100.	100.	100.	100.	100.	100.
07/11/85	24	1	.454	2.1	6.2	15.6	30.9	44.1	54.5	55.7	100.	100.	100.
		2	.338	2.7	10.8	23.7	44.1	70.2	93.3	100.	100.	100.	100.
07/17/85	14	1	.017	8.0	28.0	48.0	76.	100.	100.	100.	100.	100.	100.
05/08/86	81	1	.178	15.5	40.6	52.1	59.5	75.8	89.9	100.	100.	100.	100.
05/14/86	71	1	.328	3.6	11.9	22.2	35.6	60.7	87.2	100.	100.	100.	100.
		2	.934	2.4	12.5	27.8	51.9	78.7	97.4	100.	100.	100.	100.
05/20/86	130	1	1.85	10.8	37.9	52.7	65.4	74.7	83.7	92.4	100.	100.	100.
05/28/86	298	1	20.2	1.7	4.9	7.9	12.5	19.5	33.8	61.8	91.2	100.	100.
		2	44.6	1.3	3.8	5.8	7.6	12.1	16.6	26.1	54.8	100.	100.

(con.)

Table 3 (Con.)

Date	Water discharge	Bedload: Traverse number	Bedload: Discharge	Percent finer than sieve size (mm): 0.25	0.5	1	2	4	8	16	32	64	128
	cfs		*t/d*										
06/03/86	403	1	46.0	.9	3.6	5.7	8.2	11.0	14.9	26.7	60.8	83.3	100.
		2	11.0	3.2	9.2	16.1	27.4	43.7	62.3	80.3	97.4	100.	100.
06/12/86	250	1	.485	6.7	22.7	30.8	39.0	49.1	60.1	83.4	100.	100.	100.
		2	1.61	3.3	9.7	13.3	16.2	21.1	35.0	62.2	100.	100.	100.
06/18/86	180	1	.735	1.0	23.5	47.7	67.2	80.9	87.7	100.	100.	100.	100.
		2	.407	1.5	30.0	57.9	76.6	87.8	97.9	100.	100.	100.	100.
06/26/86	104	1	.396	.6	7.7	20.9	42.9	72.9	94.7	100.	100.	100.	100.
		2	.494	.5	6.4	13.9	25.8	50.8	84.8	100.	100.	100.	100.
07/02/86	83	1	1.13	.7	3.3	10.3	25.2	49.0	74.2	92.7	100.	100.	100.
		2	.336	2.1	10.3	31.4	55.3	71.6	81.6	100.	100.	100.	100.
07/10/86	57	1	.084	1.6	13.8	34.9	57.7	69.9	85.4	100.	100.	100.	100.
		2	.061	2.3	11.3	24.8	40.5	56.2	74.2	100.	100.	100.	100.
07/16/86	46	1	.081	1.5	6.7	13.4	30.6	64.2	92.5	100.	100.	100.	100.
		2	.120	1.5	8.6	19.2	36.4	70.2	100.	100.	100.	100.	100.
05/07/87	84	1	1.35	5.7	14.5	27.7	47.1	63.5	78.4	100.	100.	100.	100.
05/13/87	62	1	1.01	5.1	14.9	34.8	64.4	85.3	97.8	100.	100.	100.	100.
		2	.391	3.9	15.7	32.4	49.0	64.0	76.8	100.	100.	100.	100.
05/22/87	66	1	1.53	2.8	6.0	12.5	26.4	48.5	78.6	95.6	100.	100.	100.
		2	.541	2.4	12.0	27.0	46.6	68.5	86.7	100.	100.	100.	100.
05/28/87	106	1	7.76	2.0	7.0	19.3	38.0	56.2	74.1	90.	100.	100.	100.
		2	2.05	4.3	12.9	26.9	46.7	65.4	83.5	100.	100.	100.	100.
06/03/87	74	1	1.63	2.4	6.8	14.3	29.2	51.0	77.4	96.8	100.	100.	100.
		2	.096	4.2	13.9	33.3	69.1	88.5	96.4	100.	100.	100.	100.
05/12/88	68	1	.581	9.7	27.2	45.3	64.9	79.1	95.6	100.	100.	100.	100.
		2	.496	9.9	30.0	49.2	71.7	85.4	93.0	100.	100.	100.	100.
05/18/88	156	1	.998	11.9	37.3	55.2	71.4	80.5	89.2	100.	100.	100.	100.
		2	2.09	6.0	20.6	36.8	55.1	72.0	87.8	96.2	100.	100.	100.
05/27/88	149	1	1.03	4.2	12.8	23.2	36.6	49.4	58.6	71.4	100.	100.	100.
		2	1.02	11.2	41.0	61.0	77.7	86.6	92.7	95.9	100.	100.	100.
06/03/88	75	1	.930	2.0	6.8	13.0	21.5	30.7	43.6	76.6	100.	100.	100.
		2	1.20	1.3	3.9	7.5	15.8	31.8	63.4	90.9	100.	100.	100.
06/10/88	59	1	.068	4.0	11.1	25.2	53.5	73.7	100.	100.	100.	100.	100.
		2	.117	3.6	14.8	33.1	54.4	75.7	100.	100.	100.	100.	100.
06/15/88	48	1	.061	7.6	36.6	66.7	85.0	92.5	100.	100.	100.	100.	100.
		2	.147	1.9	7.5	23.9	55.8	82.1	100.	100.	100.	100.	100.
06/22/88	41	1	.023	2.9	14.7	29.4	58.8	100.	100.	100.	100.	100.	100.
		2	.063	5.1	18.4	38.8	66.3	100.	100.	100.	100.	100.	100.
05/05/89	84	1	.441	2.0	10.9	24.0	51.4	77.1	98.4	100.	100.	100.	100.
		2	1.42	3.7	9.3	22.5	51.1	80.8	97.9	100.	100.	100.	100.
05/09/89	173	1	5.03	3.0	23.2	39.4	50.8	56.1	59.7	62.8	83.9	100.	100.
		2	6.45	2.7	19.7	37.1	54.6	70.9	84.3	94.1	100.	100.	100.
05/18/89	154	1	9.67	.6	1.5	4.5	13.4	28.0	42.7	54.9	61.2	100.	100.
		2	2.19	4.0	13.1	24.8	42.8	60.8	82.8	95.6	100.	100.	100.
05/25/89	137	1	6.42	.8	3.1	10.2	27.4	50.1	71.4	89.9	100.	100.	100.
		2	—	—	—	—	—	—	—	—	—	—	—
06/02/89	119	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/07/89	166	1	4.51	2.5	9.3	19.8	35.8	53.7	71.2	88.	100.	100.	100.
		2	1.31	5.6	22.2	40.5	55.6	66.9	71.9	77.4	100.	100.	100.
06/15/89	122	1	.147	7.4	33.5	61.1	89.5	100.	100.	100.	100.	100.	100.
		2	.587	5.8	21.1	36.9	53.7	62.1	65.	66.9	100.	100.	100.
06/21/89	78	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/29/89	52	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
07/05/89	45	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—

(con.)

Table 3 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	0.25	0.5	1	2	4	8	16	32	64	128
				Percent finer than sieve size (mm)									
	cfs		*t/d*										
04/27/90	54	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/03/90	45	1	—	—	—	—	—	—	—	—	—	—	—
05/10/90	69	1	.696	4.4	17.6	41.3	77.2	95.7	100.	100.	100.	100.	100.
		2	—	—	—	—	—	—	—	—	—	—	—
05/18/90	55	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/25/90	72	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/31/90	80	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/05/90	72	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/14/90	63	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/20/90	61	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/28/90	52	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
07/05/90	34	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/29/91	100	1	.017	12.5	37.5	59.4	78.2	93.8	100.	100.	100.	100.	100.
		2	.088	7.6	31.1	49.3	66.0	86.4	100.	100.	100.	100.	100.
05/29/91	94	1	.075	5.5	16.5	25.7	43.1	52.3	68.8	100.	100.	100.	100.
		2	.026	13.8	48.3	69.0	93.1	100.	100.	100.	100.	100.	100.
05/29/91	94	1	.140	9.9	50.0	77.2	95.0	100.	100.	100.	100.	100.	100.
		2	.104	11.0	56.2	82.2	97.3	100.	100.	100.	100.	100.	100.
06/01/91	86	1	.062	6.5	41.3	67.4	91.3	97.8	100.	100.	100.	100.	100.
		2	.083	6.4	37.1	56.5	71.0	82.3	100.	100.	100.	100.	100.
06/01/91	96	1	.048	8.9	47.1	70.6	91.2	100.	100.	100.	100.	100.	100.
		2	.091	6.2	32.3	55.4	80.0	87.7	100.	100.	100.	100.	100.
06/01/91	84	1	.227	10.4	46.0	73.0	94.5	100.	100.	100.	100.	100.	100.
		2	.107	7.3	34.5	58.0	81.5	85.2	100.	100.	100.	100.	100.
06/03/91	111	1	.363	9.1	44.7	72.7	92.1	98.9	100.	100.	100.	100.	100.
		2	.895	5.3	25.9	45.7	71.8	86.5	94.7	100.	100.	100.	100.
06/03/91	149	1	.569	10.6	44.4	70.2	89.9	97.2	100.	100.	100.	100.	100.
		2	.668	8.1	40.4	63.2	84.1	93.7	99.2	100.	100.	100.	100.
06/03/91	140	1	1.29	9.0	38.4	61.1	77.3	83.2	86.4	90.2	100.	100.	100.
		2	1.01	8.4	37.3	58.5	77.3	85.1	89.7	93.2	100.	100.	100.
06/04/91	183	1	3.57	3.2	16.8	38.5	66.4	82.0	94.8	100.	100.	100.	100.
		2	1.47	4.3	18.5	30.0	40.2	46.8	56.2	60.9	100.	100.	100.
06/04/91	190	1	1.93	4.9	22.6	42.7	68.7	84.1	96.7	100.	100.	100.	100.
		2	2.11	5.9	28.7	47.1	69.0	84.0	98.2	100.	100.	100.	100.
06/11/91	143	1	.444	6.1	29.2	58.3	84.1	95.2	100.	100.	100.	100.	100.
		2	.357	6.7	29.7	53.5	74.7	85.1	96.6	100.	100.	100.	100.
06/11/91	143	1	.787	2.3	11.7	29.4	60.9	78.2	88.9	100.	100.	100.	100.
		2	.330	4.8	24.7	52.0	83.6	95.3	100.	100.	100.	100.	100.
06/11/91	144	1	.674	4.6	22.9	42.2	59.9	70.1	82.9	100.	100.	100.	100.
		2	.295	5.5	28.5	53.9	80.2	89.4	94.9	100.	100.	100.	100.
06/11/91	158	1	.374	5.4	25.3	48.4	67.5	74.	77.3	77.3	100.	100.	100.
		2	.504	8.3	38.9	69.2	92.8	99.7	100.	100.	100.	100.	100.
06/12/1991	150	1	1.20	3.1	14.8	35.7	69.3	89.5	98.	100.	100.	100.	100.
		2	.617	4.3	18.6	39.2	69.2	83.3	96.8	100.	100.	100.	100.
06/12/1991	139	1	1.23	1.9	8.5	18.1	28.2	34.1	43.8	54.2	100.	100.	100.
		2	.406	5.7	23.6	47.4	77.6	91.3	96.5	100.	100.	100.	100.
06/12/1991	148	1	.363	7.9	32.5	60.5	87.8	95.4	100.	100.	100.	100.	100.
		2	.589	4.9	21.7	44.7	73.1	88.6	97.5	100.	100.	100.	100.
06/12/1991	154	1	.974	3.5	16.9	37.1	60.9	77.2	92.5	100.	100.	100.	100.
		2	.389	7.3	30.9	60.4	86.8	96.2	100.	100.	100.	100.	100.
06/12/1991	159	1	.550	6.3	31.1	59.5	85.1	94.7	100.	100.	100.	100.	100.

(con.)

Table 3 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Percent finer than sieve size (mm) 0.25	0.5	1	2	4	8	16	32	64	128
	cfs		*t/d*										
		2	.653	8.4	36.5	68.1	94.7	99.6	100.	100.	100.	100.	100.
06/12/1991	166	1	.942	5.7	22.5	40.6	59.5	69.1	78.8	90.1	100.	100.	100.
		2	.487	8.5	36.4	65.7	88.6	97.4	100.	100.	100.	100.	100.
06/13/1991	156	1	.257	7.6	34.2	61.9	83.1	91.8	100.	100.	100.	100.	100.
		2	.676	5.3	24.4	50.0	74.8	87.4	95.7	100.	100.	100.	100.
06/13/1991	152	1	.392	7.4	32.3	61.4	88.4	97.2	100.	100.	100.	100.	100.
		2	.209	10.6	42.3	71.2	93.7	100.	100.	100.	100.	100.	100.
06/13/1991	146	1	.475	6.5	27.6	55.1	83.5	94.7	100.	100.	100.	100.	100.
		2	1.29	3.1	14.7	33.1	64.2	82.4	91.6	100.	100.	100.	100.
06/05/1992	26	1	.004	12.5	33.2	70.4	96.8	100.	100.	100.	100.	100.	100.
		2	.003	26.4	59.8	85.5	95.8	100.	100.	100.	100.	100.	100.
06/06/1992	26	1	.004	12.8	36.1	71.4	95.4	100.	100.	100.	100.	100.	100.
		2	.019	4.6	21.4	49.5	76.1	100.	100.	100.	100.	100.	100.
06/07/1992	25	1	.035	5.7	26.2	62.4	87.0	96.1	100.	100.	100.	100.	100.
		2	.012	9.7	34.4	69.9	95.5	100.	100.	100.	100.	100.	100.
06/08/1992	25	1	.007	16.9	47.5	72.8	89.7	100.	100.	100.	100.	100.	100.
		2	.004	26.0	65.4	84.8	100.	100.	100.	100.	100.	100.	100.
05/26/93	196	1	3.59	2.1	8.4	17.5	31.8	41.1	50.5	54.9	100.	100.	100.
		2	4.57	2.4	10.4	22.0	36.4	46.7	60.9	74.9	100.	100.	100.
05/26/93	182	1	9.33	.8	3.3	8.7	21.1	33.2	47.5	62.6	66.6	100.	100.
		2	5.42	1.9	8.2	17.2	31.7	43.5	53.8	61.8	75.7	100.	100.
05/27/93	217	1	2.15	8.0	33.1	58.7	81.6	91.0	94.1	95.4	100.	100.	100.
		2	1.98	8.2	34.2	61.2	84.4	92.2	94.4	100.	100.	100.	100.
05/27/93	221	1	2.76	4.8	19.9	41.1	68.7	83.3	93.0	100.	100.	100.	100.
		2	1.96	7.1	28.8	50.8	74.1	85.8	92.2	100.	100.	100.	100.
05/28/93	216	1	6.24	1.4	5.5	10.0	12.9	14.2	15.3	28.0	69.8	100.	100.
		2	8.60	1.0	4.4	8.2	12.1	13.7	15.9	28.7	33.3	100.	100.
05/28/93	238	1	3.44	4.2	18.5	35.0	56.8	67.7	79.1	84.3	100.	100.	100.
		2	3.52	3.4	15.2	30.2	49.4	61.7	74.9	82.5	100.	100.	100.
06/06/93	155	1	.175	1.5	14.7	35.3	63.2	100.	100.	100.	100.	100.	100.
		2	.163	6.8	32.2	57.6	81.3	96.6	100.	100.	100.	100.	100.
06/07/93	153	1	.121	26.6	48.8	71.0	80.0	100.	100.	100.	100.	100.	100.
		2	2.33	.9	5.2	16.2	52.2	80.6	99.1	100.	100.	100.	100.
06/07/93	137	1	.127	4.3	27.7	57.5	89.4	100.	100.	100.	100.	100.	100.
		2	.098	11.4	39.9	62.8	85.7	100.	100.	100.	100.	100.	100.
06/08/93	134	1	.067	8.7	34.8	56.5	91.3	100.	100.	100.	100.	100.	100.
		2	.135	6.0	30.0	54.0	84.0	100.	100.	100.	100.	100.	100.
06/08/93	133	1	.060	10.0	45.0	65.0	90.0	100.	100.	100.	100.	100.	100.
		2	.101	3.0	20.0	40.0	80.0	100.	100.	100.	100.	100.	100.
06/09/93	125	1	.043	6.0	25.0	50.0	88.0	100.	100.	100.	100.	100.	100.
		2	.109	5.0	22.5	40.0	75.0	100.	100.	100.	100.	100.	100.
05/20/97	275	1	81.7	.9	4.6	9.5	17.7	30.7	48.5	71.0	82.7	100.	100.
	282	2	55.0	1.6	7.2	14.4	27.4	47.6	69.3	91.7	100.	100.	100.
05/21/97	289	1	29.0	1.5	8.9	19.2	33.9	51.0	67.0	78.3	85.5	100.	100.
	289	2	21.0	1.8	9.8	17.2	24.3	30.6	37.7	55.0	77.4	100.	100.
05/21/97	337	1	60.1	1.0	5.9	10.7	17.0	23.7	30.6	45.3	77.4	100.	100.
	355	2	61.7	1.5	7.2	13.0	20.2	29.3	38.4	56.3	81.6	100.	100.
05/22/97	315	1	51.9	1.1	5.3	9.8	16.2	23.5	32.4	54.6	87.6	100.	100.
	289	2	41.1	1.1	6.3	12.2	21.4	32.2	41.6	54.2	70.1	100.	100.
05/22/97	324	1	37.9	1.5	7.2	13.3	22.7	35.7	48.2	64.0	80.8	100.	100.
	328	2	30.7	2.0	10.4	19.6	33.1	48.4	61.0	75.4	82.0	100.	100.
05/28/97	218	1	2.11	5.5	29.4	46.8	60.3	71.0	78.1	88.3	100.	100.	100.
	219	2	12.5	1.4	8.4	18.4	34.2	54.8	73.5	88.3	100.	100.	100.
05/29/97	240	1	27.8	1.0	6.4	16.6	31.4	44.7	54.5	65.6	88.2	100.	100.
	245	2	55.3	.7	3.3	8.0	16.7	30.2	47.7	67.1	84.7	100.	100.
05/29/97	248	1	13.7	2.3	15.7	32.1	50.8	69.3	82.8	92.8	100.	100.	100.

(con.)

Table 3 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Percent finer than sieve size (mm) 0.25	0.5	1	2	4	8	16	32	64	128
	cfs		*t/d*										
	252	2	73.0	.7	3.3	8.0	16.1	27.9	40.8	58.3	76.6	90.5	100.
05/30/97	268	1	6.25	2.3	17.6	35.5	57.9	77.3	87.9	93.6	100.	100.	100.
	261	2	3.85	4.2	26.2	46.7	67.2	82.0	90.6	95.3	100.	100.	100.
05/30/97	261	1	10.4	2.5	12.6	23.2	37.8	51.1	60.7	71.7	80.1	100.	100.
	265	2	5.44	4.1	20.6	38.0	59.5	79.2	91.5	100.	100.	100.	100.
05/30/97	310	1	14.8	2.8	14.3	29.0	46.6	59.7	68.4	78.6	88.6	100.	100.
	316	2	30.7	1.6	8.6	17.7	29.9	42.6	53.3	64.5	84.4	100.	100.
05/31/97	275	1	8.19	2.4	10.7	23.4	40.4	62.3	80.0	100.	100.	100.	100.
	275	2	7.75	2.7	18.3	31.4	45.9	62.1	77.9	95.0	100.	100.	100.
05/31/97	285	1	13.8	2.2	13.9	25.3	39.3	53.4	63.4	73.2	75.5	100.	100.
	289	2	12.0	2.3	13.0	23.7	44.2	67.9	80.1	93.6	100.	100.	100.
05/31/97	328	1	23.0	2.8	13.0	22.3	31.6	40.9	51.3	68.9	100.	100.	100.
	337	2	23.1	3.4	17.3	30.0	45.6	65.4	84.3	96.0	100.	100.	100.
06/01/97	364	1	15.4	3.2	20.0	31.9	45.0	59.1	71.4	79.4	100.	100.	100.
	364	2	20.5	2.4	12.9	20.1	28.7	40.1	51.9	64.1	78.9	100.	100.
06/01/97	355	1	14.2	3.2	18.3	29.3	40.0	54.1	68.5	77.9	89.4	100.	100.
	355	2	19.5	2.7	16.7	27.9	41.6	62.	81.6	94.9	100.	100.	100.
06/01/97	346	1	13.4	3.4	18.6	30.8	40.9	50.2	60.6	75.1	93.5	100.	100.
	350	2	11.8	4.9	28.6	45.0	54.6	58.2	59.5	61.9	85.8	100.	100.
06/04/97	394	1	98.1	2.5	10.3	17.1	25.6	36.5	52.4	72.5	89.1	100.	100.
	400	2	71.2	3.0	14.7	23.0	30.7	41.1	54.0	71.9	89.1	100.	100.
06/05/97	353	1	80.6	2.3	10.7	19.8	30.9	45.6	60.4	73.7	89.0	100.	100.
	350	2	76.8	2.4	12.0	20.6	30.4	41.8	52.1	62.4	78.0	100.	100.
06/05/97	350	1	109.	2.2	10.4	19.0	28.8	39.	49.2	63.6	84.5	100.	100.
	358	2	80.2	2.9	16.0	26.3	35.3	42.8	51.1	70.2	87.6	88.8	100.
06/05/97	389	1	96.1	3.1	16.6	28.2	39.1	50.9	61.8	71.5	83.3	100.	100.
	399	2	107.	2.2	11.0	18.0	22.4	25.7	29.5	47.8	80.1	100.	100.
06/05/97	413	1	174.	1.7	8.9	16.3	24.1	31.7	39.0	47.3	65.3	93.5	100.
	404	2	94.6	3.2	17.7	32.2	46.8	61.4	72.0	81.1	92.2	100.	100.
06/06/97	350	1	56.9	3.7	22.0	36.3	52.5	68.9	80.9	92.2	100.	100.	100.
	337	2	47.8	3.7	22.0	36.2	49.6	60.5	69.3	79.8	92.3	100.	100.
06/06/97	328	1	35.3	3.8	26.4	43.0	57.2	68.1	75.9	83.0	88.4	100.	100.
	328	2	82.7	2.9	15.8	25.9	36.9	48.1	58.4	72.8	94.8	100.	100.
06/10/97	252	1	45.5	1.7	8.7	16.9	27.2	36.5	45.1	58.5	80.3	100.	100.
	259	2	35.9	2.1	11.9	22.4	34.5	46.6	58.2	69.7	77.9	100.	100.
06/11/97	217	1	60.5	1.1	5.8	11.2	16.8	25.6	47.3	78.9	97.3	100.	100.
	217	2	32.4	1.8	10.0	18.0	27.8	39.1	50.7	61.4	84.3	100.	100.
06/11/97	217	1	50.5	1.1	7.3	17.7	30.8	44.	59.4	80.6	100.	100.	100.
	217	2	57.3	.9	5.0	11.1	19.3	30.7	44.5	62.4	90.4	100.	100.
06/11/97	212	1	37.3	1.5	8.8	22.3	42.6	63.	77.1	88.2	96.1	100.	100.
	214	2	73.8	.7	3.8	10.4	26.5	49.2	68.8	84.6	98.8	100.	100.
06/12/97	201	1	6.56	2.6	16.3	38.4	65.2	83.3	93.6	98.2	100.	100.	100.
	198	2	14.0	1.7	9.3	22.6	42.4	60.6	74.0	87.4	92.3	100.	100.
06/12/97	194	1	9.36	2.2	11.1	25.2	43.3	58.2	71.2	84.8	100.	100.	100.
	194	2	7.24	1.7	9.0	21.6	39.1	51.7	57.9	71.8	79.3	100.	100.
06/12/97	201	1	7.45	2.0	13.0	27.2	39.7	46.0	48.3	50.7	53.4	100.	100.
	201	2	13.4	1.5	8.9	21.3	39.5	57.2	71.4	86.4	100.	100.	100.
06/13/97	180	1	5.05	2.4	14.6	30.5	50.7	68.3	78.4	92.2	100.	100.	100.
	180	2	5.90	1.7	12.4	25.5	39.8	53.0	65.3	91.5	100.	100.	100.
06/13/97	174	1	3.45	2.7	15.6	31.9	49.7	62.5	72.2	78.8	100.	100.	100.
	174	2	5.91	1.1	8.8	22.4	41.1	54.4	64.3	77.7	100.	100.	100.

Table 4—Bedload particle-size distribution, computed particle size at specific percentages, Little Granite Creek, Wyoming 1982–1993 and 1997.

Date	Water discharge	Bedload Traverse number	Bedload Discharge	D_5	D_{16}	D_{25}	D_{35}	D_{50}	D_{65}	D_{75}	D_{84}	D_{90}	D_{95}
	cfs		*t/d*										
05/27/82	354	1	9.18	0.32	0.49	0.75	1.23	3.24	16.2	33.4	36.5	39.4	43.5
06/02/82	204	1	1.44	.37	.68	1.09	1.71	3.41	7.76	16.8	18.4	19.8	21.8
06/09/82	165	1	.477	.30	.43	.53	.72	1.05	1.49	1.93	2.51	3.14	4.11
06/18/82	290	1	7.05	.34	.59	.98	1.69	4.27	22.3	33.2	36.3	39.3	43.4
06/24/82	237	1	22.5	.53	1.84	3.59	6.78	12.6	18.9	23.6	30.3	34.4	39.1
06/29/82	215	1	14.2	.63	2.41	5.08	8.55	13.3	20.7	28.8	34.4	37.4	41.7
07/07/82	96	1	.293	.31	.48	.72	1.07	2.07	3.98	5.46	7.76	10.1	13.9
07/13/82	78	1	.191	.23	.39	.53	.78	1.37	2.57	4.16	5.71	7.51	9.03
05/17/83	35	1	.450	.27	.52	.76	1.10	2.65	16.5	17.7	19.2	20.6	22.5
05/25/83	160	1	3.61	.20	.30	.36	.43	.60	.97	1.63	3.78	7.21	11.4
06/01/83	259	1	30.9	.80	2.26	4.14	5.31	7.40	10.9	14.7	17.2	18.7	20.9
06/08/83	220	1	3.65	.34	.49	.75	1.15	2.31	4.74	7.91	16.5	18.1	20.3
06/18/83	163	1	1.31	.24	.43	.64	1.05	1.99	3.03	4.11	5.38	6.81	8.62
06/22/83	119	1	1.38	.32	.64	1.04	1.53	2.52	4.09	6.05	9.07	12.2	16.8
06/29/83	93	1	.273	.24	.49	1.12	2.70	9.12	14.9	17.1	18.6	20.0	22.0
07/06/83	78	1	.272	.26	.46	.71	1.14	2.23	4.37	7.95	8.79	9.54	10.6
07/13/83	54	1	.135	.25	.46	.67	.97	1.57	2.45	3.34	4.20	4.59	5.14
04/18/84	49	1	.290	.17	.29	.38	.49	.86	1.51	2.17	2.95	3.85	5.79
05/10/84	50	1	.685	.19	.41	.59	.80	1.13	1.49	1.82	2.22	2.59	3.16
05/17/84	198	1	11.9	.44	1.73	4.45	8.57	13.3	18.3	21.7	26.3	31.1	36.3
05/22/84	166	1	9.11	.27	.49	.89	1.67	3.93	10.8	27.8	34.9	37.9	42.2
05/30/84	253	1	42.1	.36	1.44	8.89	16.0	21.0	27.4	32.6	35.8	38.7	42.9
06/07/84	142	1	2.49	.31	.76	1.53	2.84	5.6	9.41	12.7	16.5	18.1	20.3
06/13/84	111	1	.278	.27	.47	.73	1.14	2.16	3.72	5.20	7.46	8.63	9.79
06/21/84	121	1	1.74	.26	.55	1.03	1.80	3.35	5.72	8.08	8.87	9.61	10.7
06/28/84	110	1	1.28	.30	.73	1.18	1.71	2.67	4.08	5.61	8.01	10.5	14.9
07/06/84	74	1	.088	.26	.58	.91	1.33	2.15	3.28	4.40	5.89	7.59	9.04
07/11/84	51	1	.035	.23	.46	.74	1.25	3.66	5.40	6.88	8.37	9.15	10.3
07/18/84	41	1	.017	.12	.25	.37	.51	.87	1.36	1.87	2.38	2.88	3.67
05/08/85	139	1	1.91	.18	.29	.37	.46	.76	1.42	2.47	5.32	9.91	17.1
		2	7.57	.29	.59	1.07	1.76	3.52	13.1	33.9	37.0	39.89	43.9
05/15/85	104	1	.156	.16	.29	.39	.51	.92	1.67	3.42	8.19	17.4	19.7
		2	1.62	.46	1.21	1.85	2.72	4.51	7.19	8.44	9.21	9.94	11.0
05/25/85	129	1	1.14	.21	.35	.46	.64	1.05	1.62	2.40	4.17	6.17	8.64
		2	2.00	.21	.39	.56	.90	1.56	2.81	4.68	10.5	17.0	19.3
05/30/85	100	1	.726	.30	.56	.80	1.10	1.65	2.58	3.72	6.60	8.52	9.69
		2	1.77	.46	1.06	1.60	2.34	3.96	6.35	8.23	9.01	9.75	10.8
06/05/85	68	1	.243	.31	.59	.92	1.37	2.27	3.49	4.65	6.24	8.02	9.23
		2	.443	.43	.88	1.23	1.63	2.31	3.18	4.03	4.83	5.64	6.90
06/13/85	56	1	1.09	.54	1.27	1.85	2.55	3.89	5.78	7.77	8.73	9.49	10.6
		2	.749	.48	1.09	1.63	2.30	3.54	4.93	6.14	7.86	9.69	12.7
06/19/85	44	1	.144	.38	.64	.86	1.11	1.55	2.11	2.50	3.04	3.60	4.33
		2	.039	.22	.41	.56	.78	1.20	1.86	2.44	3.26	4.08	4.68
06/27/85	29	1	.010	.15	.28	.39	.53	.89	1.48	2.03	2.23	2.41	2.68
		2	.013	.24	.36	.43	.53	.84	1.31	1.81	2.15	2.34	2.61
07/02/85	25	1	.017	.27	.42	.55	.87	1.52	2.10	2.25	2.43	2.6	2.84
		2	.019	.04	.10	.15	.23	.38	.52	.56	.61	.65	.71
07/11/85	24	1	.454	.43	1.02	1.58	2.50	5.93	17.0	18.2	19.6	21.0	22.9
		2	.338	.33	.68	1.05	1.50	2.33	3.45	4.44	5.60	6.85	8.54
07/17/85	14	1	.017	.20	.35	.46	.65	1.05	1.49	1.94	2.18	2.37	2.64
05/08/86	81	1	.178	.14	.25	.34	.44	.88	2.49	3.85	5.74	8.02	9.23
05/14/86	71	1	.328	.30	.68	1.17	1.94	2.98	4.38	5.53	7.18	8.43	9.61
		2	.934	.33	.60	.90	1.25	1.90	2.73	3.57	4.52	5.37	6.68
05/20/86	130	1	1.85	.18	.30	.38	.47	.88	1.96	4.08	8.22	12.7	17.5
05/28/86	298	1	20.2	.51	2.86	5.35	8.25	12.0	16.9	20.5	25.4	30.5	36.0
		2	44.6	.78	7.21	14.90	20.2	28.7	34.1	36.4	39.5	42.1	45.8
06/03/86	403	1	46.0	.82	8.56	14.70	19.2	25.9	35.8	47.8	64.7	71.1	80.1
		2	11.0	.33	.98	1.75	2.80	5.05	8.78	12.7	17.5	21.0	26.5
06/12/86	250	1	.485	.22	.40	.62	1.44	4.23	9.07	12.0	16.2	17.7	20.0

(con.)

Table 4 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	D_{5}	D_{16}	D_{25}	D_{35}	D_{50}	D_{65}	D_{75}	D_{84}	D_{90}	D_{95}
				Computed particle size (mm) at specific percentages									
	cfs		*t/d*										
		2	1.61	.32	1.86	4.95	8.00	11.7	16.3	17.5	19.0	20.4	22.4
06/18/86	180	1	.735	.34	.44	.53	.71	1.08	1.84	2.90	5.43	8.36	9.55
		2	.407	.31	.41	.47	.57	.83	1.28	1.88	3.09	4.39	5.87
06/26/86	104	1	.396	.44	.81	1.16	1.59	2.34	3.28	4.18	5.23	6.36	8.11
		2	.494	.46	1.15	1.92	2.63	3.92	5.14	6.27	7.85	8.72	9.87
07/02/86	83	1	1.13	.63	1.36	1.99	2.71	4.10	6.10	8.17	10.8	13.8	17.4
		2	.336	.36	.63	.85	1.12	1.72	2.98	4.97	8.26	9.04	10.2
07/10/86	57	1	.084	.35	.55	.75	1.00	1.59	3.00	4.88	7.46	8.66	9.81
		2	.061	.34	.66	1.01	1.59	3.05	5.52	8.06	8.85	9.60	10.7
07/16/86	46	1	.081	.43	1.13	1.65	2.20	2.99	4.06	4.89	6.03	7.23	8.74
		2	.120	.39	.83	1.30	1.90	2.63	3.57	4.16	4.55	4.92	5.43
05/07/87	84	1	1.35	.23	.55	.89	1.32	2.26	4.26	6.72	8.54	9.31	10.4
05/13/87	62	1	1.01	.25	.52	.74	1.01	1.43	2.03	2.73	3.80	4.73	6.14
		2	.391	.28	.50	.76	1.12	2.09	4.21	7.19	8.66	9.42	10.5
05/22/87	66	1	1.53	.42	1.22	1.89	2.67	4.13	5.69	7.25	9.36	11.6	15.3
		2	.541	.33	.62	.93	1.35	2.20	3.56	4.94	7.07	8.50	9.67
05/28/87	106	1	7.76	.41	.86	1.27	1.81	3.17	10.1	11.7	13.9	16.0	18.4
		2	2.05	.27	.60	.92	1.35	2.26	3.94	5.59	8.07	8.86	10.0
06/03/87	74	1	1.63	.40	1.09	1.68	2.43	3.88	5.63	7.41	9.34	11.2	14.0
		2	.096	.27	.55	.77	1.04	1.38	1.84	2.38	3.28	4.40	6.70
05/12/88	68	1	.581	.18	.34	.47	.68	1.18	2.01	3.21	4.63	5.76	7.63
		2	.496	.19	.33	.44	.61	1.02	1.61	2.31	3.70	5.82	8.62
05/18/88	156	1	.998	.17	.29	.38	.48	.82	1.50	2.59	5.18	8.14	9.34
		2	2.09	.23	.42	.62	.93	1.65	2.96	4.46	6.57	9.14	13.8
05/27/88	149	1	1.03	.28	.63	1.11	1.85	4.18	11.2	16.5	18.1	19.5	21.6
		2	1.02	.19	.29	.37	.45	.68	1.17	1.76	3.22	5.67	12.7
06/03/88	75	1	.930	.41	1.30	2.64	5.09	9.07	12.3	15.4	17.4	18.9	21.0
		2	1.20	.64	2.01	3.07	4.31	5.98	8.24	10.1	12.7	15.4	18.1
06/10/88	59	1	.068	.29	.66	.99	1.30	1.85	2.92	4.05	4.44	4.81	5.34
		2	.117	.29	.53	.76	1.07	1.74	2.77	3.90	4.37	4.75	5.28
06/15/88	48	1	.061	.22	.33	.41	.49	.68	.96	1.32	1.92	3.05	4.37
		2	.147	.40	.76	1.03	1.30	1.78	2.48	3.21	4.11	4.50	5.06
06/22/88	41	1	.023	.31	.54	.83	1.15	1.64	2.08	2.23	2.42	2.59	2.83
		2	.063	.25	.46	.65	.89	1.32	1.93	2.14	2.33	2.51	2.76
05/05/89	84	1	.441	.35	.68	1.03	1.35	1.94	2.82	3.74	4.54	5.22	6.25
		2	1.42	.31	.74	1.07	1.39	1.95	2.68	3.41	4.32	5.11	6.35
05/09/89	173	1	5.03	.28	.39	.45	.66	1.91	17.0	23.0	32.1	35.3	39.8
		2	6.45	.30	.46	.63	.93	1.67	3.08	4.83	7.91	11.3	16.6
05/18/89	154	1	9.67	1.06	2.31	3.55	5.64	12.1	32.8	35.3	38.3	41.1	44.9
		2	2.19	.28	.61	1.01	1.51	2.64	4.49	6.05	8.40	10.9	15.1
05/25/89	137	1	6.42	.65	1.32	1.85	2.56	3.99	6.41	8.90	12.2	16.0	18.5
		2	—	—	—	—	—	—	—	—	—	—	—
06/02/89	119	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/07/89	166	1	4.51	.35	.80	1.28	1.94	3.47	6.18	9.10	13.1	16.6	19.0
		2	1.31	.24	.41	.56	.83	1.55	3.54	11.7	17.2	18.8	20.9
06/15/89	122	1	.147	.22	.34	.42	.52	.76	1.08	1.32	1.67	2.02	2.32
		2	.587	.23	.42	.61	.93	1.72	8.00	17.1	18.6	20.0	22.0
06/21/89	78	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/29/89	52	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
07/05/89	45	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
04/27/90	54	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/03/90	45	1	—	—	—	—	—	—	—	—	—	—	—

(con.)

Table 4 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Computed particle size (mm) at specific percentages D_5	D_{16}	D_{25}	D_{35}	D_{50}	D_{65}	D_{75}	D_{84}	D_{90}	D_{95}
	cfs		*t/d*										
05/10/90	69	1	.696	.26	.47	.64	.85	1.17	1.54	1.90	2.40	2.93	3.80
		2	—	—	—	—	—	—	—	—	—	—	—
05/18/90	55	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/25/90	72	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/31/90	80	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/05/90	72	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/14/90	63	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/20/90	61	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
06/28/90	52	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
07/05/90	34	1	—	—	—	—	—	—	—	—	—	—	—
		2	—	—	—	—	—	—	—	—	—	—	—
05/29/91	100	1	.017	.17	.28	.37	.47	.74	1.21	1.75	2.45	3.17	4.20
		2	.088	.21	.34	.44	.59	1.03	1.92	2.61	3.62	4.27	4.85
05/29/91	94	1	.075	.24	.49	.95	1.47	3.37	6.76	8.41	9.18	9.91	10.9
		2	.026	.17	.27	.33	.40	.53	.87	1.13	1.43	1.74	2.15
05/29/91	94	1	.140	.21	.29	.35	.41	.51	.73	.94	1.22	1.51	2.00
		2	.104	.20	.28	.33	.38	.46	.62	.80	1.06	1.28	1.65
06/01/91	86	1	.062	.23	.33	.39	.46	.63	.94	1.19	1.52	1.89	2.71
		2	.083	.23	.34	.41	.48	.79	1.48	2.50	4.10	4.49	5.05
06/01/91	86	1	.048	.21	.30	.36	.42	.54	.84	1.12	1.48	1.88	2.25
		2	.091	.23	.35	.44	.55	.85	1.28	1.70	2.82	4.18	4.77
06/01/91	84	1	.227	.20	.29	.36	.42	.55	.80	1.04	1.31	1.6	2.05
		2	.107	.22	.34	.42	.51	.79	1.20	1.60	3.24	4.34	4.92
06/03/91	111	1	.363	.21	.30	.37	.42	.57	.81	1.06	1.41	1.79	2.40
		2	.895	.25	.39	.49	.70	1.12	1.65	2.27	3.49	5.09	8.11
06/03/91	149	1	.569	.20	.29	.36	.43	.58	.86	1.14	1.55	2.01	2.99
		2	.668	.22	.32	.39	.46	.67	1.05	1.42	2.00	2.89	4.38
06/03/91	140	1	1.29	.20	.31	.39	.47	.71	1.17	1.79	4.85	15.4	18.4
		2	1.01	.21	.32	.40	.48	.76	1.25	1.82	3.63	8.44	17.1
06/04/91	183	1	3.57	.29	.49	.67	.91	1.33	1.93	2.85	4.34	5.72	8.08
		2	1.47	.27	.46	.76	1.42	5.06	16.4	17.7	19.2	20.6	22.5
06/04/91	190	1	1.93	.25	.41	.55	.78	1.21	1.80	2.58	4.00	5.05	6.82
		2	2.11	.24	.37	.46	.64	1.09	1.75	2.56	4.01	4.79	6.02
06/11/91	143	1	.444	.23	.37	.46	.58	.83	1.17	1.50	2.00	2.69	3.92
		2	.357	.23	.36	.45	.59	.91	1.43	2.04	3.71	4.95	6.82
06/11/91	143	1	.787	.34	.61	.87	1.14	1.58	2.32	3.46	5.66	8.19	9.39
		2	.330	.25	.40	.51	.66	.95	1.29	1.59	2.04	2.71	3.88
06/11/91	144	1	.674	.26	.41	.55	.79	1.36	2.80	5.09	8.13	8.92	10.1
		2	.295	.24	.37	.47	.61	.90	1.30	1.70	2.60	4.25	8.38
06/11/91	158	1	.374	.24	.39	.50	.68	1.06	1.82	4.91	17.3	18.8	20.9
		2	.504	.21	.32	.39	.47	.64	.90	1.13	1.43	1.76	2.21
06/12/91	150	1	1.20	.30	.52	.73	.98	1.34	1.82	2.34	3.16	4.10	5.61
		2	.617	.27	.46	.64	.88	1.28	1.80	2.59	4.11	5.12	6.80
06/12/91	139	1	1.23	.38	.88	1.63	4.28	12.1	17.1	18.3	19.7	21.1	23.0
		2	.406	.24	.40	.52	.71	1.06	1.46	1.86	2.64	3.66	6.20
06/12/91	148	1	.363	.21	.34	.43	.53	.77	1.10	1.37	1.76	2.34	3.79
		2	.589	.25	.42	.56	.76	1.13	1.62	2.14	3.14	4.29	5.99
06/12/91	154	1	.974	.29	.48	.68	.94	1.46	2.35	3.60	5.16	6.84	8.74
		2	.389	.22	.35	.44	.55	.79	1.10	1.40	1.82	2.38	3.49
06/12/91	159	1	.550	.23	.36	.44	.55	.80	1.13	1.46	1.93	2.67	4.06
		2	.653	.21	.32	.40	.49	.67	.93	1.13	1.38	1.63	2.04
06/12/91	166	1	.942	.24	.41	.56	.82	1.41	2.95	6.00	10.6	15.9	18.4
		2	.487	.21	.32	.40	.49	.69	.98	1.26	1.67	2.15	3.02

(con.)

Table 4 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	D_5	D_{16}	D_{25}	D_{35}	D_{50}	D_{65}	D_{75}	D_{84}	D_{90}	D_{95}
				Computed particle size (mm) at specific percentages									
	cfs		*t/d*										
06/13/91	156	1	.257	.22	.34	.42	.51	.74	1.09	1.48	2.14	3.36	4.44
		2	.676	.25	.40	.51	.69	1.04	1.52	2.02	3.24	4.72	7.33
06/13/91	152	1	.392	.22	.34	.43	.54	.77	1.08	1.34	1.72	2.18	3.09
		2	.209	.19	.29	.37	.44	.60	.85	1.09	1.37	1.68	2.11
06/13/91	146	1	.475	.23	.37	.47	.61	.88	1.24	1.57	2.06	2.79	4.06
		2	1.29	.30	.53	.76	1.05	1.46	2.05	2.92	4.45	6.89	8.93
06/05/92	26	1	.004	.16	.29	.40	.52	.68	.90	1.08	1.28	1.48	1.79
		2	.003	.11	.19	.24	.30	.41	.56	.72	.95	1.26	1.84
06/06/92	26	1	.004	.16	.28	.38	.49	.65	.87	1.07	1.31	1.56	1.95
		2	.019	.26	.43	.56	.72	1.01	1.47	1.93	2.18	2.37	2.64
06/07/92	25	1	.035	.24	.38	.49	.60	.80	1.06	1.36	1.80	2.37	3.52
		2	.012	.19	.32	.41	.51	.68	.90	1.10	1.33	1.57	1.94
06/08/92	25	1	.007	.15	.24	.31	.39	.53	.80	1.07	1.51	2.01	2.32
		2	.004	.13	.20	.25	.30	.38	.50	.68	.97	1.09	1.23
05/26/93	196	1	3.59	.38	.90	1.48	2.56	7.71	17.0	18.2	19.7	21.0	22.9
		2	4.57	.35	.72	1.17	1.88	4.69	9.68	16.0	17.6	19.1	21.2
05/26/93	182	1	9.33	.66	1.57	2.55	4.38	8.96	24.2	34.2	37.2	40.1	44.1
		2	5.42	.39	.92	1.49	2.45	6.20	18.6	30.8	35.0	38.0	42.3
05/27/93	217	1	2.15	.21	.33	.42	.53	.79	1.18	1.59	2.34	3.65	12.7
		2	1.98	.21	.33	.41	.51	.75	1.10	1.45	1.98	3.17	8.21
05/27/93	221	1	2.76	.25	.44	.61	.84	1.25	1.81	2.62	4.19	6.15	8.62
		2	1.96	.22	.36	.46	.62	.98	1.50	2.09	3.56	6.09	8.80
05/28/93	216	1	6.24	.47	8.76	17.40	20.2	24.6	29.9	33.4	36.5	39.4	43.5
		2	8.60	.57	7.93	13.40	32.3	34.9	37.6	39.9	42.5	45.0	48.3
05/28/93	238	1	3.44	.27	.46	.68	1.00	1.62	3.35	5.25	7.93	8.78	9.92
		2	3.52	.28	.39	.46	.60	1.03	2.35	4.03	8.17	8.96	10.1
06/06/93	155	1	.175	.35	.53	.74	.99	1.44	2.03	2.18	2.37	2.54	2.79
		2	.163	.23	.35	.43	.54	.82	1.21	1.62	2.17	2.68	3.50
06/07/93	153	1	.121	.08	.16	.24	.33	.52	.82	1.34	2.10	2.30	2.57
		2	2.33	.49	.99	1.23	1.49	1.93	2.66	3.40	4.26	4.85	5.74
06/07/93	137	1	.127	.26	.39	.48	.60	.85	1.14	1.37	1.70	2.03	2.33
		2	.098	.18	.29	.37	.46	.68	1.06	1.39	1.88	2.16	2.45
06/08/93	134	1	.067	.20	.32	.41	.50	.82	1.14	1.35	1.62	1.91	2.25
		2	.135	.24	.36	.45	.58	.90	1.25	1.56	2.00	2.20	2.49
06/08/93	133	1	.060	.20	.30	.36	.43	.59	1.00	1.25	1.61	2.00	2.30
		2	.101	.29	.45	.61	.86	1.17	1.50	1.80	2.10	2.30	2.57
06/09/93	125	1	.043	.09	.18	.25	.34	.52	.64	.75	.91	1.04	1.19
		2	.109	.25	.41	.56	.83	1.21	1.61	2.00	1.20	2.39	2.65
05/20/97	275	1	81.7	.54	1.79	3.12	4.97	8.54	13.9	21.5	33.1	38.3	42.7
	282	2	55.0	.40	1.12	1.82	2.76	4.45	7.21	10.0	13.3	15.4	20.4
05/21/97	289	1	29.0	.37	.85	1.40	2.13	3.88	7.51	13.7	28.7	42.6	54.3
	289	2	21.0	.35	.92	2.22	6.47	13.7	23.1	30.3	35.2	38.1	40.6
05/21/97	337	1	60.1	.45	1.84	4.75	10.4	18.3	25.8	30.8	36.9	41.5	45.2
	355	2	61.7	.40	1.42	3.05	6.51	13.2	21.5	27.8	33.7	37.9	41.5
05/22/97	315	1	51.9	.48	1.97	4.67	8.93	14.4	21.1	25.9	30.3	35.7	43.4
	289	2	41.1	.44	1.42	2.67	5.20	13.3	26.9	35.5	41.8	46.0	49.5
05/22/97	324	1	37.9	.40	1.29	2.35	3.90	8.90	17.0	26.5	38.5	50.7	60.9
	328	2	30.7	.34	.80	1.40	2.25	4.50	10.2	15.8	34.9	43.6	50.8
05/28/97	218	1	2.11	.24	.36	.45	.66	1.24	2.87	6.26	12.6	16.7	18.9
	219	2	12.5	.38	.88	1.42	2.08	3.53	6.18	8.81	13.7	17.0	20.0
05/29/97	240	1	27.8	.43	.97	1.57	2.54	6.15	15.6	22.6	29.0	33.5	37.8
	245	2	55.3	.68	1.92	3.23	5.10	8.94	15.1	23.2	31.4	39.6	46.8
05/29/97	248	1	13.7	.30	.51	.78	1.15	1.96	3.53	5.69	8.99	13.8	18.2
	252	2	73.0	.68	1.98	3.50	6.20	12.2	21.9	30.6	49.1	62.9	68.3
05/30/97	268	1	6.25	.29	.47	.71	.99	1.65	2.73	3.76	6.53	10.9	17.5
	261	2	3.85	.26	.38	.49	.72	1.16	1.89	3.06	4.94	7.74	15.4
05/30/97	261	1	10.4	.31	.66	1.12	1.81	3.83	11.1	22.3	33.2	35.0	36.5

(con.)

Table 4 (Con.)

Date	Water discharge	Bedload Traverse number	Bedload Discharge	Computed particle size (mm) at specific percentages D_{5}	D_{16}	D_{25}	D_{35}	D_{50}	D_{65}	D_{75}	D_{84}	D_{90}	D_{95}
	cfs		*t/d*										
	265	2	5.44	.26	.43	.63	.91	1.56	2.56	3.57	5.55	7.50	10.5
05/30/97	310	1	14.8	.30	.56	.86	1.34	2.52	6.43	13.2	24.6	32.6	34.8
	316	2	30.7	.37	.91	1.60	2.80	6.77	16.4	24.4	31.7	38.4	44.2
05/31/97	275	1	8.19	.33	.71	1.09	1.68	2.87	4.60	6.86	9.78	12.5	14.8
	275	2	7.75	.29	.46	.76	1.25	2.50	4.73	7.26	10.8	13.7	16.0
05/31/97	285	1	13.8	.31	.59	.99	1.69	3.52	9.34	28.3	36.5	39.7	42.3
	289	2	12.0	.31	.64	1.06	1.55	2.49	3.76	6.33	10.3	13.9	17.5
05/31/97	328	1	23.0	.31	.66	1.29	2.73	7.49	14.2	20.7	27.6	32.3	36.1
	337	2	23.1	.28	.48	.80	1.32	2.45	3.96	6.03	7.94	11.9	15.3
06/01/97	364	1	15.4	.27	.44	.71	1.24	2.71	5.92	11.6	22.8	31.5	38.7
	364	2	20.5	.31	.72	1.57	3.11	7.36	17.0	27.8	34.4	37.3	39.6
06/01/97	355	1	14.2	.28	.46	.81	1.53	3.42	7.02	13.5	24.5	32.5	36.2
	355	2	19.5	.29	.49	.87	1.52	2.82	4.61	6.65	9.45	13.1	16.3
06/01/97	346	1	13.4	.28	.46	.76	1.41	3.95	10.4	15.9	23.7	29.0	33.4
	350	2	11.8	.25	.37	.46	.70	1.52	18.1	24.8	30.8	33.5	35.2
06/04/97	394	1	98.1	.33	.92	1.93	3.72	7.40	13.0	18.4	27.1	33.7	43.4
	400	2	71.2	.29	.58	1.26	2.82	6.75	12.9	18.9	27.3	33.4	41.2
06/05/97	353	1	80.6	.33	.79	1.47	2.56	5.20	10.8	17.4	26.8	33.9	43.0
	350	2	76.8	.32	.73	1.45	2.80	7.19	18.7	28.9	39.6	47.3	53.6
06/05/97	350	1	109.	.34	.83	1.61	3.21	8.45	17.0	24.7	31.6	37.3	42.2
	358	2	80.2	.29	.50	.94	1.97	7.47	13.8	20.5	28.7	64.3	65.7
06/05/97	389	1	96.1	.28	.49	.86	1.62	3.84	10.7	20.8	32.8	38.9	43.9
	399	2	107.	.33	.86	3.60	10.4	17.1	24.5	29.5	38.3	47.9	56.0
06/05/97	413	1	174.	.36	.98	2.24	5.79	18.4	31.8	43.0	53.2	60.0	64.9
	404	2	94.6	.28	.47	.75	1.19	2.44	5.36	10.6	20.1	28.8	37.3
06/06/97	350	1	56.9	.27	.42	.61	.96	1.85	3.52	6.03	10.2	14.5	20.3
	337	2	47.8	.27	.42	.61	.96	2.06	6.04	12.3	21.4	29.1	37.3
06/06/97	328	1	35.3	.26	.38	.48	.76	1.49	3.44	7.55	19.0	34.6	42.8
	328	2	82.7	.29	.51	.96	1.83	4.73	11.7	17.6	24.2	28.5	32.4
06/10/97	252	1	45.5	.37	.95	1.79	3.68	10.9	20.8	28.1	34.3	37.9	41.0
	259	2	35.9	.32	.70	1.22	2.08	5.18	12.7	26.4	37.3	42.4	46.7
06/11/97	217	1	60.5	.46	1.85	3.86	5.73	8.68	12.5	15.0	20.4	25.7	30.0
	217	2	32.4	.35	.87	1.71	3.28	7.75	18.5	25.5	31.8	38.2	43.6
06/11/97	217	1	50.5	.41	.92	1.56	2.64	5.56	10.1	13.9	19.0	24.2	28.6
	217	2	57.3	.50	1.60	3.01	5.26	10.5	17.5	23.2	28.3	31.8	35.8
06/11/97	212	1	37.3	.37	.77	1.13	1.63	2.73	4.58	7.40	13.0	22.3	40.0
	214	2	73.8	.59	1.35	1.91	2.75	4.15	7.23	11.1	15.7	22.1	27.7
06/12/97	201	1	6.56	.29	.49	.70	.92	1.43	1.99	3.08	4.28	6.60	10.4
	198	2	14.0	.36	.75	1.12	1.63	2.84	5.30	8.57	14.0	24.5	33.8
06/12/97	194	1	9.36	.33	.68	.99	1.54	2.90	6.10	10.2	15.6	18.8	21.4
	194	2	7.24	.36	.78	1.19	1.77	3.72	12.1	22.9	32.9	34.1	35.0
06/12/97	201	1	7.45	.32	.61	.92	1.63	13.7	35.0	37.6	39.9	41.4	42.7
	201	2	13.4	.37	.79	1.20	1.75	3.19	6.21	9.94	14.7	18.1	21.1
06/13/97	180	1	5.05	.30	.54	.83	1.22	1.96	3.63	6.65	11.2	14.7	20.7
	180	2	5.90	.33	.64	.98	1.66	3.55	7.89	10.9	13.7	15.5	20.5
06/13/97	174	1	3.45	.30	.51	.79	1.18	2.05	5.03	11.4	18.0	20.2	22.1
	174	2	5.91	.38	.76	1.14	1.67	3.33	8.44	14.4	18.0	19.9	21.4

Table 5—Summary of bedload size-distribution data, percentage retained on sieve size, Little Granite Creek, Wyoming, 1982–1993 and 1997.

Water	Percentage of	Percentage retained on sieve size (mm)									
year	measured bedload	Pan	0.25	0.5	1	2	4	8	16	32	64
1982	1.81	1.1	7.0	7.7	9.0	9.4	10.0	15.2	20.4	20.2	—
1983	1.37	1.6	7.0	7.2	9.5	10.5	11.0	16.4	20.1	16.7	—
1984	2.29	2.7	7.2	6.3	6.4	6.1	6.0	14.2	30.0	21.1	—
1985	.669	4.4	11.2	11.9	16.4	16.7	13.3	10.5	3.6	12.0	—
1986	4.28	1.6	3.8	3.3	4.1	6.1	7.8	14.2	28.4	24.9	5.8
1987	.534	3.0	6.2	12.3	18.8	19.1	19.2	16.1	5.5	—	—
1988	.288	6.3	14.5	13.8	15.7	13.7	14.6	13.0	8.4	—	—
1989	1.25	2.1	8.7	10.6	14.8	16.1	14.5	11.3	10.0	11.9	—
1990	.023	4.4	13.2	23.7	35.9	18.5	4.3	—	—	—	—
1991	.993	5.5	19.8	21.5	23.5	11.9	8.6	4.2	5.0	—	—
1992	.003	9.2	22.5	32.4	23.7	10.7	1.6	—	—	—	—
1993	1.87	2.7	8.6	10.8	14.7	9.6	8.6	9.6	14.3	21.1	—
1997	84.6	2.1	9.0	9.0	10.7	12.0	11.9	14.8	16.9	12.6	1.0
1982–1993	15.4	2.4	7.6	8.2	10.2	9.6	9.5	12.9	20.0	18.0	1.6
1982–1993, 1997	100.	2.1	8.7	8.8	10.6	11.6	11.5	14.6	17.4	13.5	1.1

Table 6—Summary of bedload size-distribution data, percentage finer than sieve size, Little Granite Creek, Wyoming, 1982–1993 and 1997.

Water	Percentage of	Percentage finer than sieve size (mm)									
year	measured bedload	0.25	0.5	1	2	4	8	16	32	64	128
1982	1.81	1.1	8.1	15.8	24.8	34.2	44.2	59.4	79.8	100.	100.
1983	1.37	1.6	8.7	15.8	25.4	35.9	46.8	63.2	83.3	100.	100.
1984	2.29	2.7	9.9	16.2	22.6	28.7	34.7	48.9	78.9	100.	100.
1985	.669	4.4	15.6	27.5	43.9	60.6	73.9	84.4	88.0	100.	100.
1986	4.28	1.6	5.4	8.7	12.8	18.9	26.7	40.9	69.3	94.2	100.
1987	.534	3.0	9.1	21.4	40.2	59.3	78.5	94.5	100.	100.	100.
1988	.288	6.3	20.8	34.6	50.3	64.0	78.6	91.6	100.	100.	100.
1989	1.25	2.1	10.8	21.4	36.2	52.3	66.8	78.1	88.1	100.	100.
1990	.023	4.4	17.6	41.3	77.2	95.7	100.	100.	100.	100.	100.
1991	.993	5.5	25.3	46.8	70.3	82.2	90.8	95.0	100.	100.	100.
1992	.003	9.2	31.7	64.0	87.7	98.4	100.	100.	100.	100.	100.
1993	1.87	2.7	11.3	22.1	36.8	46.4	55.0	64.6	78.9	100.	100.
1997	84.6	2.1	11.0	20.0	30.7	42.7	54.6	69.4	86.3	99.0	100.
1982–1993	15.4	2.4	10.0	18.2	28.4	38.0	47.5	60.4	80.4	98.4	100.
1982–1993, 1997	100.	2.1	10.8	19.6	30.2	41.8	53.4	67.9	85.4	98.9	100.

Table 7—Summary of bedload size-distribution data, computed particle size at specific percentages, Little Granite Creek, Wyoming, 1982–1993 and 1997.

Water	Percentage of	Computed particle size (mm) at specified percentages									
year	measured bedload	D_{5}	D_{16}	D_{25}	D_{35}	D_{50}	D_{65}	D_{75}	D_{84}	D_{90}	D_{95}
1982	1.81	0.41	1.01	2.03	4.24	10.4	19.0	26.6	33.7	36.8	41.2
1983	1.37	.39	.99	1.93	3.74	9.08	16.9	23.1	32.3	35.4	40.0
1984	2.29	.34	.97	2.66	8.12	16.4	22.6	28.7	34.0	37.1	41.4
1985	.669	.27	.51	.88	1.39	2.57	4.97	8.53	15.7	33.3	38.0
1986	4.28	.48	2.90	6.95	12.2	19.9	28.6	35.7	44.1	53.0	67.1
1987	.534	.34	.76	1.16	1.67	2.85	4.83	6.93	9.58	12.2	16.4
1988	.288	.22	.42	.63	1.01	1.97	4.16	6.62	10.2	14.3	17.9
1989	1.25	.35	.72	1.21	1.90	3.63	7.34	13.1	23.6	33.2	38.0
1990	.023	.26	.47	.64	.85	1.17	1.54	1.90	2.40	2.93	3.80
1991	.993	.24	.39	.50	.70	1.10	1.69	2.57	4.55	7.32	16.0
1992	.003	.19	.33	.43	.54	.74	1.02	1.31	1.74	2.17	2.79
1993	1.87	.33	.70	1.17	1.85	5.35	16.3	26.0	34.0	37.1	41.4
1997	84.6	.33	.78	1.47	2.71	6.46	13.6	21.3	29.8	41.3	54.0
1982–1993	15.4	.35	.84	1.62	3.25	9.14	18.5	25.9	34.6	40.2	48.9
1982–1993, 1997	100.	.33	.79	1.51	2.82	6.84	14.4	22.5	30.8	43.0	54.9

Table 8—Hydraulic geometry measurements at Little Granite Creek.

Date	Discharge	Width	Area	Mean velocity	Gage height	Adjusted gage height	Depth	Used in hydraulic geometry analysis
	$ft^3 s^{-1}$	ft	ft^2	$ft\ s^{-1}$	- - - - - - - - - - - - - - - *ft* - - - - - - - - - - - - - - - -			
11/17/1981	6.2	20.0	8.5	0.73	0.77	0.77	0.42	
12/16/1981	5.7	20.0	7.4	.78	1.40	1.40	.37	*
01/11/1982	4.3	17.0	6.7	.64	1.32	1.32	.39	
02/10/1982	7.3	19.0	11.5	.64	1.37	1.37	.61	
02/27/1982	354.	22.0	50.9	6.95	3.15	3.14	2.31	
03/18/1982	4.1	9.0	4.7	.87	1.40	1.40	.52	
04/14/1982	7.8	14.5	7.5	1.05	1.52	1.58	.51	*
05/11/1982	77.	21.0	26.8	2.89	2.30	2.32	1.28	
06/02/1982	204.	23.0	38.8	5.25	2.95	3.02	1.69	
06/09/1982	165.	21.0	33.2	4.98	2.70	2.77	1.58	
06/18/1982	290.	22.0	50.3	5.76	3.37	3.28	2.29	
06/24/1982	237.	23.0	47.4	5.00	3.20	3.08	2.06	
06/29/1982	215.	23.0	47.7	4.51	2.87	2.86	2.07	
07/07/1982	96.	22.0	27.3	3.52	2.50	2.54	1.24	
07/13/1982	77.7	23.0	26.9	2.89	2.42	2.45	1.17	
08/18/1982	19.4	21.0	13.1	1.48	1.87	1.95	.62	*
09/14/1982	14.1	20.0	11.0	1.28	1.64	1.74	.55	
10/20/1982	9.3	20.0	12.0	.78	1.75	1.62	.60	
11/17/1982	10.2	18.0	10.4	.98	1.96	1.90	.58	*
12/16/1982	8.1	13.0	7.8	1.05	1.56	1.64	.60	*
01/18/1983	5.6	16.0	13.7	.41	1.75	1.75	.86	
02/16/1983	6.1	13.0	5.3	1.14	1.44	1.44	.41	*
03/17/1983	8.3	15.5	7.1	1.18	1.50	1.61	.45	*
04/13/1983	9.1	15.0	6.9	1.31	1.53	1.63	.46	*
05/17/1983	35.6	22.0	17.8	2.00	2.04	2.09	.81	*
06/01/1983	259.	22.0	46.4	5.58	3.03	3.05	2.11	
06/08/1983	220.	22.0	41.1	5.34	3.16	3.13	1.87	
06/15/1983	163.	22.0	37.3	4.38	2.75	2.77	1.70	
06/22/1983	119.	22.0	32.5	3.68	2.64	2.65	1.48	
06/29/1983	92.5	21.0	26.7	3.46	2.46	2.51	1.27	
07/06/1983	78.1	21.0	25.9	3.02	2.35	2.41	1.23	
07/13/1983	55.2	22.0	25.0	2.21	2.15	2.26	1.14	
08/24/1983	23.3	22.0	15.3	1.52	1.79	2.00	.70	*
09/13/1983	14.0	20.0	13.2	1.06	1.58	1.59	.66	
10/12/1983	18.0	20.0	13.8	1.30	1.69	1.71	.69	
11/14/1983	18.5	20.0	12.0	1.54	1.76	1.71	.60	*
12/15/1983	24.3	20.0	17.6	1.39	1.68	1.68	.88	
01/26/1984	11.6	14.6	10.5	1.10	1.53	1.53	.72	*
02/15/1984	9.1	14.0	8.6	1.06	1.40	1.40	.61	*
03/14/1984	9.0	15.0	7.1	1.27	1.50	1.44	.47	*
04/18/1984	48.8	22.0	19.8	2.46	2.06	2.16	.90	
05/10/1984	49.8	22.0	22.0	2.27	2.06	2.15	1.00	
05/17/1984	198.	22.0	37.4	5.28	2.71	2.83	1.70	
05/22/1984	166.	32.0	41.4	4.00	2.89	2.87	1.29	*
05/30/1984	253.	22.0	44.7	5.66	3.13	3.12	2.03	
06/07/1984	142.	31.5	36.6	3.88	2.82	2.73	1.16	*
06/13/1984	111.	22.0	31.4	3.54	2.64	2.69	1.43	
06/21/1984	181.	30.0	41.4	4.38	2.77	2.92	1.38	*
06/28/1984	110.	27.0	27.8	3.95	2.50	2.60	1.03	*
07/06/1984	74.1	22.0	27.3	2.71	2.29	2.35	1.24	
07/11/1984	5.7	22.0	24.1	2.18	2.15	1.10		
07/18/1984	40.9	22.0	19.4	2.10	2.13	2.16	.88	*
08/15/1984	18.3	21.0	14.7	1.24	1.88	1.86	.70	*
09/11/1984	12.3	19.0	10.8	1.14	1.56	1.56	.57	*
10/24/1984	9.6	18.0	9.7	.99	1.72	1.72	.54	*
11/14/1984	8.2	16.0	10.1	.82	1.44	1.41	.63	*
12/12/1984	6.9	16.0	8.5	.82	1.39	1.35	.53	*

(con.)

Table 8 (Con.)

Date	Discharge	Width	Area	Mean velocity	Gage height	Adjusted gage height	Depth	Used in hydraulic geometry analysis
	$ft^3 s^{-1}$	ft	ft^2	$ft\ s^{-1}$	- - - - - - - -	- - - - - - - - ft - - - - - - - -	- - - - - - - -	
01/08/1985	7.6	15.0	7.3	1.04	1.37	1.37	.49	*
02/13/1985	6.0	12.0	6.8	.88	1.30	1.31	.56	*
03/19/1985	6.7	15.0	7.7	.87	2.01	2.01	.51	*
04/17/1985	78.7	22.0	28.0	2.81	2.39	2.39	1.27	
05/08/1985	139.	27.0	32.8	4.24	2.87	2.87	1.21	*
05/15/1985	104.	30.0	32.0	3.26	2.58	2.58	1.07	*
05/22/1985	129.	27.0	31.2	4.14	2.70	2.70	1.16	*
05/30/1985	99.6	29.0	31.0	3.22	2.50	2.50	1.07	*
06/05/1985	68.2	22.0	25.6	2.66	2.33	2.33	1.16	
06/13/1985	55.5	26.0	19.5	2.84	2.29	2.29	.75	*
06/19/1985	43.6	22.0	21.6	2.02	2.06	2.06	.98	
06/27/1985	27.5	21.0	17.0	1.62	1.96	1.91	.81	*
07/02/1985	24.8	21.0	15.8	1.56	1.95	1.90	.75	*
07/11/1985	23.8	20.0	13.7	1.74	1.86	1.85	.69	*
07/17/1985	14.0	20.0	11.0	1.28	1.74	1.74	.55	*
07/19/1985	17.4	21.5	10.9	1.59	1.72	1.68	.51	*
08/16/1985	7.3	19.0	9.3	.78	1.42	1.37	.49	*
08/21/1985	10.1	21.0	11.3	.89	1.49	1.49	.54	*
10/09/1985	6.1	20.0	9.0	.68	1.40	1.31	.45	*
12/18/1985	4.9	19.4	.0	.62	1.32	1.32	.41	*
02/21/1986	7.0	16.0	.0	.93	1.31	1.31	.47	
03/24/1986	25.4	22.0	.0	1.90	1.84	1.84	.61	*
04/16/1986	49.5	23.0	.0	2.09	2.15	2.15	1.03	
05/08/1986	81.1	27.0	.0	3.01	2.46	2.46	1.00	*
05/14/1986	71.	22.0	.0	2.83	2.32	2.32	1.14	
05/20/1986	130.	27.0	.0	3.67	2.77	2.77	1.31	*
05/28/1986	298.	23.0	.0	5.88	3.22	3.22	2.21	
06/03/1986	403.	23.0	.0	6.83	3.38	3.38	2.57	
06/12/1986	250.	23.0	.0	4.86	3.11	3.11	2.23	
06/18/1986	180.	23.0	.0	3.94	2.81	2.81	1.99	
06/26/1986	104.	27.5	.0	3.27	2.60	2.60	1.15	*
07/02/1986	82.8	22.0	.0	3.06	2.46	2.46	1.23	
07/10/1986	56.7	28.0	.0	2.34	2.20	2.20	.86	
07/16/1986	45.5	23.0	.0	2.22	2.11	2.11	.89	*
08/20/1986	16.6	21.0	13.6	1.22	1.73	1.67	.65	*
10/22/1986	9.3	20.0	11.2	.83	1.54	1.45	.56	*
11/11/1986	6.1	21.0	.0	.63	2.22	2.22	.46	
12/11/1986	6.2	25.0	.0	.64	1.36	1.36	.39	
12/17/1986	6.1	21.0	9.6	.63	2.22	2.22	.46	
02/11/1987	6.2	25.0	9.8	.64	1.36	1.36	.39	
04/08/1987	19.6	17.0	13.	1.50	1.77	1.73	.76	
05/07/1987	83.5	28.0	27.2	3.07	2.46	2.42	.97	*
05/13/1987	62.0	28.0	22.6	2.75	2.30	2.26	.81	*
05/22/1987	65.7	29.0	22.4	2.94	2.29	2.29	.77	*
05/28/1987	106.	30.0	31.0	3.43	2.50	2.56	1.03	*
06/03/1987	73.3	27.0	25.0	2.94	2.36	2.35	.93	*
06/10/1987	56.6	22.0	24.	2.35	2.25	2.21	1.09	
07/15/1987	20.2	26.0	13.6	1.49	1.78	1.74	.52	*
08/19/1987	11.3	21.0	15.2	.74	1.59	1.52	.72	*
10/21/1987	3.3	14.0	6.6	.49	1.40	1.40	.47	
11/24/1987	5.3	18.0	7.9	.67	1.54	1.54	.44	*
12/18/1987	10.1	26.0	16.3	.62	1.39	1.39	.63	
02/25/1988	4.1	15.0	14.6	.28	2.20	2.20	.97	
03/17/1988	4.9	14.5	6.0	.81	1.30	1.30	.41	*
04/06/1988	8.6	14.0	8.3	1.04	1.60	1.60	.59	*
05/04/1988	47.4	28.0	20.8	2.27	2.11	2.11	.74	*
05/12/1988	67.5	22.0	26.7	2.53	2.36	2.30	1.21	

(con.)

Table 8 (Con.)

Date	Discharge	Width	Area	Mean velocity	Gage height	Adjusted gage height	Depth	Used in hydraulic geometry analysis
	$ft^3 s^{-1}$	ft	ft^2	$ft\ s^{-1}$	- - - - - - - - - - - - - - -	ft - - - - - - - - - - - - - - - -		
05/18/1988	156.	23.0	36.8	4.24	2.71	2.80	1.60	
05/27/1988	129.	22.0	35.6	3.62	2.66	2.68	1.62	
06/03/1988	75.1	28.0	24.2	3.10	2.30	2.36	.86	*
06/10/1988	59.0	22.0	28.7	2.06	2.30	2.23	1.30	
06/15/1988	47.5	22.0	24.2	1.96	2.14	2.14	1.10	
06/22/1988	40.5	21.0	22.2	1.82	2.05	2.05	1.06	
07/14/1988	15.4	17.0	11.8	1.30	1.78	1.78	.69	*
07/14/1988	17.6	20.0	10.3	1.70	1.78	1.69	.52	*
08/24/1988	6.9	16.5	8.3	.84	1.50	1.36	.50	*
10/19/1988	5.1	16.5	6.6	.77	1.41	1.26	.40	*
12/14/1988	4.6	16.0	6.9	.67	1.38	1.23	.43	*
02/16/1989	3.2	11.5	6.3	.51	1.48	1.48	.54	
03/20/1989	7.3	15.0	8.4	.88	1.52	1.37	.56	*
04/19/1989	68.4	23.0	29.2	2.34	2.33	2.31	1.27	
05/05/1989	83.7	22.0	30.1	2.78	2.47	2.42	1.37	
05/09/1989	173.	33.0	43.7	3.96	2.83	2.86	1.32	*
05/18/1989	154.	32.0	40.1	3.84	2.78	2.79	1.25	*
05/25/1989	122.	31.0	37.8	3.23	2.75	2.75	1.22	*
05/25/1989	137.	31.0	40.2	3.41	2.75	2.72	1.30	*
06/02/1989	119.	30.0	37.1	3.21	2.75	2.75	1.24	*
06/02/1989	126.	30.0	38.8	3.24	2.75	2.71	1.29	*
06/07/1989	166.	30.0	40.0	4.15	2.88	2.84	1.33	*
06/15/1989	122.	30.0	32.4	3.77	2.68	2.64	1.08	*
06/21/1989	78.4	30.0	26.8	2.93	2.48	2.38	.89	*
06/29/1989	52.2	29.0	23.1	2.26	2.24	2.17	.80	*
07/05/1989	44.8	28.0	21.4	2.09	2.16	2.10	.76	*
07/13/1989	36.3	22.0	18.8	1.93	2.05	1.99	.85	*
08/23/1989	12.3	20.0	10.8	1.14	1.64	1.55	.54	*
10/26/1989	6.3	22.0	8.7	.72	1.46	1.46	.39	
12/13/1989	5.3	19.0	9.9	.53	1.46	1.46	.52	*
02/14/1990	4.3	17.0	10.9	.39	1.57	1.57	.64	
03/21/1990	6.2	17.0	6.8	.91	1.49	1.49	.40	*
04/17/1990	43.5	24.0	20.0	2.18	2.07	2.17	.83	*
04/27/1990	52.7	28.0	22.5	2.34	2.13	2.25	.80	*
05/03/1990	44.6	24.0	20.2	2.21	2.13	2.18	.84	*
05/10/1990	68.3	28.0	26.8	2.55	2.32	2.37	.96	*
05/18/1990	57.2	28.0	22.6	2.53	2.21	2.29	.81	*
05/25/1990	72.3	30.0	27.2	2.66	2.38	2.38	.91	*
05/31/1990	79.6	30.0	31.0	2.57	2.48	2.43	1.03	*
05/31/1990	75.2	30.0	29.4	2.56	2.48	2.43	.98	*
05/31/1990	75.6	28.0	23.7	3.19	2.48	2.43	.85	*
06/05/1990	72.5	30.0	26.2	2.77	2.47	2.42	.87	*
06/14/1990	62.9	28.0	26.0	2.42	2.32	2.32	.93	*
06/20/1990	61.3	28.0	25.3	2.42	2.30	2.30	.90	*
06/02/1990	51.9	27.0	24.2	2.14	2.13	2.15	.90	*
07/05/1990	34.4	26.0	19.2	1.79	2.02	2.06	.74	*
07/20/1990	20.1	20.0	15.1	1.34	1.84	1.84	.76	*
08/20/1990	10.4	17.0	10.3	1.00	1.62	1.62	.61	*
10/24/1990	8.9	22.0	11.3	.79	1.54	1.57	.51	*
12/13/1990	4.1	17.0	9.6	.43	1.67	1.67	.56	
02/14/1991	4.9	14.0	5.7	.85	1.37	1.39	.41	*
04/18/1991	12.1	22.0	10.7	1.13	1.64	1.67	.49	*
05/23/1991	140.	30.0	35.8	3.91	2.77	2.77	1.19	*
05/29/1991	100.	30.0	28.3	3.54	2.55	2.55	.94	*
05/29/1991	93.8	30.0	31.0	3.02	2.52	2.52	1.03	*
05/29/1991	93.6	30.0	31.9	2.93	2.53	2.53	1.06	*
06/01/1991	85.9	29.8	31.6	2.72	2.48	2.48	1.06	*
06/01/1991	85.7	29.8	31.4	2.73	2.50	2.50	1.05	*

(con.)

Table 8 (Con.)

Date	Discharge	Width	Area	Mean velocity	Gage height	Adjusted gage height	Depth	Used in hydraulic geometry analysis
	$ft^3 s^{-1}$	*ft*	ft^2	$ft\ s^{-1}$	- - - - - - - -	*ft*	- - - - - - - -	
06/01/1991	87.5	30.0	33.0	2.65	2.53	2.53	1.10	*
06/03/1991	111.	30.8	40.9	2.72	2.66	2.66	1.33	*
06/03/1991	149.	30.8	40.8	3.66	2.79	2.79	1.32	*
06/03/1991	140.	31.2	42.2	3.32	2.83	2.83	1.35	*
06/04/1991	188.	31.6	44.2	4.24	2.83	2.83	1.40	*
06/04/1991	190.	31.6	43.3	4.40	2.85	2.85	1.37	*
06/11/1991	143.	30.6	37.4	3.83	2.75	2.75	1.22	*
06/11/1991	144.	30.6	38.3	3.76	2.76	2.76	1.25	*
06/11/1991	158.	30.8	39.8	3.96	2.79	2.79	1.29	*
06/12/1991	150.	30.6	38.5	3.89	2.78	2.78	1.26	*
06/12/1991	139.	30.6	38.3	3.64	2.76	2.76	1.25	*
06/12/1991	148.	30.6	38.2	3.88	2.77	2.77	1.25	*
06/12/1991	154.	30.6	39.8	3.88	2.77	2.77	1.30	*
06/12/1991	159.	30.8	41.3	3.84	2.80	2.80	1.34	*
06/12/1991	166.	31.0	41.6	3.99	2.82	2.82	1.34	*
06/13/1991	156.	30.8	39.5	3.94	2.77	2.77	1.28	*
06/13/1991	152.	30.8	40.4	3.76	2.77	2.77	1.31	*
06/13/1991	146.	30.6	39.2	3.73	2.77	2.77	1.28	*
07/16/1991	27.8	26.0	21.7	1.28	1.93	1.98	.83	*
08/28/1991	13.9	17.0	11.8	1.18	1.72	1.72	.69	*
10/23/1991	6.8	17.0	8.9	.76	1.50	1.50	.52	*
12/19/1991	4.1	17.0	8.4	.49	1.57	1.57	.49	
02/12/1992	3.9	12.5	5.1	.76	1.42	1.42	.41	*
04/15/1992	26.4	25.0	19.2	1.38	1.88	1.96	.77	*
05/21/1992	58.9	29.0	30.0	1.96	2.20	2.30	1.03	*
06/05/1992	25.7	25.6	16.8	1.52	1.96	1.96	.66	*
06/06/1992	25.1	25.6	16.4	1.53	1.96	1.94	.64	*
06/07/1992	25.0	25.3	16.5	1.52	1.95	1.95	.65	*
06/08/1992	25.4	25.3	16.8	1.51	1.95	1.95	.66	*
06/15/1992	27.2	25.0	21.2	1.28	1.89	1.97	.85	*
08/26/1992	7.6	19.0	8.8	.87	1.49	1.52	.46	*
10/05/1992	5.1	19.0	8.7	.59	1.46	1.40	.46	*
05/21/1997	288.	32.8	54.3	5.32	3.35	—	1.66	*
05/22/1997	321.	32.8	58.1	5.61	3.38	—	1.77	*
05/28/1997	220.	30.2	48.1	4.59	3.08	—	1.59	*
05/29/1997	245.	30.5	49.2	5.32	3.15	—	1.61	*
05/29/1997	250.	30.8	50.6	4.95	3.23	—	1.64	*
05/30/1997	249.	31.5	50.2	4.95	3.23	—	1.59	*
05/30/1997	268.	31.5	51.7	5.54	3.28	—	1.64	*
05/30/1997	316.	32.2	55.2	5.71	3.36	—	1.72	*
05/31/1997	279.	31.8	53.4	5.22	3.30	—	1.68	*
06/01/1997	363.	34.4	62.1	5.87	3.50	—	1.80	*
06/04/1997	400.	35.1	66.5	6.04	3.60	—	1.89	*
06/12/1997	195.	28.9	37.6	5.18	2.97	—	1.30	*
06/13/1997	173.	28.2	36.0	4.79	2.88	—	1.28	*
07/29/1997	36.6	23.3	15.1	2.43	2.00	—	.65	*

Table 9—Channel surface and subsurface particle-size distribution, computed particle size at specific percentages, Little Granite Creek, Wyoming.

Type of sample	Surface or subsurface	Year collected	Computed particle size (mm) at specific percentages									
			D_5	D_{16}	D_{25}	D_{35}	D_{50}	D_{65}	D_{75}	D_{84}	D_{90}	D_{95}
Pebble count	Surface	1994	1.0	10.	21.	32.	55	85	118	140	175	235
Pebble count	Surface	1997	25.	48.	65.	78.	99	155	180	220	270	295
Pebble count	Surface	2000	2.0	24.	39.	56.	89	134	173	208	250	325
Barrel sample #1	Surface	2000	19.	28.	29.	31.	38	53	65	78	90	115
Barrel sample #2	Surface	2000	23.	28.	30.	33.	39	46	53	62	65	75
Barrel sample #3	Surface	2000	23.	36.	40.	42.	46	58	64	69	71	84
Barrel sample #4	Surface	2000	12.	30.	35.	43.	67	75	79	89	120	135
Barrel sample #5	Surface	2000	17.	25.	27.	31.	35	39	45	56	74	110
Barrel sample #6	Surface	2000	22.	32.	35.	40.	52	67	78	88	98	171
Barrel sample #1	Subsurface	2000	.9	2.8	5.2	9.5	17	24	31	39	45	57
Barrel sample #2	Subsurface	2000	.9	2.5	5.0	9.5	18	29	39	48	55	62
Barrel sample #3	Subsurface	2000	.9	2.9	5.7	10.1	19	30	39	47	57	67
Barrel sample #4	Subsurface	2000	.9	2.8	6.3	12.	21	34	42	52	59	65
Barrel sample #5	Subsurface	2000	.6	2.2	3.8	5.9	10	15	20	25	31	37
Barrel sample #6	Subsurface	2000	1.0	3.9	8.1	13.1	20	27	34	41	46	56

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