Little Buckhorn Creek

General Information

Little Buckhorn Creek is a tributary to Buckhorn Creek which flows into the South Fork of the Salmon River. The study reach is about a 210 ft length of stream at the US Geological Survey discontinued gage 13310660 (Little Buckhorn Creek near Krassel Ranger Station, Idaho), near the confluence with Buckhorn Creek. The site is on land administered by the Payette National Forest at an elevation of 4,150 ft. The drainage area is 5.99 mi^2 and the geology of the watershed is predominantly intrusive igneous.

Sediment transport measurements were made by Forest Service personnel during the spring snowmelt flows in 1990 through 1994. Additional measurements at this site by Case Western Reserve University include a survey of the stream reach and pebble counts of substrate surface in 1994. In 2000, Forest Service personnel collected additional information to characterize surface and subsurface channel material. Figure 1 is a photograph of the site looking upstream from a point downstream of the USGS gaging station.

Figure 1. Little Buckhorn Creek looking upstream.

Streamflow records are available from the USGS for water years 1990 through 1994. The range of daily mean discharge for this period is 1 ft^3/s to 34 ft^3/s. The highest daily mean flow occurred on May 31, 1990. Average annual streamflow (Q_a) for the period of record is 4.91 ft^3/s and the estimated long-term average annual discharge is 6.65 ft^3/s. There were no floodplains identified in this reach, thus, there is no estimate of bankfull discharge.

Channel Profile and Cross-Section

Figure 2 shows the longitudinal profile for the channel bed in the center of the channel and the water surface elevations along each bank at the time of the survey. No floodplains were present to identify the bankfull flow elevations. The average gradient for the study reach is 0.0509 ft/ft. Cross-sections of the channel were surveyed at three locations. Discharge and sediment transport measurements were made at or near cross-section 2 (XS2).
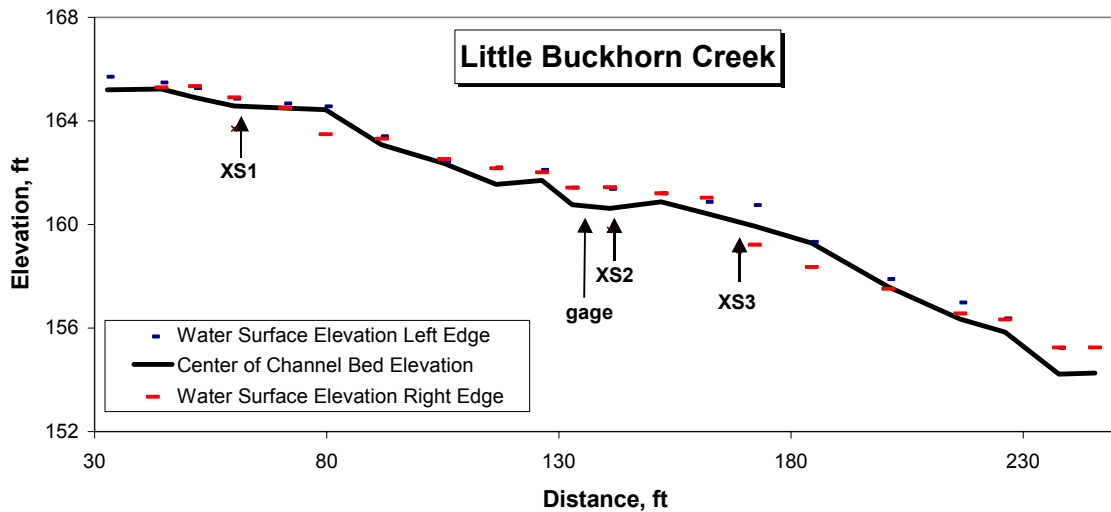

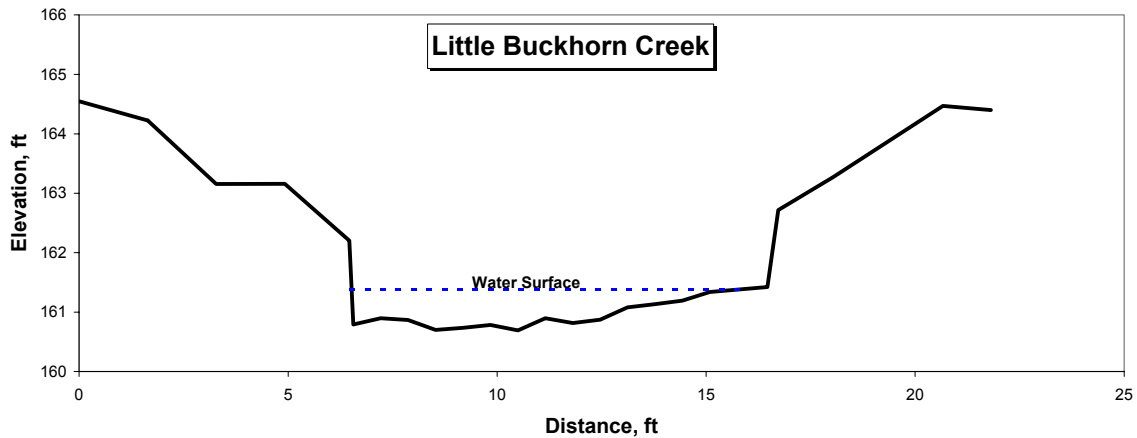Figure 2. Longitudinal profile of the study reach in Little Buckhorn Creek.

Figure 3. Cross-section 2 of Little Buckhorn Creek.

Channel Geometry

        Figure 3 shows the cross-section about 15 ft downstream of the gaging station and the water surface at the time of the survey, July 29, 1994. The station geometry relationships for this approximate location are shown in Figure 4. Information for 1989 through 1994 within 15 to 20 ft downstream of the gage station (solid symbols) were used to develop the power relationships with discharge. Data for distances of 25 to 30 ft downstream of the gaging station (small open symbols) and within 5 ft of the gaging station (large open symbols) are also shown in Figure 4. Over the range of discharges when sediment transport was measured (2.4 to 26 ft^3/s) estimated stream width, estimated average depth and estimated average velocity varied from 8.1 to 14.9 ft, 0.35 to 1.12 ft, and 0.85 to 1.56 ft/s, respectively. The average reach slope is 0.0509 ft/ft.
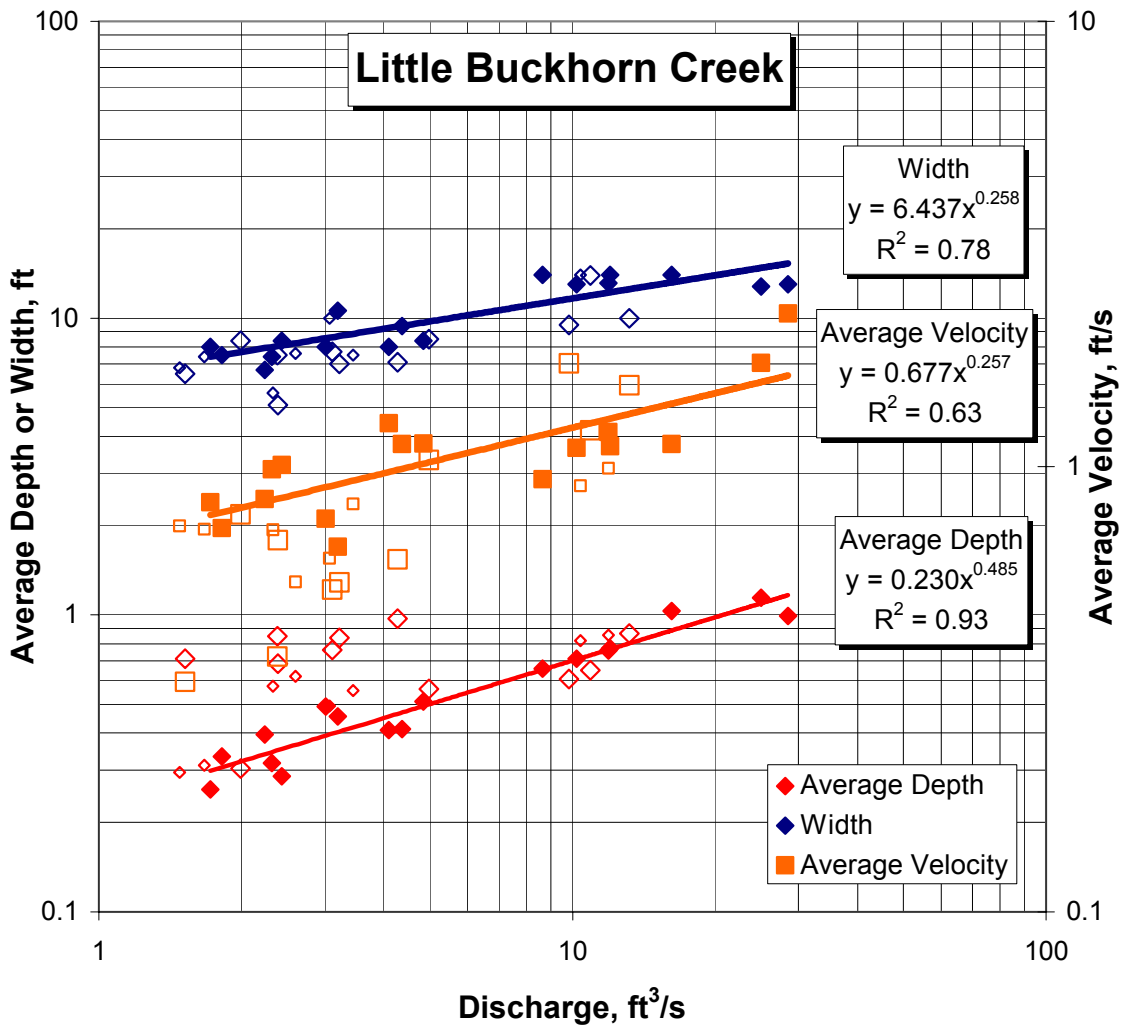

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Width
$y = 6.437x^{0.258}$
$R^2 = 0.78$

Average Velocity
$y = 0.677x^{0.257}$
$R^2 = 0.63$

Average Depth
$y = 0.230x^{0.485}$
$R^2 = 0.93$

◆ Average Depth
◆ Width
■ Average Velocity

Average Depth or Width, ft

Average Velocity, ft/s

Discharge, ft^3/s

Figure 4. Width, average depth and average velocity versus stream discharge near cross-section 2 in the study reach of Little Buckhorn Creek.

Channel Material

Surface pebble counts were made near cross-section 2 in July 1994 and at three cross-sections in September 2000. The D_{50} and D_{90} for the 1994 pebble count were 28 mm and 450 mm, respectively (Figure 5) and the D_{50} and D_{90} for the 2000 combined pebble counts were 81 mm and 285 mm, respectively. In 2000, about 12% of the surface material was sand size or smaller. In September 2000, core samples of the surface and subsurface material were collected at three locations within the study reach. The D_{50} and D_{90} for the combined surface cores were 119 mm and 191 mm, respectively. The D_{50} and D_{90} for the combined subsurface cores were 14.5 mm and 108 mm, respectively.
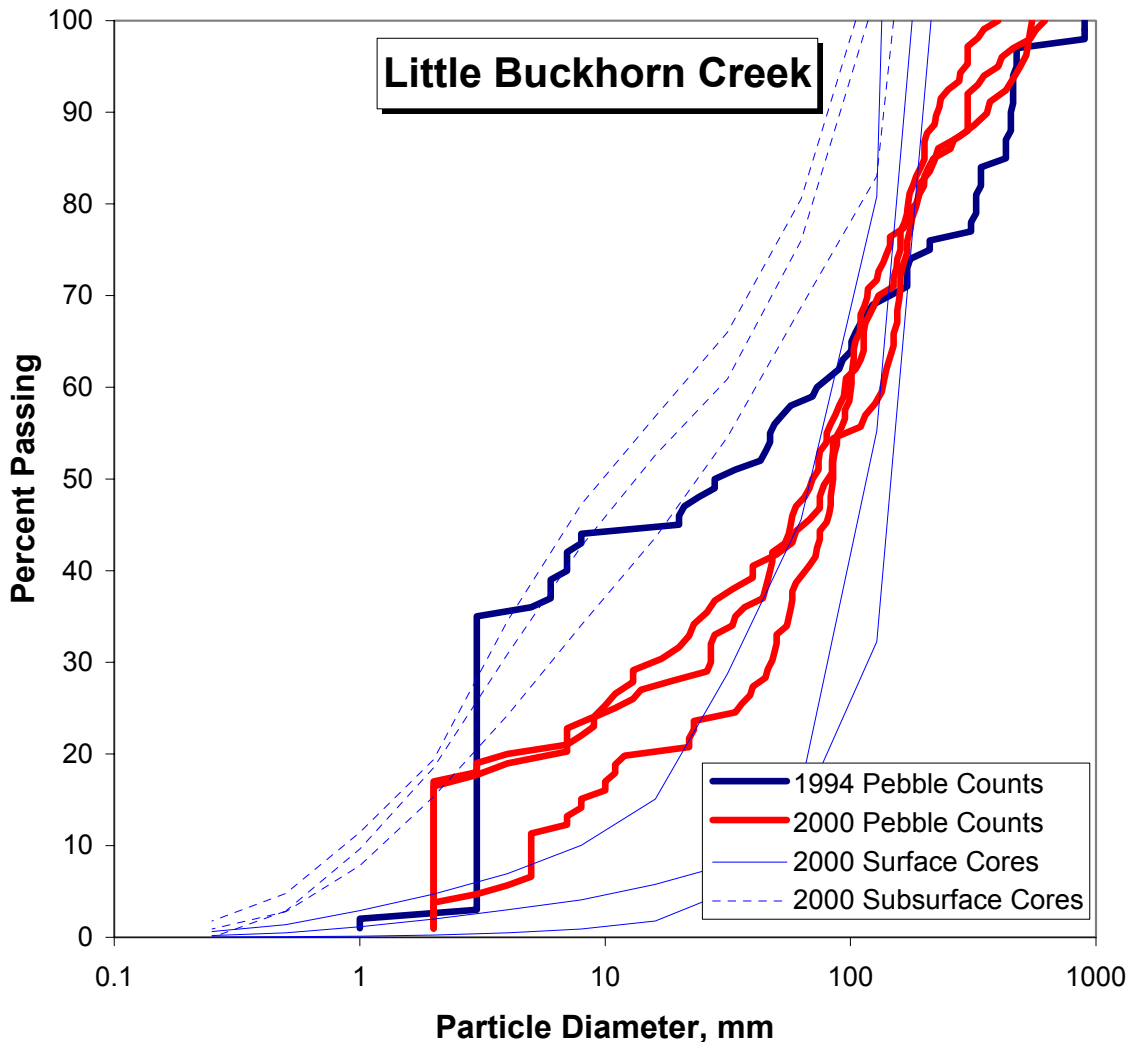

Figure 5. Particle size distribution for surface and subsurface material samples in the Little Buckhorn Creek study reach.

The sediment transport data include 78 measurements of bedload transport and 73 measurements of suspended sediment transport. Sediment transport measurements spanned a range of stream discharges from 2.4 ft^3/s ($0.49Q_a$) to 26 ft^3/s ($5.30Q_a$). Bedload transport ranged from 0.00190 to 5.02 t/d and suspended transport ranged from 0.0 to 5.75 t/d. At the lowest discharges suspended sediment rate is about an order of magnitude larger than bedload rates. At the highest discharges suspended and bedload transport rates are about equal (Figure 6).
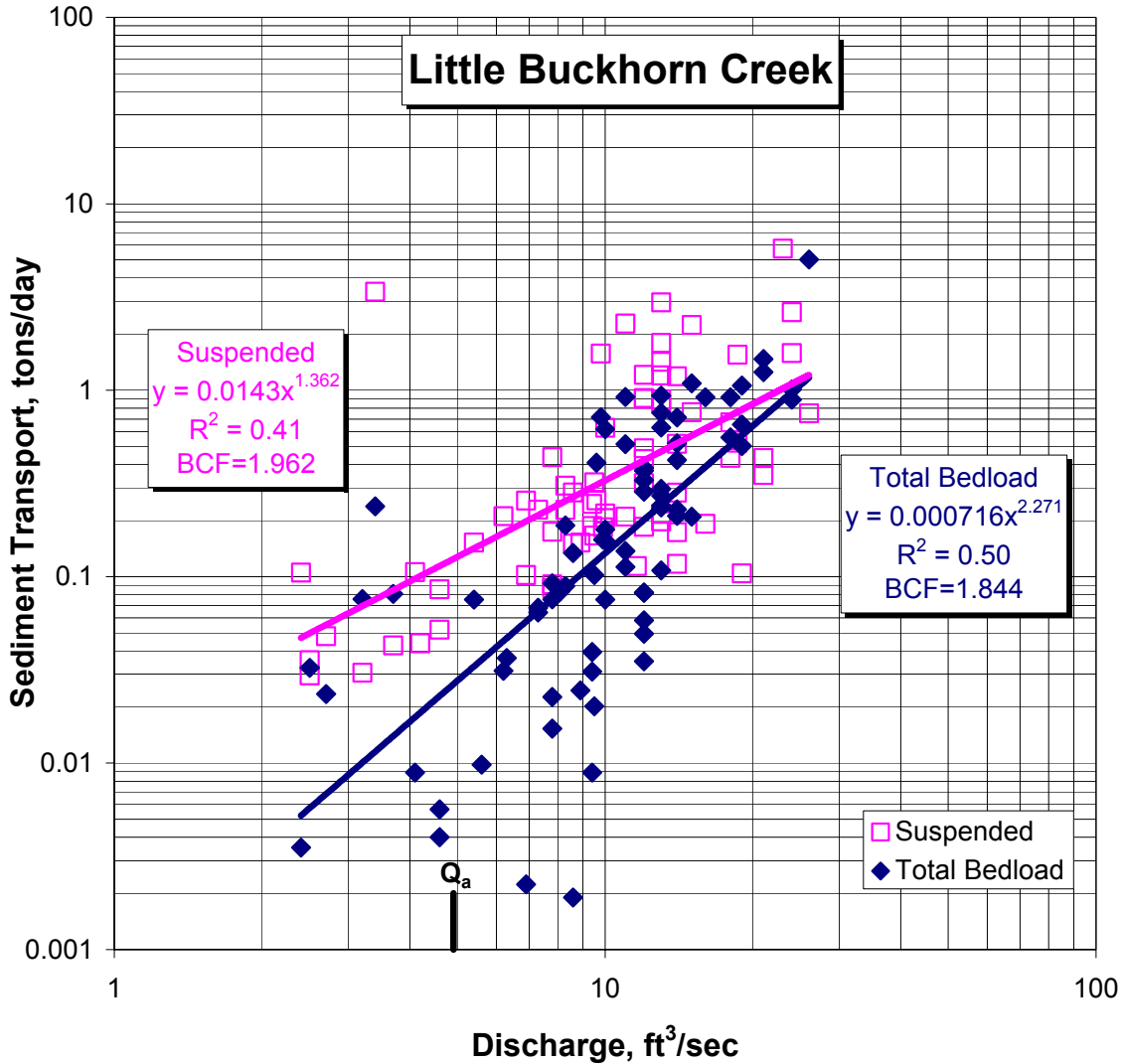

Figure 6. Bedload and suspended load transport rate versus discharge.

The bedload transport rates by size class (Figure 7) shows that the larger rates are associated with material in the 0.5 to 2mm diameter size class. None of the bedload samples contained material larger than 16 mm diameter.
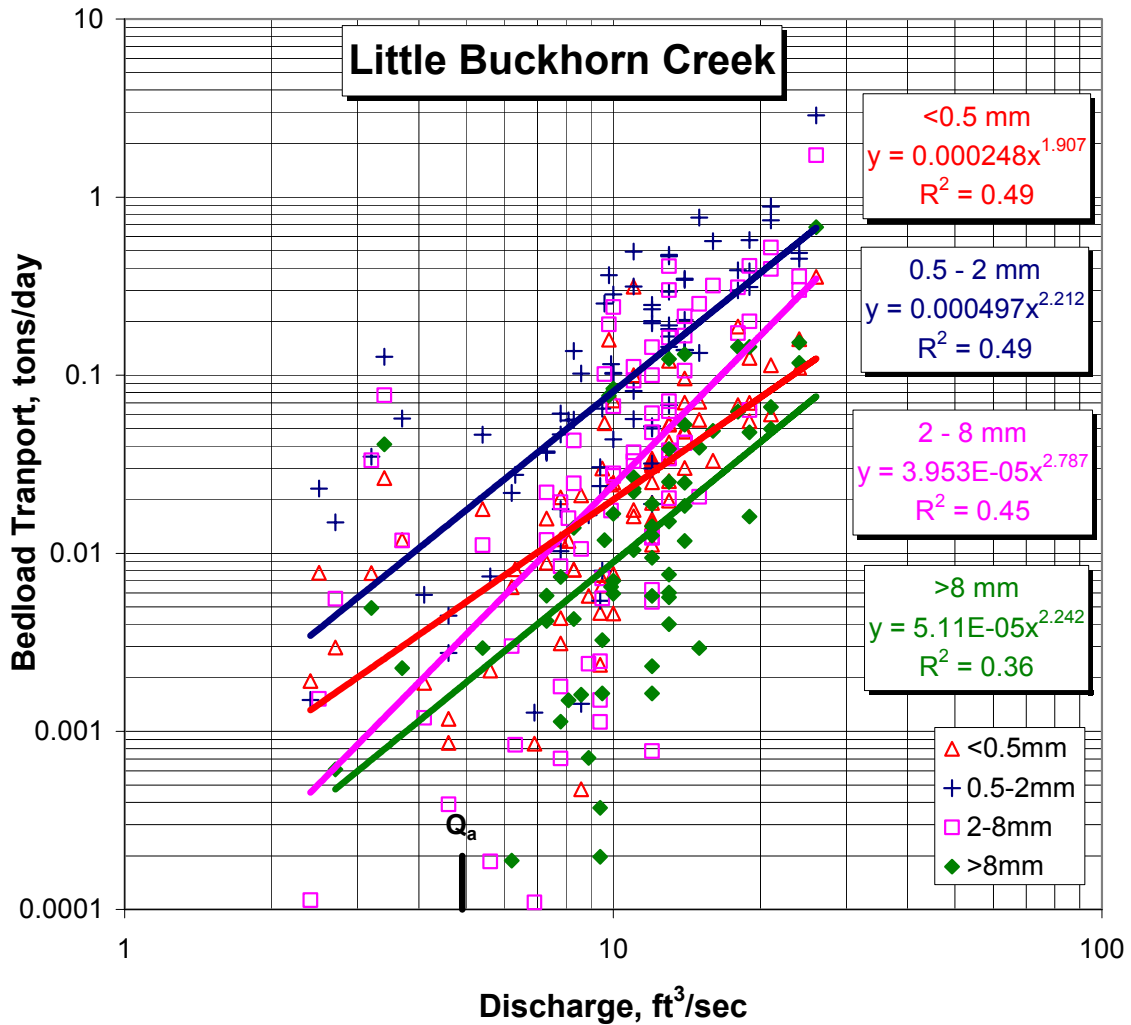

Figure 7. Bedload transport rate versus discharge for selected size classes.

Measurements of the largest particle in the bedload samples were not made for this site. None of the bedload samples contained particles larger than 16 mm diameter and 32% of the samples contained particles 8-16 mm in diameter. There was a weak relationship between the median diameter (D_{50}) of the bedload samples and discharge. The D_{50} for all of the samples was sand size, 0.5 to 2.0 mm, or smaller. The largest median diameter of the bedload samples was 1.9 mm at a discharge of 13 ft^3/s.
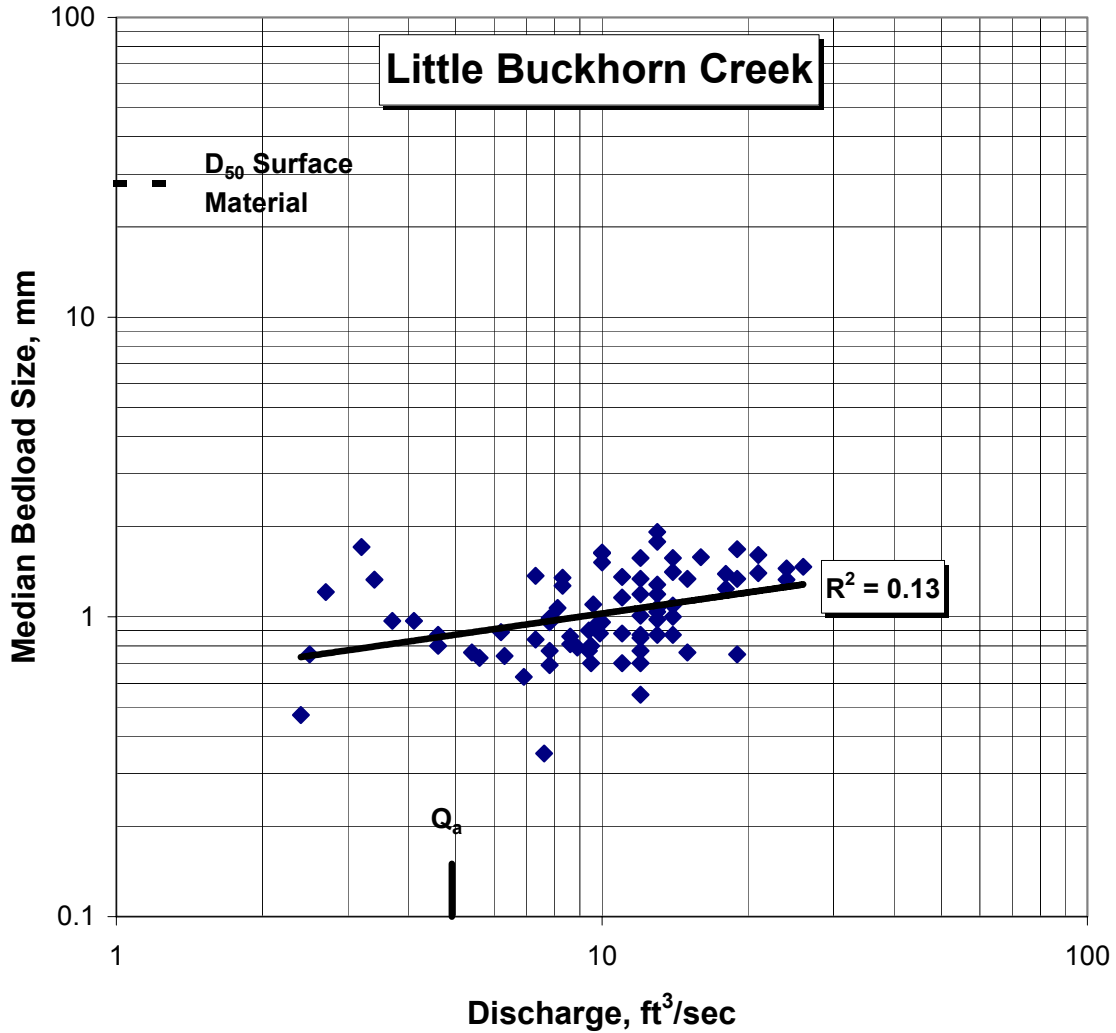

Figure 8. Median size of the bedload sample versus stream discharge for the Little Buckhorn Creek study site.