

South Fork Red River

General Information

The South Fork Red River confluences with the Main Fork Red River at the Red River Work Center on the Nez Perce National Forest. The study reach is about a 585 ft length of river beginning about 500 ft upstream of the confluence. The site is on land administered by the Forest service at an elevation of about 4,350 ft. The drainage area upstream of this location is 38.2 mi² and the geology of the watershed is predominantly metamorphic.

This site is associated with an existing Forest Service gaging station. Streamflow records and sediment transport measurements are available from water year 1986 to 1999. Additional information collected at the site include a survey of the stream reach, pebble counts of the substrate surface, core samples of the substrate subsurface material, core samples of floodplain material, movement of painted rocks during the high snowmelt flows of 1995 and movement of large bedload into bedload traps during the high snowmelt flows of 1997. Figures 1 and 2 show photographs of looking upstream and downstream from the gaging station.

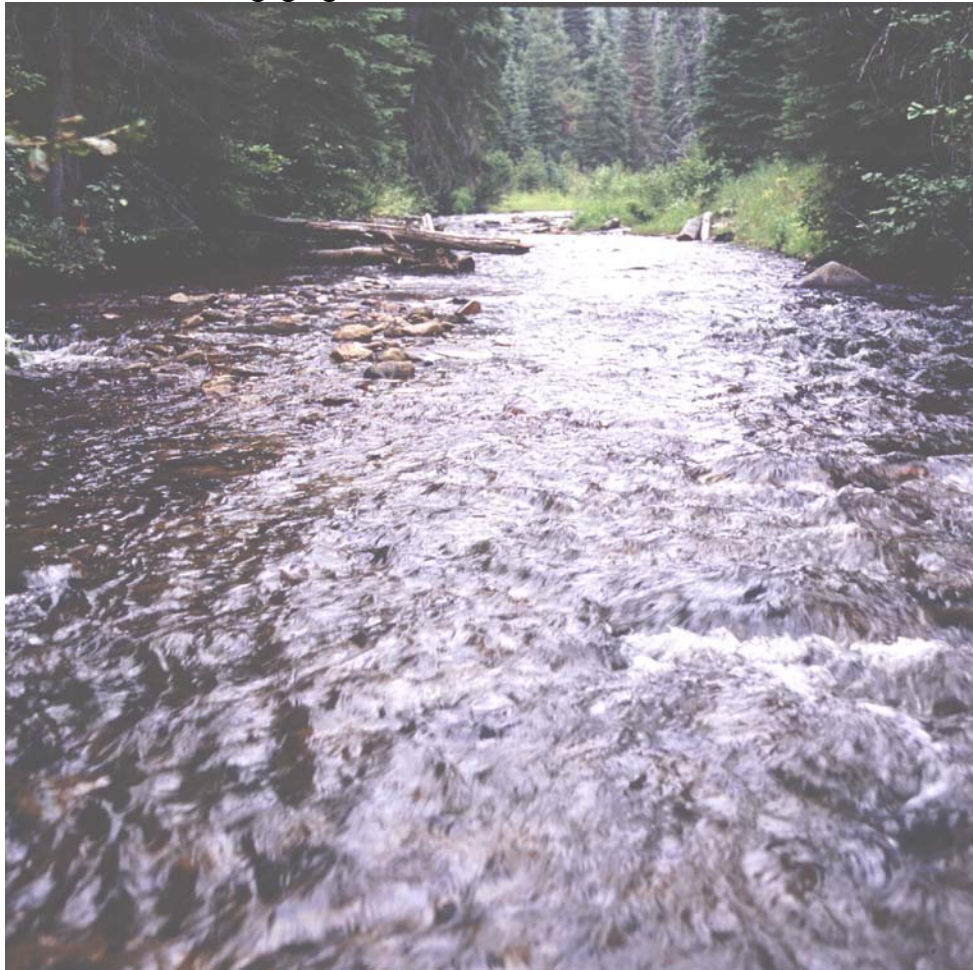


Figure 1. South Fork Red River looking upstream from the gaging station.



Figure 2. South Fork Red River looking downstream from the gaging station.

Streamflow records are available for water years 1986 through 1999, typically from the beginning of the spring snowmelt hydrograph into the fall. Estimated average annual streamflow (Q_a) is about $48.5 \text{ ft}^3/\text{s}$ (17.2 in) and bankfull discharge (Q_b) is estimated at $256 \text{ ft}^3/\text{s}$. During the period of record, daily mean discharges ranged from $5.02 \text{ ft}^3/\text{s}$ to $489 \text{ ft}^3/\text{s}$. The highest instantaneous discharge recorded was $678 \text{ ft}^3/\text{s}$ on May 17, 1996.

Channel Profile and Cross-Section

Figure 3 shows the longitudinal profile for the channel bed in the center of the channel, the water surface elevations along each bank at the time of the survey and bankfull flow elevations (floodplains). The average gradient for the study reach is 0.0146 ft/ft. Cross-sections of the channel were surveyed at four locations. The gage is located at cross-section 2 (XS2). Most wading sediment transport measurements were made at cross-section 2.

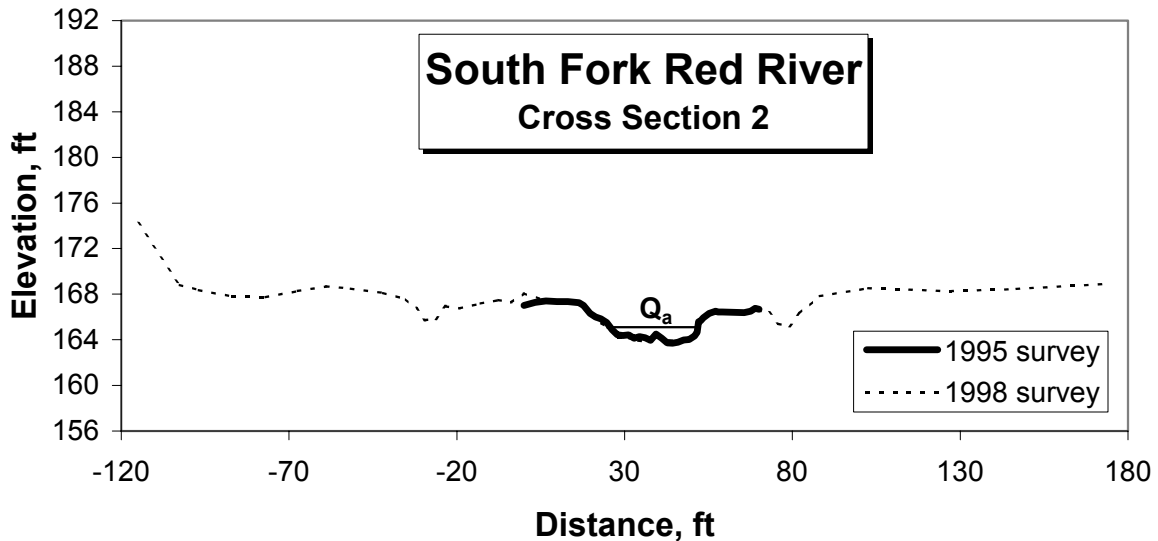
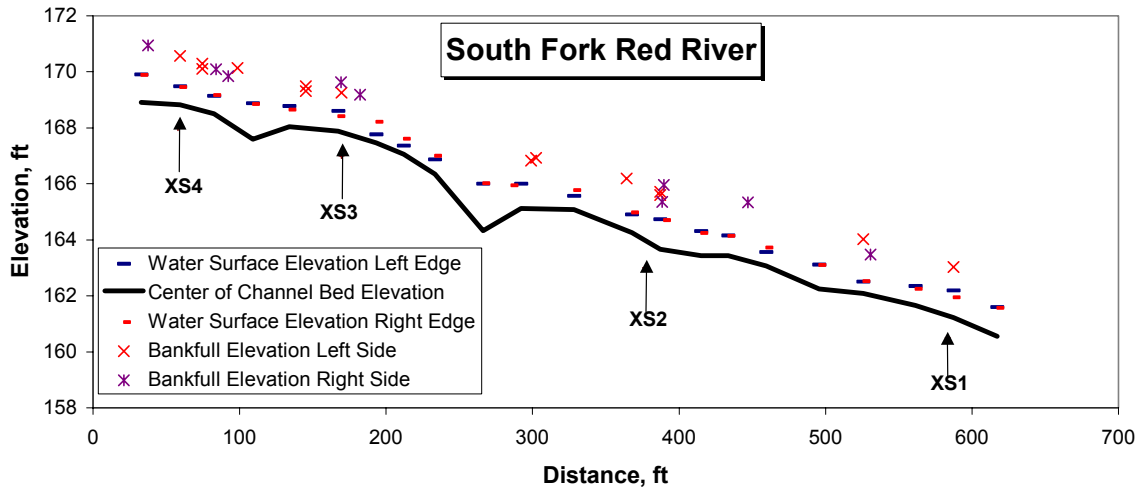


Figure 3. Longitudinal profile of the study reach in South Fork Red River.

Figure 4. Cross-section 2 of the South Fork Red River.

Channel Geometry

Figure 4 shows the cross-section just downstream of the gage, cross-section 2. The channel geometry relationships for this cross-section are shown in Figure 5 (solid symbols). During high discharges, measurements are taken from a bridge about 900 ft downstream of the gage. Data points associated with the bridge cross-section are shown as open symbols. All data collected in 1986 through 1997 were used to develop the displayed power relationships with discharge. Over the range of discharges when sediment transport was measured by wading at cross-section 2 (5.93 to 190 ft³/s) estimated stream width, estimated average depth and estimated average velocity varied from 24.4 to 28.7 ft, 0.39 to 1.79 ft, and 0.6 to 3.7 ft/s, respectively. The average reach gradient is 0.0146 ft/ft.

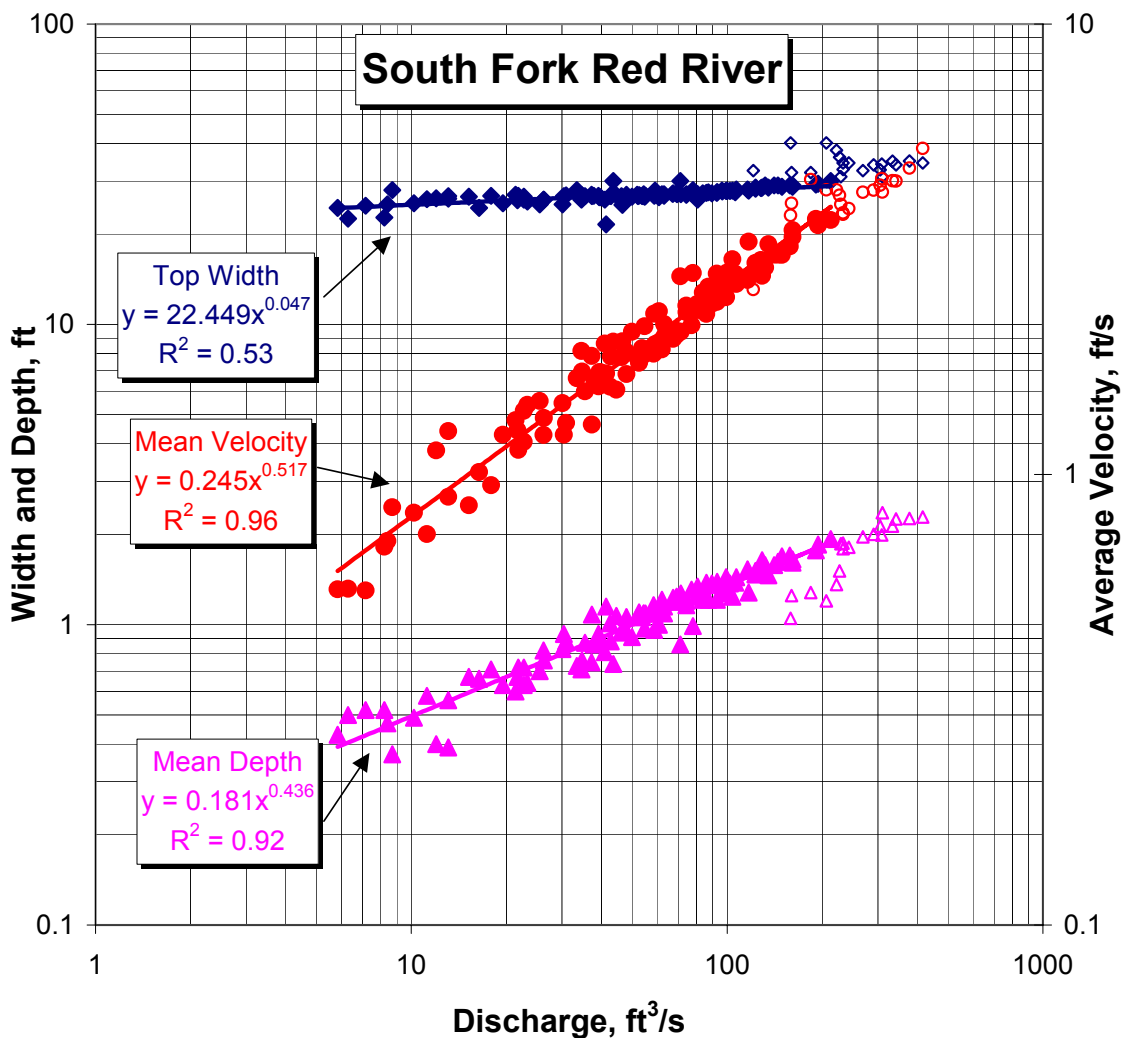


Figure 5. Width, average depth, and average velocity versus stream discharge at cross-section 2 on the South Fork Red River.

Channel Material

Surface pebble counts were made at one location in July 1994. Surface pebble counts were also made along three transects in August 1995 and a core of subsurface material was collected, one per transect. The average D_{50} and D_{90} for the 1994 surface material were 86 mm and 165 mm, respectively (Figure 5). The average D_{50} and D_{90} for the surface material in 1995 were 106 mm and 258 mm, respectively, and the average D_{50} and D_{90} for the subsurface material were 25 mm and 145 mm, respectively. About 8% of the surface material is sand (2 mm) size or smaller. Floodplain samples were collected at three locations in November 1997. The median size of floodplain surface material was less than 0.54mm.

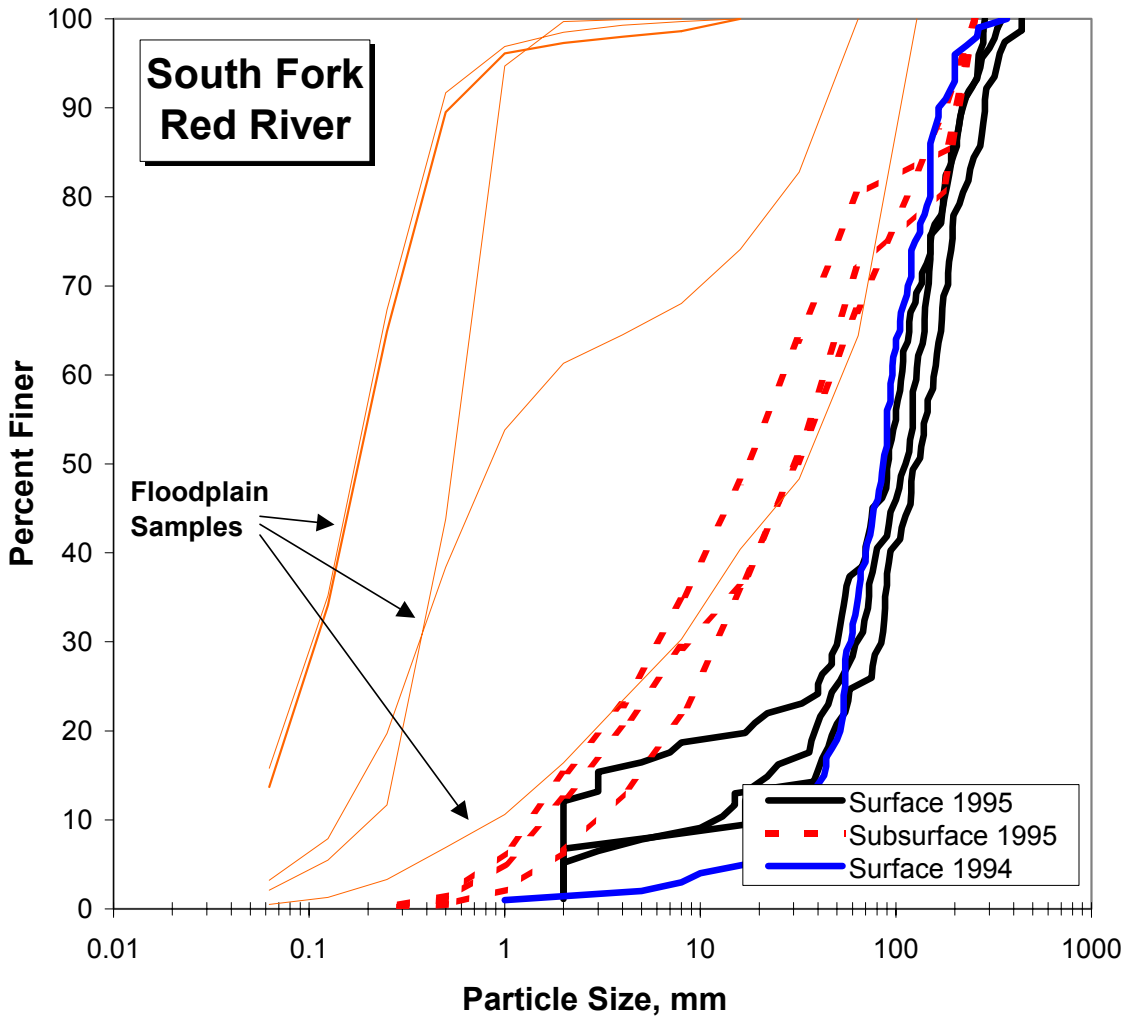


Figure 5. Particle size distribution for surface and subsurface material and floodplain samples in the South Fork Red River.

Sediment Transport

Sediment transport measurements were made in 1986 through 1999 and include 204 measurements of bedload transport and 136 measurements of suspended sediment. Sediment transport measurements spanned a range of stream discharges from 5.93 ft³/s (0.12Q_a; 0.02Q_b) to 458 ft³/s (9.44Q_a; 1.79Q_b). Bedload transport ranged from 0.0 to 22.4 t/d and suspended sediment transport ranged from 0.01 to 119 t/d. Over the range of measured discharges, suspended transport accounts for the majority of the material in transport with approximately a four to six -fold difference in the rates (Figure 6).

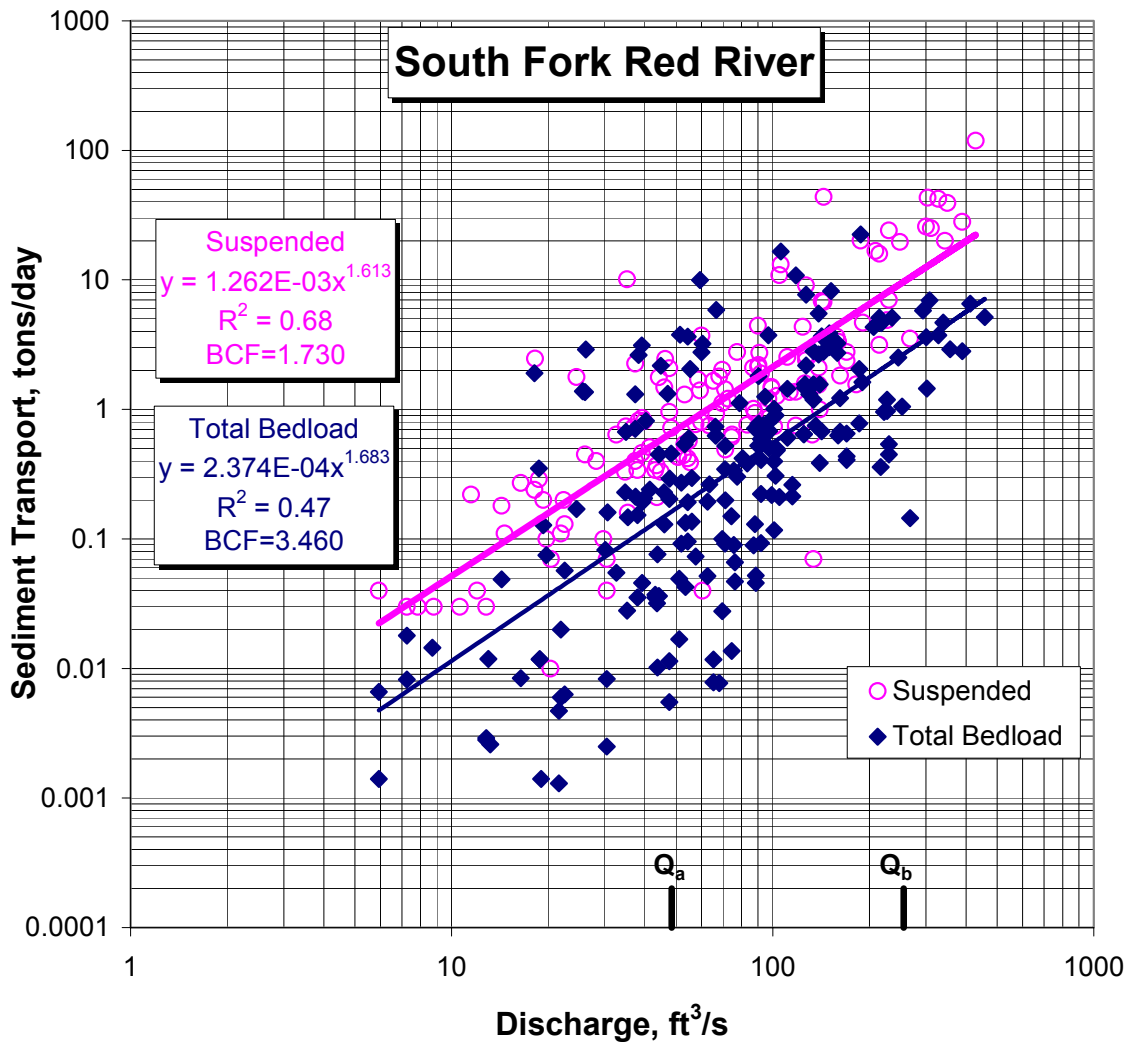


Figure 6. Bedload and suspended load transport rate versus discharge.

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. No curve fitting was done for sediment >32mm diameter since only two of the samples contained this size class of material at sampling discharges of 357 and 412 ft³/s.

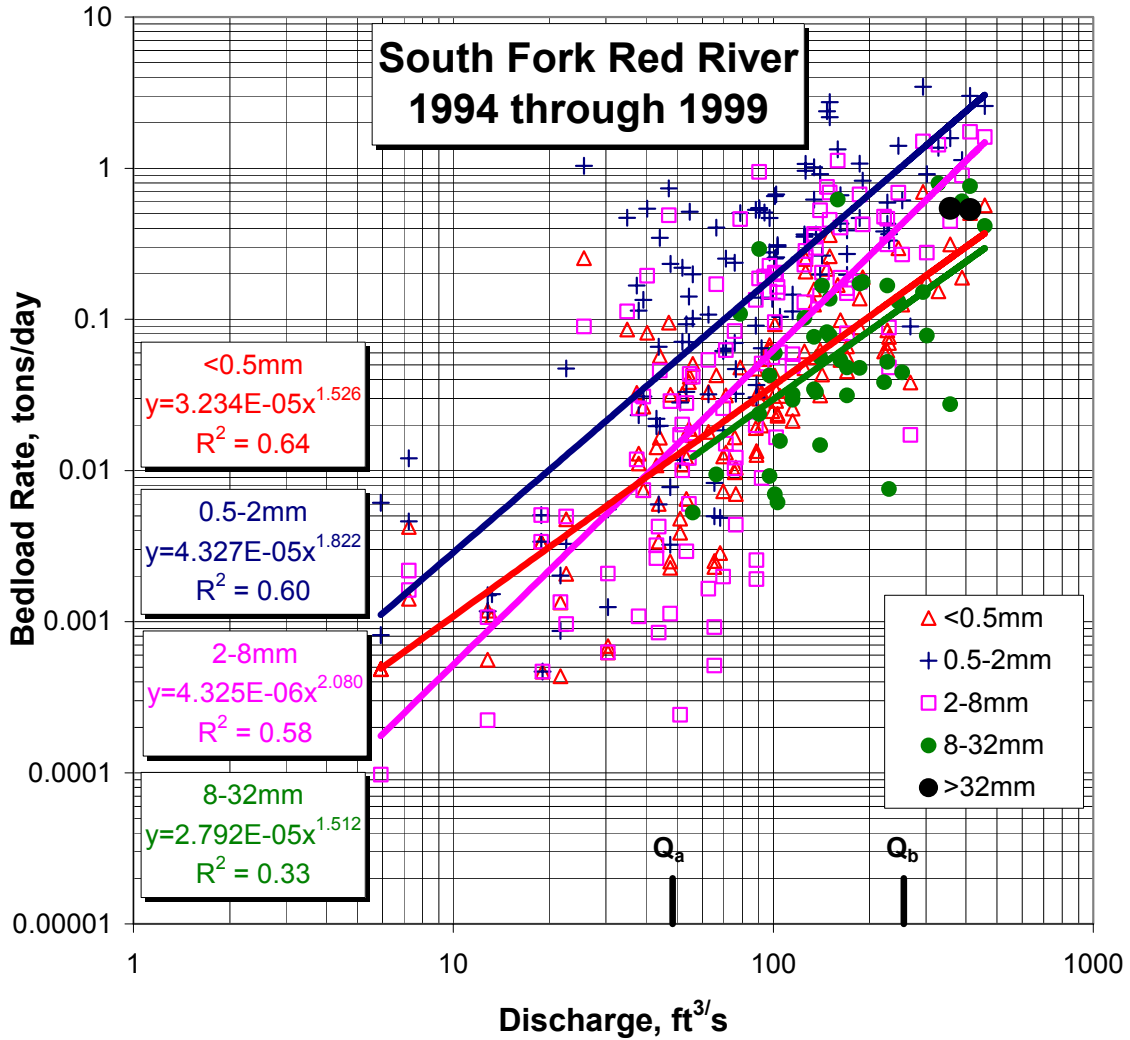


Figure 7. Bedload transport rate versus discharge for selected size classes.

The size of the largest particle in the bedload sample increased with discharge (Figure 8). The largest particle measured in the bedload sample was 49 mm at a discharge of 357 ft³/s. There is perhaps a weak trend of increasing median sample diameter with increasing discharge. The D₅₀ for most samples was <2 mm. The information on the largest particle in the bedload sample and observations of painted rock movement, particles caught in bedload traps and large particles recently moved all suggest that discharges near bankfull discharge are capable of moving the median diameter particles on the channel surface.

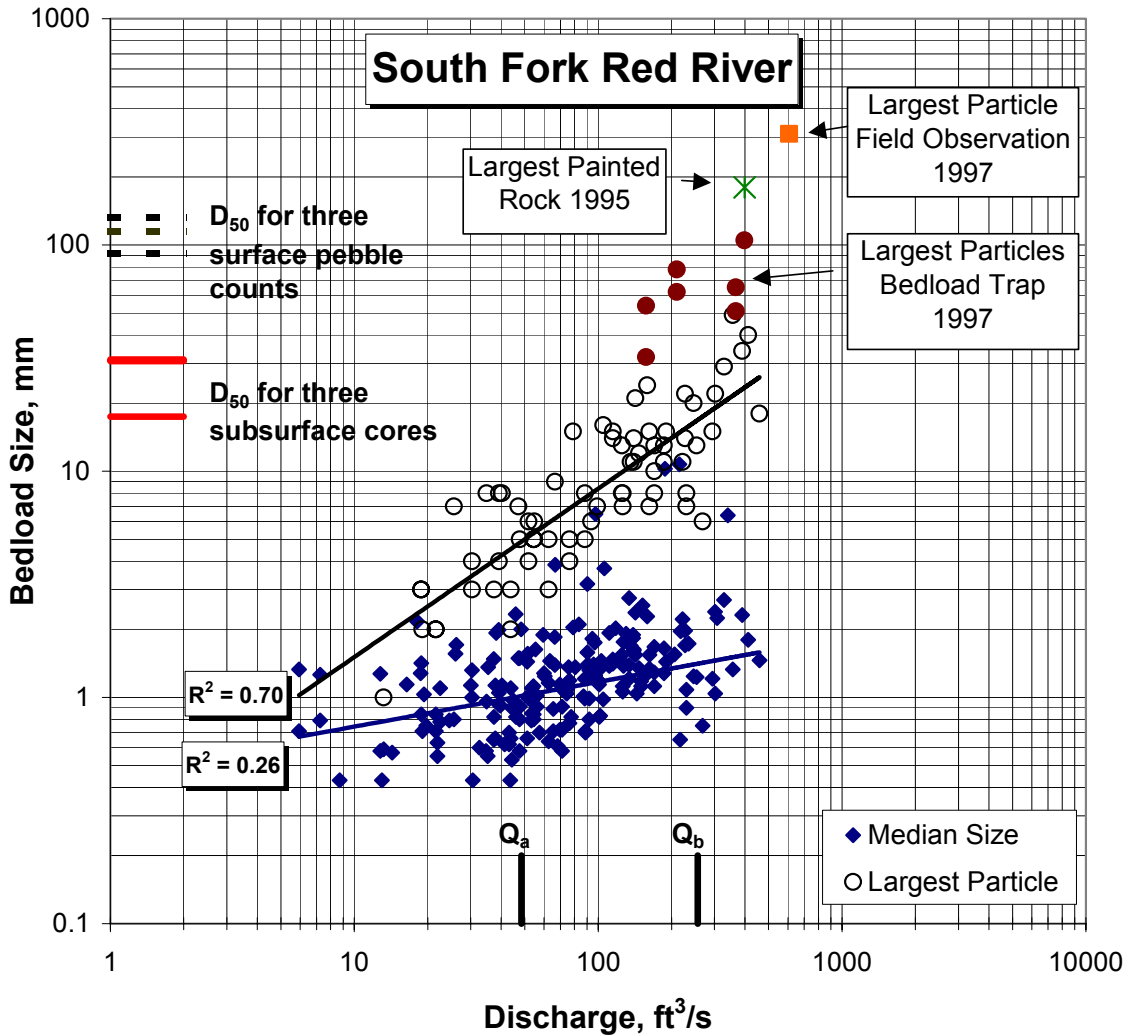


Figure 8. Largest particle in the bedload sample and median size of the sample versus stream discharge for the South Fork Red River.

Painted Rock Transport

A total of forty painted rocks were placed across two transects (twenty per transect) on April 19, 1995. Daily mean discharge on the day of rock placement was 53.1 ft³/s. The size of the rocks ranged from 70 to 183 mm diameter (b-axis) which represents the D₃₃ up to the D₇₈ of the surface particle size distribution. Transport of the rocks as of June 15, 1995 are shown in Figures 9 and 10.

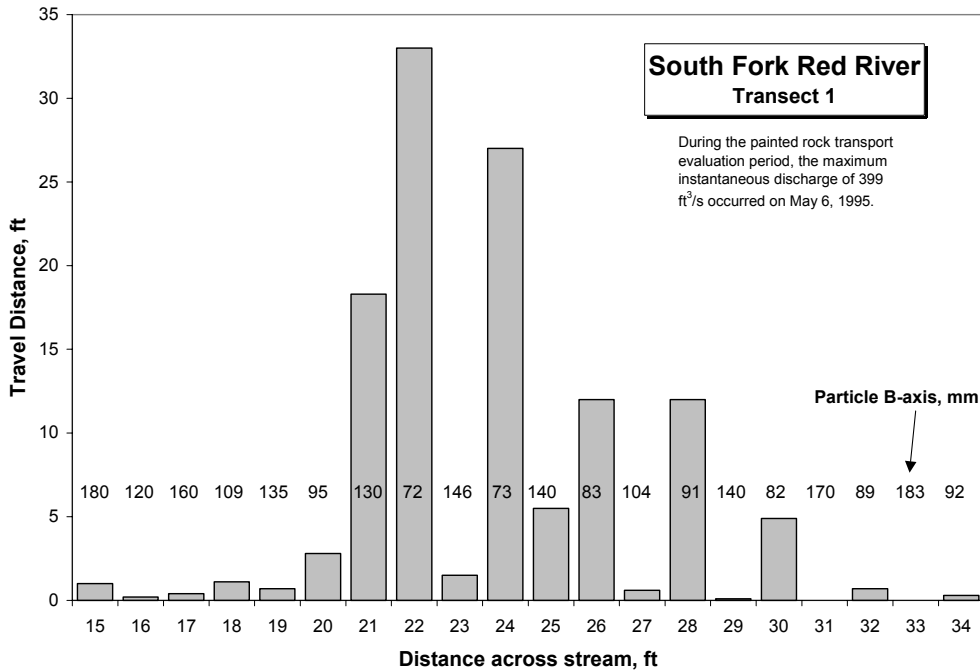


Figure 9. Transport distance of painted rocks at transect 1.

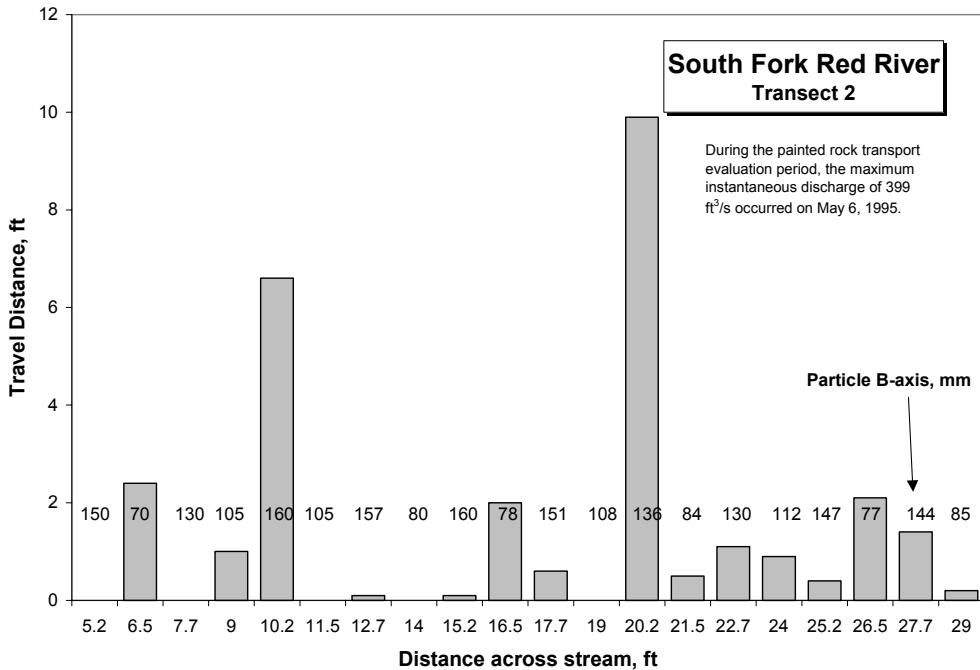


Figure 10 Transport distance of painted rocks at transect 2.

All of the forty rocks were found and seven had not moved. The maximum transport distance was 18.3 ft for a 130 mm diameter rock and the average was transport distance was 3.8 ft. The largest daily mean discharge during the period when painted rocks were on the bed was 257 ft³/s on May 11, 1995 and the largest instantaneous discharge was 399 ft³/s.