

## Main Fork Red River

### General Information

The Main Fork Red River confluences with the South Fork Red River at the Red River Work Center on the Nez Perce National Forest. The study reach is about a 1000 ft length of river beginning several hundred feet 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 49.7 mi<sup>2</sup> and the geology of the watershed is predominantly metamorphic.

This site is associated with an existing Forest Service gaging station. Streamflow records measurements are available from water year 1986 to 2000 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 surface material, core samples of the 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 the reach.



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



Figure 2. Main Fork Red River looking downstream from near upper end of the study reach.

Streamflow records are available for water years 1986 through 2000, typically from the beginning of the spring snowmelt hydrograph into the fall. Estimated average annual streamflow ( $Q_a$ ) is about  $73 \text{ ft}^3/\text{s}$  (20.0 in) and bankfull discharge ( $Q_b$ ) is estimated at  $330 \text{ ft}^3/\text{s}$ . During the period of record, daily mean discharges ranged from  $8.12 \text{ ft}^3/\text{s}$  to  $638 \text{ ft}^3/\text{s}$ . The highest instantaneous discharge recorded was  $678 \text{ ft}^3/\text{s}$  on May 16, 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 0.0059 ft/ft. Cross-sections of the channel were surveyed at four locations. The USFS gage is located on the downstream side of a bridge about 115 ft downstream of cross-section 1 (XS1).

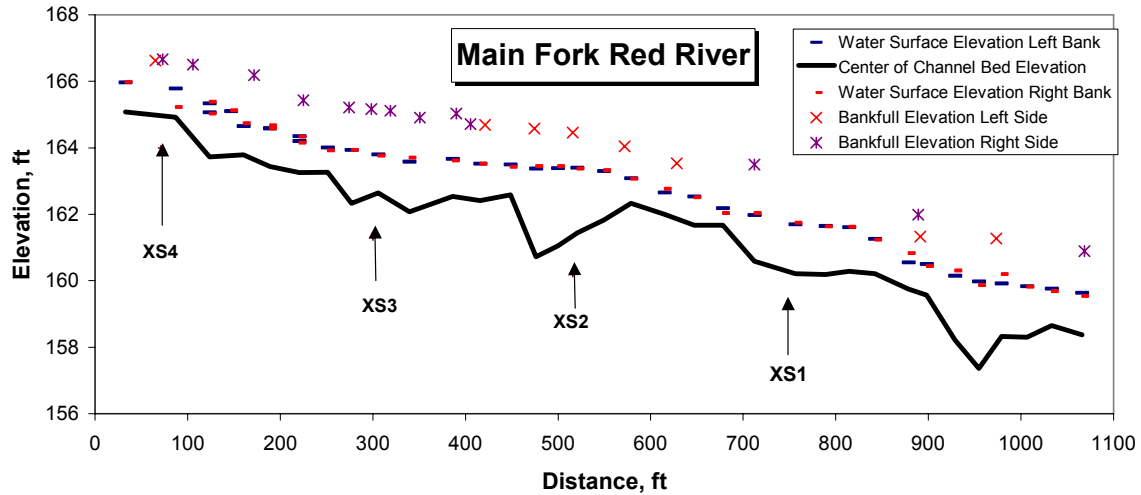


Figure 3. Longitudinal profile of the study reach in Main Fork Red River.

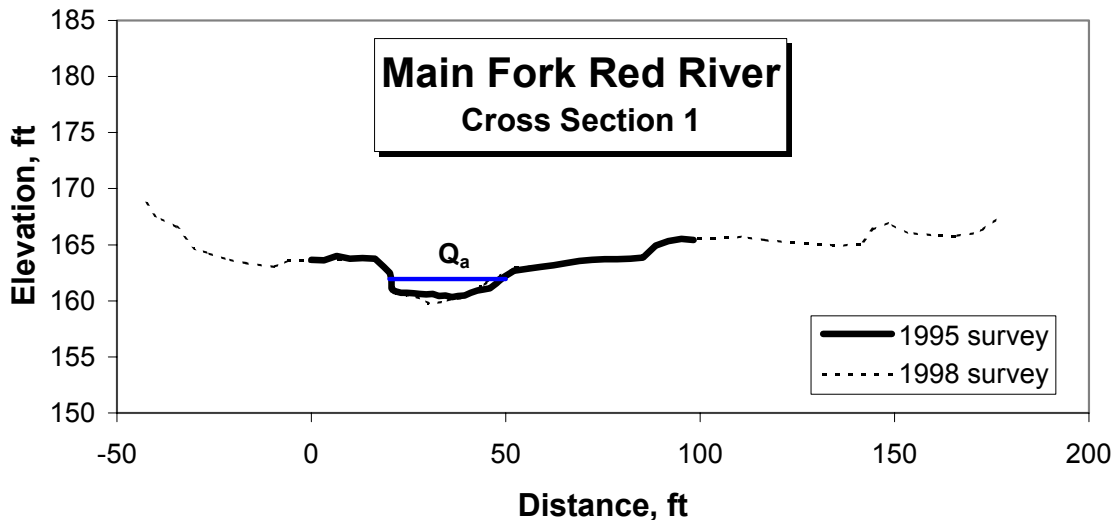


Figure 4. Cross-section 1 of the Main Fork Red River.

## Channel Geometry

Figure 3 shows the channel cross-section of the natural channel about 115 ft upstream of the gaging station. The station geometry relationships for the cross-section at the gaging station (bridge) are shown in Figure 4. During higher streamflows, sediment transport is measured from the bridge. During lower flows when wading is possible, sediment transport measurements were made at several locations, including the bridge location. Information for 1986 through 1997 were used to develop the power relationships. Over the range of discharges when sediment transport was measured (9.88 to 646 ft<sup>3</sup>/s) estimated stream width, estimated average depth and estimated average velocity vary from 25.6 to 40.7 ft, 0.60 to 2.58, and 0.64 to 6.16 ft/s, respectively. The average reach slope is 0.0059 ft/ft.

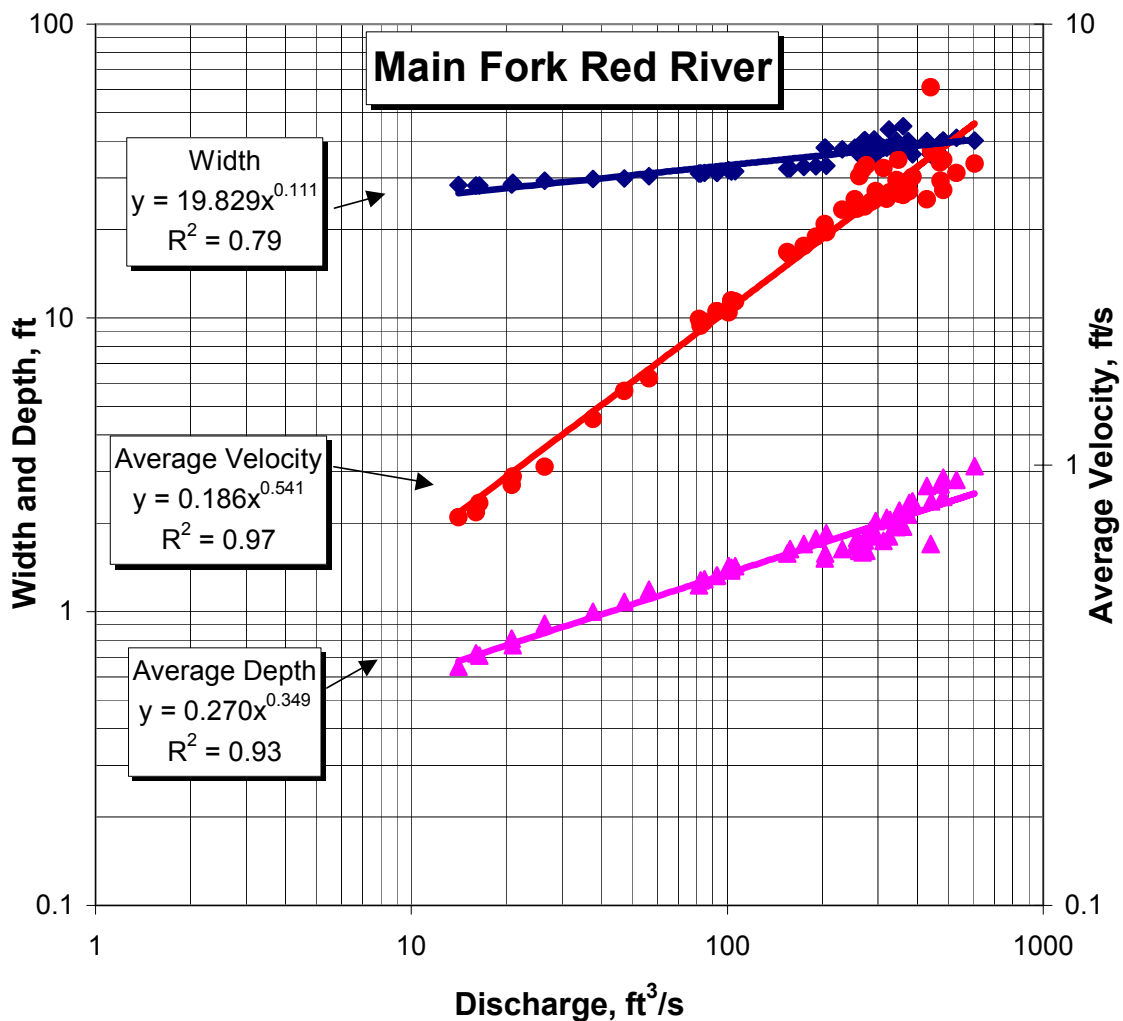


Figure 4. Width, average depth, and average velocity versus stream discharge at the gaging station on the Main Fork Red River.



## Channel Material

A surface pebble count was made near cross-section 4 in July 1994. Additional surface pebble counts were made along four transects in August 1995 and a core of subsurface material was collected, one per transect. The average  $D_{50}$  and  $D_{90}$  for the surface material were 68 mm and 110 mm, respectively in 1994 and 50 mm and 160 mm, in 1995 (Figure 5). The average  $D_{50}$  and  $D_{90}$  for the subsurface material (1995) were 18 mm and 86 mm, respectively. About 24% (1995) of the surface material was sand (2 mm) size or smaller. The median diameter of the surface floodplain material ranged from 0.14 to 0.32 mm.

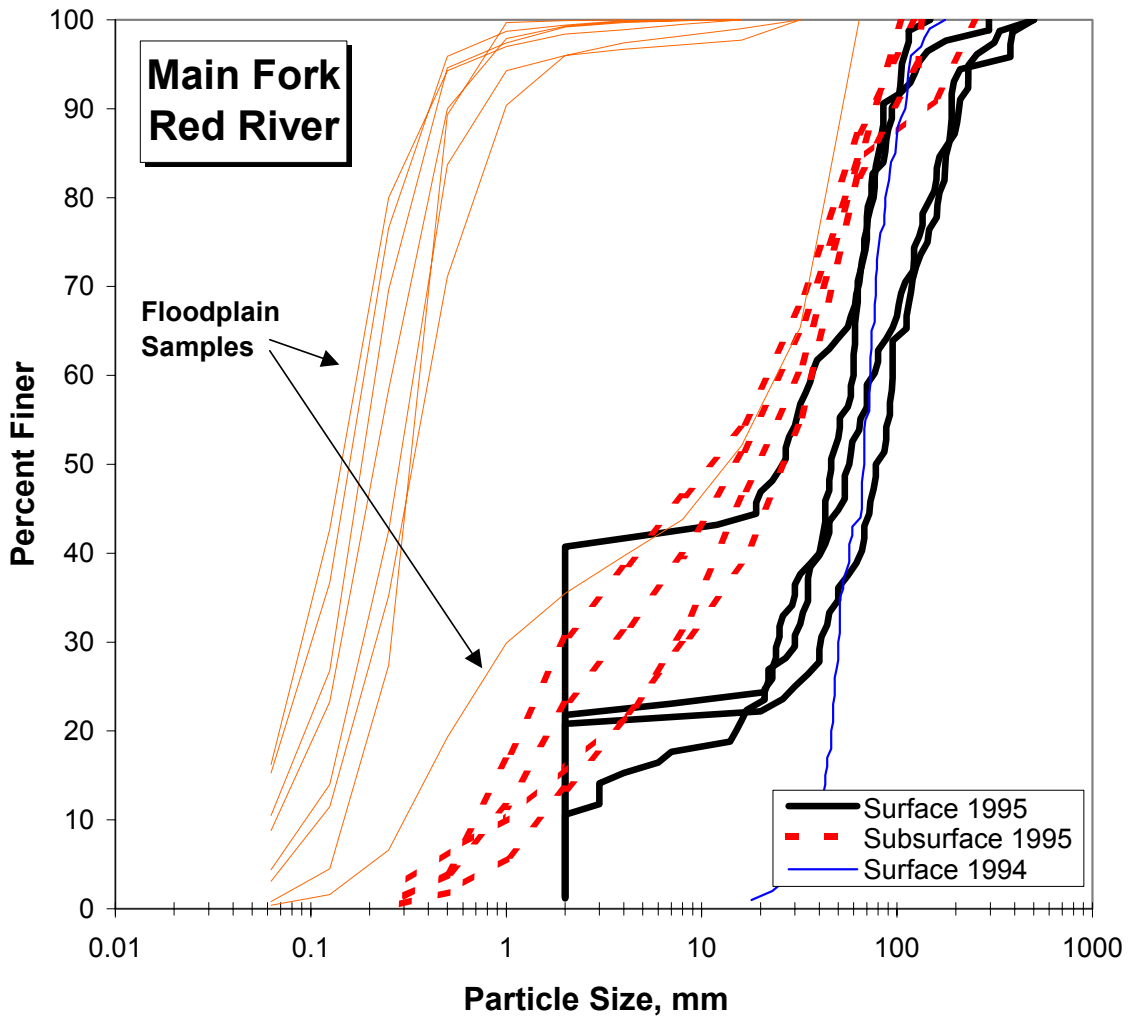


Figure 5. Particle size distribution for surface and subsurface material and floodplain samples collected in the Main Fork Red River reach.

## Sediment Transport

Sediment transport measurements were made in 1986 through 1999. The sediment transport data include 200 measurements of bedload transport and 136 measurements of suspended sediment. Sediment transport measurements spanned a range of stream discharges from 9.88 ft<sup>3</sup>/s (0.14Q<sub>a</sub>; 0.03Q<sub>b</sub>) to 646 ft<sup>3</sup>/s (8.85Q<sub>a</sub>; 1.96Q<sub>b</sub>). Bedload transport ranged from 0.0 to 23.6 t/d and suspended sediment transport ranged from 0.02 to 194 t/d. Over the range of measured discharges, suspended transport accounts for the majority of the material in transport. At the lowest measure discharges predicted suspended transport is about seven times that of bedload and at the highest measured discharge about 1.5 times (Figure 6).

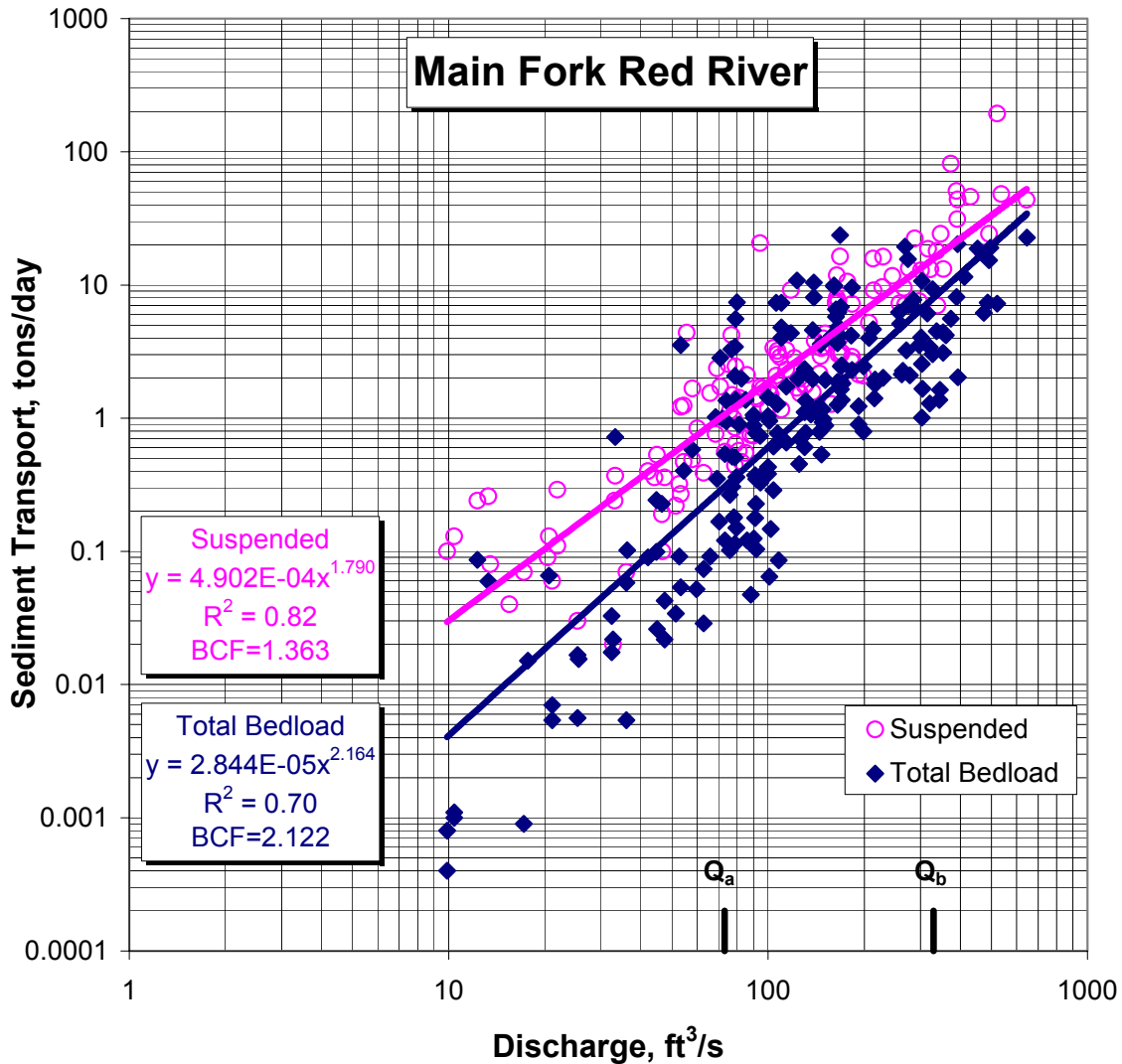


Figure 6. Bedload and suspended load transport rate versus discharge.

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. Only five samples contained material >32mm diameter and associated discharges were greater than 131 ft<sup>3</sup>/s.

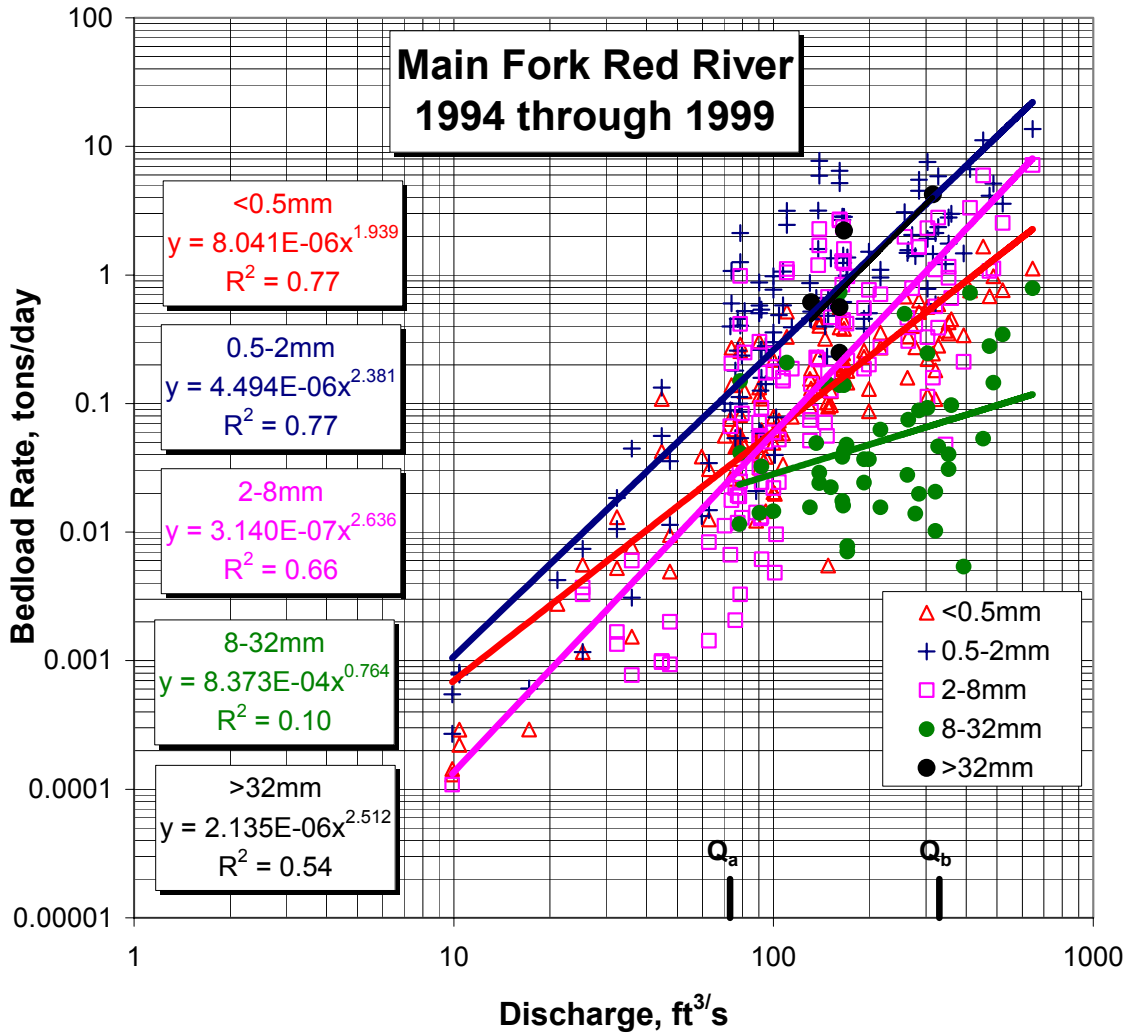


Figure 7. Bedload transport rate versus discharge for selected size classes.

The size of the largest particle in the bedload sample increased with discharge (Figure 8). The largest particle measured in a bedload sample was 60 mm at a discharge of 315 ft<sup>3</sup>/s. Although the largest particle size increased with discharge, the D<sub>50</sub> for the majority of the samples was <2 mm. The largest D<sub>50</sub> was 38.9 mm associated with a sampling discharge of 315 ft<sup>3</sup>/s. 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 the bankfull discharge are capable of moving the median diameter particles on the channel surface.

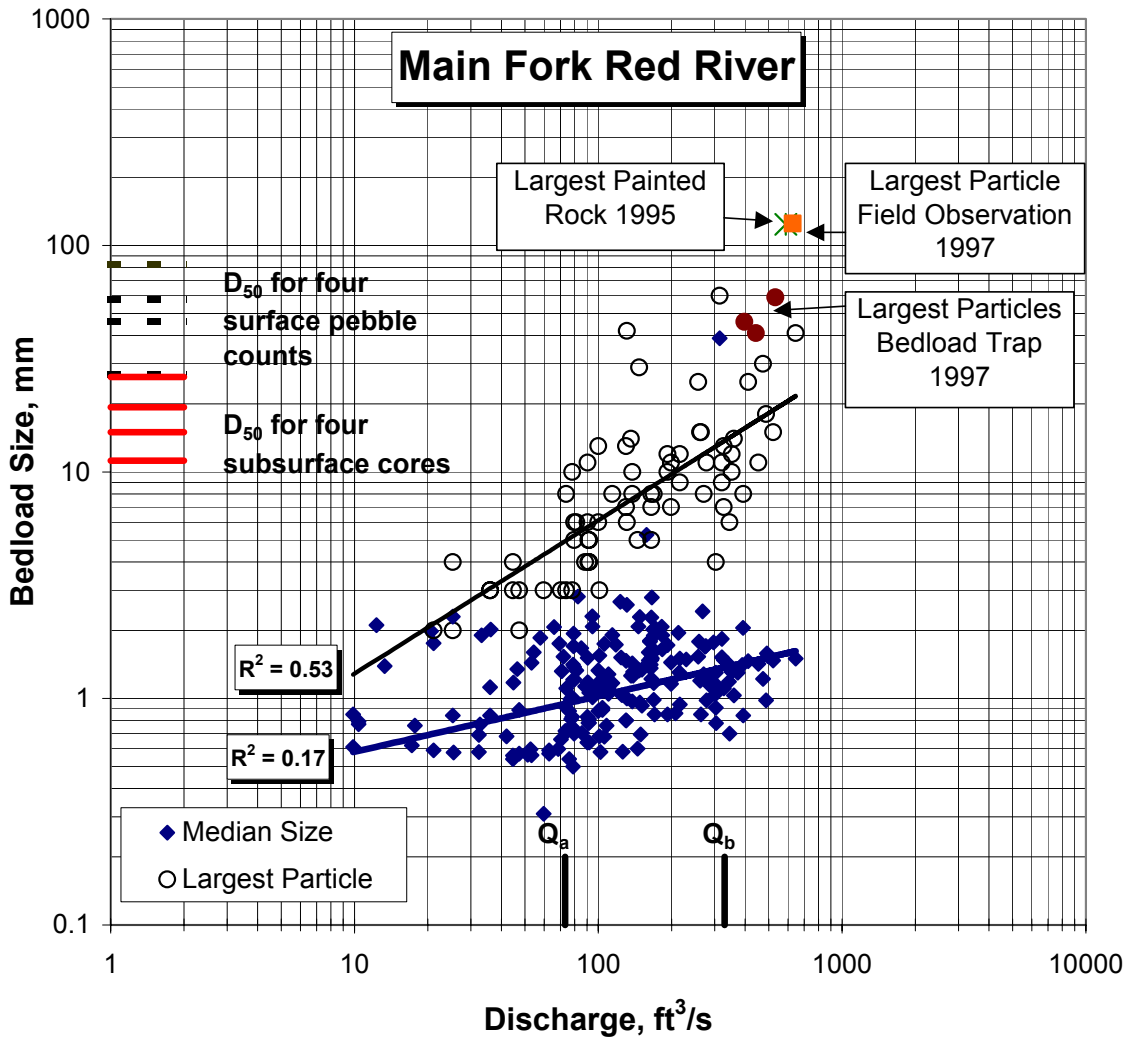


Figure 8. Largest particle in the bedload sample and median size of the sample versus stream discharge for the Main Fork Red River site.



## 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 77.6 ft<sup>3</sup>/s. The size of the rocks ranged from 55 to 150 mm diameter (b-axis) which represents the D<sub>52</sub> up to the D<sub>89</sub> of the surface particle size distribution. Transport distance of the rocks as measured on June 15, 1995 are shown in Figures 9 and 10.

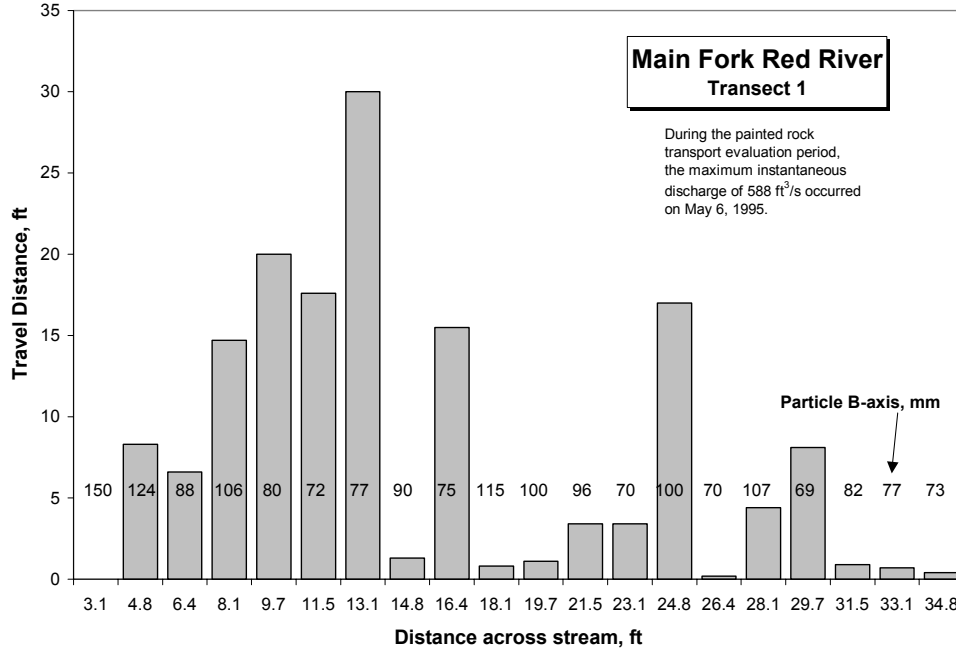


Figure 9. Transport distance of painted rocks at transect 1.

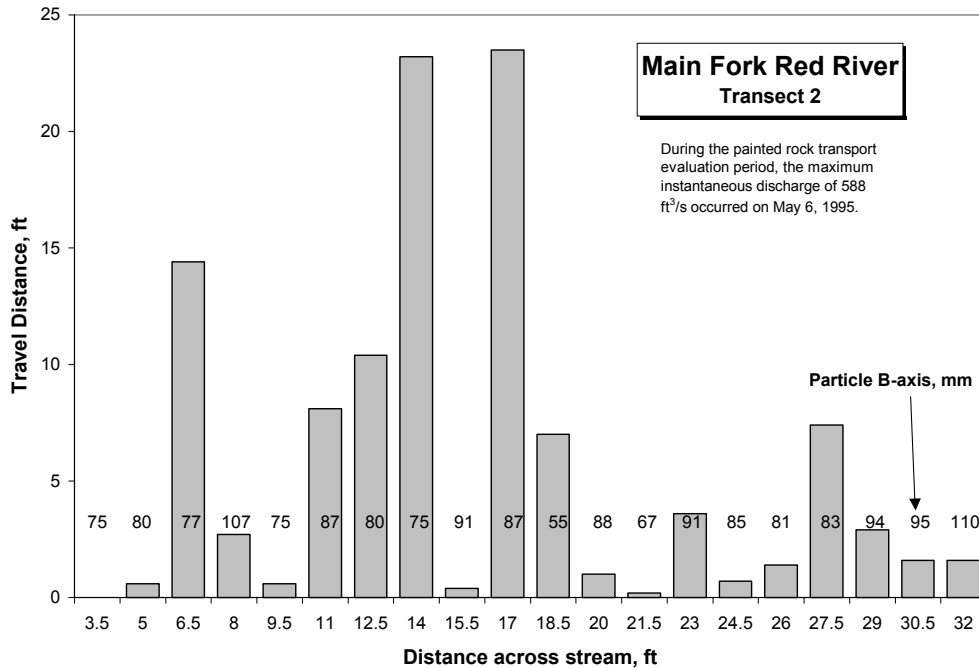


Figure 10 Transport distance of painted rocks at transect 2.

All of the forty rocks were found and only two had not moved. The maximum transport distance was 23.5 ft for a 87 mm diameter rock and the average was transport distance was 6.6 ft. The largest daily mean discharge during this period was 420 ft<sup>3</sup>/s on May 7, 1995 and the largest instantaneous discharge was 588 ft<sup>3</sup>/s on May 6.