

Pebble count methods

The composition of the streambed and banks are important facets of stream character, influencing channel form and hydraulics, erosion rates, sediment supply, and other parameters. Each permanent reference site includes a basic characterization of bed and bank material. For studies of fish habitat, riparian ecosystems or stream hydraulics, the characterization of substrates and bank materials may require greater detail than can be covered here.

Observations tell us that steep mountain streams with beds of boulders and cobbles act differently from low-gradient streams with beds of sand or silt. You can document this difference by collecting representative samples of the bed materials using a procedure called a pebble count.

The most efficient basic technique is the [Wolman Pebble Count](#). This requires an observer with a metric ruler who wades through the stream and a note taker who wades along side, or remains on the bank with the field book. Particles are tallied by using size classes or categories similar to the ones shown in Table 1.

Table 1. Pebble count size classes ^(modified)

Size categories	Size ranges (mm)
(BC) Silt/clay <small>Very small (smooth feel)</small>	
(BC) Sand <small>(Small grainy feel)</small>	< 2
(BC) Gravel <small>(Pea to tennis ball diameter)</small>	
1. Fine gravel	2 – 8
2. Medium gravel	9 – 16
3. Coarse gravel	17 – 64
(BC) Cobble <small>(Tennis ball to basket ball diameter)</small>	
1. Small cobble	65 – 90
2. Medium cobble	91 – 128
3. Large cobble	129 – 256
(BC) Boulder <small>(Basketball to car diameter)</small>	
1. Small boulder	257 – 512
2. Medium boulder	513 – 1024
3. Large boulder	> 1024
(BC) Bedrock <small>Large solid surface</small>	
(BC) Woody debris <small>Sticks, leaves etc.</small>	
(BC) – Broad category	

Pebble counts grids along the stream's length can be transects, zigzags, or based upon the channel habitats (i.e. percentage of riffles, runs and pools). Usually, a random step-toe procedure is used to collect the pebbles. The step-toe procedure is described below and a zigzag pattern is illustrated on page two.

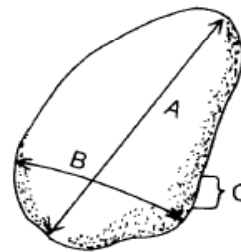
Collection procedure

Select a reach and indicate it on your site map. For stream characterization, sample pools, runs and riffles in the same proportions as they occur in the study reach. For other purposes, it may be appropriate to sample these separately or sample the entire reach randomly

using a zigzag pattern. In some cases only riffles are sampled. Measure a minimum of 100 particles to obtain a valid count. Usually less are collected if single channel features are sampled.

Start the collection at the lower end (downstream) of your reach at one of the bankfull elevations (not necessarily the present water level). Averting your gaze, pick up the first particle touched by the tip of your index finger at the toe of your wader.

Measure the intermediate axis (neither the longest nor shortest of the three mutually perpendicular sides of each particle picked up). Measure embedded particles or those too large to be moved in place. For these, measure the smaller of the two exposed axes. Call out the measurement. The note taker tallies it by size class and repeats it back for confirmation.



- (A) Long axis
- (B) Intermediate axis
- (C) Short axis

The intermediate axis is the pebble's diameter.

Take one step across the channel in the direction of the opposite bank and repeat the process, continuing to pickup particles until you have the requisite number (100 or more) of measurements. The note taker keeps count. Traverse across the stream perpendicular to the flow or in a zigzag pattern. Continue your traverse until you reach the opposite bank so that all areas between the bankfull elevations are representatively sampled. You may have to duck under bank top vegetation or reach down through brush to get an accurate count. Move upstream randomly or at a predetermined distance and make additional transects to sample a total of at least 100 particles.



The **red line** drawn in the image indicates the approximate path the students chose while conducting their pebble count within a 100-meter reach of [Skaggs Run](#).

Pebble count methods

Bankfull physical features include the top (level surface) of adjacent point bars, change in slope, and change in bank composition, limit of woody vegetation and in some cases debris and scour lines. About of 10% of your pebble count should be collected from bankfull (i.e. exposed bars).

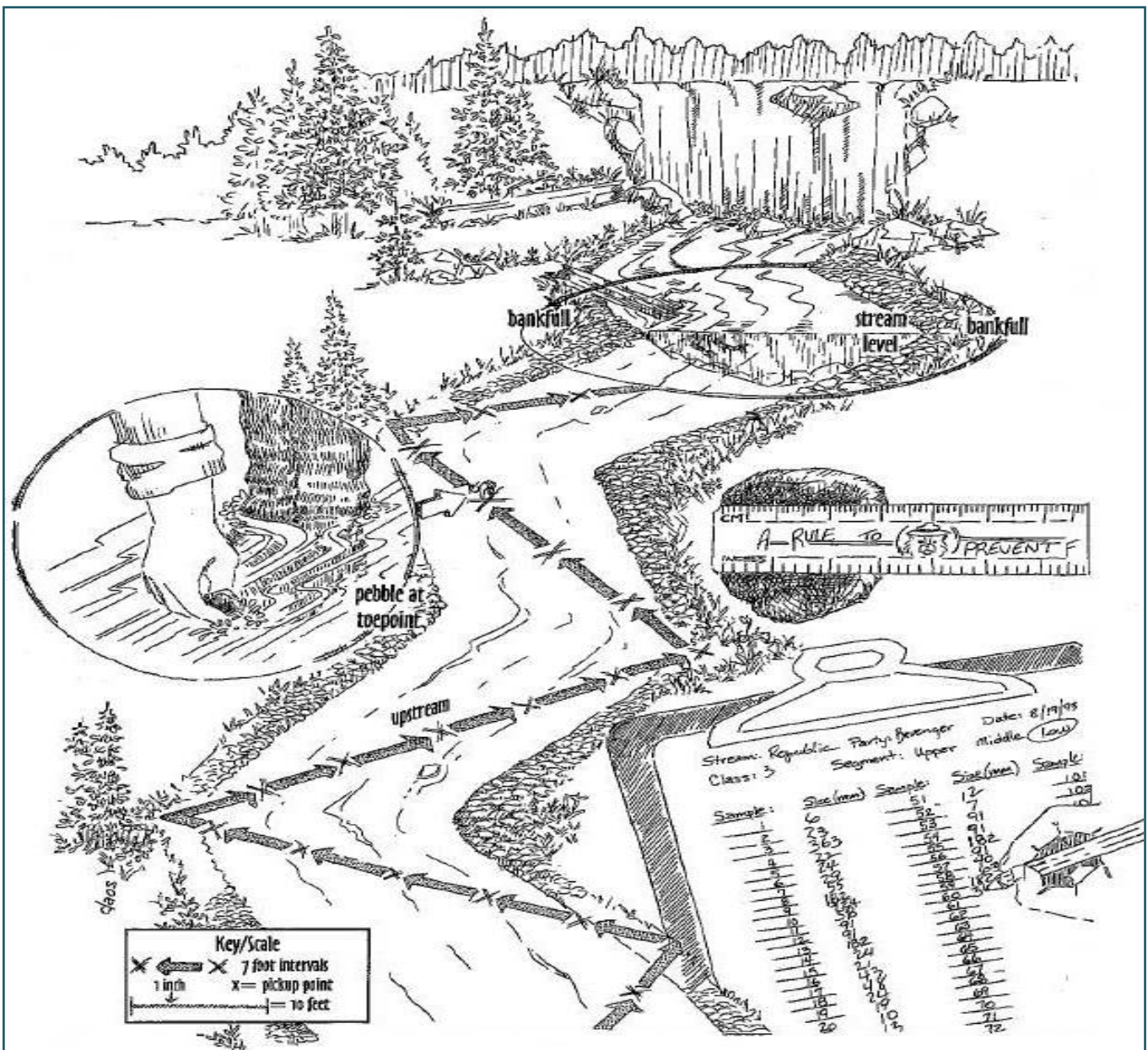
Leopold, L. B., M. Wolman, and J. Miller, 1964. Fluvial Processes in Geomorphology. W. H. Freeman, San Francisco, CA

G.S. Bevenger and R.M. King. 1995. A Pebble Count Procedure for Assessing Watershed Cumulative Effects. Res. Pap. RM-RP-319. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station

References

Harrelson, Cheryl C; Rawlins, C. L.; Potyondy, John P. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station

The zigzag pattern



Pebble Count Data Sheet

Size categories	Size ranges (mm)	Tallies (counts)	Stations
Silt/clay	< 0.06		1
Very fine sand	0.06 – 0.125		
Fine sand	0.126 – 0.25		2
Medium sand	0.26 – 0.5		
Coarse sand	0.5 – 1		3
Very coarse sand	1 - 2		
Very fine gravel	2 - 4		4
Fine gravel	5 - 8		
Medium gravel	9 - 16		5
Coarse gravel	17 - 32		
Very coarse gravel	33 - 64		6
Small cobble	65 - 90		
Medium cobble	91 - 128		7
Large cobble	129 - 180		
Very large cobble	181 - 255		8
Small boulder	256 - 512		
Medium boulder	513 - 1024		9
Large boulder	1025 – 2048		
Very large boulder	> 2048		10
Bedrock	Large unbroken rock surface		
Woody debris	Leaves, sticks etc.		

Enter the tape positions

Indicate the method used below

- Zigzag
- % Habitat
- Transects/Stations
(Enter your tape position)

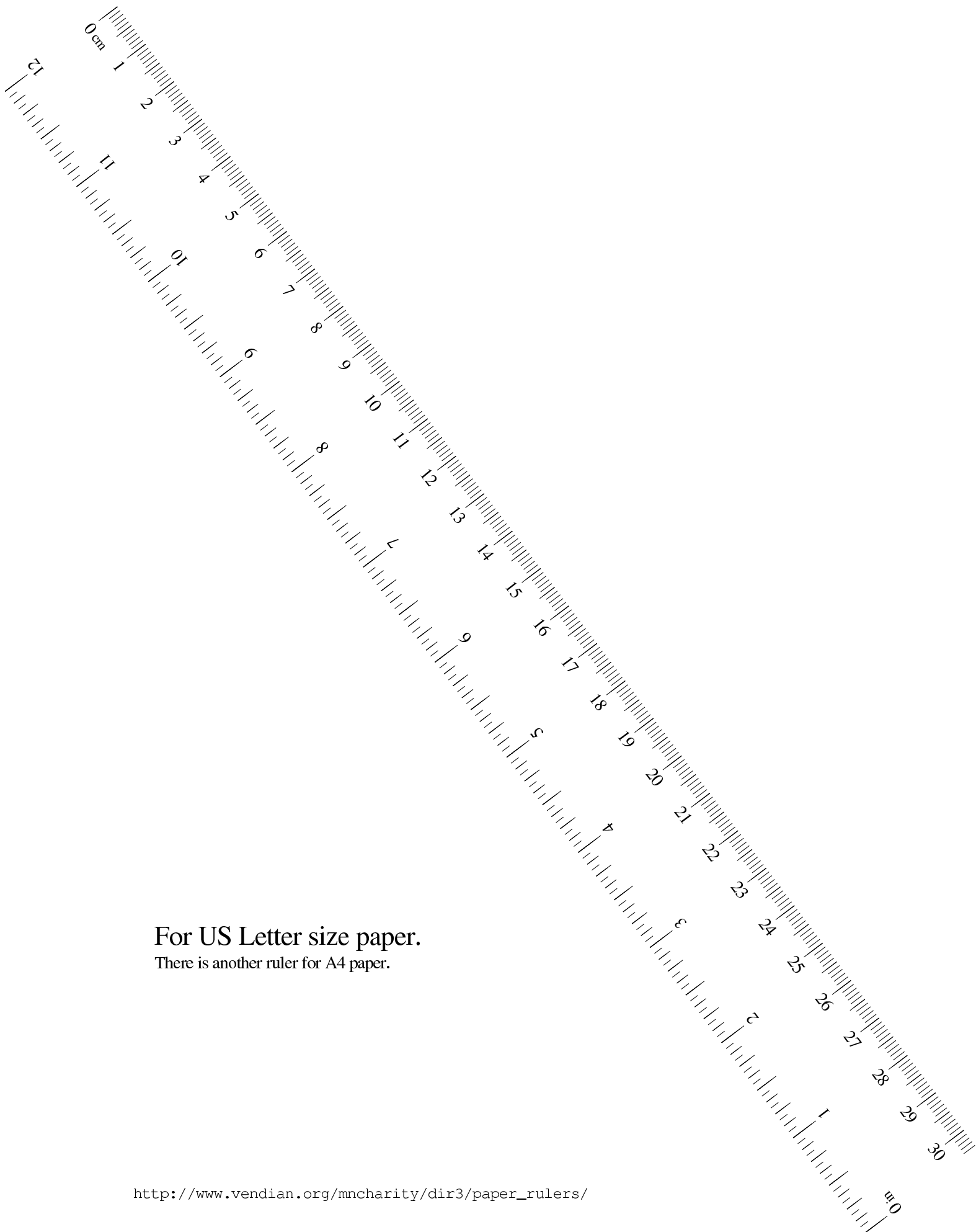
Total count

% Channel features (Estimate)

Riffles Runs Pools

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Note: This data sheet incorporates both basic and advanced pebble count classification. Basic categories include silt, sand, fine and coarse gravel, cobble, boulder and bedrock. Pebble counts can be part of SOS levels 1-3 and should be performed at least once per year during low-water conditions. A version of the pebble count is included on all SOS biosurvey forms.



For US Letter size paper.

There is another ruler for A4 paper.