Federal Interagency Sedimentation Project (FISP)
Technical Committee Memorandum 2009.01

April 20, 2009

Subject: FISP Technical Committee Approval of the Use of Bedload Traps in Wadeable Coarse-bedded Streams

Introduction

The FISP Technical Committee approved a bedload trap as an official FISP sampler at its November 4-5, 2008 meeting. The bedload trap was developed and tested by Kristin Bunte (Bunte, et al., 2004, 2007, 2008) in coordination with the U.S. Forest Service and Colorado State University. The purpose of this memorandum is to provide guidelines for the appropriate use of the bedload traps.

Description

Figure 1 is a schematic diagram of the bedload trap and its parts. The bedload trap has an aluminum frame (figure 2) the shape of a large shoe box without a bottom (Bunte, et al., 2007). It is made of aluminum sheet stock 0.25 inches thick and 4 inches wide with inside dimensions 12 inches wide and 8 inches high. The bottom front edge of the frame is beveled at an angle of 30 degrees. The bedload trap frame is mounted onto a metal ground plate (figure 3) when in the stream. The ground plate is 12 by 16 inches in size and is made of 0.125 inch thick aluminum sheet stock. The leading edge of the ground plate is bent downward slightly (by about 10 degrees) along a fold line 3 inches from the edge. Stakes made of 0.5 inch diameter cold-rolled steel are used to anchor the ground plate on the streambed. The bottom end of the stakes is ground to a pointed tip to facilitate penetration through the streambed material. The length of the stakes could vary from 2.5 to 4 feet depending on flow depth and bed characteristics. The ground plate has predrilled holes to accept the stakes. Pieces of 0.75 inch diameter PVC pipe are used to hold the ground plate on the stream bottom when the bedload trap frame is not in place. Pieces of garden hose about 12 inches long or mushroom-shaped plastic rebar caps are placed on the end of the stakes for safety purposes. The bedload trap frame is held on the ground plate by four adjustable webbing straps that connect the frame to the stakes. Shaft collars with a thumb screw are placed on the stakes to help hold the frame securely against the ground plate. The bedload trap sample bag (figure 4) is made using bulk nylon Raschel knotless netting that is wrapped around the frame and sown in place. The nylon mesh opening is 3.6 mm and the bag should be at least 3 feet long, and can be up to 9 feet long, depending on the application. Bunte, et al. (2007) presents detailed instructions for fabrication of the sampler bag and other incidental hardware needed for bedload trap deployment. The report also includes details for the construction, installation and operation of the bedload trap and processing of samples collected with the trap.

Guidelines for Appropriate Use

Bunte, et.al., 2007, contains detailed guidelines for using the bedload traps. The traps are intended for use in coarse-bedded mountain streams. Users should obtain a copy of the report for careful study before deploying the bedload traps. Below is a summary of the detailed guidelines contained in the report.

Optimum conditions for the use of the bedload trap:

1. The bed should be a stable, gravel or cobble bed suitable for the placement of 12 x 16 inch ground plates.
2. The bedload should consist of sizes ranging from 4 – 180 mm. The bedload trap has a bag with a 4 mm mesh.
3. Bedload transport rates should be such that the sampler can be left in place for 1 hour with the bag filling no more than 40 percent. Higher transport rates require shorter sampling times to avoid overfilling the bag.
4. The stream needs to be wadeable at the time of measurement. The practical limit of wadeability corresponds to products of flow depth (ft) and mean flow velocity (ft/s) of 8 – 12. This equals unit discharges of 0.8 – 1.2 $m^3/s \cdot m$. In mountain gravel-bed streams with a snowmelt regime, the upper limits of wadeablility occur at flows of approximately 80-140 percent of bankfull.
5. Streams should be low in organic material transport at the time of sampling. Organic material especially during the rising limb of the hydrograph can be a problem.
6. Field sites should be suitable for the placement of a portable footbridge to serve as a platform for bedload measurements and other field data collection.
7. Sampled streams will generally need to be less than 50 feet wide.

Operational considerations for use of bedload traps:

1. Desirable field site properties include: a locally wide cross-section to ensure wadeability at high flow, vehicle accessibility to within a short walking distance, sufficient dry work space on the banks to process samples and store gear, the absence of boulders from the sampling cross-section, and suitability for the placement of a footbridge (if one is to be used).
2. Bedload traps need to be placed on ground plates. Ground plates need to be carefully installed at the general height of the bed, typically during low flows and at least one day prior to sampling so that the bed around the plates can re-equilibrate after installation. Ground plates should be installed 3-6 ft apart to cover the lateral variability of transport rates.
3. Bedload traps require as a minimum a two-person field team: one person to hold the end of the net and the receiving bucket when the sampler is emptied, and one person to untie the net, shake the sample into a bucket, and retie the net. Operators need to be prepared for physically demanding and strenuous work. Safety considerations for working in remote areas during highflow conditions also speak strongly in favor of using teams of two or more people for this type of field work.

References

Bunte, K., Abt, S.R., Potyondy, J.P., and Ryan, S.E. 2004b. Measurement of coarse gravel and cobble transport using portable bedload traps. Journal of Hydraulic Engineering 130(9): 879-893.

Bunte, Kristin; Swingle, Kurt W.; Abt, Steven R. 2007. Guidelines for using bedload traps in coarse-bedded mountain streams: Construction, installation, operation, and sample processing. Gen. Tech. Rep. RMRS-GTR-191. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 91 p.

Bunte, K., S.R. Abt, J.P. Potyondy, and K.W. Swingle, 2008. A comparison of coarse bedload transport measured with bedload traps and Helley-Smith samplers, Geodinamica Acta 21(1/2): Geodinamica Acta 21(1/2): 53-66 (supplement, Gravel-Bed Rivers VI Meeting)

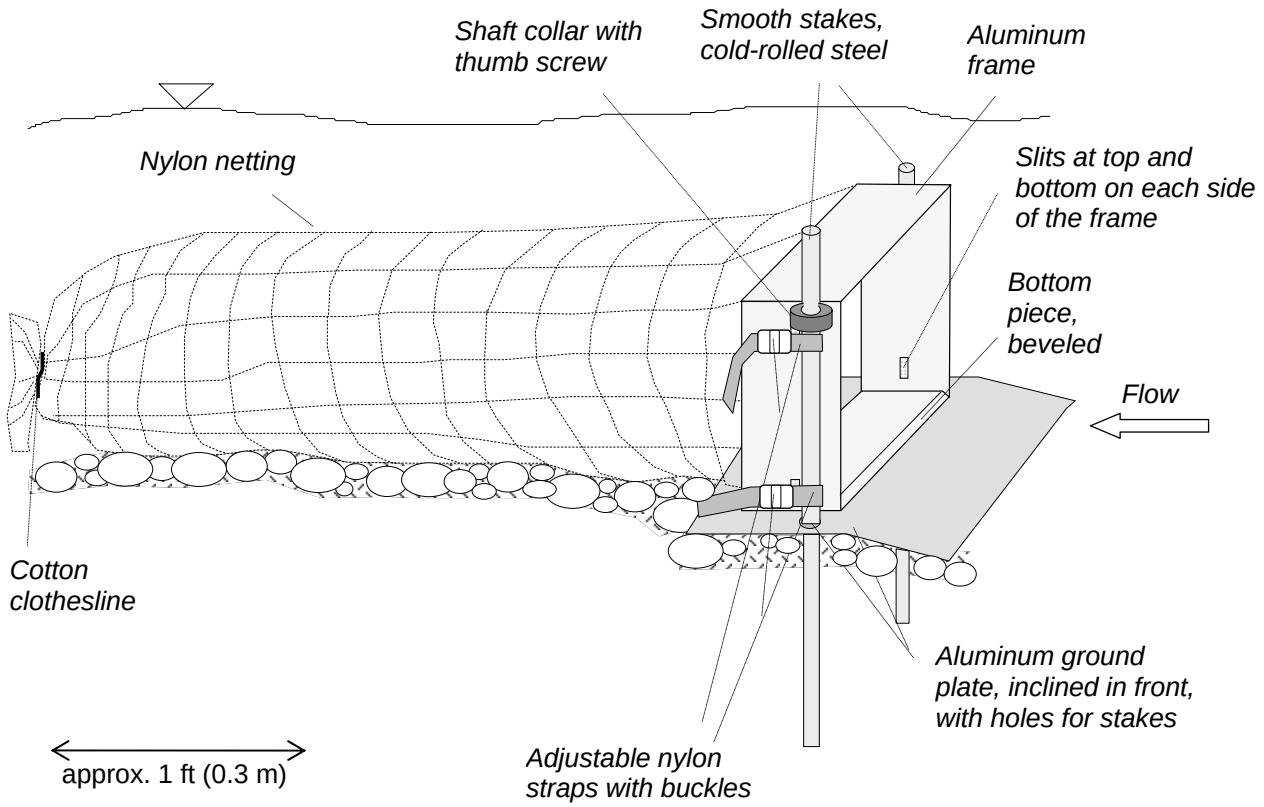

Figure 1-- Schematic diagram of a bedload trap and its parts

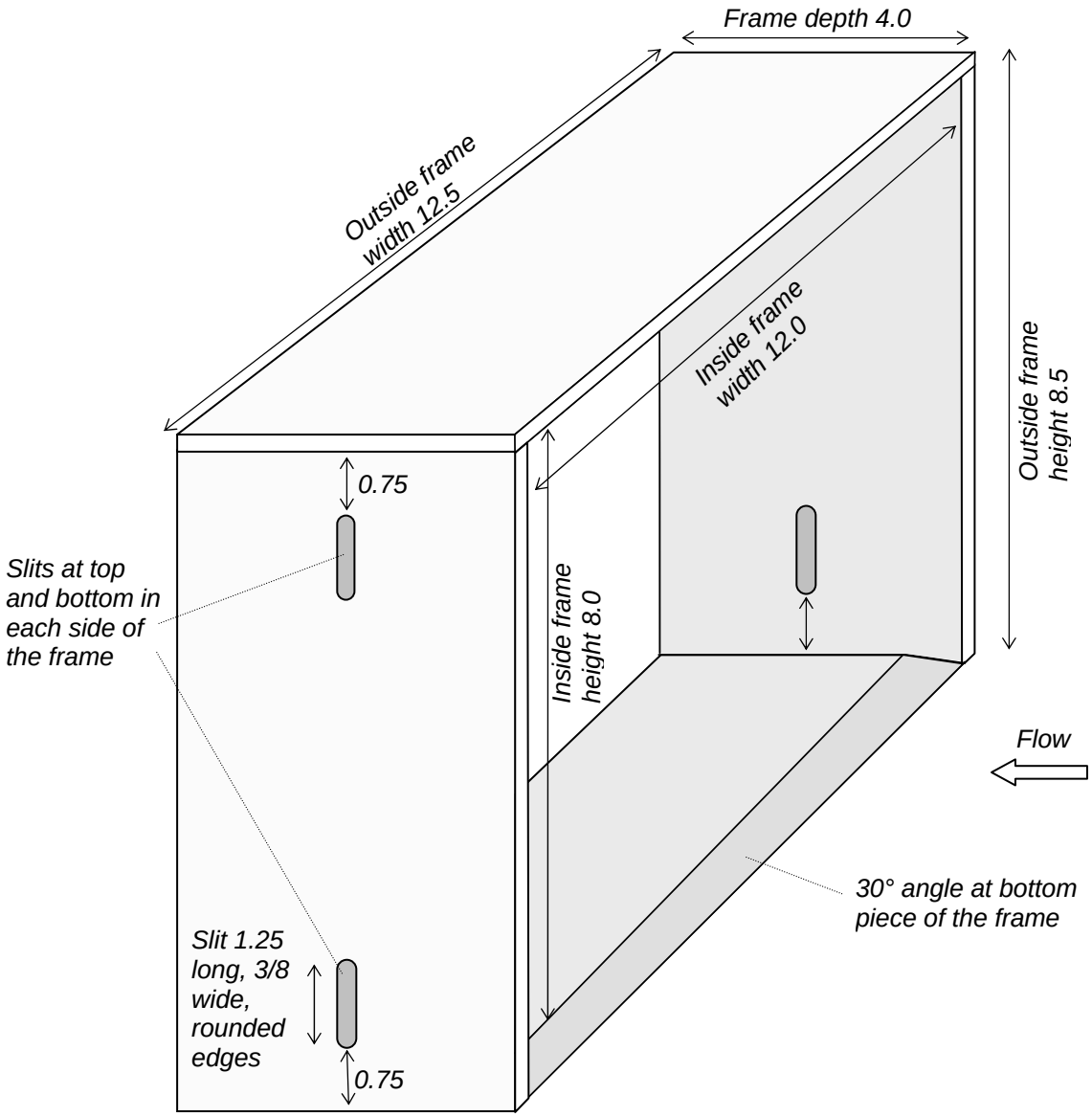

Figure 2-- Detail view of the frame with slits and beveled front edge (all measurements in inches; oblique view)

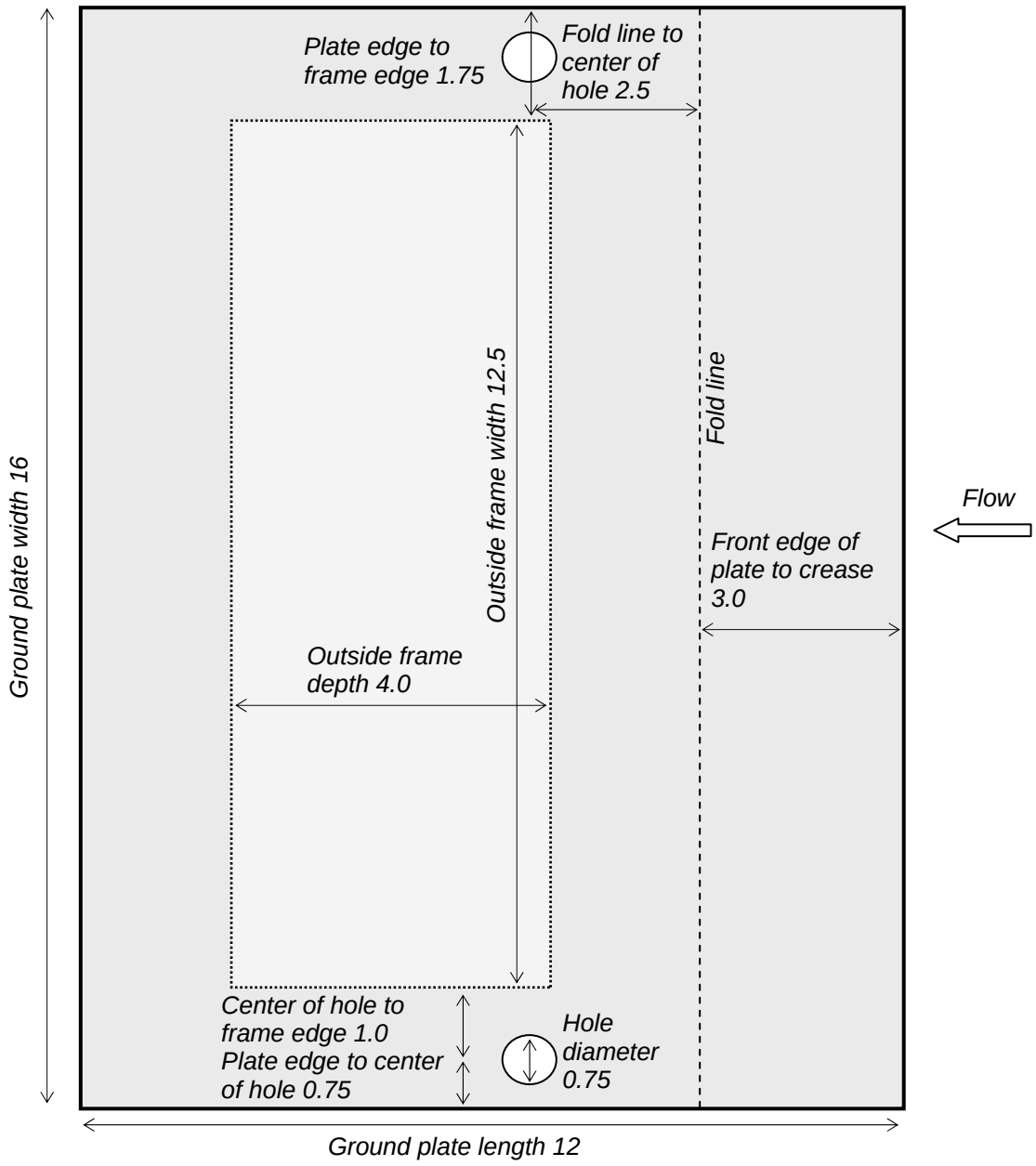

Figure 3-- Top view of a ground plate and frame outline (dimensions in inches)

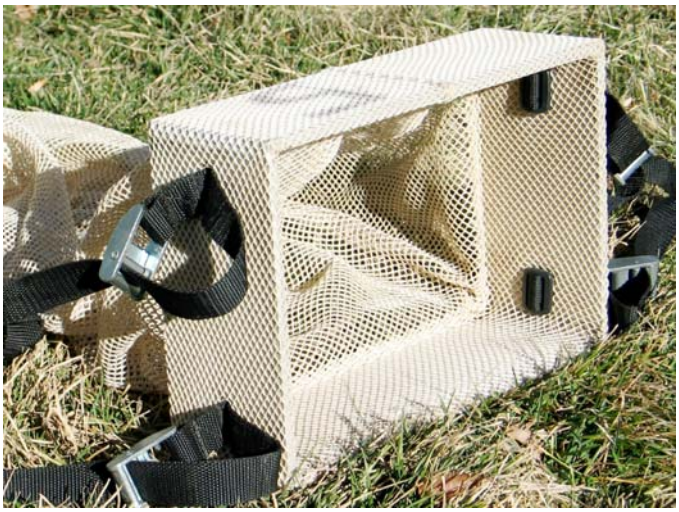

Figure 4-- Bedload frame with webbing straps and sampler bag sown into place