Standard Operating Procedure (SOP) 4.8.3

# Measuring V-star (Residual Pool Volume)

From: Thomas E. Lisle. Using "Residual Depths" to Monitor Pool Depths Independently of Discharge. Research Note PSW-394. United States Department of Agriculture. December 1978
http://www.fs.fed.us/psw/rsl/projects/water/Lisle87.pdf accessed November 2009

Pools are vital components of fish habitat in streams, especially for larger fish, because their great depth offers protection from predators. Residual depth is the difference in depth or bed elevation between a pool and the downstream riffle crest (Fig. 1). Residual pool depth or volume can be measured at wadable flows by using only a tape and graduated sounding rod. Residual dimensions represent extreme low-flow conditions, which often determine the capacity of streams to produce fish. The measurement of residual depth is an unbiased way to easily distinguish pools from other reaches.

Residual depth is measured by sounding or surveying a pool with tape, rod, and (optionally) an engineer's level and subtracting the depth or elevation of the riffle crest from those in the pool. Data can be plotted as profiles or used to draw residual depth contours on a map. The method is simple and unbiased, and can be adapted to measure pool length, area, and volume. Residual pool dimensions can represent low flow conditions that are important for summer rearing habitats of fish.

"Residual depth" is independent of discharge and need only be measured once before and once after stream treatment (stream enhancement project) in order to detect changes. Residual depth is the depth that, if flow were reduced to zero, water would fill pools just up to their lips that are located at riffle crests downstream. Depths in pools would then correspond to residual values. Thus, residual depths represent extreme low flow conditions, which can limit a stream's capacity to support fish populations. The method also provides an unbiased way to easily distinguish pools from other reach types: pools are simply reaches having residual depths greater than zero.

Materials:

Tape measure, stadia rod, and a notebook.

Methods:

Pool frequency and the residual depth and length of pools in a vertical plane running down the channel can be measured quickly by using the following procedure. Measurements should be obtained during low flow when the water surface over the pools is nearly horizontal.

1. To measure distances between residual depth measurements, stretch a tape along the thalweg (zone of greatest depth) or the centerline of the channel. Thalweg distances give the real distance between depth measurements. Centerline distances give distances along the channel as a whole and vary little from year to year.

2. At distances measured along, the tape, note reach type (pool, riffle, run, etc.) and measure depths in the thalweg (deepest thread of the channel). Be certain to measure the distance and depth at riffle crests (Fig. 2 and 3).
3. To compute residual depths, subtract depth at riffle crests from depths in upstream pools. Mean or maximum residual depths or the entire frequency distribution of residual depth can then be easily determined.

A longitudinal profile of the stream bed can be surveyed by using an engineer's level (Fig. 4). After plotting the longitudinal profile, residual depths are measured from horizontal lines extending upstream from riffle crests.

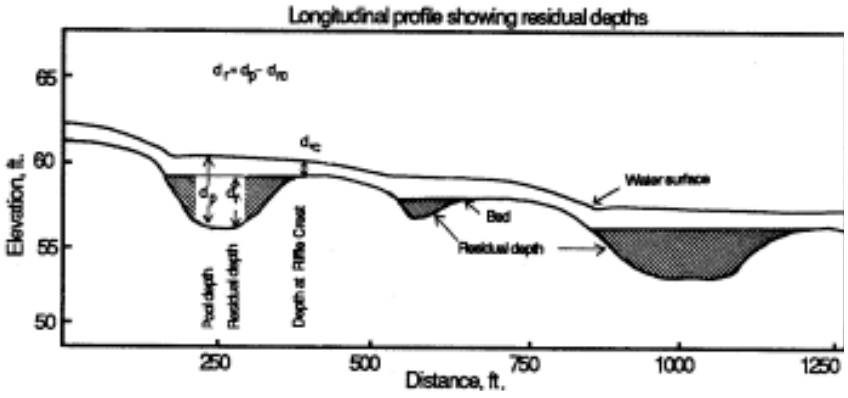


Figure 1 – A longitudinal profile of a reach of stream, showing the method for measuring residual depths.

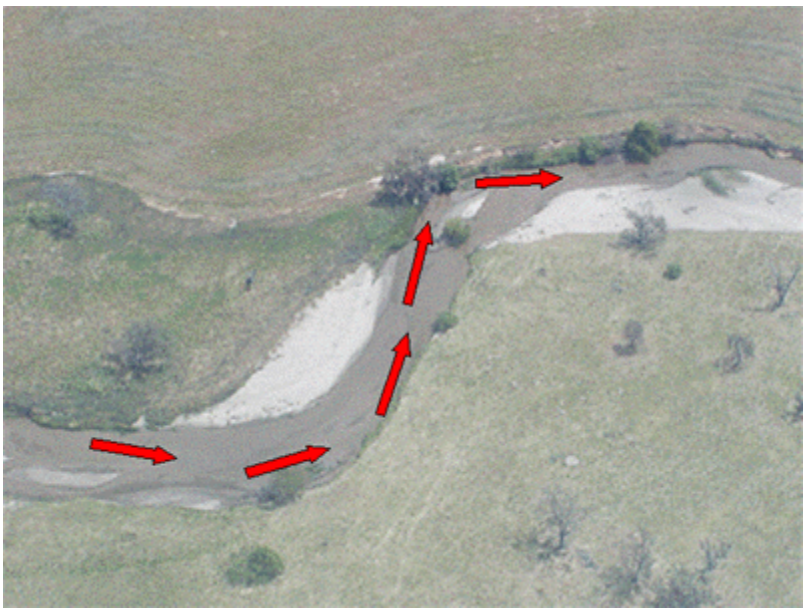

Fig. 2 - The red arrows show the line of highest velocity and depth known as the **thalweg.** This swings from side to side causing erosion at the apex of bends and deposition on point bars on the inside of bends. Picture by Dr. Tim Stott

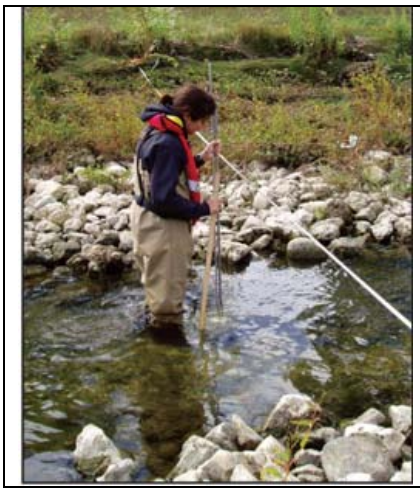

Figure 3 - Personnel collecting streamflow and depth measurements. Image from usgs.gov

Figure 4 – An engineer's level with a tripod may be used to measure distances between streambed changes from riffles, cut-banks, step, pool, bank, flood planes, and channel obstructions among other. Image from N-Cone Group