

## FIELD PROCEDURE: ESTABLISHING CROSS SECTION MONUMENTS

### EQUIPMENT NEEDED:

- reach map from prior monitoring
- 100' measuring tape
- 100' of string
- 6" - 8" galvanized nails
- small sledge hammer
- hand pruner
- lengths of 1/2" rebar 2 - 4 feet long
- rebar caps
- hardhat
- safety glasses
- first aid kit
- flagging tape
- line level
- compass
- stadia rod
- clipboard, pencil

In this procedure, you will establish a permanent monument on each bank of the stream from which to measure its cross-sectional profile. You will perform this procedure only once: before your first August monitoring session. (If the monuments are removed or disturbed, you will have to reestablish them.) By stretching a string and a measuring tape between the two monuments (using the Cross Section Survey field procedure), teams can take annual measurements that will accurately show changes from year to year. Large changes indicate possible problems in the watershed.

### CHOOSING A LOCATION FOR THE LINE

In most reaches, you will establish a single cross-section line, preferably across a fairly straight and even stretch of stream in a riffle, run, or glide (not in a pool or cascade), where there are no islands with woody vegetation. Midway between bends is ideal. (If your reach has two pool/riffle sequences, you may want to establish two cross-section lines, one in each of the riffles.) Do not put the line across a place where the streambed or banks are bedrock (i.e., you want an "alluvial" rather than a "confined" reach). In exceptional circumstances, you might have to place the line outside of your reach--but it should be near enough to mark on your reach map.

Consider the following points when establishing your line:

- You'll want a place easy to find again and to put in monuments.
- When possible, find two trees (preferably fir) >8" diameter that are on opposite sides of the stream and show no sign of imminently falling. In that case, you can establish monuments simply by driving nails in low on the trunks of the two trees. Where trees are not available, you will have to drive rebar into the ground, ideally leaving about 4" protruding from ground level. Often one monument will be in a tree and the opposite will be located with rebar.
- Attachment points should be well above the level of bankfull flow (see definition in "Bankfull" chapter)—a few feet above is ideal. HOWEVER, the line should be low enough that the stadia rod (14.5 feet as of July 1999) can measure up to it from the lowest point in the channel, and you can accurately read it.

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- The cross-section line should be as perpendicular as possible to the bankfull channel (see definition in “Bankfull” chapter).
- The two monuments need to be easily accessible without damaging the banks. (Otherwise, changes in the channel’s cross-section will be due to the stream teams themselves!)
- Avoid placing rebar in high-traffic areas, for both safety and the integrity of the markers.
- If you place your cross-section line in a good place to measure stream flow, you may be able to combine measurements for both protocols. (Program managers will help you determine if your cross-section line is a good spot to also designate flow measurements.) However, in that case your line must be perpendicular to the stream channel.

## LOCATING THE MONUMENTS

Monuments should ideally be directly across the stream from each other, marking a line that is more-or-less perpendicular to the channel. To determine perpendicularity, first choose a point on either bank where you wish to place your first monument. Stand in the middle of the channel facing this chosen point. Hold your arms out to your sides and shift your feet until your arms line up with the flow. Then bring your hands flat together in front of you. Your hands should be pointing at the chosen marker. If they are not, move your body up- or downstream until they are. Now double check your position by again holding your hands out from your sides and bringing them together in front of you. You will be pointing to the marker along a line that is roughly perpendicular to the flow. Then turn 180 degrees keeping your body in the same place, and repeat the movement with your arms. You will be pointing along the same perpendicular line towards the other bank at the best spot for your second monument. Use this procedure to determine if

two trees will work or if you’ll have to place rebar on one or both banks.

## INSTALLING THE MARKERS

1. To decide exactly where to drive nails or rebar, have two people stretch a string between the proposed points, with the line level attached in the middle. **BE CAREFUL NOT TO FLIP THE LINE LEVEL OFF THE STRING.** Adjust as necessary to make the line level and perpendicular to the channel.
  - There must be NO interference with the string. Use the hand pruner to remove branches that are in the way.
  - If the monument will be a nail in a tree, try to locate the nail on the upstream or downstream side of the tree so that the nail itself is parallel to the channel; however, the most important concern is to make the line perpendicular to the channel. Locate the nail as low in the tree as is practical.
  - If the monument will be rebar driven into the ground, hold the string about 2 inches above ground level. The person on the other bank should adjust height as necessary.
  - If there are no trees, put rebar on both banks.
2. Before driving nails, make a number of pleats in flagging tape, leaving a 6” tail on the end. Then hammer the nail through the pleats. (This will assure that some flagging will remain if the tail is pulled off.) Try to leave at least 3” of nail protruding. If the nail is not parallel to the channel, bend it with hammer blows near the base until it is, but do not bend the nail head closer than 1” to the tree trunk. The attachment point will be the head of the nail.
3. If driving rebar, use hardhat and safety glasses. Leave at least 4” protruding. Use the two-foot lengths of rebar if possible. If the ground is hard, you can use a piece that has a point ground into it. If the ground is soft, use a longer piece. You can also

pound fist-sized rocks into the ground around the rebar to stabilize it. If you cannot drive the rebar any further and it is secure, you can cut it off at 4" height with the hacksaw. The attachment point will be just below the rebar cap, once installed.

4. Test your two attachment points with the string and line level to see if they are secure and level with each other, and adjust if necessary.
5. Install a safety cap on the top of rebar pieces, then use the hacksaw to score the rebar just below the bottom of the cap, thus making a permanent mark for the attachment point for the string.

### MEASURING THE DISTANCE

Use the steel measuring tape to take an accurate measurement of the distance between your monuments, to the nearest 0.1 foot. Get the tape as taut as you can; you may need one or two people pulling on each end. Measure between the designated measuring points on the monuments:

- For rebar: just below the rebar cap.
- For a nail: at the head of the nail.

### FLAGGING THE MONUMENTS

Make it as easy as you can for volunteers to find the markers in future years. You may wish to:

- tie flagging around the trunk of the tree at eye level
- tie flagging in the brush above your rebar
- tie flagging to overhanging vegetation at eye-level in mid-channel near the cross-section line

However, if the site is frequented by the public, flagging may serve as both a visual nuisance and an invitation to disturb the markers. Use your best judgment.

### MARKING THE MONUMENTS

If available, label the monuments themselves with metal tags. Include:

- Site name
- LBM or RBM
- Distance & azimuth to another landmark at the site (e.g., the other cross-section monument, reach marker, or other landmark)
- Instructions as to where to attach the string to the rebar or spike.

### RECORDING THE MONUMENTS

Measure the distance from your reach's zero point to the cross-section line, and record this information on your reach map. Also on your map, indicate the placement of the markers:

- For nails in trees, record the approximate position and height on the tree.
- For rebar, indicate the approximate position.
- Also give the distance and true bearings from two prominent landmarks nearby (one of which can be your monument on the other bank). (See "Compass Use" section for instructions on taking a bearings.) That way, if the tree or rebar "disappears" (whether through vandalism, blowdown, or a year's worth of brush growth), you can relocate or reestablish it.

### SEE THE SAMPLE MAP AT THE END OF THE REACH MAP PROTOCOL.

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