

FIELD PROCEDURE: REACH MAP

(Note: You only need to draw this map if you are monitoring physical habitat parameters at your site. As of 2005, these parameters are optional, pending further research and discussion among Streamkeepers staff, technical advisors, and volunteers.)

EQUIPMENT NEEDED:

- pencils with erasers
- graph paper
- ruler
- protractor
- clipboard
- marker with permanent ink
- 3 tape measures, 100-200', marked in tenths of a foot
- sighting compass
- flagging tape
- stakes
- big nails
- rebar
- rebar caps (required on rebar)
- small sledge hammer
- hardhat and safety glasses (to use with sledge hammer)
- first aid kit

This procedure will guide you in drawing a stream reach map, which will help you document the location and path of the stream channel, various features of the channel and riparian area (area on either side of the stream), and important sampling information. The reach map will help you to replicate sampling procedures and track changes in the stream and riparian area.

It is also an essential component in continuity of knowledge about your monitoring reach; as you compose this map, keep in mind that all those things you have up in your head won't do Streamkeepers any good if you get run over by the proverbial bus!

A Streamkeepers monitoring *reach* is typically a 100 x 100 foot square area roughly straddling the stream (with exceptions that we will deal with later.) The central spine of this 100' square reach is a 100'-long ***baseline*** extending along the stream.

You will make a reach map when first establishing your reach and then every 3-5 years thereafter, or as needed (for instance, if there is a major change in the reach). Once you have created a map, the original will be filed in your stream's binder in the Streamkeepers office, and you will be given a duplicate on which to document any changes that have occurred, each time you visit your reach.

Scale: Ideally, use a scale that will fit your entire reach on one sheet of 8.5 x 11 inch graph paper, leaving a ½" margin on all sides. One inch to twelve or fifteen feet usually works well. Draw out a scale bar on the map with increment distances marked, so that the scale can still be measured if the map changes size in duplication. ***For an example of this scale bar as well as other map features, see the sample map that follows.***

NOTE: In the instructions that follow, measurements follow the "lay of the land." So if you're measuring up a hill, you extend the tape going up the hill rather than on a level. Therefore, if your reach is hilly, your reach map will not truly reflect the plan (overhead) view of the reach. At this stage, full-blown surveying is a luxury we can't afford!

OPTION: LARGER REACH DIMENSIONS

The instructions below are written as if all reaches are 100' by 100', but you may wish to make your reach longer or wider than 100'. For instance, a broad stream may require a 150' wide reach to even minimally reflect its riparian area, and a reach that is 200' long might do a better job of reflecting the habitat diversity along the stream. Any reach size is okay as long as it is mapped accurately. Feel free to consult on this issue with Streamkeepers staff or local biologists. Obviously, larger reaches take longer to map and survey; consider the extra time required when making a decision.

1. Decide where your reach will be; see "Identify Prospective Monitoring Reaches" in the Reach Establishment protocol.
2. Next, decide where your **baseline** will run. Typically, this will be a 100' straight line that stays close to the stream. If possible, locate both ends or at least the beginning-point at or near some fairly stable and prominent landscape feature, such as a big tree, stump, or signpost.
3. The beginning-point ("**zero-point**") of the baseline should be the end easiest for other people to find, following only your map and written instructions. This may be either the upstream or downstream end. If both ends are easy to find, choose the end easiest to access. If safe and permitted to do so, place a flagged stake, rebar (which must be capped), or else just flagging, at the zero-point. Mark the flagging, "zero point." In areas that receive foot traffic, keep in mind that:
 - a) Stakes are liable to get pulled out.
 - b) Stakes and rebar might present a safety hazard.
 - c) Markers can mar the beauty of a natural area.

Weigh these factors in as best you can.
4. Run a measuring tape from the zero-point in the direction you want your baseline to

go. Try to keep it close to the stream. It is okay to cross the stream one or more times. If there is a fairly straight trail or road that parallels the stream, you can use it to set up your baseline. This will make mapping easier.

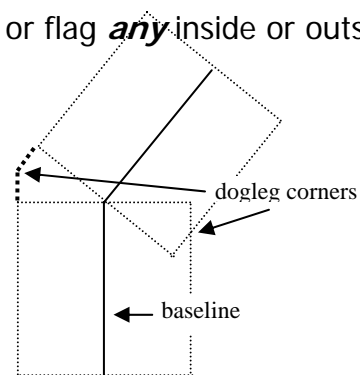
5. If the stream bends such that no straight line can stay within 20 feet of it, make a **dogleg** in the baseline. Mark that point with a flag and/or stake if appropriate. Then dogleg the tape until you reach the 100-foot point.
6. Draw your baseline on your map as a vertical line, using the scale you have predetermined. Standing at your zero-point, take a bearing to the endpoint or dogleg (see "Compass Use" directions following this protocol), and record the **true azimuth** ("true azimuth" = the compass bearing corrected to true north, on a 0-360° scale) to the nearest degree on your map alongside your baseline. (If your baseline doglegs, you will have to record more than one azimuth and use the compass to draw the dogleg at the proper angle on your graph paper. You may need to produce a cleaned-up version at home, using a protractor. To make scaling easier, it may be easier to tape a second piece of graph paper onto the first at the appropriate angle.) Clearly mark on your map the zero-point, the number of feet along the baseline at which doglegs occur (to the nearest tenth of a foot), the 100' point, and true azimuths of all lines.
7. Reference the zero-point of your baseline to two prominent nearby landmarks. Draw and describe the landmarks on your map, and record both the distance and true azimuth from the landmark to the zero-point. If the zero-point is at one of the landmarks (much preferred!), simply indicate what the landmark is on your map. For example, you may want to draw and write "stake for zero-point at edge of 6-foot diameter cedar stump, at 20° true from center of stump."

8. From the zero-point, extend another 100' measuring tape perpendicular to your baseline. Use the compass to orient this tape correctly. (Simply add 90° to your baseline's azimuth.) Such a line, perpendicular to the baseline, is called a **transect**. Normally, you will put the middle of the 100' transect at the baseline, so that the baseline bisects the 100' x 100' outline of your reach. However, feel free to offset the placement of the baseline within the square if that would make the reach more evenly straddle both sides of the stream. For example, if your baseline runs about 20' to the right of the stream, you could have the transects cross the baseline at the 70' rather than the 50' mark. If possible, monument or flag the two ends of this transect, which constitute two of the corners of the reach. Mark the flagging as appropriate.
9. Along this transect, measure the distance from the baseline to each wetted edge of the stream (the points where the water surface hits the banks). Record these distances on your map, and mark an "X" on the map at the locations where the transect crosses a wetted edge.
10. Do the same as above with bankfull width (see definition in the Large Woody Debris protocol).
11. Sketch as much information as you can about the stream and riparian areas in the vicinity of this transect. Include observations about such features as vegetation types and locations, pools and riffles, gravel bars, downed logs, and human alterations. Indicate whether these features are measured to scale for location and size.
12. Now move the transect-tape up the baseline at 10- or 20-foot intervals, keeping its intersection with the baseline perpendicular and at the same number of feet that it was for the zero-foot transect. If appropriate, use stakes or flag vegetation to mark the location of the

transect lines along the baseline, and mark the flagging as "10' transect," etc. If these markers are not visible from the creek, place additional markers on the bank along the transect line—these markers will prove helpful in subsequent monitoring sessions. Mark distances and wetted edges on your map as above, and draw in any landmarks or prominent vegetation that occur near the ends of your transect lines.

13. **If your reach doglegs**, your reach shape will not be a nice square. Instead, it will have two or more rectangles that overlap each other. On one side, there will be a wedge-shaped piece of gap between the rectangles. If possible, close this gap by extending the outside lines of the two rectangles until they intersect, and make this a single outside corner (see diagram). On the other side, there will be a wedge-shaped overlap between the two rectangles. Eliminate this overlap by establishing a single inside corner where the two outside lines intersect (see diagram).

Monument or flag **any** inside or outside



corners if possible—it will enable you to much more easily determine the boundaries of your reach while in the field. And make **very** clear on your map exactly what the outside lines of your reach are.

14. When you have done the above for all transects, draw the wetted stream by making a curve of the wetted-edge "Xs," and draw the bankfull channel by doing the same with the bankfull "Xs." Draw the boundaries of the reach by connecting the

REACH MAP

corners with straight dotted lines. Label all of these lines clearly.

15. You'll probably want to use the rough map you drew in the field to draw a more precise map at home, with straight lines, proper angles, legible handwriting, etc. For this, you'll need more graph paper, a protractor, and a ruler, preferably with a strip of the graph paper pasted to it so you can measure distance-increments easily.

BE SURE THAT YOU HAVE THE FOLLOWING ITEMS ON YOUR MAPS:

- Site name (stream name plus the number of stream-miles to the zero-point of your reach, to the nearest tenth)
- Date you surveyed for the map
- First initials and last names of all map authors
- Exact outside boundaries of the reach, drawn in straight dotted lines
- Baseline clearly drawn and marked as such
- Zero-point of baseline marked and labeled
- References to zero-point from two landmarks; these references consist of both a distance and a true azimuth from the landmark to the zero-point. The landmarks should be drawn in and described.
- True azimuth of baseline, written alongside the baseline as " ° true."
- If the baseline doglegs, the distance(s) along the baseline at which the dogleg(s) occur, plus the true azimuths of the doglegged lines. The angles between the doglegged lines must be accurate on your reach map; use a protractor or compass to get the angles right.
- Wetted edges of the stream drawn in as curvy lines.
- Arrow marked "Flow."
- A legend, consisting of:

- A scale, ticked off like a ruler with map dimensions. Do *not* put in text such as "One inch equals 20 feet," because dimensions may change when pages get photocopied!
- A true north arrow, clearly marked.
- Features of the stream and riparian areas in your reach: vegetation types and locations, pools and riffles, gravel bars, downed logs, human alterations, etc.

AFTER COMPLETING THE “REACH ESTABLISHMENT” PROCEDURE (previous section in this manual), ALSO INCLUDE ON YOUR MAP:

- The elevation to the nearest 100', or more precisely if you can.

AFTER INSTALLING CROSS-SECTION MONUMENTS AT YOUR REACH (see “Establishing Cross-Section Monuments”), ALSO INCLUDE ON YOUR MAP:

- The cross-section monuments, indicated as “l_{bm}” or “r_{bm}” (left- and right-bank monuments—see protocol on establishing monuments), and as “rebar” or “nail in tree.”
- References to each monument from one or preferably two landmarks—same procedure as for landmarking the zero-point, see above.
- The cross-section line as a dotted line, with the true azimuth clearly indicated.

IF PERMANENT FLOW-MONITORING MARKERS HAVE BEEN INSTALLED AT YOUR REACH (see “Flow”), ALSO INCLUDE ON YOUR MAP:

- The flow-monitoring monuments, indicated as “flow l_{bm}” or “flow r_{bm}”, and as “rebar” or “nail in tree.”
- References to each monument from one or preferably two landmarks—same procedure as for landmarking the zero-point, see above.

(over for sample reach map)

SAMPLE REACH MAP

(The original will be filed in your stream's binder in the office, and you will receive a copy on waterproof paper to take into the field with you.)

