TECHNICAL NOTES

U.S. Department of Agriculture Natural Resources Conservation Service

Fluvial Geomorphology – 1 **Spokane, Washington**
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Determining Floodprone Width

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Introduction

Key terms are defined in the **Glossary** and underlined the first time they appear. Left bank and right bank are looking *downstream*. Unless otherwise noted, terms are from Rosgen (1996).

This technical note is a field guide for measuring the floodprone width and will aid in determining the minimum widths for the Riparian Forest Buffer (Practice Code 391). For this practice, the buffer width is based on an undefined "floodplain" width. Washington State NRCS chose the floodprone width to define the floodplain width. Floodprone width applies to natural watercourses (streams, rivers) and is based on the principle that the bankfull discharge is the channel-forming flow (Wolman 1960). The floodprone width includes three elements: channel bankfull width; left bank floodprone width; and right bank floodprone width (**Figures 1** and **2**).

Depending on the purpose for which it is used, Practice 391 may consist only of **Zone 1**, which has a minimum width of 15 feet. For purposes that require an additional **Zone 2**, the minimum width for **Zone 2** is 20 feet, for a minimum combined width of 35 feet. However, where there is an active floodplain, the *minimum combined width* is the smaller of either 100 feet or 30% of the left bank or right bank floodprone (floodplain) width.

Method

The floodprone width varies from one site to the next along a watercourse and between left and right banks at any given site (**Figure 1**). Floodprone widths can be determined using basic equipment such as a 100 ft tape, stadia rod and laser level (or hand level), following these steps:

Step 1. If possible, obtain an aerial photo and mark the upstream and downstream limits of the practice installation, as well as where the channel crosses the property lines. Delineate the longest continuous reach where there are no artificial stream disturbances such as road crossings, water diversions or livestock watering areas. Take this photo to the site.

Step 2. For the first cross-section (**Figure 1, A-A´**), choose a relatively straight section of the channel (usually a riffle, if substrate is cobble or gravel) near the upstream end of the delineated stream reach. Do *not* use a pool cross-section (**Figure 1, C-C´**). Use bankfull indicators to determine the bankfull elevation on both left and right banks. For stream reaches

that are incised (downcut or entrenched), the bankfull elevation may be below the top of the banks. **NOTE**: Bankfull indicators are more obvious at meander bends - go up or downstream to the nearest pointbar and note (preferably by flagging) where the line of vegetation begins and/or sediment size is noticeably smaller along the top of the deposition area. This line should form a continuous, smooth demarcation back to the bankfull indicators in the straight section. In general, the line should be parallel to a line drawn along the existing water surface.

Step 3. Extend a tape tightly across the channel, from the left bankfull indicator to the right bankfull indicator, as shown in **Figure 2.** This tape should create a level line (could also use a handheld laser light). This level line is the bankfull elevation; the distance between the two indicators is the bankfull width. Find the deepest part (thalweg) of the channel and measure the distance from the bottom of the channel to the tape. This is "**d**" - the maximum bankfull depth [2.5 ft in the example shown in **Figure 2**].

Step 4. The floodprone elevation is two times the maximum bankfull depth (**2d**) – 5 ft in the example. At this elevation, a horizontal line, drawn across and perpendicular to the channel and continued to where it intersects the ground on each side of the valley, demarcates the floodprone width. **NOTE:** It may be easier to stand on the streambank and set the level at a height of "**d**" at the bankfull elevation (bankfull indicator flag) to determine where the floodprone line intersects the higher ground.

Step 5. Measure the distance from the left bankfull elevation to the end of the left side of the floodprone width to obtain the left bank floodprone width – 30 ft in **Figure 2**. Do the same on the right bank side to obtain the right bank floodprone width – 250 ft in **Figure 2**.

Step 6. Select two more straight-channel segments, one near the middle of the project reach (**Figure 1, B-B´**) and one near the downstream end (**Figure 1, D-D´**). Repeat Steps 2-5 at each site. Add the three left bank floodprone widths together and divide by three to obtain the left bank *mean* floodprone width (LMFW) = 30 + 45 + 20 ÷ 3 = 32 ft in the example. Do the same for the right bank (RMFW) = 250 + 280 + 120 ÷3 = 216 ft in the example.

Step 7. The buffer width for the right side of the stream is then (0.3) × (RMFW) = 65 ft. The left floodprone width averaged only 32 ft, so set the buffer width at the minimum practice requirement of 35 ft along the left bank.

Glossary

Bankfull discharge - or: Bankfull flow or: Effective flow	flow at which the stream is moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of the channel – the channel-forming flow. For channels that are not incised, it is the flow that reaches the top of the banks, just before flooding – the bankfull flow.
Bankfull elevation -	height of the bankfull discharge.
Bankfull indicators -	channel features used to identify bankfull elevations on a bank, such as certain plant growth patterns (especially for woody plants), significant changes in particle sizes at pointbars and other depositional features.
Bankfull width -	width of channel at the bankfull elevation.
Floodprone area -	entire area that is flooded when the flow is at the floodprone elevation.
Floodprone elevation -	flow (discharge) height during a flood that covers the floodprone area.
Floodprone width -	width of the active floodplain at the floodplain elevation (twice the maximum bankfull depth); composed of the active channel (bankfull width) and left and right bank floodplain (floodprone) widths.
Maximum bankfull depth -	distance from the deepest part of the channel to the bankfull elevation line; always measured across a straight section of channel.
Pointbar -	depositional area that forms on the inside bank of a meander; it usually remains bare of vegetation due to the frequent recurrence of flow.
Watercourse -	channel of flowing water – e.g. stream, river, creek, brook.

References

Rosgen, D. (1996). Applied River Morphology. Pagosa Springs, CO. Wildland Hydrology

Wolman, M.G. and J.P. Miller (1960). Magnitude and Frequency of Forces in Geomorphic Processes. Journal of Geology 68(1): 54-74.

Suggested reading:

Harrelson, C.H., C.L. Rawlins and John P. Potyondy. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. April 1994. USFS General Technical Report RM-245.

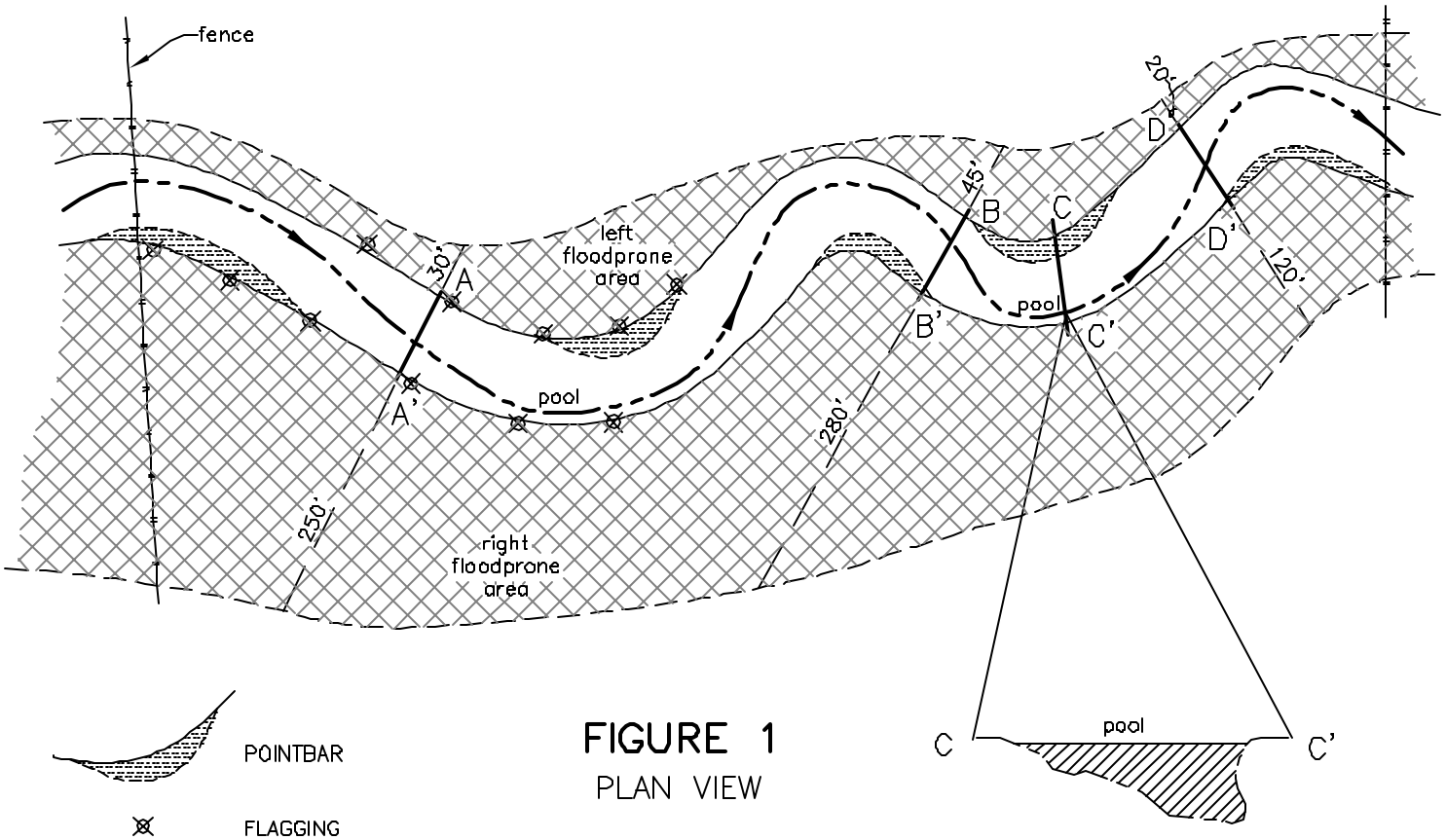

FIGURE 1
PLAN VIEW

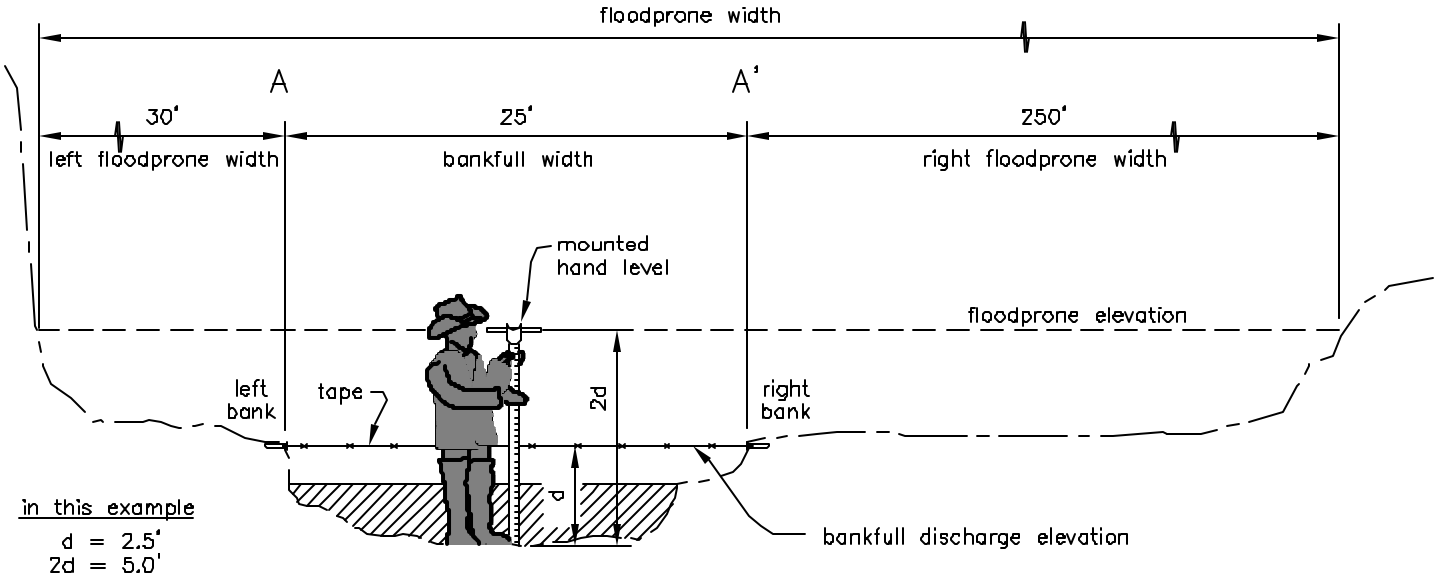

FIGURE 2
CROSS-SECTIONS

FIGURES ARE NOT TO SCALE