

IDENTIFYING BANKFULL ELEVATION

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Bankfull flow is defined as the discharge that just begins to spill out of the channel onto the floodplain (Leopold et al. 1964). Bankfull flow is significant because it is the dominant discharge in sand- and gravel-bed rivers (the discharge that transports the most sediment in the long term) (Wolman and Miller 1960; Andrews and Nankervis 1995; Emmett and Wolman 2001). Many gravel-bed rivers also exhibit a near-bankfull threshold for significant bedload transport and morphologic adjustment (pool scour, bar deposition, bank erosion, etc.); hence it is the channel-forming flow for gravel-bed rivers (Henderson 1963; Parker 1978) and the flow that sets many aquatic habitat characteristics (pool dimensions, substrate size, width-depth ratio, etc.) for fish and macroinvertebrates (e.g., Buffington et al. 2003; 2004).

There are several indicators that can be used in the field to help locate the bankfull elevation (given in order of reliability):

- a) floodplain surface (topographic break between the channel banks and floodplain). Note that the floodplain surface may not be extensive in incised channels. Incised channels may also exhibit flights of terraces (abandoned floodplains).
- b) high-flow markers:
 - “trash” line (deposits of leaves, branches, and other detritus)
 - mud line
 - sand and silt deposits along the upper banks
 - stain lines on boulders and other rock
 - scour line of roots and banks (cut bank)Note that the above markers represent one or more high-flow events, which may, or may not, have been the bankfull discharge. Also, note that “trash” left in shrubs and small trees may be misleading. Vegetation may be bent over by the flow and then rebound when the flood waters recede, with the rebound elevation and the consequent elevation of “trash” potentially greater than the actual flood height.
- c) vegetation line. The vegetation limit is commonly referred to as the *active channel* (frequent flow level) which typically is a lower elevation than bankfull. Vegetation lines can be influenced by seasonal and annual variation of flow. e.g., vegetation will encroach on the channel and occur at lower elevations during periods of drought, or be scoured to high elevations during high-magnitude floods.
- d) bar tops. The flow had to be at least as high as the bar tops to deposit sediment there and build the bars to their current level.

One should use all of the above indicators to help identify the bankfull elevation when conducting channel surveys. Also make use of upstream and downstream indicators and visually project the corresponding bankfull plain through your cross section to

corroborate correct local identification of bankfull. If the bankfull elevation is questionable on one side of your cross section, project the one that you have confidence in to the opposite bank.

Strictly speaking, bankfull discharge can only be evaluated for floodplain rivers, although vegetation lines and stain lines are commonly used in non-floodplain rivers to estimate “bankfull-equivalent” flows. The bankfull discharge has an average recurrence interval of about 1.5 years in floodplain rivers in temperate climates (Wolman and Leopold 1957; Leopold et al. 1964; Williams 1978).

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