California Department of Fish and Wildlife

INSTREAM FLOW PROGRAM

WINTER 2017 UPDATE

What is a Low-Flow Threshold?

A low-flow threshold identifies where flow levels are receding into the "danger zone" for aquatic life* (DFO 2013). *These are survival-level flows and definitely not "optimal" ecological flows. For example, the breakpoint flow level identified by a ≥50% wetted perimeter on a *wetted perimeter vs. discharge* curve identifies the *lower ecosystem threshold flow*, below which aquatic invertebrate production, habitat, and general ecological health rapidly decline (Annear et al. 2004).

What are the Benefits of Low-Flow Thresholds?

A low-flow (i.e., floor value) is a widely recognized flow-related component that is needed to protect and ensure the long-term persistence of fisheries and aquatic insects (Linnansaari et al. 2013; DFO 2013). ***A low-flow threshold helps prevent the reduction of natural base flow levels of a stream or river hydrograph by water withdrawal or other water management activities.*** The establishment of a seasonally appropriate low-flow threshold helps protect fishery productivity during critically low-flow time periods by supporting stream channel forms and riparian communities that directly affect aquatic life (Annear et al. 2004).

How is a Stream's Low-Flow Threshold Identified?

Low-flow thresholds can be identified using site-specific and/or desktop hydrology-based methods, and are based on the needs of fish and aquatic insects (Annear et al. 2004). The wetted perimeter method (WPM) is an established, site-specific method for use in quantifying a low-flow threshold value for streams and rivers (Annear et al. 2004). The term *wetted perimeter* refers to the cross sectional area, or perimeter, of a streambed from wetted edge to wetted edge. The WPM is used to identify the relationship between wetted perimeter, average depth, and average velocity over a range of flows. ***A primary strength of the WPM is that it can be used to identify a threshold flow for constraining permits or other requests for water withdrawal at any time of year (Annear et al. 2004).*** When using a hydraulic modeling approach to conduct the WPM, the following are recommended:

1. Incorporate site-specific measurements to validate the WPM by assessing the predicted versus observed wetted perimeter for three separate riffle habitats.
2. Incorporate site-specific measurements based on hydraulic simulations from data collected at three widely spaced flow levels (Annear et al. 2004)

A desktop hydrology-based approach developed by the Canadian Environmental Protection Agency uses 30% of the mean annual discharge (MAD) to identify the low-flow threshold (DFO 2013). The MAD is a relatively robust hydrological indicator that has a strong correlation to the size of the drainage basin on a regional basis. There is a consensus among experts that cumulative flow alterations resulting in instantaneous flows that are ≤30% of the MAD have a heightened risk of impacts to ecosystems that support fisheries (Tennant 1976; Figure 1; DFO 2013).

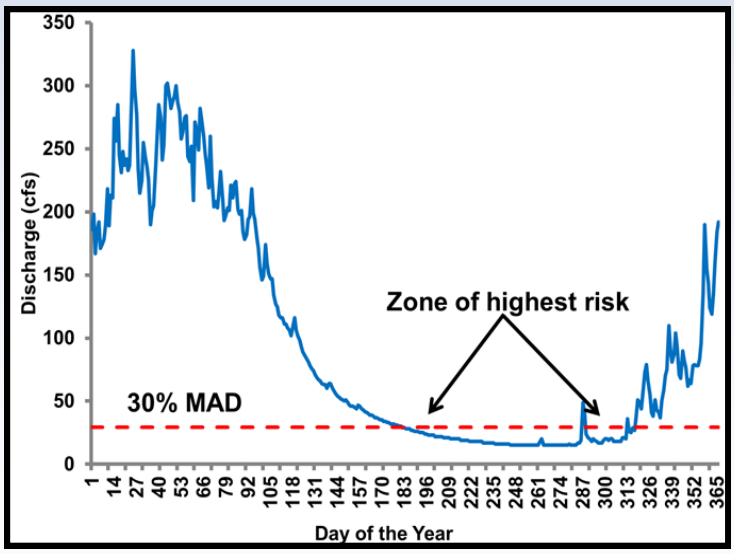

Figure 1: Detailed annual depiction of average daily discharge and zone of highest risk expressed as instantaneous discharges that are ≤30% of the mean annual discharge (MAD) for the assessed river/stream

Does a Low-Flow Threshold Mean the Same as a "Bypass Flow" for Water Management Purposes?

No. A bypass flow refers to a volume of water that must flow past a point of diversion before water may be diverted pursuant to a water right. A bypass flow may be any flow level that is needed for an in-channel use. ***A low-flow threshold is a cut-off flow that is generally synonymous with implementing a "forbearance period," during which flow should remain instream rather than being diverted.***

Are Flow Levels Identified by the Low-Flow Threshold Always Present or Achievable in California Streams?

No. In fact it is possible in the dry summer and fall months, especially in below normal water month types, that natural flows may recede below the stream's threshold cutoff in some California streams. This is not a justification for artificially reducing flows to those levels on a permanent basis. ***A low-flow threshold does not equate to a request or recommendation for more water than nature can provide.***

Literature Cited

Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other coauthors. 2004. *Instream Flows for Riverine Resource Stewardship*, Revised Edition. Instream Flow Council, Cheyenne, Wyoming.

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