

# Hydrologic Indicators

## CANDIDATE HYDROLOGIC CRITERIA

### Ranking for Criteria 1-3

Indicator	Criterion			Notes
	1	2	3	
Low Pulse Count	ns <sup>a</sup>	7	sig <sup>a</sup>	
High Pulse Count	4	2	sig	Strong match w/criteria 1-3
Low Pulse Duration	8	4	ns	
High Pulse Duration <sup>b</sup>	7	3	ns	
Low Pulse Range	ns	ns	ns	
High Pulse Range	2	1	sig	Very strong match w/ criteria 1-3
7-day Annual Minimum Flow	ns	ns	ns	
Date of the 1-day Minimum Flow	ns	ns	ns	
Onset of Fall Flows <sup>c</sup>	ns	ns	sig	
Fall Count	ns	ns	ns	
Rise Count	ns	ns	ns	
Fall Rate	ns	ns	sig	
Rise Rate	ns	ns	ns	
Flow Reversals <sup>b</sup>	5	8	ns	
T <sub>Qmean</sub> <sup>b</sup>	ns	6	sig	
R-B Index <sup>b</sup>	3	5	ns	
Time above 2-Year Mean Flow <sup>c</sup>	1	10	ns	Strong match w/ criteria 1-2; potential ability to provide independent info.
2-Year Peak: Winter Base Flow Ratio <sup>c</sup>	6	9	na <sup>a</sup>	Strong match w/ criteria 1-2; potential ability to provide independent info.
Normalized Effective Stream Power	ns	ns	ns	
Q <sub>2 current</sub> :Q <sub>10 forested</sub>	ns	ns	ns	

<sup>a</sup> ns—not statistically significant correlation between candidate indicator and TIA (criterion 1) or B-IBI (criterion 2); sig—significant correlation at p < 0.01; na—not available

<sup>b</sup> Significantly correlated with a potentially confounding variable and thus does not meet criterion 4

<sup>c</sup> Not highly correlated with other candidates and therefore can provide independent information according to criterion 5

**Criterion 1**  
Extent and quality (relative certainty) of the research database linking the indicator to watershed land use/land cover.

**Criterion 2**  
Extent and quality (relative certainty) of the research database linking the indicator to aquatic biological integrity.

**Criterion 3**  
Demonstrated ability of the indicator to be established reliably by the available stream gauge data and calculated by HSPF in relatively good agreement with gauge data.

## DEFINITIONS OF CANDIDATE HYDROLOGIC CRITERIA

### GROUP 1: PULSE METRICS

**Low Pulse Count**—Number of times that the daily time-step hydrograph pulses below the low-flow threshold for each calendar year; threshold set at 50 percent of the mean flow rate under forested conditions over full period of record

**High Pulse Count**—Number of times that the daily time-step hydrograph pulses above the high-flow threshold for each water year; threshold set at twice (2 times) the mean flow rate under forested conditions over full period of record

**Low Pulse Duration**—Mean number of days per occurrence that the daily time-step hydrograph is below the low-flow threshold for each water year

**High Pulse Duration**—Mean number of days per occurrence that the daily time-step hydrograph is above the high-flow threshold for each water year

**Low Pulse Range**—Range in days between the start of the first low-flow pulse and the end of the last high flow pulse during a water year

**High Pulse Range**—Range in days between the start of the first high-flow pulse and the end of the last high flow pulse during a water year

### GROUP 2: MINIMUM FLOW METRICS

**7-Day Annual Minimum Flow**—Minimum mean flow rate over a 7-day period for each calendar year

**Date of the 1-Day Minimum Flow**—Julian date of each annual daily minimum flow

**Onset of Fall Flows**—Julian date of the day after the annual 7-day minimum flow period for the dry season

### GROUP 3: HYDROGRAPH PATTERN METRICS

**Fall Count**—Number of days for each water year in which the change in daily flow from the previous day is more than 10 percent of the current day's flow rate and declining

**Rise Count**—Number of days for each water year in which the change in daily flow from the previous day is more than 10 percent of the current day's flow rate and rising

**Fall Rate**—Mean rate of fall for all falling portions of the daily time-step hydrograph for each calendar year

**Rise Rate**—Mean rate of rise for all rising portions of the daily time-step hydrograph for each calendar year

**Flow Reversals**—Number of times that a trend change occurred in the daily time-step hydrograph (rising to falling limb or falling to rising limb, except for minor variations (< 2 percent))

### GROUP 4: FLASHINESS METRICS

**T<sub>Qmean</sub>**—Fraction of the time in each water year that the daily time-step hydrograph exceeds annual mean discharge for a forested condition

**Richards-Baker (R-B) Index**—Mean daily rate of change (absolute value) of daily time-step hydrograph for each water year

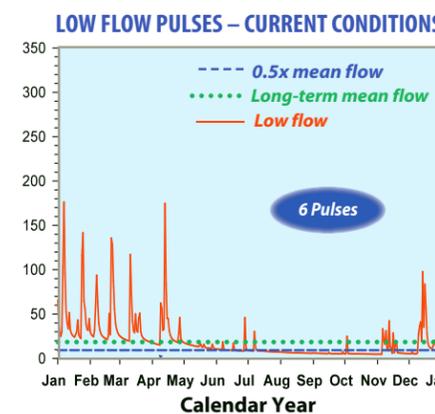
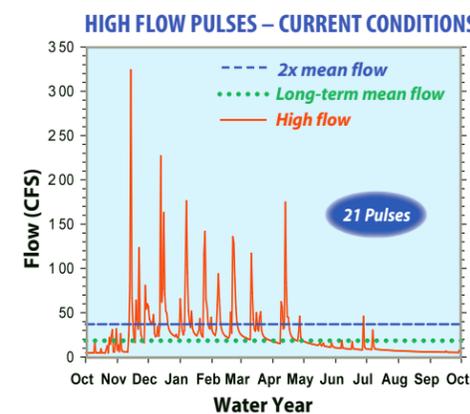
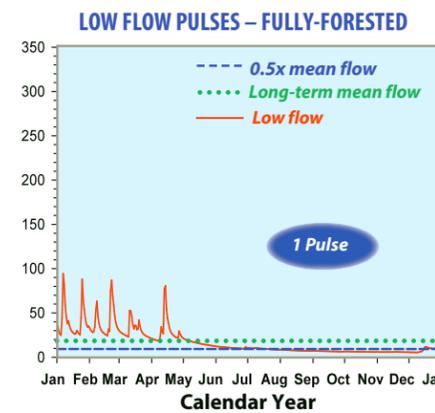
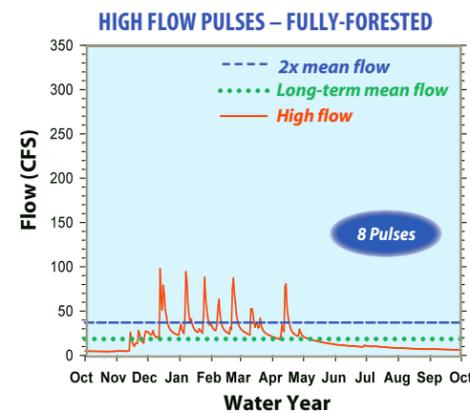
**Time above 2-Year Mean flow**—Fraction of the time in each water year that the daily time-step hydrograph exceeds the 2-year mean flow rate for a forested condition

### GROUP 5: RELATIVE STREAM POWER METRICS

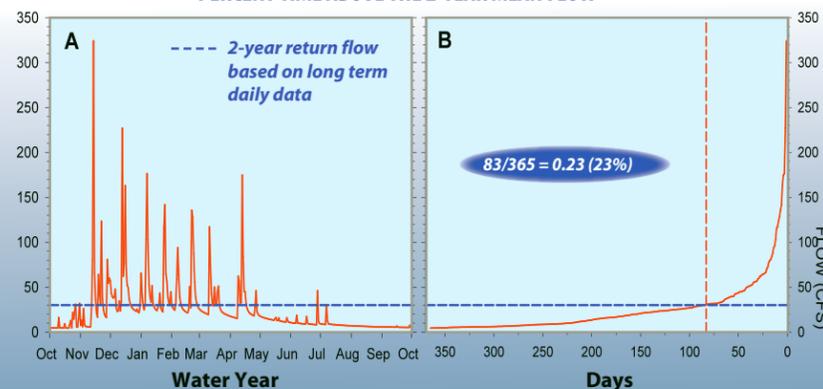
**2-Year Peak: Winter Base Flow Ratio**—Ratio of peak flow rate with a 2-year return frequency to the mean winter base flow rate

**Normalized effective Stream Power**—Percentage increase in stream power (rate of energy dissipation against the bed and banks of a stream) between forested condition and point in time of analysis

**Q<sub>2 current</sub>: Q<sub>10 forested</sub>**—Ratio of hourly flow rate with a 2-year return frequency at point in time of analysis to the hourly flow rate with a 10-year return frequency in a forested condition



### PERCENT TIME ABOVE THE 2-YEAR MEAN FLOW



### 2-YEAR PEAK: WINTER BASE FLOW RATIO

