ISC Hydrology sub-index

Index of Stream Condition (ISC3)

The ISC treats Hydrology in two different ways, depending if the reach had priority watering actions set for 2011-12. The 73 reaches that did have priority watering actions, were assessed against how many of their priority watering actions were fully achieved. Reaches that did not have priority watering actions, had their hydrology score calculated using the Flow Stress Ranking procedure (as was done in the 2004 ISC).

Flow Stress Ranking

Reaches that did not have priority watering actions were assessed using the Flow Stress Ranking procedure. The hydrology scores are calculated through a numerical modelling process. Water flow gauges across the State with at least 15 months of monthly flow data, were used. Scoring was based on the differences between current and un-impacted flows (i.e. no dams, diversions or off-takes). Therefore any two of the following data sets were required:

- a current stream flow series
- an un-impacted stream flow series and/or
- a time series of catchment water demands

It was not possible to update all of the stream flow and demand data from 2004 (70% were updated). Sites selected to be updated were those sites of most interest to water resource managers. A range of data inputs were updated and these included: flow series data, computer models and software, regional and urban flow demand patterns, private flow diverters and farm dam data.

For reaches that did not have priority watering actions, the hydrology sub-index has 5 indicators:

1. High flow
2. Low Flow
3. Zero Flow
4. Seasonality
5. Variability

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High Flow

The high flow indicator measures the highest and second highest monthly flows in a year.

Flood flows determine the maximum depths, velocities and shear stresses that occur in a river system. High flows drive geomorphic process in rivers through transporting and depositing sediment and altering channel form. High flows act as a natural disturbance in river systems, removing vegetation and organic matter and resetting successional processes. A reduction in the magnitude of flood flows is likely to correspond with a reduction in overbank flows, important in providing connectivity between rivers and their floodplains.

Low Flow

The low flow indicator measures the lowest and second lowest monthly flows in a year.

Low flow periods are a natural feature of Australian river systems but are generally regarded as a period of high flow stress for aquatic biota. Increasing the magnitude of low flows reduces the availability of in-stream habitat, which can lead to long term reduction in the viability of populations of flora and fauna.

Zero Flow

The zero flow indicator measures the proportion of time that the stream is dry (or nearly so).

Periods of zero flow are a natural feature of ephemeral rivers. However, increases in the duration of cease to flow periods are regarded as harmful to aquatic ecosystems. In many ways they can be regarded as extreme low flow periods when habitat availability is restricted and water quality is prone to deterioration. Extended cease to flow periods can result in partial or complete drying of the channel. This can lead to loss of connectivity between pools and even complete loss of aquatic habitat. Under natural conditions aquatic biota are able to recolonise dried sections of river channels once flows return.

Seasonality

The seasonality indicator is a measure of the shift in the maximum flow month and the minimum flow month between natural and current conditions. Floods stimulate biological activity in aquatic ecosystems, while low flows are a time of reduced biological activity.

The timing of periods of flooding and low flow has an important influence on how floodplain and riverine ecosystems respond. In temperate Australia, plants and animals are generally adapted to the natural occurrence of floods in Winter/ Spring and low flows in Summer/ Autumn. Changes to these flow patterns, such as occurred through regulation, are thought to have caused significant changes in some aquatic communities.

Variability

The variability indicator reflects the variability in monthly streamflows. Seasonal variation in flow is relatively predictable and acts as an important hydrological driver in aquatic ecosystems. Rises in water levels are known to provide important life-history cues for many plant and animal species.

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Calculating the Hydrology sub-index

Each of the 5 indicator values are scored between 0 (stressed) and 10 (natural condition). Each of the indices can be calculated for Summer, Winter and annually, except the seasonality indicator, which can only be calculated on an annual basis. Each index compares the current condition to its natural condition.

The Hydrology sub-index score is a score out of 10 and is calculated by adding the five Hydrology sub-index indicator scores according to the following formula:

Hydrology sub-index =10/6 (High flow score + Low flow score + Zero flow score + (Seasonality score*2) + Variability score)

The Hydrology sub-index is based on the uniform weighting of the individual indicators, except the seasonality indicator, which is given twice the weight of the other indicators. The additional weighting given to the seasonality indicator ensures that highly impacted regulated rivers that exhibit marked seasonal flow reversal, but which still experience high flows associated with irrigation releases, are appropriately ranked. The score is then 'standardised'. That is, a score of 7 indicates that 70% of reaches assessed are more stressed than the reach under consideration, and a score of 5 indicates a 'typical' or median (50%) level of hydrological stress.

Priority watering actions

For reaches that had priority watering actions set for 2011-12, the Hydrology sub-index was based on the percentage of priority watering actions that were fully achieved (see Table 1).

Table 1. Hydrology sub-index scores for reaches with priority watering actions set for 2011-12.

Number of priority watering actions met	Score
No priority actions met	4
< 20% of priority actions met	5
20 - 39% of priority actions met	6
40 - 59% of priority actions met	7
60 - 79% of priority actions met	8
> 80% of priority actions met	9
100% of priority actions met	10

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