

## Low water level regulation

Responsible partner: IGB

Actuality: November 2021

### Interpretation

The retention of water during periods of low flow is determined first by the cross-sectional shape and hydraulic roughness of the river bed, including roughness produced by aquatic vegetation, and second by the curvature degree of the course of the river. The indicator captures the key hydraulic factors that contribute to a mitigation of the water level drop associated with low flows via the average values of the hydro-morphological assessments for the river bed and the river banks. Water levels at low flow conditions are often artificially raised by weirs or dams that are impounding certain river stretches. Such impounded sections have to be assessed with a high score for low water level regulation. Impounded sections then have to be averaged with the remaining free flowing sections in the floodplain segment on a length-weighted basis.

If available data allow to derive evidence about natural impoundment effects e.g. in places where river enters a larger watercourse, a lake or the sea, such segments (or part of them) are to be assessed with a very high low-flow compensation.

In case it is known (from expert assessment) that a certain river stretch receives significant inflow from groundwater, this may be included into the assessment, too.

### ■ Original approach according to River Ecosystem Service Index (RESI) (Podschun et al., 2018)

Class	Abbr.	Description		Spatial reference	
Regulating	DRI	Low water level regulation by hydrological self-regulation due to hydraulic roughness produced by river bed hydro-morphology incl. aquatic macrophytes, thus mitigating the drop of water levels at low flow.		Floodplain segment or compartment <input type="checkbox"/> former floodplain <input type="checkbox"/> active floodplain <input checked="" type="checkbox"/> river	
Variable	Abbr.	Unit	Variable description	Data basis	Comment
Flow length of the relevant mapping section within the river-floodplain segment	$L_i$	m	Length	-hydro-morphological assessment (river structure quality mapping)	
Total length	$L_{tot}$	m	Length	- hydro-morphological assessment	
Ratings for riverbank (RB), riverbed (RB)	$RB_{ai}$ $RB_{ei}$	Ordinal 5 ... 1	Rating class (5 $\triangleq$ class 1 1 $\triangleq$ class 5)	- hydro-morphological assessment	
Possibility of extension of the used ES: backwater influence of transverse structures	$BI$		Site and influence of transverse structures/damms: Backwater sections are to be assigned to assessment class 1 ( $RB_{ai}$ , in that case $RB_{ei}$ will be skipped)	Information on backwater sections, e.g. from hydro-morphological assessment	Describes the used ecosystem service.

Calculation						
Indicator						
<div>Calculation of the length-weighted overall classification of the watercourse in the floodplain segment (where it is possible the calculation of the length-weighted mean classification from "bank" and "bed"):</div> <div><math display="block">LWRI = \sum_{i=1}^n \frac{L_i}{L_{tot}} \cdot (\frac{RBa_i + RBe_i}{2})</math></div>						
<div>Scaling</div> <div><input checked="" type="checkbox"/> national <input type="checkbox"/> local</div>	<div><i>DRI</i></div>	<div>≤ 1.5</div>	<div>&gt; 1.5 ... ≤ 2.5</div>	<div>&gt; 2.5 ... ≤ 3.5</div>	<div>&gt; 3.5 ... ≤ 4.5</div>	<div>&gt; 4.5</div>
<div>Evaluation Class</div>		<div>5</div>	<div>4</div>	<div>3</div>	<div>2</div>	<div>1</div>
<div>Qualitative Evaluation</div>		<div>Very high</div> <div>Low-water compensation and/or very high groundwater inflow</div>	<div>High</div> <div>Low-water compensation and/or very high groundwater inflow</div>	<div>Moderate high</div> <div>Low-water compensation and/or very high groundwater inflow</div>	<div>Low</div> <div>Low-water compensation</div>	<div>No or very low</div> <div>Low-water compensation</div>

■ Adaption for Danube-wide application

Class		Abbr.	Description		Spatial reference	
Regulating		DRI	Low water level regulation by hydrological self-regulation due to macrophyte growth and morphology (reduction of water level dropdown), if applicable also compensation by strong groundwater inflow (expert assessment)		Floodplain segment or compartment <input type="checkbox"/> former floodplain <input type="checkbox"/> active floodplain <input checked="" type="checkbox"/> river	
Variable		Abbr.	Unit	Variable description	Data basis	Com-ment
Flow length of the relevant mapping section within the river-floodplain segment		$L_i$	m	Length	-hydro-morphological assessment (river structure quality mapping)	
Total length		$L_{tot}$	m	Length	-hydro-morphological assessment	
Hydro-morphological status ratings for riverbank, floodplain, riverbed		$HyMo$	Ordinal 5 ... 1	rating class of hydro-morphological integrity and hydraulic roughness	-hydro-morphological assessment	
Calculation						
Indicator						
Calculation of the length-weighted overall classification of the watercourse in the floodplain segment (where it is possible the calculation of the length-weighted mean classification from "bank" and "bed"):						
$LWRI = \sum_{i=1}^n \frac{L_i}{L_{tot}} * (HyMo_i)$						
Scaling						
<input checked="" type="checkbox"/> national <input type="checkbox"/> local	<i>DRI</i>	≤ 1.5	> 1.5 ... ≤ 2.5	> 2.5 ... ≤ 3.5	> 3.5 ... ≤ 4.5	> 4.5
Evaluation Class		5	4	3	2	1
Qualitative Evaluation		Very high Low-water compensation and/or very high groundwater inflow	High Low-water compensation and/or very high ground-water inflow	Moderate high Low-water compensation and/or very high ground-water inflow	Low Low-water compensation	No or very low Low-water compensation

■ Data sources

Data set	Data type	Spatial reference	Spatial resolution	Source	Creation date	Comments
<b>Li, HyMo, L<sub>tot</sub></b>  Hydro-morphological assessment (River structure quality mapping - RSQM)	Line	Danube catchment		<a href="https://www.danubegis.org/">https://www.danubegis.org/</a>	2015	In case of availability of data on floodplain condition, these can be directly applied for a more accurate or alternative determination of the indicator, for example, the assessments of the land, bank and bed of the river.