

## Interpretation

Sediment includes the bedload transported at the riverbed and the suspended load transported in suspension. The local hydrodynamic conditions (flow velocity, bed shear stress) determine which grain sizes are transported or deposited. Suspended solids are kept in suspension by the turbulence of flow. In an undisturbed watercourse that has developed over a long period of time, a morphological equilibrium between erosion and sedimentation is (nearly) established. The indicator uses the hydro-morphological (structural quality) assessment of the river bed, as well as the impacts of transverse structures on the sediment continuity/morphological effect as a measure for the integrity of the sediment balance.

If measured data or calibrated sediment transport models are available, these more accurate data can/should be referenced; in this case, the scale should be appropriately applied or modified.

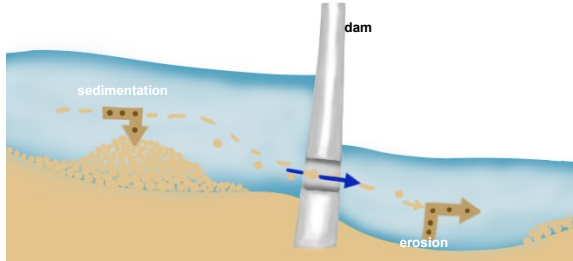
## References

DWA-M 525. Sedimentmanagement in Fließgewässern – Grundlagen, Methoden, Fallbeispiele. Merkblatt. – Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e. V. – DWA [Hrsg.], 2012

DWA-M 526. Grundlagen morphodynamischer Phänomene in Fließgewässern. Merkblatt. – Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e. V. – DWA [Hrsg.], 2015

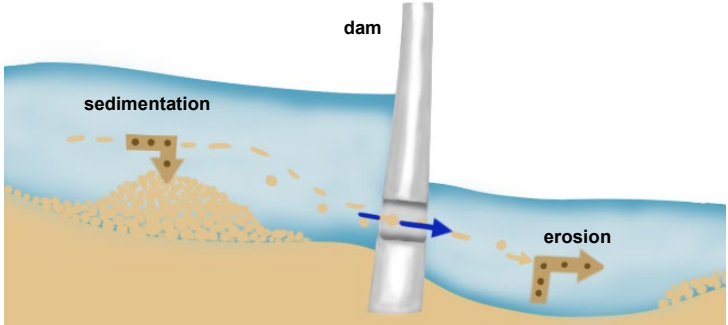
LAWA (2017). Bewertung der Durchgängigkeit von Fließgewässern für Sedimente, im Rahmen des Projektes "Bewertung der Durchgängigkeit von Fließgewässern für Fische und Sedimente", Projekt-Nr. O 5.14, Anwenderhandbuch Sedimente Entwurf Februar 2017

Class	Abbr.	Description		Spatial reference
Regulating	DRI	Evaluation of the internal sediment balance of the river by the naturalness of morphological structures and effects of transverse structures on sediment consistency / morphological effects		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
Flow length of each relevant mapping section within the river-floodplain segment	$L_i$	m	Length of the relevant river section along the traverse structure where the sediment transport is affected	Hydro-morphological assessment (river structure quality mapping)
Total flow length	$L_{tot}$	m	Length	Hydro-morphological assessment (river structure quality mapping)
Evaluation of the category riverbed	$RBe$	Ordinal 5 ... 1	Rating class (5 $\triangleq$ class 1 1 $\triangleq$ class 5)	Hydro-morphological assessment (river structure quality mapping)

Calculation							
RBI: Calculation of the length-weighted mean bed assessment class of the watercourse			TSI: Rapid Assessment of the hydraulic and morphological impacts of transverse structures in rivers according to LAWA (2017; modified)				
$RBI = \sum_{i=1}^n \frac{L_i}{L_{tot}} * RBe_i$			Construction type		TSI		
			No transverse structure		1		
			Low weir		1		
			Bed sill		2		
			Retaining weir and retaining sill		4		
			Movable weir and barrage		4		
			Pumping station and sluices		4		
			Weir		2		
			Culvert, pipework, hollowing out		3		
			Bottom ramp, bottom slope		2		
			Cascade		2		
			Dam		5		
Indicator			Influence of cross construction type on sediment regulation.				
Determination of the worse assessment between the RBI and TSI indicators (Worst-Case-Method):  $SRI = MAX(RBI, TSI)$							
Scaling		SRI	1	2	3	4	5
<input checked="" type="checkbox"/> national <input type="checkbox"/> local							
Evaluation Class		5	4	3	2	1	
Qualitative Evaluation		Undisturbed sediment balance	Slightly disturbed sediment balance	Considerably disturbed sediment balance	Heavily disturbed sediment balance	Very heavily disturbed sediment balance	

■ Adaption for Danube-wide application

Class	Abbr.	Description		Spatial reference		
Regulating	DRI	Evaluation of the internal sediment balance of the river by the naturalness of morphological structures and effects of transverse structures on sediment consistency / morphological effects		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	
Flow length of each relevant mapping section within the river-floodplain segment	$L_i$	m	Length of the relevant river section along the traverse structure where the sediment transport is affected		Hydro-morphological assessment (river structure quality mapping)	
Total flow length	$L_{tot}$	m	Length		Hydro-morphological assessment (river structure quality mapping)	
Evaluation of the category riverbed	$RBe$	Ordinal 5 ... 1	Rating class (5 $\triangleq$ class 1 1 $\triangleq$ class 5)		Hydro-morphological assessment (river structure quality mapping)	
Calculation						
<b><i>RBI</i>: Calculation of the length-weighted mean bed assessment class of the watercourse</b>		<b><i>TSI</i>: Rapid Assessment of the hydraulic and morphological impacts of transverse structures in rivers</b>				
$RBI = \sum_{i=1}^n \frac{L_i}{L_{tot}} * RBe_i$			Flow		Connectivity	
	Structure	Value [-]	Effect [m]	Direction [upstream (U), downstream (D)]	Effect [m]	Direction [upstream (U), downstream (D)]
	No transverse structures/ barriers	1	0	-	0	-
	Groundsills	1	250	U	100	U: 50 m D: 50 m
	Grade sill/submerged dyke	3	300	U	100	U: 50 m D: 50 m
	Barrage	5	variable	U D: 250 m	variable	U + D
	Bucket elevator/lock	3	100	U + D	5000	U: 50 m D: 50 m
	Sluice gate	3	250	U + D	500	U: 50 m D: 50 m
	Tubing casing	3	100	U: 50 m D: 50 m m	0	-
	Chute	3	75	D	5000	U: 2500 m D: 2500 m
	Large dam	5	variable	D U: 250 m	variable	U + D
	Bridge	3	400	-	200	-

Indicator		Influence of cross construction type on sediment regulation.				
Determination of the worse assessment between the RBI and TSI indicators (Worst-Case-Method):  $SRI = MAX(RBI, TSI)$						
Scaling						
<input checked="" type="checkbox"/> national <input type="checkbox"/> local	SRI	1	2	3	4	5
Evaluation Class		5	4	3	2	1
Qualitative Evaluation		Undisturbed sediment balance	Slightly disturbed sediment balance	Considerably disturbed sediment balance	Heavily disturbed sediment balance	Very heavily disturbed sediment balance

## ■ Data sources

Data set	Data type	Spatial reference	Spatial resolution	Source	Creation date	Comments
$L_i$	Line shape file	international/river		river-floodplain segments (1-10 km)	2021	calculated from the segment polygon
$L_{tot}$	Line shape file	international/river		river-floodplain segments (1-10 km)	2021	based on the location of the traverse structures
<b>RBe</b>  Evaluation of the category riverbed	by the method of evaluation of the Water Framework Directive	international/river		<a href="https://www.vizugy.hu/vizstrategia/documents/988BF7DB-B869-46C6-9463-E9E4BFC81D2A/6_4_hatteranyag_hidromorfologiai_allapotertekeles.pdf">https://www.vizugy.hu/vizstrategia/documents/988BF7DB-B869-46C6-9463-E9E4BFC81D2A/6_4_hatteranyag_hidromorfologiai_allapotertekeles.pdf</a>	2021	Locations of the traverse structures are based on the data provided by the PP's, and KÖTIVIZIG also collected them (dams, barrages, bridges, etc) from Google Maps and orthophotos