

1 - METHOD BACKGROUND			
NAME OR CODE		HAP-SR - Hydromorphological Assessment Protocol for the Slovak Republic Slovakia NERI & SHMI (2004); Lehotský & Grešková (2007)	
COUNTRY			
KEY REFERENCE			
WEBPAGE			
CATEGORY		The protocol aims to monitor and assess the hydromorphological quality elements of rivers for the definition of the ecological status. It derives from a draft Slovak protocol developed by Adamkova et al. (2004) and based on the German ESLR (Bundesanstalt für Gewässerkunde, 2001)	
2 - METHOD CHARACTERISTICS			
A - SOURCE OF INFORMATION / DATA COLLECTION	Maps/Remote sensing	Maps (topographic, historical, geological, vegetation), aerial photographs, GIS layers (e.g. land use) are collected during the first step of data collection. Maps are also used to help in defining reaches and reference conditions. Maps are used to assess map-based parameters (historical changes and large scale characteristics)	
	Field survey	It is carried out in the Survey Unit (SU) defined on maps. Map survey parameters must be checked in the field. Three survey forms are used for each SU: one "site protocol" and two "assessment forms" (one for morphology, one for hydrology)	
	Rapid field assessment	NOT AVAILABLE	
	Existing database	It uses hydrological time series, data on reservoir management, water abstraction	
B - SPATIAL SCALE	Modelling	NOT APPLICABLE	
	HIERARCHICAL SPATIAL SCALE	River catchment/Water body/ Reach/Cross Section	
	LONGITUDINAL SPATIAL SCALE	Fixed length	
	L SPATIAL SCALE	Scaled to channel width	SU and SSU are scaled to river size; the SU is representative of the river (with respect to channel morphology, land use, geology and geomorphology)
		Variable length	NOT APPLICABLE
	LATERAL SPATIAL SCALE	Channel	All the stream channel is assessed
C - TEMPORAL SCALE	Banks/Riparian zones	Riparian vegetation is assessed in a 20-meter wide zone along both sides of the river	
	Floodplain	The floodplain parameters are based on the whole floodplain	
	Physical and morphological assessment	The method assesses the present state, as well as historical changes (e.g. channel pattern, river regime)	
	Hydrological assessment	The method assesses changes in mean and low flow, flow range and flow fluctuation	
D - TYPE OF METHOD	Characterization/classification	The method collects a certain number of parameters useful to characterize the overall landscape features at the sites and in the catchment. The "site protocol" is divided into 5 parts: identification, channel parameters, riparian and floodplain features, catchment features and hydrological parameters (36 in total)	
	Assessment by index	Two main groups of parameters are assessed: morphological (divided into 4 categories) and hydrological (4 parameters) parameters: a score from 1 (best) to 5 (worst) is assigned to each parameter. For the morphology: each parameter is averaged between SUU to obtain a SU score (for the parameter). SU parameters values for each category are averaged to have a SU category score; the average between categories, gives the morphological value for the SU. For the hydrology: the final score is the average of the 4 parameters scores. 2 final indices (quality classes), 1 for morphology, one for hydrology	
	Deviation from reference	The method compares the quality status to the corresponding reference condition, by using the assessment parameters (not for "site protocol" parameters)	
	General assessment / Design framework	NOT APPLICABLE	
	Modelling status / Scenario	NOT APPLICABLE	
	Final expert judgment	Expert judgement helps during the map-based assessment where map data are unavailable (transfer of data or knowledge from similar sites), or to assess particular features such as changes of hydrological regime, presence of migration barriers	
	Links with other systems	NOT APPLICABLE	
E - REFERENCE CONDITIONS	It is the original state of the river before it was affected by human influences (empirical/historical state). It corresponds to the maximum obtainable range of values within the high ecological status band, according to stream type		
F - GENERAL INFORMATION	RIVER TYPOLOGY	Typology and reach definition are not included in the protocol (given that they are part of the implementation of the WFD)	
	TYPOLOGY LIMITATIONS	No typology limitation, at least in Slovakia	
	TYPE-SPECIFIC (Protocol / Assessment method)	It covers all stream types in Slovakia	
	BASIS FOR STANDARDS / THRESHOLDS	Parameters are scored from 1 (reference) to 5 (worst). Sub-indices and 2 main indices are obtained as mean values. It is proposed an "a posteriori" graduation of reference scores and thresholds calibration. Division in quality bands should also be verified using field trials and making a sensitivity analysis (the deviation between results of the assessment protocol and results of expert assessment)	
	REACH SCALE SURVEY STRATEGY	The survey unit (reach) is subdivided into 5 sub-units of equal length and they are surveyed by walking along the river or wading it (e.g. by boat for larger rivers)	
	TIMING AND FREQUENCY	Surveys should be carried out during low flow and in the vegetation period	
	DATA PRESENTATION (OUTPUT/LAYOUT)	Compiled field protocols, photos about features, indices (sub-indices for parameters at SU, for categories at SU and for main groups at SU), quality classes	
	METHOD SUPPORT / APPLICATION TOOLS	Guidance on sample site selection, a map based protocol, field procedures (site protocol and 2 assessment forms), scoring system, a guidance on training, accreditation and intercalibration procedures	
	SPATIAL COMPARISON	Most parameters collected during the site protocol can be used to group streams with identical features, enabling comparison of hydromorphological and biological parameters among similar streams	
	CONNECTION TO ECOLOGY	Specific biological indicators need to be identified and linked to results of the hymo protocol. The method assesses and characterizes the effect of the presence of migration barriers (and fish pass where present)	
	USERS	Training, accreditation and inter-calibration are needed to avoid subjectivity	
	SCALE INFORMATION	The method provides information at catchment scale, water body scale and reach scale	
	NUMBER OF END PARAMETERS	For the Site protocol: 5 categories and 36 parameters described in total. For the Assessment form: 2 main groups, 4 categories (for the 1st group) and 18 parameters in tot (14 for the 1st + 4 for the 2nd main group)	

3. RECORDED FEATURES			
A - CATCHMENT / VALLEY	LARGE SCALE CHARACTERISTICS		Assessed during the map based assessment (e.g. floodplain structure, catchment land use, stream order, site altitude, distance to source, mean slope, river use, geology, soil type, minimum and maximum elevation)
	HYDROLOGICAL REGIME	Hydrological conditions	Mean annual discharge, Changes to the hydrological regime (due to groundwater and/or surface water abstraction)
		Metrics of hydrological regime	Mean flow (scored), low flow (scored), water level range (scored), frequent flow fluctuations (scored)
	VALLEY FORM / FEATURES		NOT APPLICABLE
B - CHANNEL			River valley form/type (map based assessment)
	CHANNEL PATTERN / PLANFORM		Present/dominant channel planform, sinuosity (scored), channel type (scored), channel shortening (scored), spatial variation in width (scored)
	CHANNEL FORMS		Bed elements (SSU, scored)
	BED CONFIGURATION		Bed elements (SSU, scored)
	CHANNEL DIMENSIONS		Cross section dimension (channel width, bankfull width depth width, width/depth variation)
	FLOW-TYPE		Flow type diversity (SSU, scored)
	PHYSICAL / HYDRAULIC VARIABLES		NOT APPLICABLE
	SUBSTRATE		The score concerns: Number of river bed substrate, mud covers and presence of artificial substrate (SSU)
C - RIVER BANKS/ RIPARIAN ZONE	IN-CHANNEL VEGETATION		Macrophytes coverage
	WOODY DEBRIS		Presence/abundance of large woody debris (scored)
	ARTIFICIAL FEATURES AND STRUCTURES		Presence of migration barriers, presence of artificial bed features (SSU, scored)
	BANK PROFILE / SHAPE		Cross-section type, Naturalness of bank profile (SSU, scored)
	BANK MATERIAL		NOT APPLICABLE
	RIPARIAN VEGETATION STRUCTURE		Naturalness of riparian vegetation (SSU, scored); Tall herbs/shrubs (coverage)
	LONGITUDINAL CONTINUITY OF RIPARIAN VEGETATION		Natural/non-natural isolated tree (coverage), Natural/non-natural closed line (coverage)
	RIPARIAN VEGETATION WIDTH		NOT APPLICABLE
	VEGETATION COMPOSITION, COVERAGE AND OTHER RIPARIAN VEGETATION CHARACTERISTICS		Non-natural vegetation in 20 m riparian zone (assessment and coverage)
	ARTIFICIAL FEATURES AND STRUCTURES		Extent of bank stabilization (scored)
D - FLOODPLAIN	LAND USE		Non-natural vegetation in 20 m riparian zone (assessment and coverage)
	FLUVIAL FORMS		Non-natural vegetation in 20 m riparian zone (assessment and coverage)
	INFO ON FLOODPLAIN FEATURES		Flooded area compared to historical (SSU, scored); Extent of natural floodplain vegetation (SSU, scored)
	LAND USE		Predominant land use on floodplain (assessed)
4. RIVER PROCESSES			
A - LONGITUDINAL CONTINUITY	Sediment and wood		Characterization of barrier for migration
	Water flow		The method assesses changes in water discharge (due to dam, hydropower operations, water abstraction, industrial outlets)
B - LATERAL CONTINUITY	Lateral hydraulic continuity		Evaluated through the assessment of cross profile changes, presence of embankments, and modification in flow regime
	Sediment (and wood) lateral continuity		Size (percentage) of present natural floodplain area is compared to potential (historical)
C - BANK EROSION / STABILITY		Bank stabilisation, compared to reference past state, is assessed at the SSU level	
E - CHANNEL ADJUSTMENTS	Planimetric (pattern & width)		The method assesses channel shortening, changes in channel pattern and planform
	Vertical		NOT APPLICABLE
F - VERTICAL CONTINUITY		Groundwater connection	Changes in water discharge due to groundwater water abstraction is described
5. APPLICATION TO WFD			
OFFICIAL METHOD (WFD implementation) / COMMONLY USED METHOD (not compulsory)			The protocol development was part of a project (TWINNING) aiming to the harmonization of water legislation of the Slovak Republic with the regulations of the European Union (WFD), and to support the definition of the ecological status of rivers. The 2004 version was a proposal of protocol
APPLICATION TO ALL WATER BODIES			The method applies to all water bodies (natural, heavily modified and artificial water bodies)
USED IN THE CLASSIFICATION OF HIGH-STATUS / OTHER STATUS CLASSES			It can be used for assessing hydromorphological quality in natural, heavily modified and artificial water bodies
USED TO PREDICT RISK OF DETERIORATION			The assessment relates to past conditions therefore it could be used to predict the risk of deterioration
USED TO IDENTIFY IMPROVEMENT TARGETS			Potentially it could be used for this purpose
USED TO HELP IDENTIFY CAUSE OF ECOLOGICAL IMPACTS			If opportunely related to biological indicators, it could be used for this purpose; the characterization of migration barrier can help to identify cause of ecological impact for fish communities
KEY STRENGTHS FOR RIVER MANAGEMENT			It has been developed to comply with WFD requirement. It uses either field and remote sensing data, and includes a relatively detailed analysis of hydrological data. The part concerning the site characterization provides information potentially useful for other scopes