1 - METHOD BACKGROUND			
NAME OR CODE			**MQI - Morphological Quality Index**
COUNTRY			Italy
KEY REFERENCE			Rinaldi et al. (2013)
WEBPAGE			
CATEGORY			The method aims to assess the morphological quality of rivers based on river geomorphic forms and processes
2 - METHOD CHARACTERISTICS			
A - SOURCE OF INFORMATION / DATA COLLECTION		Maps/Remote sensing	Maps (e.g. topographic, geological, geomorphological), and remote sensing data (e.g. aerial images, DEM) are used in the first part of segmentation of the river network, in the historical analysis (Channel Changes), as well as most of the features in the evaluation form
		Field survey	Field survey is accomplished at one or more representative sub-reaches ('sites')
		Rapid field assessment	NOT APPLICABLE
		Existing database	Inventory of artificial intervention (if existing), information on river management/practices (e.g. sediment / wood removal) from public agencies
		Modelling	NOT APPLICABLE
B - SPATIAL SCALE	HIERACHICAL SPATIAL SCALE	River catchment/Water body/ Reach/Cross Section	The method adopts a hierarchical nested approach where the reach represents the basic spatial unit of assessment
	LONGITUDINAL SPATIAL SCALE	Fixed length	NOT APPLICABLE
		Scaled to channel width	NOT APPLICABLE
		Variable length	The method uses the concept of homogenous reaches, where present morphological conditions are sufficiently uniform; their identification is carried out during the initial phase of river segmentation
	LATERAL SPATIAL SCALE	Channel	All the channel bed is assessed
		Banks/Riparian zones	Bank and riparian zones are included in the assessment
		Floodplain	Floodplain (and terraces) is included in the assessment
C - TEMPORAL SCALE		Physical and morphological assessment	Present conditions are assessed; historical analysis of channel adjustments (last 50 – 100 years) is performed
		Hydrological assessment	Alteration of channel-forming discharges and/or flows with higher return period are evaluated
D - TYPE OF METHOD		Characterization/classification	The method makes an initial classification/segmentation of river reaches relevant for the assessment procedure (4 steps: Physiographic units, Confinement, River Morphology, Longitudinal discontinuities)
		Assessment by index	The IAM (Morphology Alteration Index) and the MQI (Morphology Quality Index) are calculated as result of the evaluation form; IAM = Stot/Smax (score tot/maximum score of alteration); MQI = 1-IAM (from 0 to 1)
		Deviation from reference	The method measures the deviation from undisturbed or only very slightly disturbed geomorphic conditions
		General assessment / Design framework	NOT APPLICABLE
		Modelling status / Scenario	NOT APPLICABLE
		Final expert judgment	The expert judgment of the authors was used several times in the method protocol and definition (selection of variables, indicators, classes, and scores)
		Links with other systems	The method is part of the methodology IDRAIM (system for stream hydromorphological assessment, analysis, and monitoring) which aims to an integrated analysis of morphological quality and channel dynamics hazard
E - REFERENCE CONDITIONS			Theoretical reference conditions are defined (by expert judgement of authors) as: (a) full functionality of geomorphic processes; (b) absence or negligible presence of artificial elements along the reach and to some extent in the catchment; (c) absence of significant adjustments due to channel instability (configuration, width, bed elevation) over a temporal frame of about 100 years
F - GENERAL INFORMATION	RIVER TYPOLOGY		River reaches are defined on the basis of a hierarchical classification process which considers mainly physical characters: physiographic units, confinement, river morphology, and other river discontinuities
	TYPOLOGY LIMITATIONS		The method potentially applies to all stream types (but verification over EU and non-EU country is recommended)
	TYPE-SPECIFIC (Protocol / Assessment method)		The method provides two different evaluation protocols for confined and partly confined/unconfined channels
	BASIS FOR STANDARDS / THRESHOLDS		Thresholds, as well as reference conditions, are defined by expert judgment of the authors. For each indicators, in most cases, 3 classes are used: class A = reference conditions (value = 0 = no alteration), class B = intermediate conditions (variable scores); class C = completely altered conditions (variable scores depending on the importance assigned to each indicators, generally 5 or 6). A degree of confidence and a second choice can be also assigned to each indicator (and used to define a range of final MQI value). MQI classes: high, MQI>0.85; good, MQI=0.7÷0.85; moderate, MQI= 0.5÷0.7; poor, MQI=0.3÷0.5; bad, MQI=0÷0.3
	REACH SCALE SURVEY STRATEGY		The reach represents the basic spatial unit, maps and remote sensing are used for the reach scale assessment; field survey is carried out along a representative sub-reach
	TIMING AND FREQUENCY		Authors indicate that the duration of the survey depends upon the background of the surveyor. Frequency: not indicated, but for WFD monitoring every 3-6 years
	DATA PRESENTATION (OUTPUT/LAYOUT)		Field forms; classification in quality classes (several outputs); 2 main indices (quality and alteration) and several sub-indices (vertical, horizontal sub-indices)
	METHOD SUPPORT / APPLICATION TOOLS		A guidebook is provided (with field forms and guidance for compilation)
	SPATIAL COMPARISON		The method could be used to make comparison at least among Italian rivers. It could potentially be used in other EU and non-EU countries but verifications/calibrations are needed to check whether the method covers the full range of physical conditions and morphological types
	CONNECTION TO ECOLOGY		NOT APPLICABLE (but indirectly some information is provided through the assessment of large wood, substrate alterations, etc.)
	USERS		Environmental or water agencies, managers, scientists, with training and adequate background (fluvial geomorphology)
	SCALE INFORMATION		The method uses a hierarchical nested approach; it gives information at large (river type classification) and reach (status classification) scales
	NUMBER OF END PARAMETERS		The method assesses 28 indicators divided into 3 main components: F, functionality (13 indicators); A, artificiality (12 indicators); V, channel changes (3 indicators)

3. RECORDED FEATURES			
A - CATCHMENT / VALLEY	LARGE SCALE CHARACTERISTICS		Large scale characteristics are investigated at Steps 1 and 2 of the initial segmentation phase: geology, geomorphology, climate and land use
	HYDROLOGICAL REGIME	Hydrological conditions	The method takes into account only hydrological aspects which have influence on morphological processes => alterations of channel-forming discharges
		Metrics of hydrological regime	NOT APPLICABLE
		Hydro-peaking	NOT APPLICABLE
	VALLEY FORM / FEATURES		Valley slope is considered; valley form partially assessed in term of confinement
B - CHANNEL	CHANNEL PATTERN / PLANFORM		Channel pattern and planform characters are used in the Step 3 of the initial segmentation (definition of river morphology)
	CHANNEL FORMS		Following the reach pattern type, the presence of expected forms is assessed
	BED CONFIGURATION		Bed configuration is assessed for a further classification of river morphology in steep, confined rivers (but it does not affect river segmentation). Bed configuration is also used in one indicator for confined streams
	CHANNEL DIMENSIONS		Channel width is required and is take into account in the assessment of some indicators
	FLOW-TYPE		NOT APPLICABLE
	PHYSICAL / HYDRAULIC VARIABLES		NOT APPLICABLE
	SUBSTRATE		The alteration of channel bed is assessed (e.g. armouring, clogging, bedrock outcropping bed revetments)
	IN-CHANNEL VEGETATION		NOT APPLICABLE
	WOODY DEBRIS		The presence of in-channel large woods is assessed as well as wood removal practices
	ARTIFICIAL FEATURES AND STRUCTURES		Many types of artificial features and structures are considered in the assessment of artificiality, including alteration of discharge (spillway, diversions, retention catchments), as well as alteration of sediment transport (check dams, weirs, diversion structures, etc.). The presence and frequency of crossing structures which interfere with the fluvial corridor is also assessed (bridges, fords, culverts)
C - RIVER BANKS/ RIPARIAN ZONE	BANK PROFILE / SHAPE		Bank profile/shape is assessed in terms of expected variability of the cross section for the river reach type
	BANK MATERIAL		NOT APPLICABLE
	RIPARIAN VEGETATION STRUCTURE		The riparian vegetation structure is assessed within the evaluation of the width of functional vegetation
	LONGITUDINAL CONTINUITY OF RIPARIAN VEGETATION		The linear extension of functional vegetation along the banks is assessed
	RIPARIAN VEGETATION WIDTH		The width of functional vegetation is assessed in relation to its natural expected presence
	VEGETATION COMPOSITION, COVERAGE AND OTHER RIPARIAN VEGETATION CHARACTERISTICS		NOT APPLICABLE
	ARTIFICIAL FEATURES AND STRUCTURES		Presence, position and longitudinal continuity of banks protections and artificial levees is assessed
	LAND USE		Land use on the banks and riparian zone is indirectly assessed by the indicators of riparian vegetation (e.g. presence and width of functional riparian vegetation, management of riparian vegetation)
D - FLOODPLAIN	FLUVIAL FORMS		In lowland, low energy river reaches, the presence of expected landforms in the floodplain (oxbow lakes, secondary channels, etc.) is assessed
	INFO ON FLOODPLAIN FEATURES		The presence and extension of a 'modern' floodplain is assessed; the width of the whole floodplain (modern floodplain and recent terraces) is considered in the degree of confinement and in the evaluation of the potentially erodible corridor
	LAND USE		Floodplain land use is indirectly assessed by the indicators of riparian vegetation
4. RIVER PROCESSES			
A - LONGITUDINAL CONTINUITY		Sediment and wood	Longitudinal continuity in sediment and wood flux are indirectly assessed based on the presence of transversal structures, as well as the upstream alteration of sediment discharges
		Water flow	The longitudinal continuity alteration of channel-forming discharge is assessed both at reach and larger scales
B - LATERAL CONTINUITY		Lateral hydraulic continuity	The lateral hydraulic continuity is assessed through the presence of a 'modern' floodplain
		Sediment (and wood) lateral continuity	The lateral continuity of sediment ad fluxes is assessed through the presence of a 'modern' floodplain, the potentially erodible corridor and, for confined channels, through the connectivity between the river corridor and its hillslopes
C - BANK EROSION / STABILITY			Processes of bank retreat are assessed as important for sediment supply and recovery
E - CHANNEL ADJUSTMENTS		Planimetric (pattern & width)	Historical changes in channel pattern are evaluated, as well as historical changes in channel width. Artificial changes of channel courses are also evaluated (meander cut-off, channel diversions, etc.)
		Vertical	Data from topographic surveys (cross-section and longitudinal profiles, past and present) are used to assess vertical adjustments, given their importance in several river processes (floodplain connectivity, in-channel habitats, etc.)
F - VERTICAL CONTINUITY		Groundwater connection	The presence of bed-revetments, which alter the vertical continuity, is assessed
5. APPLICATION TO WFD			
OFFICIAL METHOD (WFD implementation) / COMMONLY USED METHOD (not compulsory)			The method has been designed to comply with WFD requirements; it has been formally approved for application (at least) to all water bodies in high state. It could be used for other purposes in river management
APPLICATION TO ALL WATER BODIES			It is also applied for the designation of HMWBs (in progress)
USED IN THE CLASSIFICATION OF HIGH-STATUS / OTHER STATUS CLASSES			It could be used in the classification of any status
USED TO PREDICT RISK OF DETERIORATION			It can be used to predict risk of deterioration since it assesses past and present human impacts and separates artificiality from functionality and instability
USED TO IDENTIFY IMPROVEMENT TARGETS			It can be used to identify improvement targets, starting from the assessment of the quality and the alteration states and because it separates artificiality from functionality
USED TO HELP IDENTIFY CAUSE OF ECOLOGICAL IMPACTS			If properly linked to ecological data it can be used to identify ecological impacts, given that it makes a detailed analysis of impact (artificiality)
KEY STRENGTHS FOR RIVER MANAGEMENT			The method has been developed to be used by environmental or water agencies on a national level; it evaluates processes and takes into account the temporal context/changes; the protocol aims to an assessment of morphological conditions rather than a features inventorying. It defines different protocols for lowland unconfined and confined rivers