Final factsheets on Environmental Effectiveness of Selected Hydro-morphological Measures

Contract No. 070311/2011/603663/ETU/D1 'Comparative Study of Pressures and Measures in the Major River Basin Management Plans' (Task 3b)

Eleftheria Kampa, Ulf Stein

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Ecologic Institute, Berlin
www.ecologic.eu

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1 Introduction

The Water Framework Directive (WFD) required Member States to report their first River Basin Management Plans (RBMPs) by March 2010. To date, 22 Member States have reported their RBMPs through the Water Information System for Europe (WISE). The European Commission is currently assessing the compliance of RBMPs against the provisions of the WFD and carrying out a “bottom up” assessment of the plans.

In the same time, a „Comparative Study of Pressures and Measures in the Major River Basin Management Plans in the EU“ is ongoing (DG ENV study carried out by a consortium led by WRc). This entails a “top down” assessment of the RBMPs on certain topics that merit a deeper analysis. In this comparative study, the analysis builds on the information available within RBMPs and complemented by other sources in order to broaden the scope of the analysis. The following topics are examined: governance and legal aspects, development and analysis of appropriate methodologies, integration of water policy into related sectors and the WFD programme of measures, economic aspects, innovation and technology.

One of the tasks of the “Comparative Study of Pressures and Measures in the Major River Basin Management Plans in the EU“ is dedicated to the compilation of existing information on hydromorphological measures and their effectiveness. One of the aims of the task is to produce **an overview of the environmental effectiveness of the most common hydromorphological measures used in RBMPs**.

Ultimately, this overview work on selected measures has been combined with additional information on further hydromorphological measures to produce a database of measures applied to deal with specific pressures in the RBMPs. The pressures covered by the database relate to hydromorphological alterations but also other pressures including agriculture, drinking water protection, water abstraction and mining.

2 Scope of this overview of measure effectiveness

The hydromorphological measures selected for the present overview of environmental effectiveness are those which are most commonly applied in the 1st RBMPs and/or are more relevant for achieving good ecological status/potential across the EU. The underlying objective has been to focus on those hydromorphological measures, which have been identified as key tools to reach the environmental objectives of the WFD on an EU level.

The overview of environmental effectiveness has been produced on the basis of factsheets, which are attached to this note. The work approach used is explained in some more detail in the following sections.

The factsheets focus on providing information on the effects and the applicability of measures, with the overall aim to promote existing knowledge on the effectiveness of successful hydromorphological measures in the EU.

The information included in the factsheets is meant to be an overview of key information and experience gained through practice and empirical work, in order to help expert decisions in measure selection. The factsheets may support decision-making on a more general (higher)

level of management in catchments and RBDs. They can be used as a source of information and ideas on measure effectiveness, when setting strategic priorities for the whole catchment. They are less suitable as a tool when searching for single-site solutions.

The factsheets are not a scientific literature review and not all relevant scientific literature could be included in the pool of references. When doing detailed planning of measures, experts with specific scientific knowledge should be involved.

Please note that the factsheets attached to this report have been used to supply background information to the database of measures developed in the context of the "Comparative Study of Pressures and Measures in the Major River Basin Management Plans in the EU". In the process of developing the database, the information from certain factsheets has been updated or restructured to reflect the final structure of the database.

3 Measures selected for the overview

The following hydromorphological measures are treated individually in factsheets:

- Fish passes for upstream migration
- Removal of barriers
- Instream structures (large wood, boulders)
- Restoration of bank structure
- Sediment transport management
- Establishing ecological flow
- Remeandering of formerly straightened water courses
- Reconnecting of backwaters

The selection of measures has taken place on the basis of the analysis of frequency with which measures have been reported in ca. 80 RBMPs (screened in the context of the RBMP assessment of the EC by February 2012). The measures above featured amongst the measures most commonly reported in the RBMPs. In addition, measures have been included which are considered as most relevant for achieving good ecological status/potential across the EU.

4 Approach used

Factsheet template

The overview of effectiveness of the measures selected is presented in individual factsheets. The factsheet template includes space to enter information for each of the following categories that were judged as most relevant:

- Key messages

- Measure ID
- Primary pressure addressed
- Secondary Pressure addressed
- Description
- Related measures
- Type of measure
- Water type
- Environmental effectiveness related to ecological status of potential of waer
- Effects on WFD quality elements
    - Biological quality elements
    - Physic chemical quality elements
    - Hydromorphological quality elements
- Quantitative improvement
- Certainty of effectiveness
- Negative side effects of measure
- Research gaps related to effectiveness
- Limitations
- Benefits not related to water
- Timescale to become effective
- Spatial scale
- Costs
- Case studies
- Literature

In some factsheets, the analysis of effectiveness concentrates on sub-measures included in the broader category of the measure.

Sources of information

The information in the factsheets comes from recent case studies, relevant scientific literature with empirical work results, and expert knowledge reported on websites and grey literature of recent research projects. As mentioned above, the work performed for each measure by no means constitutes an exhaustive scientific literature review.

Expert knowledge

To complete and strengthen the overview work on hydromorphological measure effectiveness, an expert meeting was held at DG ENV, Brussels on 21 March 2012 to validate preliminary findings for each measure. The meeting gathered experts from both academic and river basin administration background. A geographical balance and diversity in experts' background ensured the success of the meeting.

The participation of the following experts on hydromorphological measures is gratefully acknowledged for their input during and after the expert meeting:

- Nikolai Friberg, NERI, Denmark
- Jochem Kail, IGB, Germany
- Johan Kling, Swedish Water Agency for Marine and Water Management
- Stephan Schmutz, BOKU, Austria
- Anastasios Varveris, RBMP consultant, Greece

5 Key messages / lessons learned

The following is a selection of key messages and lessons learned on the effectiveness of the hydromorphological measures of the present overview.

Overall messages on hydromorphological restoration

- Biota should be able to move freely across the river continuum.
- Restoration should not only target specific biota species but the entire biota community at reference condition.

Fish passes for upstream migration

- The installation of fish passes should be considered on the catchment and sub-catchment level. It is important to prioritise the location of fish passes; improvements of fish migration have to go together with enhancement of spawning habitats.
- Implementing a fish pass is a mitigation measure. Other restoration means to re-establish connectivity should be sought out when possible.
- Natural by-pass channels are more effective and require less maintenance than fish ladders. By mimicking natural structures, by-pass channels yield additional benefits for other biological elements.
- There is a gap in the biological monitoring of effects of fish passes. There is a need for standardised assessment methods to check the effectiveness of fish passes.

Removal of barriers

- The removal of single barriers is an important measure to provide benefits on a local scale; however effects of single projects can be negligible on a larger scale (river basin). Thus, it is good practice to have a barrier removal concept that sets priorities for the whole river basin. Priority should be given to the removal of obsolete barriers and those that are not used anymore.
- The social aspects of dam removal are crucial; there are many cases where removal projects did not go through due to low or negative social acceptance despite large amount of information about the benefits. For decision-making, there is a need to find trade-offs between environmental and cultural benefits.

Instream structures (large wood, boulders)

- The use of large wood is a restoration measure which should be considered as part of a pool of measures to go back to reference systems. Wood is a natural element in most European rivers and should be considered as part of the substrate. Wood placement is most successful if it mimics natural wood.
- The placement of large wood can have very long lasting effects, but the planning has to consider the transport of wood during higher flows or during flood events.
- Instream placement of boulders leads to rapid improvements, but similarly to large wood, planning of this measure has to consider potential transport during high flow events.
- The benefits, and their longevity, yielded by the use of instream structures vary and are highly contingent upon instream conditions.

Restoration of bank structure

- When planning restoration measures, river managers should consider bank restoration together with the restoration of river processes. There is a need to establish links between bank restoration, the river pattern and stream power.
- Removing bank fixation will reinstate erosion and sedimentation processes in the riparian zone. The main channel can again migrate laterally which may lead to more natural width -depth ratio and lateral connectivity.
- The restoration effects of bank fixation removal are mostly limited to the stretch where bank fixations are removed. The magnitude of the restoration process determines how significant the influence will be.
- Removing hard bank fixations can allow the recreation of river/floodplain and river/groundwater continuity.

Sediment transport management

- Careful addition of sediment can be used to provide suitable spawning sites; planning must take into consideration the risk of having the added material flushed out during floods. In addition, a sediment budget and monitoring program to enable adaptive management are recommended.
- The benefits of sediment replenishment are optimized when accompanied by other measures (e.g. establishing environmental flows to transport the added sediment).
- Sand traps are also used to improve spawning ground conditions and downstream habitats. However, consensus is developing that large wood is more effective than sand traps.

Establishing ecological flow

- Minimum flow is a prerequisite to reach WFD environmental objectives (good status/potential) in different types of water bodies.
- It is crucial to maintain a minimum water flow throughout the river continuum. Minimum flow may be an element of more complex environmental flow regime, that includes other aspects such as the hydrological variability (interannual and seasonal) and connectivity (both longitudinal and lateral), essential for proper structure and functioning of aquatic ecosystems.

- However, there is so far little documentation on the effects of not preserving minimum flow on biological elements in a quantified way. Literature is available on general effects of the application of this measure.
- There is need for monitoring the effects of minimum flow on biological elements.
- There are different methods to define minimum ecological flow requirements (hydrological, hydraulic, habitat simulation, holistic. Currently, different legal requirements and technical standards are set in different Member States.
- Minimum flow should not be established by single target species, but, instead, by the reference condition defined in terms of composition of biological communities.
- Minimum ecological flow requirements should be defined with a view on the possible effects of climate change.

Remeandering of formerly straightened water courses

- It is more important to restore river processes than the river forms.
- Meanders should not be created in historically straight rivers.
- Remeandering is depended on the availability of space.
- Active remeandering is a costly measure and can only work in streams with sufficient stream power.
- Passive restoration by ceasing stream maintenance or initial restoration activities can be a restoration measure as effective as active re-meandering of the stream channel.
- There is still limited evidence on the positive impacts of remeandering on specific biological elements in the aquatic environment, but it is a restoration measure with important aesthetic value and societal acceptance.

Reconnecting of backwaters

- Natural processes must be taken into account when reconnecting backwaters.
- Backwaters quickly fill up with sediments; thus, side arms should be opened on the upper end of rivers with enough water power for self-cleaning processes.
- Reconnected backwaters should not be used as denitrification tools (e.g. for wastewater), because this may lead to eutrophication of former oligothrophic freshwater ecosystems.

6 Annex: Factsheets on selected measures

See individual factsheet files