



European  
Commission



## Natural Water Retention Measures

[www.nwrn.eu](http://www.nwrn.eu)

Service contract n°07.0330/2013/659147/SER/ENV.C1



# *Individual NWRM*

## *Elimination of riverbank protection*



Environment

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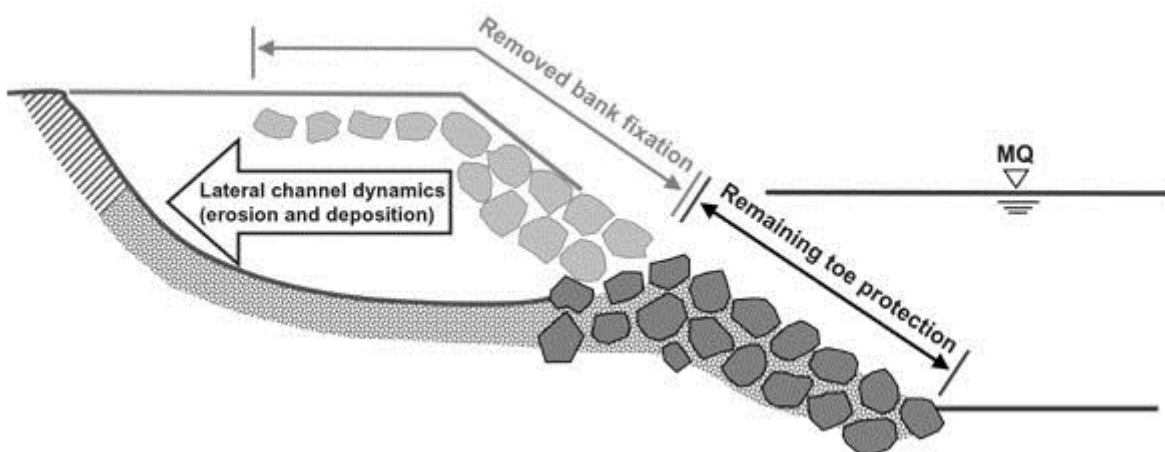
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## I. NWRM Description

A riverbank protection is an inert or living construction providing bank fixation but also an obstacle for the lateral connection of the river. Eliminating it consists in removing some parts of the bank protection, especially the inert one, in order to enhance lateral connections of the river, diversify flows (depth, substrate, and speed) and habitats, but also cap floods in the mainstream. It is a prerequisite for many other measures like re-meandering or widening, as well as initiating later channel migration and dynamics.

This measure is appropriate and very efficient in impounded large gravel riverbeds where gravel bars are drowned and shallow low-velocity habitats are virtually absent. In these impounded rivers, spawning and nursery habitats like shallow near-bank gravel bars, side channels, and backwaters are often the bottleneck for stream-type specific fish species. River banks have been heavily fixed and the potential for river restoration is limited due to uses like navigation, hydropower or flood protection and mitigation measures are restricted to the river banks.

## II. Illustration



Source: [http://wiki.reformrivers.eu/index.php/Remove\\_bank\\_fixation](http://wiki.reformrivers.eu/index.php/Remove_bank_fixation)

## III. Geographic Applicability

Land Use	Applicability	Evidence
Artificial Surfaces	No	This measure could be undertaken in any kind of water course whose banks have been modified with constructions in order to protect the riverside and canalize the river flow. This may potentially be relevant in areas with any kind of land use surrounding the river. However, attention should be paid in artificial surfaces, especially where socio-economic issues exist.
Agricultural Areas	Yes	
Forests and Semi-Natural Areas	Yes	
Wetlands	Yes	

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Region	Applicability	Evidence
Western Europe	Yes	This kind of bank removal can especially be applied and will be very efficient in impounded large gravel bed rivers like the upper Danube, where gravel bars are drowned and shallow low-velocity habitats are virtually absent. In these impounded rivers, spawning and nursery habitats like shallow near-bank gravel bars, side channels, and backwaters are often the bottleneck for stream-type specific fish species. River banks have been heavily fixed and the potential for river restoration is limited due to uses like navigation, hydropower or flood protection and mitigation measures are restricted to the river banks.
Mediterranean	Yes	
Baltic Sea	Yes	
Eastern Europe and Danube	Yes	

### IV. Scale

	0-0.1km <sup>2</sup>	0.1-1.0km <sup>2</sup>	1-10km <sup>2</sup>	10-100km <sup>2</sup>	100-1000km <sup>2</sup>	>1000km <sup>2</sup>
Upstream Drainage Area/Catchment Area			✓	✓	✓	✓
Evidence	The drainage area is not relevant for this measure, nevertheless the bank protection are more likely to be established in the low waters where the flood could be higher due to the amount of water from higher parts and other tributaries.					

### V. Biophysical Impacts

Biophysical Impacts		Rating	Evidence
Slowing & Storing Runoff	Store Runoff	Low	As this measure allows lateral connection between the river and the floodplain, it can participate to store part of the runoff.
	Slow Runoff	Low	As this measure allows lateral connection between the river and the floodplain, it can participate to slow down the runoff.
	Store River Water	High	Eliminating lateral protections helps river water more easily go to the floodplain, therefore better storing the river water. Besides floodplain will retain water for longer periods.
	Slow River Water	High	Eliminating lateral protections helps river water more easily go to the floodplain, therefore generally slowing down the river water. Besides floodplain will retain water for longer periods, letting it go slowly.

Reducing Runoff	Increase Evapotranspiration	Low	As the river water can go more easily to the floodplain, and in case vegetation is present in this floodplain, evapotranspiration can be enhanced
	Increase Infiltration and/or groundwater recharge	Low	As the river water can go more easily to the floodplain, and in case vegetation is present in this floodplain, infiltration and/or groundwater recharge can be enhanced
	Increase soil water retention	Low	As the river water can go more easily to the floodplain, and in case vegetation is present in this floodplain, soil water retention can be enhanced
Reducing Pollution	Reduce pollutant sources	None	
	Intercept pollution pathways	Medium	The elimination of river bank protection also eliminates the direct route for pollutants towards the river: they might be diverted more widely across the floodplain, with increased deposition on the floodplain, thus reducing the amount of pollutants in the river.
Soil Conservation	Reduce erosion and/or sediment delivery	Medium	As the river water is slowing down, riverbank erosion can be reduced and sedimentation can be enhanced
	Improve soils	None	
Creating Habitat	Create aquatic habitat	Medium	This measure favours aquatic ecosystem improvement due to continuity between water and floodplain, and also because the majority of fish species need slow and warm waters. Re-opened river banks provide spawning grounds for fish.
	Create riparian habitat	Medium	The elimination of riverbank can diversify the riparian habitats opening new areas to habitats.
	Create terrestrial habitat	Low	As this measure has little impact on the areas beyond the river banks, it may indirectly create terrestrial habitats.
Climate Alteration	Enhance precipitation	None	
	Reduce peak temperature	None	
	Absorb and/or retain CO <sub>2</sub>	Low	As the river water can go more easily to the floodplain, and in case vegetation is present in this floodplain, absorption and retaining of CO <sub>2</sub> can be enhanced.

## VI. Ecosystem Services Benefits

Ecosystem Services		Rating	Evidence
Provisioning	Water Storage	Medium	Since it creates a link between the river and the floodplain this measure increases water storage.
	Fish stocks and recruiting	Medium	By slowing down the river flow this measure can help increase fish stocks.
	Natural biomass production	Medium	Since it creates new habitats (aquatic, riparian and terrestrial), this measure increases the biomass production.
Regulatory and Maintenance	Biodiversity preservation	Medium	By improving the life conditions and providing various aquatic habitats, this measure may preserve biodiversity.
	Climate change adaptation and mitigation	None	
	Groundwater / aquifer recharge	Low	Infiltration and/or groundwater recharge can be enhanced in the floodplain
	Flood risk reduction	High	As it stores and slows down the river water, this measure helps flood reduction.
	Erosion / sediment control	Medium	Since it reduces the velocity of the river water during flood events, erosion is reduced. Sediment deposition on the floodplain will take place in the re-connected reaches, restoring the natural state of the floodplains and reducing sediment and nutrients in the river.
	Filtration of pollutants	Medium	The pollutants pathways are intercepted and the flow reduced, helping the filtration of pollutants.
Cultural	Recreational opportunities	Medium	This measure diversifies the landscape and broadens the access to the river, increasing recreational opportunities.
	Aesthetic / cultural value	Medium	There is no more artificial riverbanks hiding the river.
Abiotic	Navigation	None	
	Geological resources	None	
	Energy production	None	



## VII. Policy Objectives

Policy Objective		Rating	Evidence
<b>Water Framework Directive</b>			
Achieve Good Surface Water Status	Improving status of biological quality elements	Medium	The temporal dynamics in naturally functioning floodplains ensures the survival of many habitats and species identified as important for biological quality
	Improving status of physico-chemical quality elements	Medium	Likely positive impact on the water good ecological status. Can remove a part of pollutants
	Improving status of hydromorphological quality elements	Medium	Reduced erosion and sediment deposition can improve the status of hydromorphological quality elements
	Improving chemical status and priority substances	Medium	By helping the interception of pollutant pathways, this measure improves the chemical status of the river.
Achieve Good GW Status	Improved quantitative status	Low	As infiltration and/or groundwater recharge can be enhanced in the floodplain, the quantitative status of the groundwater recharge may be improved
	Improved chemical status	Low	The elimination of the river bank increases the infiltration surface in the floodplain and hence improves the natural filtration by the ground, improving at the same time groundwater quality. Moreover the more diverted water widely across the floodplain increase the amount of pollutants deposited on the floodplain, thus in the river.
Prevent Deterioration	Prevent surface water status deterioration	Medium	Slowing down river flow, intercepting pollutant pathways and favouring aquatic and riparian habitats are all benefits of this measure that help restoring the surface water balance and hence prevent its deterioration.
	Prevent groundwater status deterioration	Low	The groundwater status deterioration is prevented as a result of the interception of pollutant pathways.
<b>Floods Directive</b>			
Take adequate and co-ordinated measures to reduce flood risks		High	Floodplains are natural retention areas: restoring floodplains contributes to mitigating climate-related floods and droughts. Due to their manifold functions, floodplains store carbon and water very efficiently. Reduction and storage of surface runoff will contribute to reduced peak flows in receiving watercourses, reducing flood risk as an alternative to hard flood defence.

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<b>Habitats and Birds Directives</b>		
Protection of Important Habitats	Medium	By slowing down the river flow during flood events, improving its quality through the interception of pollutant pathways, and contributing to floodplain restoration, this measure helps protecting important habitats.
<b>2020 Biodiversity Strategy</b>		
Better protection for ecosystems and more use of Green Infrastructure	Medium	The creation of new habitats and the improvement of the quality of the water contribute to this objective.
More sustainable agriculture and forestry	None	
Better management of fish stocks	Medium	The diversity of aquatic habitats this measure creates, along with the slowing down of the river flood flows that improves the life quality for fishes, improves also the fish stock management.
Prevention of biodiversity loss	Medium	Since this measure creates favourable context for aquatic, riparian and even terrestrial species, it prevents biodiversity loss.

## VIII. Design Guidance

<b>Design Parameters</b>	<b>Evidence</b>
Dimensions	Depends on the protection constructed
Space required	n/a
Location	It is mainly implemented in downstream reaches of catchment where there is significant natural floodplain extent, but it can be done wherever bank protection exists
Site and slope stability	This measure will change the site and slope to the original state
Soils and groundwater	There is no specific condition on soil permeability or depth.
Pre-treatment requirements	n/a
Synergies with Other Measures	Natural bank stabilisation, wetland restoration, floodplain reconnection and restoration, re-meandering and riparian buffer zones. All these measures are connected helping the river to become as it was previously without man's intervention.



## **IX. Cost**

Cost Category	Cost Range	Evidence
Land Acquisition		There is no specific information from similar projects or the measure is generally implemented as a component of more complex projects and budget breakdown is not published.
Investigations & Studies		
Capital Costs		
Maintenance Costs		
Additional Costs		

## **X. Governance and Implementation**

Requirement	Evidence
Definition of responsibilities	The effective planning, design, and operation of this type of measure requires the involvement of a wide range of stakeholders. This include local planning authorities, environmental regulators, private landowners and land managers, farmers and other bodies with responsibilities water management (e.g. irrigation bodies, drainage boards, etc). "Involving stakeholders like farmers, fishermen and (local) citizens (during the design phase, through consultation meetings and sessions is) one the key factors of (this kind of) project.

## **XI. Incentives supporting the financing of the NWRM**

Type	Evidence
LIFE Nature and Biodiversity	Article 10 of the Habitats Directive promotes the natural rivers which are "essential for the migration, dispersal and genetic exchange of wild species"

## **XII. References**

Reference	Comment
Effects of embankment removal	<a href="http://www.wildtrout.org/sites/default/files/projects/AGU-poster_Clilverd.pdf">http://www.wildtrout.org/sites/default/files/projects/AGU-poster_Clilverd.pdf</a>
"Costs, benefits and climate proofing of natural water retention measures" - Stella Consulting	NWRM Final Report - May 2012

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“How to use floodplain for flood risk reduction”- Ecoflood Guidelines-2006	<a href="http://ec.europa.eu/ourcoast/download.cfm?fileID=951">http://ec.europa.eu/ourcoast/download.cfm?fileID=951</a>
“Remove bank fixation”	<a href="http://wiki.reformrivers.eu/index.php/Remove_bank_fixation">http://wiki.reformrivers.eu/index.php/Remove_bank_fixation</a>