European Commission

NWRM

Natural Water Retention Measures

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Case Study

Stream ČernýPotok

ACTeon environment research & consultancy

Office International de l'Eau

amec foster wheeler

BEF LATVIA

enveco Environmental Economics Consultancy

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This report was prepared by the NWRM project, led by Office International de l'Eau (OIEau), in consortium with Actéon Environment (France), AMEC Foster Wheeler (United Kingdom), BEF (Baltic States), ENVECO (Sweden), IACO (Cyprus/Greece), IMDEA Water (Spain), REC (Hungary/Central & Eastern Europe), REKK inc. (Hungary), SLU (Sweden) and SRUC (UK) under contract 07.0330/2013/659147/SER/ENV.C1 for the Directorate-General for Environment of the European Commission. The information and views set out in this report represent NWRM project's views on the subject matter and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this report. Neither the Commission nor any person acting on the Commission's behalf may be held Key words: Biophysical impact, runoff, water retention, effectiveness - Please consult the NWRM glossary for more information.

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I. Basic Information

Application ID	*Czech_02*			
Application Name *(provide a short name)*	**Stream_ČernýPotok**			
Application Location	Country:	Czech Republic	Country 2:	
	NUTS2 Code		*CZ04-Severozápad*	
	River Basin District Code		*CZ_5000-Elbe*	
	WFD Water Body Code			
	Description		*The Cerná louka (Eng. black Meadow) is a national Reserve (NR), within the Ramsar site Krusnohorska Mountains mires at northwest Czech Republic, along the border with Germany 50°44'4" N, 13°53'26" E, 690–760 m*	
Application Site Coordinates *(in ETRS89 or WGS84 the coordinate system)*	Latitude: *- ETRS89 or WGS84? Specify: 50.734*		Longitude: *- ETRS89 or WGS84? Specify: 13.8905*	
Target Sector(s)	Primary:	Hydromorphology		
Implemented NWRM(s)	Measure #1:	*N5*		
Application short description	The application was based on common principles of stream restoration. The main aim of the restoration was to decrease the volume of the restored streambeds especially by reducing their depth. Other important criteria included re-establishment of a natural gradient, near-natural proportions of the stream cross-section, and natural variety in current and calm riffles Modifications within the channelized streambed were not sufficient to respect all these criteria, therefore new streambeds were proposed and constructed. They were reconnected with the remains of the original stream course or directed freely to the alluvial meadows.			

II. Policy context and design targets

Brief description of the problem to be tackled	*Briefly describe the problem that needs to be tackled in this application* Comprehensive remediation of the hydrology of the area, initiation of natural, dynamic re-development of the stream channel and cessation of degradation processes in valuable habitats. These restoration measures are the main prerequisite for biodiversity protection including both stabilisation of local populations and spontaneous return of important wetland species, e.g. Snipe (Gallinago gallinago). Also expected are flood control elements, e.g. reduction of the outflow velocity and retardation and flattening of flood waves.	
What were the primary & secondary targets when designing this application?	Primary target #1:	Biodiversity and gene-pool conservation in riparian areas
	Primary target #2:	Regulation of hydrological cycle and water

		flow	
	Secondary target #1:	Flood control and flood risk mitigation	
Which specific types of pressures did you aim at mitigating?	Pressure #1:	WFD identified pressure	*4.1.5 Physical alteration of channel/ bed/ riparian area/ shore – unknown*
	Pressure #2:	Floods Directive identified pressure	*Other pressure contributing to flooding /flood risk*
	Pressure #3:	Other EU-Directive's identified pressure (specify)	*Birds Directive 2009/147/EC Surface drainage and peat cutting*
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	WFD identified impact	*Altered habitats due to hydrological changes*
	Impact #2:	Floods Directive identified impact	*Protected areas*
	Impact #3:	Other EU-Directive's identified impact (specify)	*Loss of natural habitats and wild fauna and flora*
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:	WFD-mitigation of significant pressure	*Restored stream sections (including adjustment of channelized streambeds and making water flow into the alluvium)*
	Requirement #2:	WFD-restoring a HMWB	*Restored meandering segment and pools with marsh habitats*
	Requirement #3:	Floods Directive-mitigating Flood Risk	*Natural overflow in case of Q100 floods*
	Requirement #4:	Other EU-Directive requirements (Specify)	*Habitats Directive : Both new and restored marshes with still or running waters*
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	National Wetlands Conservation Plan National Biodiversity Strategy		

III. Site characteristics

Dominant Land Use type(s)	Dominant land use	
	Secondary land use	
	Other important land use	
	Remarks	
Climate zone	cool temperate dry	
Soil type		
Average Slope	gentle (2-5%)	
Mean Annual Rainfall	600 - 900 mm	
Mean Annual Runoff	150 - 300 mm	

Average Runoff coefficient (or % imperviousness on site)	0.2 - 0.3	
Characterization of water quality status (prior to the implementation of the NWRMs)	*Cu < 0.02 mg/l* *Zn < 0.005 mg/l* *max T = 9 °C*	
Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	*Positive way:* *Presence of former wetlands and natural vegetation;* *Interest of local people and NGOs and their readiness to be involved and to contribute*	

IV. Design & implementation parameters

Project scale	Large (e.g. watershed, city, entire water system)	Cerný potok watershed (the main stream and its tributaries). In total 43,000m^2 of restored marches with still or running waters
Time frame	Date of installation/construction (MM.YYYY)	*February 2010*
	Expected average lifespan (life expectancy) of the application in years	*Specify: N/A*
Responsible authority and other stakeholders involved	*Name of responsible authority/ stakeholder*	*Role, responsibilities*
	1. Nature Conservation Agency of the Czech Republic	Responsible, Initiation of the measure
	2. Czech Union for Nature Conservation	Supporting in monitoring
	3. Local Chapter Teplice – Fergunna	Responsible for monitoring and maintainance
The application was initiated and financed by	Initiated by the Nature Conservation Agency of the Czech Republic Financed by the Free State of Saxony, Operational Programme Environment	
What were specific principles that were followed in the design of this application?	The project was based on common principles of stream restoration. The main aim of the restoration was to decrease the volume of the restored streambeds especially by reducing their depth. Other important criteria included re-establishment of a natural gradient, near-natural proportions of the stream cross-section, and natural variety in current and calm ri9es Modifications within the channelized streambed were not sufficient to respect all these criteria, therefore new streambeds were proposed and constructed. They were reconnected with the remains	

<table>
<tr><td></td><td colspan="3">of the original stream course or directed freely to the alluvial meadows.
The volume of the new beds was designed at 30-day design flows (or max. one-year flows).</td></tr>
<tr><td rowspan="2">Area (ha)</td><td>Number of hectares treated by the NWRM(s).</td><td colspan="2">Number of ha
7.4</td></tr>
<tr><td colspan="3">Both new and restored marshes with still or running waters 43,000 m2</td></tr>
<tr><td>Design capacity</td><td colspan="3">- Restored stream sections (including adjustment of channelized streambeds and making water flow into the alluvium), 4,030 m
- Natural overflow in case of Q100 floods (along meandering segment in the alluvium) 74,000 m^2
- Pools with marshes (restored or created marsh habitats), 9,630 m^2</td></tr>
<tr><td rowspan="2">Reference to existing engineering standards, guidelines and manuals that have been used during the design phase</td><td colspan="2">Reference</td><td>URL</td></tr>
<tr><td>1.</td><td>National standards and protocols</td><td></td></tr>
<tr><td>Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?</td><td colspan="3">The described restoration project, dealing with stream restoration including a large flooded alluvium, represents the first of its kind in the Czech Republic in extent and approach. New methods were applied in the design of shape and course of the streambed, and their successful implementation was enabled by good collaboration between investor, designer and subcontractors.
Changes in the natural stream courses, degradation of stream habitats as well as considerable changes in natural hydrology were the main motivations for working out a restoration project. Restoration works originally started as partial re-establishment of small shallow pools and adjustments of the channels, but finally led to a comprehensive project aimed at restoring the natural hydrology in the entire Nature Reserve.
The area of interest is an important site for many rare and endangered plants (e.g. Menyanthes trifoliata, Pinguicula vulgaris) and animals (e.g. shore-birds, amphibians) of wetlands. It was necessary to take the conservation of these species into account during the restoration works.</td></tr>
</table>

V. Biophysical impacts

Impact category (short name) Select from the **drop-down menu** below:	**Impact description** (Text, approx. 200 words)	**Impact quantification** (specifying units)	
		Parameter value; units	% change in parameter value as compared to the state prior to the implementation of the NWRM(s)
Runoff attenuation / control	A very significant effect was recorded on the delay of the flood wave. As a consequence, the peak flow downstream can be reduced due to delayed peak flows from the tributaries	% restored water regime	45%
Peak flow rate reduction	Only a small effect of the stream restoration on the peak flow was found with the exception of less frequent floods (N1, N2 and N5 peak flows were reduced by only 50–80 l/sec)	% reduction	< 5%
Impact on groundwater	*N/A info*		
Impact on soil moisture and soil storage capacity	*N/A info*		
Restoring hydraulic connection	Significant role in re-connecting former marches	% restored water regime	*90%*
Water quality Improvements	*Not relevant for this application*		
WFD Ecological Status and objectives	Proven positive impact on morphological parameters (connectivity) as well expected positive impact on BQEs. NWRM contributes to the conservation objectives of water-dependent protected areas		
Reducing flood risks (Floods Directive)	Expected flood risk reduction by options for controlled flooding of the restored wetlands and protection of adjacent habitates.		
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	In general reconnected marches contribute to the increased self-purification capacity of the river system and to the implementation of Bird Directive and Habitat Directive.		
Soil Quality Improvements			
Other			

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	The effect of restoration on the local fauna and flora was monitored as well (Nature Conservation Agency of the Czech Republic, Czech Union for Nature Conservation, Local Chapter Teplice – Fergunna, 2007–2011) but only preliminary results are available at present because of a relatively short post-restoration phase. The abundance of some amphibians has considerably increased in the constructed pools (e.g. hundreds of individuals of frog species, e.g. Bufo bufo, Rana temporaria, and dozens of individuals of Triturus vulgaris). A more frequent occurrence of some bird species of waterlogged meadows and marshes (such as Crex crex and Gallinago gallinago) was recorded mainly in the restored wetland habitats created by conducting small tributaries to the floodplain. In 2011 about 20 dragonfly species were recorded. The local population of the endangered plant species Menyanthes trifoliata has increased in the floodplain.		
Financial costs	***Total:***	*Value in 316000 €*	*Design and construction 2001–2003: €52,000; 2008–2010: €264,000*
	Capital:		
	Land acquisition and value:		
	Operational:		
	Maintenance:		
	Other:		
Were financial compensations required? What amount?	*Was financial compensation required: Yes /No* *No*		
	Total amount of money paid (in €):		
	Compensation schema:		
	Comments / Remarks:		
Economic costs	*Actual income loss :N/A info*		
	Additional costs: N/A info		
	Other opportunity costs: N/A info		

	Comments / Remarks:
Which link can be made to the ecosystem services approach? *Hint: The actual benefits of improving nature's water storage capacity are essentially linked to an improved provision of some of the following ecosystem goods and services:* - *Freshwater for drinking.* - *Water provision to deliver water services to the economy both for drinking and non-drinking purposes.* - *Water security (reliability of supply and resilience to drought).* - *Health security (control of waterborne diseases).* - *Flood security and protection.* - *Storm surge protection.* - *Biomass production.* - *Amenities (associated to habitat protection): fish and plants, tourism, recreation, and others.* - *Benefits of improved coastal water quality and ecological status for a sustainable commercial production of shellfish with human health and welfare values.*	- Increased capacities for services associated to habitat protection as eco-tourism potential of the region will generate revenue. - Improved fishery stocks will enhance fishing opportunities and revenues. - Public awareness of environmental values and benefits will increase the likelihood that future anthropogenic pressure and damage (including pollution) will be reduced. - Improved Flood security and protection. -

VII. Monitoring & maintenance requirements

Monitoring requirements	Monitoring of the restored site was supported under the transboundary project "Pestrý-Bunt". The effect of restoration on the local fauna and flora was monitored as well (Nature Conservation Agency of the Czech Republic, Czech Union for Nature Conservation, Local Chapter Teplice – Fergunna, 2007–2011)
Maintenance requirements	Maintenance activities will be focused on preservation of re-established natural conditions in the area, by the Local Chapter Teplice – Fergunna
What are the administrative costs?	M/A info

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	The main assessment method is the comparison of the ecological status of the restored wetlands pre vs. post implementation.

Which methods are used to assess costs, benefits and cost-effectiveness of measures?	No economic and financial analysis was carried out prior the Project start because of the emphasis on wetlands restoration and biodiversity conservation, as opposed to revenue generation..
How cost-effective are NWRM's compared to "traditional / structural" measures?	N/A info
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	The low inclination and the plain landscape allow the achievement of relatively large flooded areas, efficient restoration of meanders and habitats reconvention with no heavy structures.
What is the standard time delay for measuring the effects of the measures?	10-15 years are expected for the restored wetlands to reach the desired ecosystem value.

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	- Difficulties with technical design due to insufficient national expertise in wetlands restoration - Absence of sustainable business cases for sustainable reed biomass utilization - Not defined target ecosystem status (favourable conservation status) at the project start.
What were the main enabling and success factors?	- Available financing for capital investments - Commitment and support provided by competent authorities - Local communities and NGO involvement and support. - The restored site is used for education, and both experts and the public from the Czech Republic and abroad have visited it
Financing	Free State of Saxony, Operational Programme Environment 2001–2003: €52,000; 2008–2010: €264,000
Flexibility & Adaptability	Adaptation to changing hydrological and habitat conditions have been achieved by a width range of structures reflecting surface, soil and geological conditions that are flexible concerning operation and further improvement of hydraulic conditions
Transferability	Similar restoration works could be designed for other (former) wetlands along medium rivers in their low-land segments.

X. Lessons learned

Key lessons	Participatory approaches to wetland restoration design were critical for Project success, which hinged on changing people's perceptions of wetlands, and gaining the full support for restoration among authorities and stakeholders. PA Local Consultative Councils and public awareness campaigns effectively supported stakeholder involvement. Controlled restoration is a step in the right direction and is allowing further researches and studies concerning habitat restorations. Solid knowledge on the baseline and the desired ecosystem status should be embedded early in project design phase.

XI. References

Source Type	*Project Report*		
Source Author(s)	Ivana Jongepierova, Pavel Pesout, Jan Willem, Karel Prach		
Source Title	Ecological restoration in Czech Republic		
Year of publication	2012		
Editor/Publisher	Nature Conservation Agecy of the Czech Republic		
Source Weblink	http://chapter.ser.org/europe/files/2012/12/Ecological-Restoration-in-the-Czech-Republic1.pdf		
Key People		*Name / affiliation*	*Contact details*
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	2.		
	3.		
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XII. Photos Gallery

Figure 1: Section of Cerni porok stream before restoration (© J. Rous in Jongepierová et al. (2012), p. 74) Source : Jongepierová I., Pešout P., Jongepier J. W. & Prach K. (eds) (2012): Ecological restoration in the Czech Republic. – Nature Conservation Agency of the Czech Republic, Prague, 147 pp. http://chapter.ser.org/europe/files/2012/12/Ecological-Restoration-in-the-Czech-Republic1.pdf

Figure 2: Section of Cerni Potok stream after restoration (© J. Rous in Jongepierová et al. (2012), p. 75) Source : Jongepierová I., Pešout P., Jongepier J. W. & Prach K. (eds) (2012): Ecological restoration in the Czech Republic. – Nature Conservation Agency of the Czech Republic, Prague, 147 pp. http://chapter.ser.org/europe/files/2012/12/Ecological-Restoration-in-the-Czech-Republic1.pdf