European Commission

NWRM

Natural Water Retention Measures

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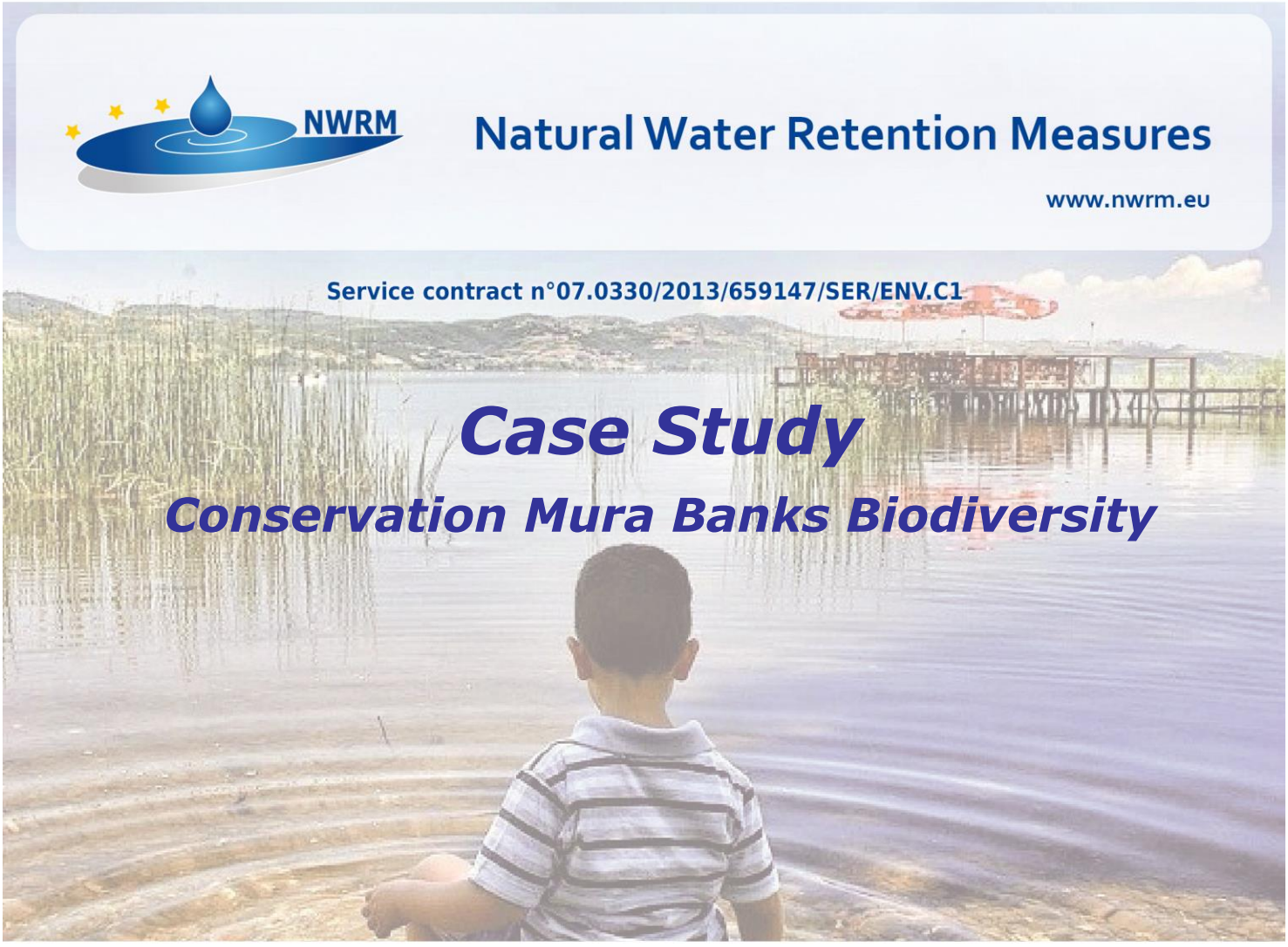
Service contract n°07.0330/2013/659147/SER/ENV.C1



Case Study

Conservation Mura Banks Biodiversity

Environment

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	*Slovenia_1*			
Application Name	**Conservation_MuraBanksBiodiversity**			
Application Location	Country:	Slovenia	Country 2:	
	NUTS2 Code		*SI01*	
	River Basin District Code		*SI_RBD_1*	
	WFD Water Body Code			
	Description *(free text, short description of the location)*		*The bed of the river Mura flows through NE Slovenia, whose area lies between the villages of Bakovci, Dokležovje, Ižakovci, Melinci, Bunčani, Veržej, Krapje and Mota.*	
Application Site Coordinates *(WGS84)*	Latitude: 46.59138		Longitude: 16.17805	
Target Sector(s)	Primary:	Hydromorphology		
Implemented NWRM(s)	Measure #1:	*N2*		
	Measure #2:	*N7*		
	Measure #3:	*N10*		
Application short description	Connection of the main channel of the Mura River with side channels, provision of conditions for the adequate water level at the intake of water into side branches (intake at average and low flows), local widening of the channel and sustainable maintenance of alluvial forests and side channels.			

II. Policy context and design targets

Brief description of the problem to be tackled	The reason for the project was high biodiversity value of the Mura River in Slovenia. In 2004 a large part of it has been declared the Natura 2000 site (SPA Mura SI5000010 and pSCA Mura SI3000215). It is crucial that proper water management and management of forest and agricultural areas are implemented to stop ecological deterioration and to support existing biodiversity value. Intensive water use, activities in the river and riverside space and the change of land use in the Mura River catchment (chain of hydropower plants on the Mura in Austria, flood protection structures and facilities, water supply, management of agricultural land, urban development) have considerably altered the river space. Most of all, they affect the bed-load discharge and processes of self-formation of the river space in Slovenia. At the border between Slovenia and Austria, the river bed of the Mura River has deepened by as much as 1.5 m in the last decades (by 33 cm on average), and there is a trend of slow deepening of the river bottom downstream of Petanjci and change of hydrological features of the Mura wetlands. Flood events occur less often and the low flow periods are longer, resulting in the gradual drying-out of the alluvial forests along the Mura. The water dynamics in oxbows, side branches and on the ground is becoming less diverse. The creative power of water, needed for operation of such a habitat structure, is diminishing. With improper management of forest and agricultural areas the ecological habitat conditions of these wetlands are deteriorating.	
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
	Remarks	The activities of the BIOMURA project aimed at improvement of growing conditions for 4 habitats from the Habitats Directive: Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris); Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation ; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae). The conservation of targeted species for more than a third of the Natura 2000 qualification species on the Mura river

		should be ensured. Targeted species from that Annex II to the Habitats Directive include: 1 butterfly species (Callimorpha quadripunctaria), 1 amphibian species (Bombina bombina), 1 dragonfly species (Ophiogomphus cecilia) and 5 fish species (Misgurnus fossilis, Rhodeus sericeus amarus, Gymnocephalus schraetzer, Umbra krameri, Aspius aspius). Also, it is assumed that the living conditions of 29 other species of birds, butterflies, dragonflies, amphibians, reptiles and mammals improved.	
Which specific types of pressures did you aim at mitigating?	Pressure #1:	WFD identified pressure	*3.1 Abstraction – Agriculture*
	Pressure #2:	WFD identified pressure	*3.2 Abstraction – Public Water Supply*
	Pressure #3:	WFD identified pressure	*4.1.1 Physical alteration of channel/bed/riparian area/shore of water body for flood protection*
	Pressure #4:	WFD identified pressure	*4.1.2 Physical alteration of channel/bed/riparian area/shore of water body for agriculture*
	Remarks	Intensive water use, activities in the river and riverside space and the change of land use in the Mura River catchment (chain of hydropower plants on the Mura in Austria, flood protection structures and facilities, water supply, management of agricultural land, urban development) have considerably altered the river space.	
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	WFD identified impact	*Ecological status*
	Impact #2:	WFD identified impact	*Alterations in discharge amount due to the uncontrolled water abstraction (e-flow)*
	Impact #3:	Floods Directive identified impact	*Water body status*
	Remarks	The changing ground water level is no longer optimal for the long-term growth of alluvial forests and grasslands	
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:	WFD-achievement of good ecological status	*Good ecological status and international collaboration*
	Requirement #2:	Floods Directive-mitigating Flood	*Flood protection and good ecological status*

		Risk	
	Requirement #3:	Other EU-Directive requirements (Specify)	*Habitats and Birds Directive*
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	RBMP of Danube River District		

III. Site characteristics

Dominant Land Use type(s)	Dominant land use	*Water courses*
	Secondary land use	*Agro-forestry areas*
	Other important land use	*Type in the relevant Code Level3*
	Remarks	
Climate zone	cool temperate moist	
Soil type	*N/A info*	
Average Slope		
Mean Annual Rainfall	600 - 900 mm	
Mean Annual Runoff	300 - 450 mm	
Average Runoff coefficient (or % imperviousness on site)	0 - 0.2	0 - 10%
	Remarks	
Characterization of water quality status (prior to the implementation of the NWRMs)	*N/A info*	
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 with a high biodiversity value.*	
	Negative way: The biggest threat to this project is the project of hydropower stations construction on Mura river which is pushed by the investor Dravske Elektrarne. In case of the future implementation of these power plants our best practice BIOMURA wills potentially be endangered or even destroyed.	

IV. Design & implementation parameters

Project scale	Medium (eg. public park, new development district)	*The area covered by the project has a surface of 15.2 km2 and is part of the Natura 2000. The area lies between the villages of Bakovci, Dokležovje, Ižakovci, Melinci, Bunčani, Veržej, Krapje and Mota.*
Time frame	Date of installation/construction (MM.YYYY)	*10.2011*
	Expected average lifespan (life expectancy) of the application in	*Specify*

	years	
Responsible authority and other stakeholders involved	*Name of responsible authority/ stakeholder*	*Role, responsibilities*
	1. Institute for water of the Republic of Slovenia (Institut za vode Republike Slovenije, IZVRS)	Initiation of the measure
	2. Engineering for Waters (Inženiring za vode d.o.o., IZVO)	Supervision in restoration
	3. Mura Water Management company (Mura vodnogospodarsko podjetje, d.d., Mura VGP)	Restoration activities and maintenance
	4. Institute of the Republic of Slovenia for Nature Protection (Zavod Republike Slovenije za Varstvo Narave ZRSVN)	Workshop, promotional and informational actions
	5. Regional Development Agency Mura (Slovenia Regionalna razvojna agencija Mura, PRA Mura)	Responsible of some information actions
	6. Prleska Development Agency (Prleška razvojna agencija giz, PRA)	Responsible of some information actions
	7. Association for the Study of Birds and Nature Conservation (Društvo za proučevanje ptic in varstvo narave, DPPVN)	Participation and support of some information actions
	8. World Wide Fund for Nature Austria (WWF Austria)	Participation and support of some information actions
The application was initiated and financed by	European Commission LIFE Nature program (49%), Ministry of Environment and Physical Planning of Slovenia (34%) and Institute for Water of the Republic of Slovenia (11%). Remaining 6% between the rests of the partners.	
What were specific principles that were followed in the design of this application?		
Area (ha)	Number of hectares treated by the NWRM(s).	*1520*
	1200 ha of floodplain forests, 1500 m of side channels and 5000 m2 of oxbows will be reached and forest areas around 2 ha of oxbow lake sand along 5000 m of side channels improved	
Design capacity	*Removal of 9990 m3 of bank protections, an area of 1.7 ha for the gravel feeding was established. Two rock-fill riffles were also established. At two locations a total of 5 070 m side-channels were improved. Clearing of trees and shrubs was carried out on 27 000 m2 and oxbow lakes, overgrown with vegetation and sediment, were cleaned (more than 13 000 m3)*	
Reference to existing	*Reference*	*URL*

engineering standards, guidelines and manuals that have been used during the design phase	1.	National monitoring data of discharges and groundwater levels on the catchment of the river Mura	http://www.arso.gov.si/en/
	2.	Maps of geology and soil), GIS layers of cartographic entities in scale 1:25000 and 1:5000 (vector and raster form), historical aero photo maps, DOF for 2002, 2005 and 2007	http://www.geo-zs.si/podrocje.aspx?langid=1033
	3.	Background studies for actions (geodesy, technical concept studies, hydrological and hydraulic studies)	
Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?	The measures undertaken depended on the knowledge of natural processes and encroachments upon the river habitat made in the past. Although the Mura River has been straightened and the meanders cut-across, leaving behind oxbows, parts of the old channel are still recharged by the river, precipitation and groundwater. The processes of more relaxed, less controlled dynamics of the water flow, with a more frequent and easily spotted bank erosion, natural sediment transport and deposition, frequent flooding, river branches and oxbows, are especially present downstream of Veržej. The Mura river space in Slovenia, and at the reach bordering Croatia, is therefore among the richest ecosystems in Slovenia.		

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	*N/A info*		
Peak flow rate reduction	*N/A info*		
Impact on groundwater	*N/A info*		
Impact on soil moisture and soil storage capacity	*N/A info*		
Restoring hydraulic connection	*Connection of the main channel of the Mura River with side channels and abandoned oxbows with the main channel of Mura*		

Water quality Improvements	*Not relevant for this application*		
WFD Ecological Status and objectives	*Creation of favourable conditions to meet the needs of wetland and river ecology, which enables high biodiversity of the river Mura.*		
Reducing flood risks (Floods Directive)	*Local widening of the channel leaving space for flooding*		
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	*The project enabled favourable conditions for many target habitats and species by maintaining and/or improving the good status.*		
Soil Quality Improvements	*Not relevant for this application*		
Other	*Provision of conditions for the adequate water level at the intake of water into side branches (intake at average and low flows)*		

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	Conservation of natural values and biodiversity will sustain if not enhance ground and surface water regimes in their dynamic character and connectivity. Wetland ecosystem services such are fish stocks, groundwater for human consumption, wood stocks and biomass will become even more important for local and regional community. Restoration and rehabilitation works in the project area are offering job opportunities for local people and providing long-term opportunities for creation of trails, observation facilities, information center, education points and paths. Development of a sustainable tourism is an option and source of local employment and income increase in the Pomurje region in the future. The project has also become a strong counterpart to the idea of electricity production on the Mura River upstream.		
Financial costs	***Total:***	*1975519 €*	
	Capital:	*1991567 €*	
	Land acquisition and value:	*61800 €*	*Thirteen purchase contracts for 26 parcels, 35663 m2 large.*
	Operational:		
	Maintenance:		*The maintenance of the side channels and oxbows is seasonal, done as small scale works in an ecologically sensitive manner.*
	Other:		
Were financial compensations required? What amount?	*Was financial compensation required: Yes /No*		
	Total amount of money paid (in €):		
	Compensation schema:		

	Comments / Remarks:
Economic costs	*Actual income loss:*
	Additional costs:
	Other opportunity costs:
	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.*	- *More Water supply for drinking and arable lands.* - *Increase in the biomass production* - *Increase in tourism, recreation, and others.*

VII. Monitoring & maintenance requirements

Monitoring requirements	Hydrological: In 2008 it was established regular hydrological monitoring with 2 surface water monitoring stations constructed in the field, 3 at ground water level and 2 groundwater/surface (oxbow lakes) stations. Habitat mapping: As no maps available in Natura 2000, the area was mapped in 2008 and inserted in to GIS form (finalized in March 2009) Birds and amphibians: Performed by DPPVN in 2008, 2009,

	2010 and 2011Fish: prepared by IzVRS in March 2008 and summer 2011. For the long-term/qualitative environmental benefits, in cooperation with ZRSVN, Slovenian forest service and DPPVN, IzVRS will perform some tasks which include monitoring of ecological status, fish and birds (1 and 3 years after the project), hydrology, and activities on the purchased lands.
Maintenance requirements	in cooperation with ZRSVN, Slovenian forest service and DPPVN, IzVRS is on duty for targeting the long-term conservation and improvement of the wetland and water habitats along the Mura, 26 plots of land on 3.57 ha were bought from private owners during the project period (from spring 2010 to April 2011). Proper maintenance of the river channel over the next few years will result in certain improvement of ecological conditions needed for the existence of wetland and water habitats in the purchased plots. In connection with the above-mentioned actions, this will help improve hydraulic connections between surface waters and groundwater. They also promote the use of a guideline for the maintenance of the main channel and branches, upgrade plans for water management use, protection and water basin management by expanding the concept of project Biomura upstream and downstream the Mura River and to the Ledava, and carried out the mowing of the vegetation before 2013.
What are the administrative costs?	N/A info

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	*pre vs. post implementation*
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	There has been used timesheets with working hours for reporting.
How cost-effective are NWRM's compared to "traditional / structural" measures?	
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	The bed of the river Mura that flows through NE Slovenia is well preserved, especially in the middle and lower stream, where it is characterized by embankment erosion, deposition of the sand, flooding and side-channels. Deepening of the riverbed due to send accumulation behind the dams of hydropower stations in Austria, however, has resulted in a greater risk of flooding. There are no dams on Slovenian river section, but plans to alter this situation are resurfacing.
What is the standard time delay for measuring the effects of the	At least 10 years, according to the beneficiary, is considered necessary, to show in full the positive effect that the changed

measures?	river morphology will have on the target fish populations, due to the lifespan of individual fish species and their sexual maturity.

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	*During the construction the water level was often too high, the work was interrupted for a few times.* *Need of coordination of borders between plots* *and compensation contracts with plot owners, since they are considered manipulative areas* *of mechanization and equipment (construction site)*
What were the main enabling and success factors?	A good organization and coordination between the activities and the stakeholders.
Financing	- EU LIFE NATURE (49%) : 969385€ - Republic of Slovenia – Ministry of Environment and Spatial Planning (34%) : 676778€ - Project leader (beneficiary) - Institute for water of Republic of Slovenia (11%) - Partners (6%): (IZVO) Engineering for waters, (Mura VGP) Mura water management company, (ZRSVN) Institute of Republic of Slovenia for Nature Protection, RRA Mura Regional Development Agency, (PRA giz) Prleška Development Agency, (DPPVN) Society of bird research and nature conservation, WWF Austria
Flexibility & Adaptability	
Transferability	The project can be easily replicable in the other sections of the river Mura in Slovenia. The project is transferrable to the lowland rivers in Croatia, mainly to the Mura river.

X. Lessons learned

Key lessons	A good knowledge and coordination of the task of each stakeholder is essential for completing the project without serious problems, there has been a good organization and mutual respect between this partners as well as engage in preparation and creation of film, workshops and field visits. This partnership should be farther developed with other environmental projects in Slovenia. Thanks to the project, local community have recognized that nature is important and that EC and national authorities "care about their Mura". So far, it is evaluated that the approach and methodology are successful.

XI. References

Source Type	*Website*
Source Author(s)	
Source Title	BIOMURA LIFE06NAT/SI/000066

Year of publication			
Editor/Publisher			
Source Weblink	www.biomura.si/default.aspx		
Key People		*Name / affiliation*	*Contact details*
	1.	*Dr. Lidija Globevnik/Project manager, Institute for Water of the Republic of Slovenia*	*lidija.globevnik@izvrs.si (00386) 01- 4775 307*
	2.	*Mr Mitja Bricelj / Contact person, Institute for Water of the Republic of Slovenia*	*Uprava@izvrs.si*
	3.	*Katarina Zore / Institute for Water of the Republic of Slovenia*	*Katarina.zore@izvrs.si*

Source Type	*Website*
Source Author(s)	
Source Title	BIOMURA
Year of publication	2011
Editor/Publisher	
Source Weblink	http://www.derreg.eu/content/best-practices/biomura

Source Type	*Website*
Source Author(s)	
Source Title	BIOMURA - Conservation of biodiversity of the Mura river in Slovenia
Year of publication	
Editor/Publisher	
Source Weblink	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3153

Source Type	*Website*
Source Author(s)	
Source Title	Case study: Biomura LIFE06NAT/SI/000066
Year of publication	
Editor/Publisher	
Source Weblink	http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study:Biomura_LIFE06NAT/SI/000066

Source Type	*Project Report*
Source Author(s)	
Source Title	Case study: Biomura LIFE06NAT/SI/000066
Year of publication	
Editor/Publisher	
Source Weblink	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE06_NAT_SI_000066_FTR.pdf

XII. Photos Gallery

Figure 1: New gravel banks, (© Biomura archieve)
http://riverwiki.restorerivers.eu/wiki/index.php?title=File%3ANew_garvel_bars.png

Figure 2: Working on the sidebanks (© Andrej Biro, Mura-VGP d.d.)
http://www.biomura.si/ang/galerija.aspx

Figure 3: Oxbow, dry river bed (© Dr. Lidija Globevnik, IzVRS)
http://www.biomura.si/ang/galerija.aspx