European Commission

NWRM

Natural Water Retention Measures

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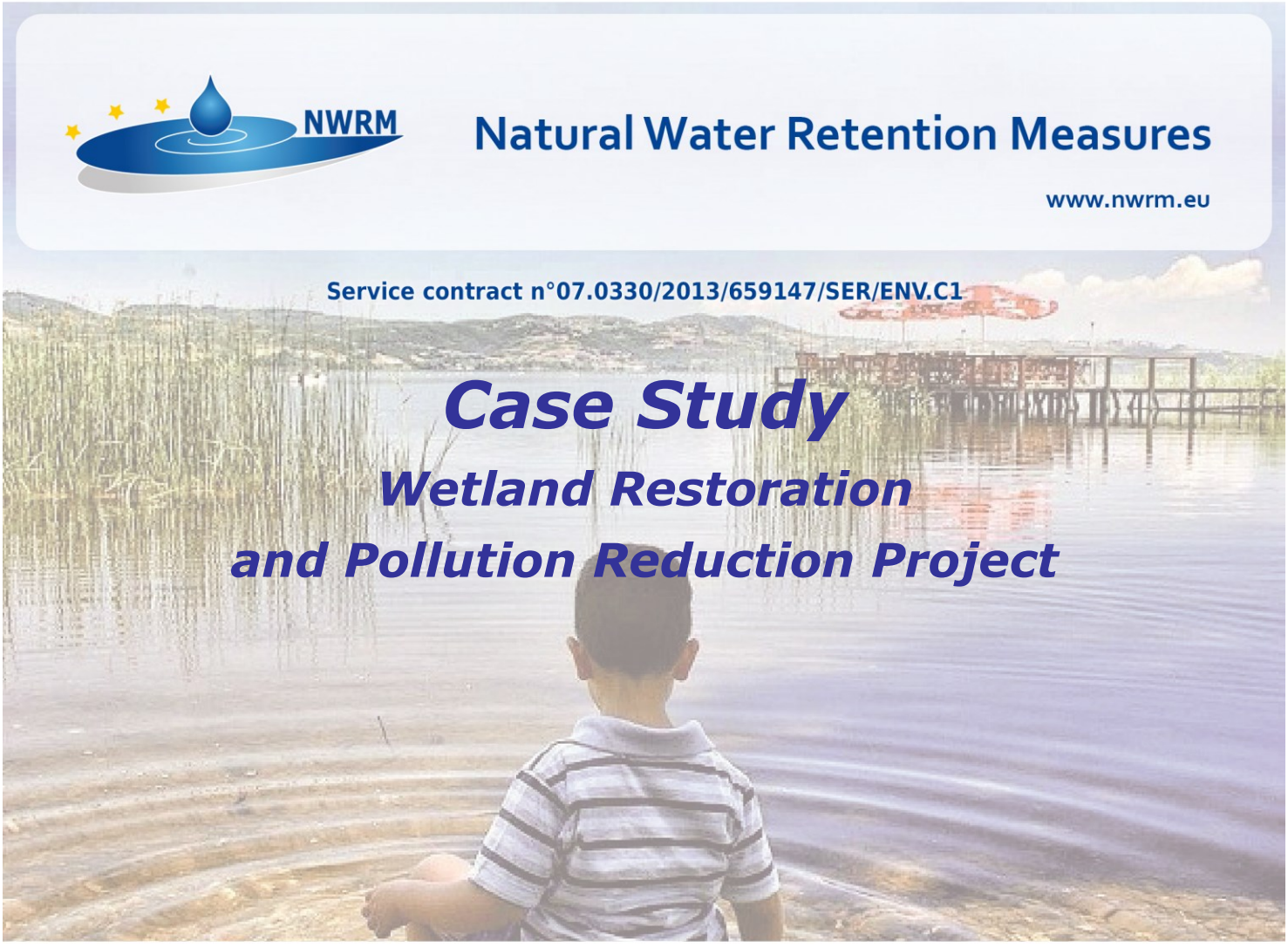
Service contract n°07.0330/2013/659147/SER/ENV.C1

Case Study

Wetland Restoration and Pollution Reduction Project



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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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http://www.nwrm.eu

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I. Basic Information

Application ID	Bulgaria_01			
Application Name	Wetland Restoration and Pollution Reduction Project			
Application Location	Country:	Bulgaria	Country 2:	*N/A*
	NUTS2 Code		*BG32*	
	River Basin District Code		*BG1000*	
	WFD Water Body Code		*BG1DU000R001*	
	Description		*Restoration of 4 035 ha of former wetlands on two project sites – Belene Island (2 280 ha) within the Persina Nature Park and Kalimok/Brushlen (1 755 ha) within the Kalimok/Brushlen Protected Site.*	
Application Site Coordinates	Latitude: Site 1: 43.66 Site 2: 44.03416. *(WGS84)*		Longitude: Site 1: 25.166 Site 2: 4 873 193,297 m. *(WGS84)*	
Target Sector(s)	Primary:	Hydromorphology		
Implemented NWRM(s)	Measure #1:	*N2*		
Application short description	Restoration of two wetlands along Danube River by construction of engineering facilities, including sluices, channels, dykes to protect the adjacent land, as well as access roads. The project aims to enable water flow into former wetlands, provide options for controlled flooding, optimized trapping of nutrient elements, and restoration of biodiversity and fish populations. The environmental effect of the wetlands restoration would be observed through monitoring on water, birds, fish, mammals, reptiles and vegetation. The baseline data on biodiversity is collected within the project framework. The project was carried out in the period 2002 – 2008 by the Ministry of the Environment and Water in Bulgaria and the main donor was the Global Environment Facility (GEF).			

II. Policy context and design targets

Brief description of the problem to be tackled	*Along the Bulgarian bank of the Danube, more than half the area is floodplain—about 1,280 sq. km. Over the years, the wetlands and floodplain have been drained or dyked to create arable land and to reduce malarial mosquito habitats. Now the wetlands area is about 10 percent of its original size at the turn of the century, reducing the capacity of its ecological function—water purification.* *Bulgarian wetlands along the Danube provide essential spawning grounds for numerous species of fish and provide critical winter and feeding habitats for water birds migrating through the northwest shelf along Eurasia to Africa flyways..* *Persina Nature Park (PNP) and Kalimok/Brushlen Protected Site (KBPS)*

	were selected as project sites due to the high value of their biodiversity, the wetland capacity to extract biogenic pollutants and their role for flood prevention.		
What were the primary & secondary targets when designing this application?	Primary target #1:	Natural assimilation (purification) of effluents through dilution, dispersion, and physic-chemical processes	
	Secondary target #1:	Biodiversity and gene-pool conservation in riparian areas	
	Remarks	Project aim: "Create a model for reducing trans-boundary nutrient loads in the Danube and Black Sea basins and to preserve biodiversity in the protected sites through: restoration of wetlands, management plans for protected sites and support to the local people in adopting environmentally friendly economic activities."	
Which specific types of pressures did you aim at mitigating?	Pressure #1:	WFD identified pressure	4.1.1 Physical alteration for flood protection
	Pressure #2:	WFD identified pressure	4.1.2 Physical alteration for agriculture
	Pressure #3:	WFD identified pressure	1.1 Point – Urban waste water
	Pressure #4:	WFD identified pressure	2.2 Diffuse – Agricultural
	Remarks		
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	WFD identified impact	Nutrient pollution
	Impact #2:	WFD identified impact	Altered habitats due to morphological changes
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:	WFD-achievement of good ecological status	Mitigation of nutrient pollution and morphological alterations
	Requirement #2:	WFD-restoring a HMWB	Lower Danube is described as HMWB in DRBMP
	Requirement #3:	WFD-achieving objectives for Protected areas	Natura 2000
	Requirement #4:	Other EU-Directive requirements (Specify)	EU-Directive 79/409/EEC (Birds Directive 1979) EU-Directive 92/43/EEC (Habitats Directive)
	Remarks		
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	RBMP of Danube River District National Wetlands Conservation Plan of Bulgaria National Biodiversity Strategy		

III. Site characteristics

Dominant Land Use type(s)	Dominant land use	Rivers and wetlands
	Secondary land use	Lowland heath (natural, semi-natural)
	Other important land use	Arable land
	Remarks	
Climate zone	cool temperate dry	
Soil type	Flovisols, Gleysols, Vertisols	
Average Slope *Select from the drop-down menu*	very gentle (1-2%)	
Mean Annual Rainfall	600 - 900 mm	
Mean Annual Runoff	150 - 300 mm	
Average Runoff coefficient (or % imperviousness on site)	0 - 0.2	0 - 10%
	No published data. The Mean Annual Runoff in main river Danube at Belene is approximately 6000 m3/s	
Characterization of water quality status (prior to the implementation of the NWRMs)	Danube River (water body BG1DU000R001) is characterized in moderate ecological status according to the monitoring data of WFD compliant quality elements. The biological monitoring (macro invertebrate fauna) vary between 2 and 2-3 (of 5 quality classes).	
Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	*Positive way: Due to the hydrogeological conditions of the sites, parts of the wetlands continued to exist and have a high potential for restoration.*	
	Negative way: Flood risk in the area: dykes all around the island with risk of flood in the arable lands.	

IV. Design & implementation parameters

Project scale	Medium (eg. public park, new development district)	Construction work and soft measures implemented in two protected sites, including one Nature park
Time frame	Date of installation/construction (MM.YYYY)	09.2007
	Expected average lifespan (life expectancy) of the application in years	50
Responsible authority and other stakeholders involved	*Name of responsible authority/ stakeholder*	*Role, responsibilities*
	1. Ministry of Environment and Water of BG	Overall project management and implementation, including subcontracting of studies, technical design and construction works

	2. Persina NP Directorate	Long-term maintenance and monitoring of impacts
	3. Dabube River Basin Directorate	Monitoring of WFD compliant quality elements, integration into RBMP
The application was initiated and financed by	Main financing: GEF / World Bank Co-financing: State budget and PHARE Pre-accession instrument	
What were specific principles that were followed in the design of this application?	Primary goal of the project is connected with the reduction of nutrient pollution by restoration of wetlands and their respective nutrient capture capacity. Besides this goal, the project design follows the objectives related to the biodiversity conservation and the principle of conformity with the management objectives of the protected sites.	
Area (ha)	Number of hectares treated by the NWRM(s).	*4035 (2280+1755)*
	The figure 4035 ha reflects the total area of restored wetlands in the two project sites – Persina and Kalimok-Brushlen. The actual area covered by technical facilities is < 1 ha.	
Design capacity	Capacity of retention of a 40 – 60 days flood annually The technical design of the project for Persina site includes inflow and outlet facilities with the following dimensions: - 3 Inflow sluices 2.0/1.5 m and maximum runoff capacity 17.3 m^3/s. - 1 Outlet facility –double sluice with dimensions 2 x 2.0/1.5 m and max. capacity 34.6 m^3/s. The technical design for Kalimok-Brushlen includes inflow and outlet facilities with the following dimensions: - Inflow sluice with dimensions 2x1.5/1.00 m and max. capacity 18.6 m^3/s - Inflow sluice 2.0/1.5 m and capacity 20.5 m^3/s. - Outlet 2 x2.0/1.5 m and capacity 37.3 m^3/s.	
Reference to existing engineering standards, guidelines and manuals that have been used during the design phase	*Reference*	*URL*
	1. National standards and protocols	
	2. Environmental Assessment	http://iwlearn.net/iw-projects/1123/reports/bulgaria-wetland-environmental-assesment.pdf
	3. EU WFD guidelines	
Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?	Design of infrastructure facilities (dykes, sluices, channels, adjacent roads) was elaborated depending mainly on the topography of the island (for Persina) and the riparian bank and floodplain zone (for Kalimok-Brushlen). Other key factors were the shape and depth profiles of the former wetlands, design of the old dykes, hydraulic parameters of Danube River (flow, water level and seasonal fluctuations) as well as the desired water regime for the wetlands biodiversity.	

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	Runoff control by controlled flooding regime of the restored wetlands.	% of the main river runoff	1-10%
Peak flow rate reduction	No published data or estimation. Taken into account the total runoff of Danube River in peak flow, the impact on flood reduction is limited.	% reduction	< 1%
Impact on groundwater	No relevant data.		
Impact on soil moisture and soil storage capacity	No relevant data.		
Restoring hydraulic connection	Significant role in re-connecting former wetlands.	% restored water regime	80%
Water quality Improvements	NWRM has impacted the overall water quality by nutrient reduction and capture (N, P) and capture of organic pollutants.		
WFD Ecological Status and objectives	Proven positive impact on morphological parameters (connectivity) as well expected positive impact on BQEs – fish fauna. NWRM contributes to the conservation objectives of water-dependant protected areas.		
Reducing flood risks (Floods Directive)	Expected flood risk reduction by options for controlled flooding of the restored wetlands and protection of adjacent agriculture lands.		
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	Improved self-purification and nutrient capture capacity of the river system, thus mitigate the impacts of untreated urban waste waters(UWWT Directive). Direct contribution to the implementation of Bird Directive and Habitat Directive.		
Soil Quality Improvements	No relevant data.		
Other			

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	Biodiversity: Bird numbers of 22 species were found to increase and fish species increased from 2 to 10 in the first test flooding of Belene Island within 2 months. Kalimok marshes also successfully flooded in December 2008. Further gradual improvements expected. Chance for future tourism development in the region, new employment opportunities and economic benefits due to fishery and biomass production as well as for protection of the Danube river basin from nutrient pollution inccreasing and improving the water quality. The project has also introduced a new idea that wetlands are not a necessary evil, making the landscape attractive.		
Financial costs	***Total:***	***9,7 m €***	
	Capital:	*5,48 m €*	*Design and construction*
	Land acquisition and value:		
	Operational:	*0,6 €*	*Management and monitoring*
	Maintenance:		
	Other:	*3,6 m €*	*Protected areas management, capacity building, technical assistance*
Were financial compensations required? What amount?	No financial compensation required. The project received grant for capital costs and one-off soft measures. The long-term maintenance and operation will be ensured by state budget and/or future grant contributions.		
	Total amount of money paid (in €): N/A		
	Compensation schema: N/A		
	Comments / Remarks: N/A		
Economic costs	No income loss estimated by the wetlands restoration. Wetland restoration design physically excluded flooding and adverse impacts on private lands. No unresolved issues remain related to the land and property ownership or access to resources.		
	Additional costs: Administration and management costs – no published data.		
	Other opportunity costs: N/A		
	Comments / Remarks: N/A		
Which link can be made to the ecosystem services approach? *Hint: The actual benefits of improving nature's water storage capacity are*	- Increased eco-tourism potential of the region will generate revenue. - Improved Danube River fishery stocks will enhance fishing opportunities and revenues.		

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.*	- Public awareness of environmental values and benefits will increase the likelihood that future anthropogenic pressure and damage (including pollution) will be reduced. - Business opportunities based on sustainable use of resources from the wetlands. The Project supported initiatives such manufacturing charcoal briquettes from reeds harvested from the restored wetlands. - Improved farming techniques and the development of organic certified crops created potential for increased value of agricultural products and revenue for farmers.

VII. Monitoring & maintenance requirements

Monitoring requirements	Nutrient load reduction: N and P monitoring on annual basis. Biodiversity benefits: Monitoring of the total number of protected species and the quantitative status of target species. A comprehensive environmental monitoring program was developed with the financial support of the PHARE program. A simplified modification of the environmental monitoring program as part of the Persina NP and Kalimok/Brushlen PS management plans was also developed (Program I of the Management Plan).
Maintenance requirements	Maintenance of the dykes, sluices and other hydraulic facilities on annual basis. Operation of the sluices on daily basis in order to ensure appropriate water regime – ensure by Park administration.
What are the administrative costs?	The administrative costs of for establishment of proper site management (including elaboration of MP), capacity building and monitoring are equal to 3.7 m EUR for the period of the Project implementation. The project management costs are equal to 0.6 m EUR.

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. The Project Appraisal included an incremental cost analysis and an analysis of cost-effectiveness for the removal of nutrients.
How cost-effective are NWRM's compared to "traditional / structural" measures?	The Project Appraisal indicated that the Project would be cost-effective in reducing nutrient loads in the Danube River. Total cost-effectiveness ratios were estimated at US$1.3 to US$5.0 per kilogram of nitrogen and US$28.9 to US$46.2 per kilogram of phosphorous removed annually.
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	The low inclination and the plain landscape along lower Danube allow the achievement of relatively large flooded areas with low-head structures. The large mean discharge of lower Danube makes difficult to assess the relative impact of the NWRM due to the scale.
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?	- Administrative difficulties, related to land ownership / statute resulted in project delay. - Difficulties with technical design due to insufficient national expertise in wetlands restoration - Absence of sustainable busines cases for sustainable reed biomass utilization - Not defined target ecosystem status (favorable conservation status) at the project start.
What were the main enabling and success factors?	- Available financing for capital investments - Comittment by the Government and ensured state co-financing - Established local Park administration, responsible for the maintenance and future operation of the NWRM - NGO involvement and support.
Financing	GEF / World Bank – 5,35 m EUR (equivalent) Government of Bulgaria – 2,0 m EUR (equivalent) Municipalities – 0,07 m EUR (equivalent) EU PHARE – 1,5 m EUR Austrian Government – 0,17 m EUR

Flexibility & Adaptability	Adaptation to changing ecological and hydrologic conditions of Danube River can be achieved by flexible operation of the hydraulic facilities (sluices) in order to maintain optimal water regime.
Transferability	Similar restoration works could be designed for other riparian (former) wetlands along medium and large rivers in their lower segments. The first follow-up Project, "Kaikusha", under EU LIFE+ program has been approved and will help develop feasibility studies to restore the Kaikusha Marshes in the Danube River basin.

X. Lessons learned

Key lessons	When plenty of stakeholders are involved, it would be appropriate to provide longer groundwork. 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 large-scale experimentation and studying of nutrient trapping processes. 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)	WB, Sustainable Development Department		
Source Title	Implementation Completion and Results Report (TF-50706 BUL)		
Year of publication	2009		
Editor/Publisher	World Bank / Report No: ICR00001004		
Source Weblink	http://documents.worldbank.org/curated/en/2009/06/10975573/bulgaria-wetlands-restoration-pollution-reduction-project		
Key People		*Name / affiliation*	*Contact details*
	1.	*Anna Gerogieva/ Project Team Leader*	*ageorgieva@worldbank.org*
	2.	*Constantia Lalova/ Project Assistant , Bulgaria; Ministry of Environment and Waters*	*wetlands_ppu@moew.government.bg*
	3.	*Ms. Marietta Stoimenova/ Project Manager, Wetlands International,*	*marietta@techno-link.com*
	4.		

Source Type	*Project Report*
Source Author(s)	

Source Title	Environmental Assessment
Year of publication	2002
Editor/Publisher	Analytical Creative Group/E545
Source Weblink	http://iwlearn.net/iw-projects/1123/reports/bulgaria-wetland-environmental-assesment.pdf

Source Type	*Website*
Source Author(s)	WB, Sustainable Development Department
Source Title	Wetlands Restoration & Pollution Reduction GEF Project
Year of publication	2002-2009
Editor/Publisher	World Bank
Source Weblink	http://www.worldbank.org/projects/P068858/wetlands-restoration-pollution-reduction-gef-project?lang=en

Source Type	*Website*
Source Author(s)	
Source Title	Bulgaria: Wetland Restoration and Pollution Reduction Project - component of Danube/Black Sea Strategic Partnership: Nutrient Reduction Investment Fund
Year of publication	2014 (Last modified)
Editor/Publisher	World Bank
Source Weblink	http://iwlearn.net/iw-projects/1123

XII. Photos Gallery

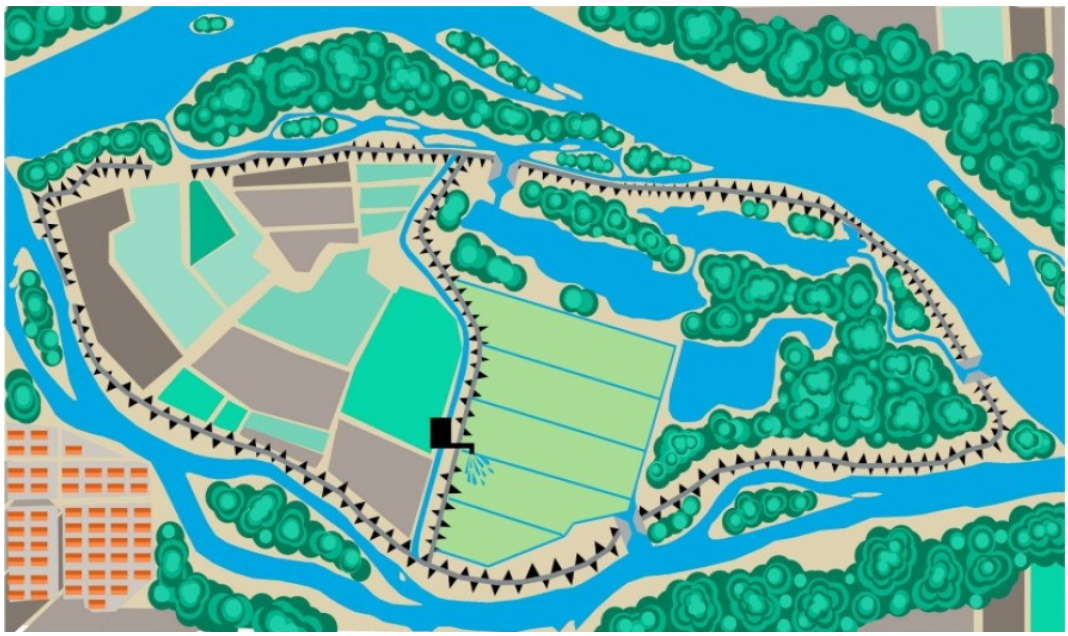

Figure 1 : Belene Island (© Stoyan Nikolov, Stoyan Mihov and Ivan Hristov / WWF 2011 - River ecology)
Source : http://www.restorerivers.eu/Portals/27/Events/IASI/120509%20IASI%20-%20Bulgaria%20-%20VU.pdf