

## Task1: NWRM Case-Study Factsheet



### Status box

**Version:** 1.4

**Date:** 15/04/14

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#### **Background:**

The Case-Study Factsheets will be filled in with information collated on applications of “particular interest”. The CS Factsheets will be an output product able to reflect on a coherent storyline and are mostly targeting, although not being limited to, design practitioners. They are linked of course to the DB via specific queries that extract the information and present it as illustrated in the hereunder document. They contain descriptive info of the specific application (that can of course showcase the implementation of an individual NWRM or o a bundle of them), technical info on the main design parameters and monitoring requirements (to allow the practitioner identify similarities and/or discrepancies as compared to his “candidate” site/environment), quantifiable indicators (especially with regards to the biophysical impacts and economic information, along with possible performance metrics) to help them grasp the range of benefits and costs and the overall performance/effectiveness, lessons learned to highlight the main risks, other outcomes, enabling factors and preconditions.

In the current draft the following elements have been considered:

- Analysis of the design practitioners’ user needs
- Feedback on the NWRM DB (WG PoM, DG ENV, EEA, NWRM Consortium)
- Existing factsheets of similar purpose/target

#### **Main contributions:** *(name of the contributor / commenter)*

- Nick Jarrit (AMEC)
- Martyn Futter (SLU)
- Verena Mattheiss, Pierre Strosser (ACTEON)
- Benoit Fribourg-Blanc, Sonia Siauve (OIEau)
- Alistair McVittie (SRUC)
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## 1. Photo Gallery

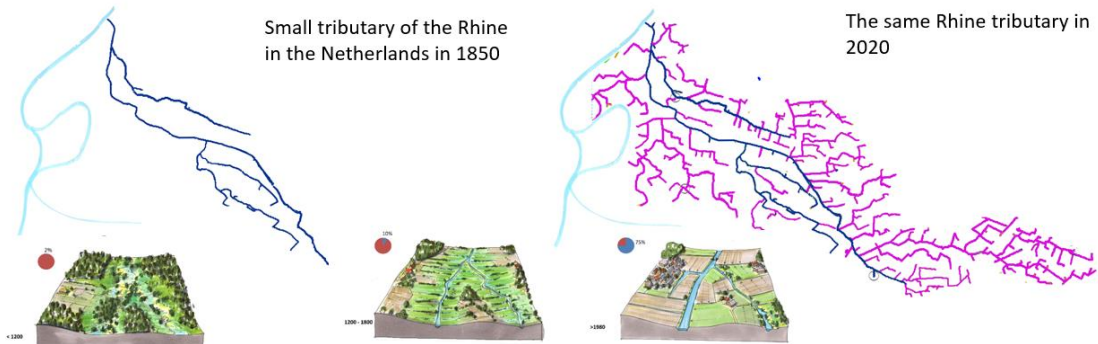


Photo 1 : An example of the enlargement of a small Rhine tributary, driven by agricultural intensification, resulting in higher peak flows and drought problems (source: Bureau Strooming)

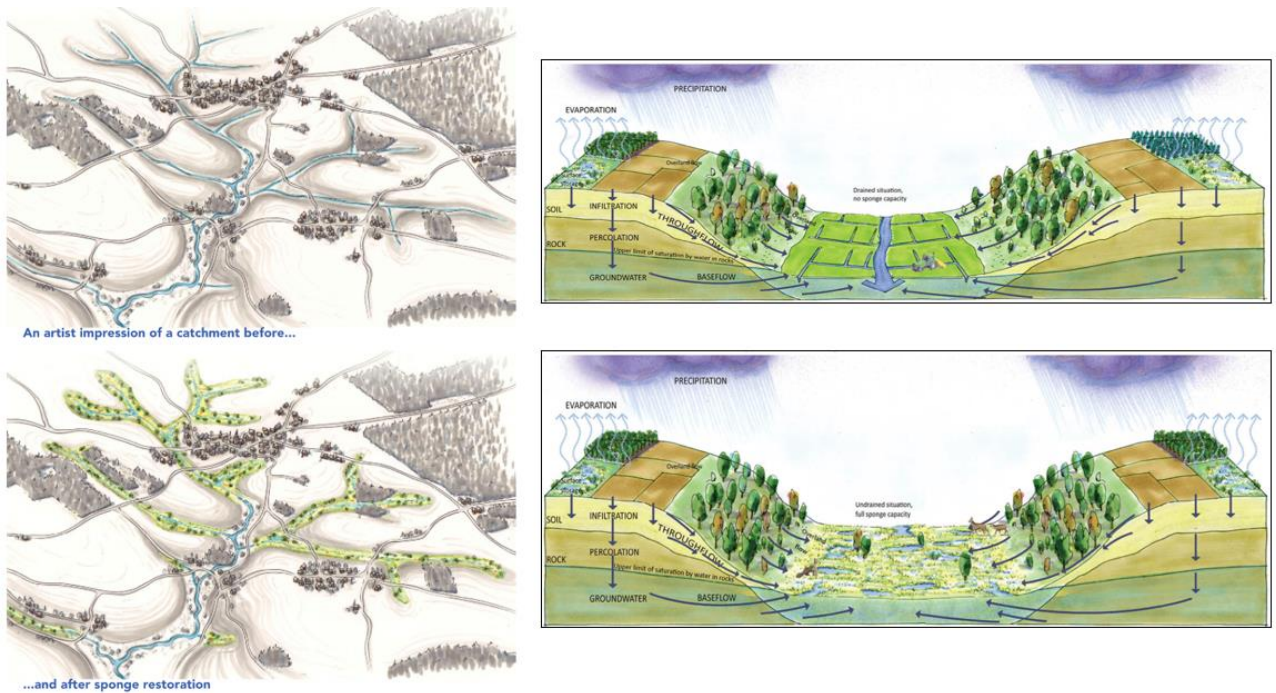


Photo 2: The concept of Natural Water Retention (sponge restoration) in upstream micro-catchment areas of the river Rhine (source Bureau Strooming)



Photo 3,4 and 5: Sponge restoration by removing drainage channels in upstream micro-catchment areas results in immediate hydrological effects of delaying and preserving the water and nutrients in upstream catchment areas. These areas transform in carbon sinks and prevent the water from entering the head stream in a cases of peak flows.



Photo 6 and 7: Recent flooding in the Kyll river. Flooding events in the Eiffel and Ardennes (14 – 15<sup>th</sup> July 2021) showed the need to delay the water in upstream catchment areas before it enters the mainstream. In the Kyll river, 58 % of the upstream catchment area contributed 89 % to the peak discharge downstream in Kordel. Upstream catchment areas contribute more to the peak discharges downstream then one would consider given the size of their catchment area.

## Basic information

Application ID <i>(Country_Numeric, e.g.: Greece_01)</i>	The Netherlands_01		
Application Name <i>(provide a short name)</i>	Wetland International – European Association		
Application Location	Country: <i>(select from list in Annex 1)</i>	Germany	Country 2: <i>In case of transboundary applications</i>
	NUTS2 Code <i>(select from list in Annex 1)</i>	No annex 1 available	
	River Basin District Code <i>(select from list in Annex 1)</i>	River Kyll, Middle Rhine Catchment	
	WFD Water Body Code <i>(select from list in Annex 1)</i>		
	Description <i>(free text, short description of the location)</i>	Kyll river, upstream of Steinebrück, tributary of the Mosel.	
Application Site Coordinates <i>(in ETRS89 or WGS84 the coordinate system)</i>	Latitude: 50.37 °N,	Longitude: 6.42 °E	
Target Sector(s) <i>Possibility to select more than 1 sectors (primary vs. secondary)</i>	Primary:	Nature	
	Secondary:	Agriculture	
Implemented NWRM(s) <i>Possibility to select more than 1 NWRM. Link to NWRM catalogue and NWRM Factsheets, Select from list in Annex 1.</i>	Measure #1:	Social Cost – benefit analyses for rewetting upstream catchment areas in the German Middle Mountains and upscaling them to the Rhine Basin. Rewetting by removing humanly enlarged drainage channels and extended river segments in upstream catchment areas to preserve water near the source and lower peak flows downstream.	
	Measure #2:		
	Measure #3:		
	Measure #4:		
Application short description	Restoration of the natural sponge function of upstream micro-catchments has the potential to let the whole catchment downstream benefit.		

## 2. Policy Context and Design Targets

Brief description of the problem to be tackled	Micro-catchments of big rivers changed dramatically in the last centuries. Marshy, upstream valley parts used to function as “natural sponges”, temporarily storing water from heavy rainfall, before gradually releasing it as small and steady streams. It is important to know that not only rainfall and snow falling in the valley itself was buffered but also precipitation of the much wider, uphill surroundings. Because of this a relatively small patch of wetland on the valley floor
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	had a disproportionately large, regulatory effect. By now, all across Europe these crucially important wetland areas have been drained. The steady flows of water emerging from them changed into strongly pulsating streams, responding almost immediately to changes in rainfall with higher occurrences of both flooding and droughts, on local, regional and (inter)national scale. This already causes problems and without action these will increase because climate change results in more erratic precipitation patterns and thus even more fluctuations in river discharge.		
<p>What were the primary &amp; secondary targets when designing this application?</p> <p><i>Select from the drop-down menu. The possibility for more than one target is provided. Additional info can be given in the "remark" field to address e.g. other targets not included in the list, and give some details</i></p>	Primary target #1:	Self-regulation of water by filtration / storage / accumulation by ecosystems	
	Primary target #2:	Flood control and flood risk mitigation	
	Secondary target #1:	Regulation of hydrological cycle and water flow	
	Secondary target #2:	Natural assimilation (purification) of effluents through dilution, dispersion, and physico-chemical processes	
	Remarks	Carbon storage is another very important target!	
<p>Which specific types of pressures did you aim at mitigating?</p> <p><i>Select the relevant Directive (EU, non-EU) from the drop-down menu and type-in the related pressures. Different types of pressures as identified by EU-Directives (WFD, FD, etc.) are listed in the Annex 2 (I have no annex 2)</i></p>	Pressure #1:	Floods Directive identified pressure	Type in the relevant pressure from the EU-Directives' lists in Annex 2
	Pressure #2:	WFD identified pressure	Type in the relevant pressure from the EU-Directives' lists in Annex 2
	Pressure #3:	Other EU-Directive's identified pressure (specify)	Type in the relevant pressure from the Directives' lists in Annex 2
	Pressure #4:	Choose an item.	Type in the relevant pressure from the Directives' lists in Annex 2
	Remarks		
<p>Which specific types of adverse impacts did you aim at mitigating?</p> <p><i>Select the relevant Directive (EU, non-EU) from the drop-down menu and type-in the related impacts. Different types of adverse impacts as identified by EU-Directives (WFD, FD, etc.) are listed in the Annex 2</i></p>	Impact #1:	Floods Directive identified impact	Flood risk mitigation (and drought prevention) with NBS by delaying and preserving water in upstream catchment areas before it enters the mainstream
	Impact #2:	WFD identified impact	Type in the relevant impact from the Directives' lists in Annex 2
	Impact #3:	Other EU-Directive's identified impact (specify)	Green Deal climate mitigation by sequestration of carbon
	Impact #4:	Choose an item.	Type in the relevant impact from the Directives' lists in Annex 2
	Remarks		
<p>Which EU requirements and EU Directives were aimed at being addressed?</p> <p><i>Select from the drop-down menu the different types of requirements as identified by EU-Directives (WFD, FD, etc.), and provide additional specification.</i></p>	Requirement #1:	Floods Directive-mitigating Flood Risk	Flood risk mitigation (and drought prevention) with NBS by delaying and preserving water in upstream catchment areas before it enters the mainstream

	Requirement #2:	WFD-achievement of good chemical status	<i>Retention of nutrients in upstream catchment areas</i>
	Requirement #3:	Other EU-Directive requirements (Specify)	<i>Green Deal climate mitigation by sequestration of carbon</i>
	Requirement #4:	Choose an item.	<i>Specify</i>
	Remarks		
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	Building a physical, social, Institutional and economic landscape in upstream catchment areas where land use is in balance with its water and soil system		

### 3. Site Characteristics

<b>Dominant Land Use type(s)</b> <i>Select from the drop-down menu with the CORINE LU types and codes. Space of additional comments/remarks is provided</i>	Dominant land use	312
	Secondary land use	231
	Other important land use	112
	Most of the forested areas are drained	
<b>Climate zone</b> <i>Select from the drop-down menu</i>	cool temperate moist	
<b>Soil type</b> <i>Select from the list with the FAO classes in Annex 3</i>	L5704_B321, L5504_B321	
<b>Average Slope</b> <i>Select from the drop-down menu</i>	sloping (5-10%)	
<b>Mean Annual Rainfall</b> <i>Select from the drop-down menu. Values are in mm,</i>	1200 - 1500 mm	
<b>Mean Annual Runoff</b> <i>Select from the drop-down menu. Values are in mm.</i>	450 - 600 mm	
<b>Average Runoff coefficient (or % imperviousness on site)</b> <i>Select from the drop-down menu. Space of additional comments/remarks is provided</i>	> 0.8	Choose an item.
	Precipitation 1207 Potential evapotranspiration 598 Actual evapotranspiration 549 Streamflow 500 Overland flow 403 Lateral flow 13 Percolation to groundwater 280	
<b>Characterization of water quality status (prior to the implementation of the NWRMs)</b> <i>Please link to the WFD water quality parameters (nutrients N,P; organic pollution; chemical pollution, Cu, Zn; saline pollution; TSS; acidification, elevated temperatures; E.coli, Fecal coliforms, etc.)</i>	Concentrations of 0.01 mg l-1 total P and 3.9 mg l-1 total N were measured at Steinebrück station on January 26, 2009 (Rheinland-Pfalz, 2020).	
<b>Comment on any specific site characteristic that influences the effectiveness of the applied</b>	Text <i>Positive way: Removal of drainage in forested areas besides the removal of drainage in pasture areas can influence the effectiveness of</i>	

NWRM(s) in a positive or negative way	<i>the NWRM. Up stream areas are important to retain rainfall and delay it to leave the catchment further downstream</i>
	Text <i>Negative way: The effectiveness can be less positive if land owners are not willing or able to cooperate. There are many landowners in the upstream areas.</i>

#### 4. Design & Implementation Parameters


Project scale <i>Select from the drop-down menu the relevant scale and specify.</i>	Large (e.g. watershed, city, entire water system)	<i>It focusses on small upstream catchment areas, the effect though has influences downstream on the river itself and eventually on the Rhine scale</i>
Time frame <i>NWRM(s) Installation date and lifespan</i>	Date of installation/construction (MM.YYYY)	<i>No pilot is started, research project</i>
	Expected average lifespan (life expectancy) of the application in years	<i>decades</i>
Responsible authority and other stakeholders involved <i>List of all + Descriptive Text of roles, responsibilities, etc.</i>	<i>Name of responsible authority/ stakeholder</i>	<i>Role, responsibilities</i>
	1. European Union	Green Deal, WFD, Flood directive
	2. River commissions	Wetland restoration is an opportunity for better water quality, flood prevention and WFD implementation in the Rhine and the Mosel.
	3. Nature organizations and environmental NGO's	The Sponge Project partners set up studies about wetland restoration. The natural park in the research area would benefit from a lift in biodiversity, water quality and a more regular water flow. (Biodiversity (main), water quality, hydrological cycle)
	4. Districts and Municipalities	Related to wetland restoration is the municipal responsibility of administering land-use planning. Furthermore, wetland restoration is of interest to the municipalities, since they are responsible for e.g. attenuating natural disasters like floods, clean drinking water, water abstraction, water legislation, land cultivation and in general for implementing (environmental) laws (Auge, 2020; Haschke, 1998; Vidaurre et al, 2016) (hazard regulation (flood/drought), water

		quality, hydrological cycle, food and fibre provision)	
	5. Farmers/landowners	Wetland restoration requires land that is still mostly in the hands of private owners. This is where a competing interest is identified. However, wetland restoration also brings advantages for this stakeholder, through ESs such as tourism, flood prevention. Also financial land compensation can benefit them. (Food and fibre production (main), tourism, flood prevention)	
The application was initiated and financed by	Initiated by Wetland International Europe, Financed by the JRC		
What were specific principles that were followed in the design of this application? <i>Examples provided: water-sensitivity, aesthetic benefit, functionality, usability, adaptability, integrative planning, integration of demands, acceptable costs, impact on public perception &amp; acceptability, etc.</i>	Nature Based Solution, technically simple with low costs for implementation, restore natural processes in the upstream catchment areas for the beneficial of the upstream residence and downstream residence		
Area (ha)	Number of hectares treated by the NWRM(s). <i>e.g. It could be the upstream drainage area in case of retention ponds</i>	47,6 km <sup>2</sup>	
	Text to specify <i>(caution to differentiate between treated or target area vs. the application area occupied by the NWRM). In some cases treated area may not have a meaning (e.g. green walls). In other cases you may have a measure applied in an upstream forest but with the purpose of mitigate an impact in a downstream area</i>	<i>The catchment of Steinebrück is 47,6 km<sup>2</sup>, the NWRM has a direct effect upstream of Steinebrück. There are significant effects downstream when the NWRM could be upscaled.</i>	
Design capacity <i>Briefly describe the design capacity(ies) of the implemented NWRM(s), e.g. maximum volume of runoff water that can be retained per time step, maximum pollutant removal capacity in mg/l, etc.</i>	Design capacity is delaying 20 – 30 % of the peak discharge in Steinebrück when 38 % of the available sponge sites in the catchment are restored.		
Reference to existing engineering standards, guidelines and manuals that have been used during the design phase <i>References: active links to specific documents or</i>	<i>Reference</i>		<i>URL</i>
	1.	<a href="https://europe.wetlands.org/publications/sponge-restoration/">https://europe.wetlands.org/publications/sponge-restoration/</a>	
	2.	<a href="https://europe.wetlands.org/publications/wetland-restoration-impact-on-streamflow-rhine-basin/">https://europe.wetlands.org/publications/wetland-restoration-impact-on-streamflow-rhine-basin/</a>	
	3.		
	4.		



<i>website(s), and if not available online, provided them on the collaborate platform in the library section and URL here</i>	5.		
<p>Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?</p> <p><i>List and describe specific factors that either guided or constrained the selection and the design (e.g. land use constraints, cooperation issues with land owners, specific legislation, existing funding for specific priorities, private investments, legal obligations - EU requirements, etc.)</i></p>	Size of the catchment, location of the catchment, land use		

## 5. Biophysical Impacts

Impact category (short name)	Impact description (Text, approx. 200 words)	Impact quantification (specifying units)	
<p>Select from the <b>drop-down menu</b> below:</p> 	<p>The response of streamflow to extreme rainfall events was attenuated, as peaks were lower but broader after wetland restoration. In this way, the maximum annual peak discharge decreased by an average of 12 – 24% in the three micro-catchments of the Rohrbach and Lewertbach streams. At the larger scale of the Kylldal catchment, with its outlet at Steinebrück, however, maximum annual winter peak flows were 10% lower after wetland restoration at 38% of the available sites. The delay in flow after extreme precipitation events also causes a higher baseflow recession after wet periods. The change to lower peak discharges and higher water availability in drier periods can be viewed as a positive impact on the hydrological regime of these areas. Nutrient exports from the Kylldal catchment were low for the reference scenario, which can be due to the limited area of pasture in the catchment, the use of filter strips to reduce stream nutrient loading and the relatively low amounts of manure applied on pasture. Wetland restoration did have a positive impact on the nutrient exports from the project areas and the Kylldal catchment as a whole. Nitrogen and phosphorous loads and concentrations were reduced by up to 67% in the project areas. The effect at catchment scale was somewhat lower, but still substantial, with simulated reductions in the order of 20%. Based on this study, wetland restoration can be viewed as a viable</p>	<p>Parameter value; units</p> <p><i>and/or</i></p>	<p>% change in parameter value as compared to the state prior to the implementation of the NWRM(s)</p>

	ecosystem-based solution to improve the hydrological services of catchments. The largest gains for both streamflow and nutrient exports can be expected in agricultural areas that now experience considerable fast runoff into the drainage and main channels.		
Runoff attenuation / control	<i>Describe the impact on runoff reduction and/or control</i>		
Peak flow rate reduction	<i>Describe the impact on the peak flow rate</i>	10 – 30 % reduction with 38% of the area with sponge restoration	
Impact on groundwater	<i>Describe the impact on the groundwater, e.g. increased groundwater level, decreased depth to groundwater, increased infiltration/percolation and recharge</i>		
Impact on soil moisture and soil storage capacity	<i>Describe the impact on the soil moisture and soil retention capacity</i>		
Restoring hydraulic connection	<i>Describe the impact on river connectivity, surface-groundwater body interaction, etc.</i>		
Water quality Improvements	<i>Has the NWRM impacted the overall water quality? In which way? Please provide some explanatory text. Provide details on specific pollutants (N, P, TSS, Cu, Zn, E.coli, Fecal coliforms, etc.)</i>	20 % reduction of N peak discharge	
WFD Ecological Status and objectives	<i>Describe any impacts related to the improvement of the WFD ecological status, and/or environmental (the biophysical related ones) objectives</i>		
Reducing flood risks (Floods Directive)	<i>Describe any impacts related to the flood risk reduction and the objectives (the biophysical related ones) of the Floods Directive</i>	10 – 30 % reduction with 38% of the area with sponge restoration	
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	<i>Describe any other biophysical impacts related to pressures and objectives (the biophysical related ones) of other EU Directives, e.g. Habitats Directive, UWWT Directive, etc.</i>	EU Habitats Directive priority habitat. Wetland restoration also contributes to the goals of the EU Birds Directive (such as Breeding and feeding grounds for songbirds, waders and waterfowl), the goals of greening the Common Agricultural Policy and the Trans-European Network for	

		Green Infrastructure TEN-G.	
Soil Quality Improvements	Has the NWRM impacted the overall soil quality? In which way? Please provide some explanatory text. Provide details on specific pollutants (N, P, soil carbon/organic matter, physical properties-bulk density, etc.)		
Other	Please described any other biophysical impacts not captured in the predefined list		

## 6. Socio-Economic Information

<p>What are the benefits and co-benefits of NWRMs in this application? Refer to the direct and ancillary benefits (including societal impacts). These are positive outcomes (or welfare gains) closely related to the implementation of the measure, through causal relationship.</p> <p>What are the direct benefits of the effective implementation of the measure? Please specify the kind of direct benefits of the effective implementation of the measure.</p> <p>What are the additional indirect benefits of the effective implementation of the measure?</p>	<p><b>Social cost-benefit analysis for sponge restoration in Rhine basin (185.000 km<sup>2</sup>)</b> + Steinebruck micro-catchment (4800 ha of which 2,3% undrained)</p>																		
<p><b>Financial costs (estimation)</b> Value in € (Total + possible breakdown) Suggested categories for the breakdown of costs: capital, land acquisition and value, operational, maintenance</p>	<table border="1"> <thead> <tr> <th>Total:</th> <th>Value in €</th> <th>Text / Specify</th> </tr> </thead> <tbody> <tr> <td>Capital:</td> <td>546.000 €</td> <td>Per hectare / per decade</td> </tr> <tr> <td>Land acquisition and value:</td> <td>180.000 €</td> <td>Per hectare / per decade</td> </tr> <tr> <td>Operational:</td> <td>25.000 €</td> <td>Per hectare / per decade</td> </tr> <tr> <td>Maintenance:</td> <td>91.000 €</td> <td>Per hectare / per decade</td> </tr> <tr> <td>Other: monitoring</td> <td>125.000</td> <td>Per hectare / per decade</td> </tr> </tbody> </table>	Total:	Value in €	Text / Specify	Capital:	546.000 €	Per hectare / per decade	Land acquisition and value:	180.000 €	Per hectare / per decade	Operational:	25.000 €	Per hectare / per decade	Maintenance:	91.000 €	Per hectare / per decade	Other: monitoring	125.000	Per hectare / per decade
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<p>Were financial compensations required? What amount? Describe if financial compensations were required, the compensation scheme (including units, beneficiaries, etc.), the total amount of money paid in €</p>	<p>Was financial compensation required: Yes /No</p> <p>Total amount of money paid (in €):</p> <p>Compensation schema:</p> <p>Comments / Remarks: Research project! Not yet implemented</p>																		

<p><b>Economic costs</b>  <i>What is the actual income loss (in some economic sectors) due to the implementation of the measure? Please specify the kind of income loss. What are the additional costs that stem from the implementation of the measure and a result of it? Please specify the kind of additional costs. Are there any specific costs the measure brought about which cannot be assimilated to the above-mentioned categories? Please specify the kind of other opportunity costs.</i></p>	<p><i>Actual income loss:</i></p> <hr/> <p><i>Additional costs:</i></p> <hr/> <p><i>Other opportunity costs:</i></p> <hr/> <p><i>Comments / Remarks: Research project! Not yet implemented</i></p>												
<p><b>Which link can be made to the ecosystem services approach?</b>  <i>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:</i></p> <ul style="list-style-type: none"> <li>- Freshwater for drinking.</li> <li>- Water provision to deliver water services to the economy both for drinking and non-drinking purposes.</li> <li>- Water security (reliability of supply and resilience to drought).</li> <li>- Health security (control of waterborne diseases).</li> <li>- Flood security and protection.</li> <li>- Storm surge protection.</li> <li>- Biomass production.</li> <li>- Amenities (associated to habitat protection): fish and plants, tourism, recreation, and others.</li> <li>- Benefits of improved coastal water quality and ecological status for a sustainable commercial production of shellfish</li> </ul>	<div style="border: 1px solid black; padding: 10px; background-color: #f0f0f0;"> <table border="0" style="width: 100%; text-align: center;"> <thead> <tr> <th style="border: 1px solid black; border-radius: 10px; padding: 5px;">Provisioning Services</th> <th style="border: 1px solid black; border-radius: 10px; padding: 5px;">Regulating Services</th> <th style="border: 1px solid black; border-radius: 10px; padding: 5px;">Cultural Services</th> <th style="border: 1px solid black; border-radius: 10px; padding: 5px;">Supporting Services</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Tangible materials that can directly be used:</td> <td style="padding: 5px;">How processes, resources and properties are regulated:</td> <td style="padding: 5px;">Non material benefits:</td> <td style="padding: 5px;">Fundamental to sustain the other services:</td> </tr> <tr> <td style="padding: 5px;">           - Dairy and fibre production            0 Timber production         </td> <td style="padding: 5px;">           + Water purification            + Water retention (flood control and drought control)            + Carbon Sequestration         </td> <td style="padding: 5px;">           + Recreational activities         </td> <td style="padding: 5px;">           + Maintenance of the hydrological cycle            + Biodiversity         </td> </tr> </tbody> </table> <p style="font-size: small; margin-top: 10px;">Figure 11 – The end result of the Ecosystem Service trade-offs that wetland restoration brings about. A plus sign shows a positive effect on this ES due to wetland restoration. A minus sign shows a negative effect and a zero shows that wetland restoration has a negligible effect on this ES.</p> </div>	Provisioning Services	Regulating Services	Cultural Services	Supporting Services	Tangible materials that can directly be used:	How processes, resources and properties are regulated:	Non material benefits:	Fundamental to sustain the other services:	- Dairy and fibre production 0 Timber production	+ Water purification + Water retention (flood control and drought control) + Carbon Sequestration	+ Recreational activities	+ Maintenance of the hydrological cycle + Biodiversity
Provisioning Services	Regulating Services	Cultural Services	Supporting Services										
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- Dairy and fibre production 0 Timber production	+ Water purification + Water retention (flood control and drought control) + Carbon Sequestration	+ Recreational activities	+ Maintenance of the hydrological cycle + Biodiversity										

<i>with human health and welfare values.</i>	
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## 7. Monitoring & Maintenance requirements

<b>Monitoring requirements</b> <i>Describe monitoring requirements: which parameters, how often, how many monitoring sites, location of these sites, etc.</i>	Research project! Not yet implemented
<b>Maintenance requirements</b> <i>Describe the maintenance scheme: requirements and intensity of, frequency of, responsible authorities, share or tasks, etc.</i>	Research project! Not yet implemented
<b>What are the administrative costs?</b> <i>These are expenses linked to information, monitoring and enforcement.</i> <i>What were/are the costs of monitoring the operation of the measure(s) or any other cost incurred by the administration of the measure(s)? Please specify on what the money has/is been spent.</i>	Research project! Not yet implemented

## 8. Performance metrics and Assessment criteria

<b>Which assessment methods and practices are used for assessing the biophysical impacts?</b> <i>Please describe e.g.: comparison to, paired watershed, pre vs. post, etc.</i>	Pre- vs post, business as usual vs NWRM
<b>Which methods are used to assess costs, benefits and cost-effectiveness of measures?</b>	Teeb methodology
<b>How cost-effective are NWRM's compared to "traditional / structural" measures?</b>	Benefit / cost ratio is estimated on 2.4. Every 1 euro spend provides 2,4 Euro's benefits
<b>How do (if applicable) specific basin characteristics influence the effectiveness of measures?</b> <i>This field is important and needs a good deal of thought. It seems that the success of NWRM may be very dependent on the biophysical regime in which they are implemented. It would be really helpful for any potential practitioner to have enough information to evaluate whether or not the biophysical preconditions for successful NWRM implementation exist before addressing the much more complex socioeconomic challenges.</i>	They influence them enormously. NWRM in this case can be implemented in upstream river catchments in middle mountain areas in the whole of Europe with low sloping areas  <a href="https://media.stroming.nl/sponges/">https://media.stroming.nl/sponges/</a>
<b>What is the standard time delay for measuring the effects of the measures?</b> <i>NWRM are multi-purpose and multi benefit measures but like other green infrastructures and on the contrary to grey infrastructure, their effects are not always immediately visible and need a certain time lapse to be fully operational and effective (free text allowed to enter the anticipated delay and the effective deviation from this finally found)</i>	Hydrological effect are immediate, ecological effects takes 3 – 5 years

## 9. Main risks, implications, enabling factors and preconditions

<b>What were the main implementation barriers?</b> <i>Were there delays in the implementation? Please describe the main implementation barriers (e.g. attitude of decision makers, stakeholders, public perception -e.g. NWRM perceived as part of a problem, existing technical standards, physical constraints, conflicts of interests, legal restrictions, lack of expert knowledge and/or tools, limited financial resources and financing potential, wide dissemination of the project, etc.)</i>	<ol style="list-style-type: none"> <li>1. Lack of vision and governance in upstream catchment areas at local, regional, national and European governments.</li> <li>2. The lack of perspective for landowners in upstream areas</li> </ol>
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<b>What were the main enabling and success factors?</b> <i>Please describe the main enabling and success factors (e.g. positive attitude of decision makers, willing stakeholders, positive public perception, solid governance and adequate institutional structures, fruitful public consultation, regulatory support, existing expert knowledge and/or tools, availability of financial resources and financing potential, etc.)</i>	The benefits from investing in upstream catchment areas for reducing peak flows, increasing low flows and carbon sequestration.
<b>Financing</b> <i>What were the main funding sources, and what amount? Where different incentives and financial instruments used? Which ones? Has private investments been encouraged – how?</i>	Research project! Not yet implemented
<b>Flexibility &amp; Adaptability</b> <i>Is the current implementation flexible and adaptable to changing baseline conditions? What does the adaptation of these measures requires? What costs could be foreseen?</i>	Research project! Not yet implemented
<b>Transferability</b> <i>When and where can a similar application be proposed, assessed and selected? What are the necessary preconditions?</i>	Research project! Not yet implemented

## 10. Lessons learned

Key lessons	<i>Natural sponges in lower mountain ranges of European river basins are with favourable characteristics are a nature-based solution with the potential to be effective for attenuating floods and droughts and meeting several EU policy objectives related to climate change, water and nature.</i>
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## 11. References

Note: To enter more references and key people please add rows as necessary

<b>Source Type</b> <i>Select from the drop-down menu</i>	Choose an item.		
<b>Source Author(s)</b> <i>Provide the Name of the author(s)</i>	Text		
<b>Source Title</b> <i>Provide the Title of the reference</i>	Text		
<b>Year of publication</b> <i>Provide the year in the format (YYYY)</i>	Value		
<b>Editor/Publisher</b> <i>e.g. Journal/Volume/Issue</i>	Text		
<b>Source Weblink</b> <i>Direct weblink(s) of the reference</i>	Weblink		
<b>Key People</b> <i>List names, affiliation and contact details of key people who have communicated important information presented in this factsheet</i>		<i>Name / affiliation</i>	<i>Contact details</i>
	1.		
	2.		
	3.		
	4.		