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)
- Gonzalo Delacamara (IMDEA)
- George Karavokiros, Ayis Iacovides (IACO)

NWRM Case-Study Factsheet

Note:
- Fill in the grey cells with the requested information

1. Photo Gallery

Pleas provide below 2-3 photos form the case study. Explanatory legend and source are mandatory.

Figure 1: WWTP with RBs Mojkovac (source: Limnos)

Figure 2: Reed beds in September 2019 (source: Limnos)

2. Basic information

<table>
<tr><td>Application ID
(Country_Numeric, e.g.: Greece_01)</td><td colspan="4">*Montenegro*</td></tr>
<tr><td>Application Name
(provide a short name)</td><td colspan="4">**Sludge Drying Reed Beds in Mojkovac**</td></tr>
<tr><td rowspan="5">Application Location</td><td>Country:
(select from list in Annex 1)</td><td>Montenegro</td><td>Country 2:
In case of transboundary applications</td><td></td></tr>
<tr><td colspan="2">NUTS2 Code *(select from list in Annex 1)*</td><td colspan="2"></td></tr>
<tr><td colspan="2">River Basin District Code *(select from list in Annex 1)*</td><td colspan="2">*TARA*</td></tr>
<tr><td colspan="2">WFD Water Body Code *(select from list in Annex 1)*</td><td colspan="2">*For the moment we only have the WFD GWsB in the Annex 1, since the SWBs provides a long list. One can leave out this matching for the moment, just provide the correct coordinates below and can do all matchings afterwards.*</td></tr>
<tr><td colspan="2">Description
(free text, short description of the location)</td><td colspan="2">*The Municipality of Mojkovac is situated in the northern part of Montenegro, in Durmitor area. Mojkovac town is located on the left bank of the Tara river upstream the Tara River Gorge. The municipality of Mojkovac covers an area of 367 km2 and is one of the smallest municipalities in Montenegro having the population of 8.622 inhabitants. The town Mojkovac is located at an altitude of 853 m (municipality 600 – 2.253 m).*</td></tr>
<tr><td>Application Site Coordinates
(in ETRS89 or WGS84 the coordinate system)</td><td colspan="2">Latitude:
- ETRS89 or WGS84? Specify: 42.96044</td><td colspan="2">Longitude:
- ETRS89 or WGS84? Specify: 19.5833</td></tr>
<tr><td rowspan="2">Target Sector(s)
Possibility to select more than 1 sectors (primary vs. secondary)</td><td>Primary:</td><td colspan="3">Urban</td></tr>
<tr><td>Secondary:</td><td colspan="3">Agriculture</td></tr>
<tr><td rowspan="4">Implemented NWRM(s)
Possibility to select more than 1 NWRM. Link to NWRM catalogue and NWRM Factsheets, Select from list in Annex 1.</td><td>Measure #1:</td><td colspan="3">Sludge drying reed beds</td></tr>
<tr><td>Measure #2:</td><td colspan="3"></td></tr>
<tr><td>Measure #3:</td><td colspan="3"></td></tr>
<tr><td>Measure #4:</td><td colspan="3"></td></tr>
<tr><td>Application short description</td><td colspan="4">Sludge drying reed beds (RBs) enable sewage sludge dewatering, stabilization, mineralization and hygenization. They are an</td></tr>
</table>

	alternative to mechanical treatment (e.g. belt presses, centrifuges). In the process, sludge is spread on a filter media (substrate) of an open bed after which drainage and evaporation takes place. Planted RBs enable effective dewatering of sewage sludge and produce a mineralized product that can be used as a soil amendment in agriculture and other uses.

3. 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* With the construction and expansion of municipal infrastructure (sewage and wastewater treatment plants), the amount of sludge produced by the wastewater treatment plants is increasing. Sewage sludge is the main waste by-product of wastewater treatment. The excess sludge presents biomass and microorganisms that contain organic matter, nutrients and persistent pollutants that originate from wastewater. RBs were constructed as a cost-effective solution to solve problems of sludge treatment, storage, and disposal in Municipality of Mojkovac. In 2004 the town of Mojkovac was equipped with a biological wastewater treatment plant with an installed capacity of 5.200 P.E. Until RBs were constructed in 2016, the generated sludge was mismanaged and mainly stored on the location of WWTP with the risk of being washed to the Tara River in high intensity rainfall events. The installed filter press was never in operation due to high operational costs. The municipality had no sustainable concept to manage the accumulating sludge or possibility to dispose it safely. Dumping of increasing volumes of sewage sludge on local landfill was not possible; also, in the entire country of Montenegro there is no incineration plant. Limited financial resources and sludge disposal problems were the key drivers of search for alternative sludge treatment solutions.

What were the primary & secondary targets when designing this application? *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*	Primary target #1:	Choose an item.
	Primary target #2:	Choose an item.
	Secondary target #1:	Choose an item.
	Secondary target #2:	Choose an item.
	Remarks	sludge dewatering, stabilization, mineralization and hygenization

Which specific types of pressures did you aim at mitigating? *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*	Pressure #1:	WFD identified pressure	wastewater and sludge
	Pressure #2:	Choose an item.	*Type in the relevant pressure from the EU-Directives' lists in Annex 2*
	Pressure #3:	Choose an item.	*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		

Which specific types of adverse impacts did you aim at mitigating? *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*	Impact #1:	WFD identified impact	chemical and physico-chemical quality elements
	Impact #2:	Choose an item.	*Type in the relevant impact from the Directives' lists in Annex 2*
	Impact #3:	Choose an item.	*Type in the relevant impact from the Directives' lists in Annex 2*
	Impact #4:	Choose an item.	*Type in the relevant impact from the Directives' lists in Annex 2*
	Remarks		
Which EU requirements and EU Directives were aimed at being addressed? *Select from the drop-down menu the different types of requirements as identified by EU-Directives (WFD, FD, etc.), and provide additional specification.*	Requirement #1:	WFD-mitigation of significant pressure	Sludge from WWTP
	Requirement #2:	Choose an item.	*Specify*
	Requirement #3:	Choose an item.	*Specify*
	Requirement #4:	Choose an item.	*Specify*
	Remarks		
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	In order to shape the adequate response and holistic sludge management on local/national level, the following steps are recommended: ▪ Sludge treatment and disposition agenda building with all relevant stakeholders (authorities and engaged sectors) agreed; ▪ Overview of possible alternative solutions aligned with sludge quantities accumulation (national scale); ▪ Selection and support to acceptable/recommended options (legal, organizational, awareness, planning); delegated key responsible authorities; ▪ Implementation (stimulated with public funds); ▪ Evaluation/monitoring of implemented solutions (responsible authorities).		

4. Site Characteristics

Dominant Land Use type(s) *Select from the drop-down menu with the CORINE LU types and codes. Space of additional comments/remarks is provided*	Dominant land use	*3.1.1*
	Secondary land use	*3.2.1*
	Other important land use	*3.1.3*
	Remarks Based on data from Corine Land Cover database, 31 % of the total area falls under agricultural land (pastures, complex cultivation patterns, land principally occupied by agriculture with significant areas of natural vegetation, and natural grasslands). 65 % of area is covered with forest (broad-leaved forest, coniferous forest, mixed forest, transitional woodland-shrub, and sparsely vegetated areas) and only 0,9 % is urban area (continuous and discontinuous).	
Climate zone *Select from the drop-down menu*	cool temperate dry	
Soil type	*Type in the relevant soil type (FAO class) from the list in Annex 3*	

Select from the list with the FAO classes in Annex 3	Rendzina and distric cambisole	
Average Slope *Select from the drop-down menu*	nearly level (0-1%)	
Mean Annual Rainfall *Select from the drop-down menu. Values are in mm,*	1500 - 1800 mm	
Mean Annual Runoff *Select from the drop-down menu. Values are in mm.*	> 900 mm	
Average Runoff coefficient (or % imperviousness on site) *Select from the drop-down menu. Space of additional comments/remarks is provided*	Choose an item.	Choose an item.
	Remarks	
Characterization of water quality status (prior to the implementation of the NWRMs) *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.)*		
Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	Positive impact: The efficiency of the system is influenced by climate, which positively affects the sludge drying rate.	
	Negative way: In winter the load on the system needs to be adjusted and dosing regime changed.	

5. Design & Implementation Parameters

Project scale *Select from the drop-down menu the relevant scale and specify.*	Large (e.g. watershed, city, entire water system)	Sludge from WWTP with capacity of 5.200 P.E for Mojkovac municipality
Time frame *NWRM(s) Installation date and lifespan*	Date of installation/construction (MM.YYYY)	2014-2016
	Expected average lifespan (life expectancy) of the application in years	At least 30 years
Responsible authority and other stakeholders involved *List of all + Descriptive Text of roles, responsibilities, etc.*	*Name of responsible authority/ stakeholder*	*Role, responsibilities*
	1. Ministry of Sustainable Development and Tourism of Montenegro	Project initiator
	2. Government of the Republic of Slovenia	Provision of funds / donor
	3. United Nations Industrial Development Organization	Procurement and project implementation
	4. Municipality of Mojkovac	WWTP Owner
	5. Public utility	WWTP Operator
The application was initiated and financed by	Ministry of Sustainable Development and Tourism of Montenegro, UNIDO; Government of the Republic of Slovenia	

<table>
<tr><td>What were specific principles that were followed in the design of this application?
Examples provided: water-sensitivity, aesthetic benefit, functionality, usability, adaptability, integrative planning, integration of demands, acceptable costs, impact on public perception & acceptability, etc.</td><td colspan="3">Treatment efficiency, long-term biosolids accumulation and storage, potential of biosolids reuse, acceptable operational costs, functionality, usability, aesthetic benefit, impact on public perception & acceptability</td></tr>
<tr><td rowspan="2">Area (ha)</td><td colspan="2">Number of hectares treated by the NWRM(s).
e.g. It could be the upstream drainage area in case of retention ponds</td><td></td></tr>
<tr><td colspan="2">Text to specify
(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</td><td></td></tr>
<tr><td>Design capacity
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.</td><td colspan="3">2.500 PE</td></tr>
<tr><td rowspan="6">Reference to existing engineering standards, guidelines and manuals that have been used during the design phase
References: active links to specific documents or website(s), and if not available online, provided them on the collaborate platform in the library section and URL here</td><td colspan="2">Reference</td><td>URL</td></tr>
<tr><td>1.</td><td></td><td></td></tr>
<tr><td>2.</td><td></td><td></td></tr>
<tr><td>3.</td><td></td><td></td></tr>
<tr><td>4.</td><td></td><td></td></tr>
<tr><td>5.</td><td></td><td></td></tr>
<tr><td>Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?
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.)</td><td colspan="3">The biggest limitation in the application of reed bed technology is area required for installation. It is a land-intensive technology. As there was enough space on the property owned by the municipality, the technology was applied without additional problems (land acquisition or through time-consuming administrative processes).</td></tr>
</table>

6. 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 *and/or*	% change in parameter value as compared to the state prior to the implementation of the NWRM(s)
Runoff attenuation / control	/		
Peak flow rate reduction	*RBs in Mojkovac can in theory retain 324 m3/day during rainfall event, which is more what a 4 hours rainfall event would bring. Thus, they contribute to flood efficient drainage of the area.*	324 m3/day	
Impact on groundwater	*The system has no direct impact on groundwater because the beds are sealed with waterproof membrane.*		
Impact on soil moisture and soil storage capacity	/		
Restoring hydraulic connection	/		
Water quality Improvements	*Negative effects of municipal wastewater runoff on water quality is reduced.*		
WFD Ecological Status and objectives	/		
Reducing flood risks (Floods Directive)	/		
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	/		
Soil Quality Improvements	*Application of natural dewatered sludge from RBs to the soil can be a source of beneficial nutrients (N, P) for agriculture, but only after laboratory analyses confirm the material is suitable and applies all local (legislative) restrictions and conditions.*	*Produced around 1.000 tons of biosolids, which can be used as soil amendment.*	
Greenhous gas emissions	*In RBs system the organic matter is decomposed by various microbial reactions. This process generates gases such as CO_2 and CH_4 emitting to the atmosphere although emitted, when compared to energy demanding systems RBs produce less. The comparison between the two carbon footprints from transportation between RBs and mechanical dewatering shows that the RBs has 4 times lower impact.*	*Carbon footprint of sludge transportation for 20 years: 12.008 kgCO_2 / 20Y*	

7. Socio-Economic Information

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.* *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.*	The technology enables a long-term and sustainable storage of sludge with low operating and maintenance costs. It can completely replace dehydration which currently represents significant (operating) cost on existing wastewater treatment plants.

<table>
<tr><td rowspan="1">What are the additional indirect benefits of the effective implementation of the measure?</td><td colspan="3">With this technology different types of sewage sludge can be treated. Sludge is stored in the reed beds normally between 8 to 10 years. Due to parallel operation of physical (drying) and biological processes (mineralisation) the treatment results in significant sludge volume reduction.

The end result of the process is a compost-like material that can be reused as fertilizer in agriculture, cover layer for landfills or construction material.</td></tr>
<tr><td rowspan="5">Financial costs
Value in € (Total + possible breakdown)
Suggested categories for the breakdown of costs: capital, land acquisition and value, operational, maintenance</td><td>Total:</td><td></td><td>investment</td></tr>
<tr><td>Capital:</td><td>193.000 €</td><td>Project documentation, construction, operation staff training, dissemination</td></tr>
<tr><td>Land acquisition and value:</td><td>0 €</td><td>Land owned by the Municipality.</td></tr>
<tr><td>Operational and Maintenance:</td><td>5.400 EUR/year</td><td>Labor costs
Electricity consumption costs
Monitoring costs
Maintenance costs of mechanical equipment
Replacement costs and repairs
Sludge disposal – biosolids reuse</td></tr>
<tr><td>Other:</td><td>0 €</td><td></td></tr>
<tr><td rowspan="4">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 €</td><td colspan="3">Was financial compensation required: Yes /No
No, it was 100 % grant capital cost.</td></tr>
<tr><td colspan="3">Total amount of money paid (in €):</td></tr>
<tr><td colspan="3">Compensation schema:</td></tr>
<tr><td colspan="3">Comments / Remarks:</td></tr>
<tr><td rowspan="4">Economic costs
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.</td><td colspan="3">Actual income loss:</td></tr>
<tr><td colspan="3">Additional costs:</td></tr>
<tr><td colspan="3">Other opportunity costs:</td></tr>
<tr><td colspan="3">Comments / Remarks: There is no economic cost.</td></tr>
<tr><td>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).</td><td colspan="3">- Protection of water resources
- Health security (control of waterborne diseases).
- Biomass production
- Nutrient circulation
- Soil formation
- Erosion control
- Gases regulation
- Shelter</td></tr>
</table>

- *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.*	

8. Monitoring & Maintenance requirements

Monitoring requirements *Describe monitoring requirements: which parameters, how often, how many monitoring sites, location of these sites, etc.*	Management of sewage sludge in Montenegro is defined by a Regulation on detailed conditions, which have to be met for municipal sewage sludge, quantities, volumes, frequency and methods of analyses of municipal sewage sludge for approved purposes, and conditions that have to be met for soil that will receive the sludge ("Official Gazette of Montenegro, No. 89/09 from 31.12.2009). The regulation was adopted on the basis of European sewage sludge Directive 86/278/EEC It is recommended to analyze sludge once per year. For biosolids reuse sludge must comply with national regulations (limit values for soil to which sludge is applied and limit values for sludge, Maximum annual load of heavy metals to land, on ten years basis). Sludge analyses include: heavy metals, organic matter, organic pollutants (PAH, PCBs), percentage of dry matter, pathogens. Soil analysis include: heavy metals (cadmium, copper, nickel, lead, zinc, mercury and chromium).
Maintenance requirements *Describe the maintenance scheme: requirements and intensity of, frequency of, responsible authorities, share or tasks, etc.*	Regular maintenance works of RBs consists of: • Daily check of plants; • Daily check if the sludge is drying out; • Weekly control of the water level in the filter layer; • Weekly check of external parts of drainage pipes and manholes; • Cleaning od pipes and manholes as needed; • RBs management and operation; • Service of the pumps; • Monitoring;

	• Landscaping; • Final disposal.
What are the administrative costs? *These are expenses linked to information, monitoring and enforcement.* *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.*	

9. Performance metrics and Assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts? *Please describe e.g.: comparison to, paired watershed, pre vs. post, etc.*	
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	"Unit value transfer method" for assessing direct and indirect benefits of RBs in Mojkovac had been used.
How cost-effective are NWRM's compared to "traditional / structural" measures?	Capital expenditures in RBs are app. 30 % higher than in mechanical dewatering, but on the other hand, operational expenditures of RBs are much lower. RBs with biosolids use can reduce operational cost for 73 % per year compared to mechanical dewatering and incineration. The investment in RBs may be more expensive, but maintenance is incomparably cheaper.
How do (if applicable) specific basin characteristics influence the effectiveness of measures? *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.*	Basin characteristics do not influence the effectiveness of measures.
What is the standard time delay for measuring the effects of the measures? *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)*	Efficiency can begin to be measured after the first growing season as the plants grow.

10. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers? *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 pf 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.)*	Lack of financial resources Lack of trust and confidence in new technology Lack of experience with RBs (construction, operation)

What were the main enabling and success factors? *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.)*	Ministry of Sustainable Development and Tourism of Montenegro together with Municipality of Mojkovac had overcome financial barrier by obtaining a grant (100% non-refundable donation from UNIDO). Municipal support of the technology was crucial for the start of the project. A close collaboration between the municipality, ministry, public utility and technology experts resulted in the successful construction of RBs. After the completion of the construction, and during the commissioning/start-up phase, there was a strong emphasis on dissemination (video, project presentation) to promote general RBs adoption. RBs in Mojkovac demonstrate good practice, which may stimulate frequent implementation of the technology, but challenges remain still. In Mojkovac, a considerable effort was invested so the contractor would understand the RBs technology and system functioning. Construction mistakes were prevented with the implementation of technological supervision. Training and knowhow transfer were provided for the staff in charge of the O&M of the WWTP Mojkovac. Training included theoretical and onsite practical training. During the first year of operation, contractor stayed in close contact with operating staff in order to observe plant growth and optimize operation. In Mojkovac, RBs competed with mechanical dewatering, but won support of decision-makers due to low operational costs and longevity of the solution for sludge storage.
Financing *What were the main funding sources, and what amount? Where different incentives and financial instruments used? Which ones? Has private investments been encouraged – how?*	Government of the Republic of Slovenia through UNIDO – 100 % grant
Flexibility & Adaptability *Is the current implementation flexible and adaptable to changing baseline conditions? What does the adaptation of these measures requires? What costs could be foreseen?*	*The solution can adjust depending on the load and the location of the WWTP and this will not incur in increase of cost or duration. Technology is resilient.*
Transferability *When and where can a similar application be proposed, assessed and selected? What are the necessary preconditions?*	Reed beds are land intensive technology. Limiting factors usually are: RBs area requirements, spatial planning process and its administrative risks, land cost and legislation.

	Generally, technology is more likely to be adopted and implemented by smaller settlements and cities where the price of land is low or land is already owned by state or municipality.

11. Lessons learned

Key lessons	• A coordinated effort of multiple levels of government is required to successfully implement RBs; • Authorities need financial, technical and operational resources to implement the project; • Authorities need technical assistance on the technology (experts); • Learning from pilot projects and dissemination is essential and builds trust in technology, creates a wondow of opportunity for change (from mechanical dewatering (standard practice) to alternative - RBs); • Construction of RBs is simple and not demanding, but the contractor must fully understand the system – functionally and structurally; • At first glance, the solution seems simple, but it is important that it is properly designed; required experience in RBs design; • Long-term storage of sludge in RBs postpones the question of final disposal/reuse od biosolids for ten years or more. • There is a need for better institutional and cross-sectoral cooperation with regards to biosolids use; • Biosolids use must be placed in the wider context of country environmental/investment strategies and goals; • RBs offer the opportunity to develop a business model - management costs are much lower than with conventional technologies.

12. References

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

Source Type *Select from the drop-down menu*	*Project Report*
Source Author(s) *Provide the Name of the author(s)*	*Limnos Ltd.* *Alenka Mubi Zalaznik* *Gregor Plestenjak* *Anja Potokar* *Ursa Brodnik* *Tea Erjavec Haložan* *Martin Vrhovšek*

Source Title *Provide the Tile of the reference*	CONSTRUCTION OF A REED BED FILTER FOR THE TREATMENT OF SLUDGE IN MOJKOVAC, MONTENEGRO FINAL REPORT		
Year of publication *Provide the year in the format (YYYY)*	June 2016		
Editor/Publisher *e.g. Journal/Volume/Issue*	UNIDO		
Source Weblink *Direct weblink(s) of the reference*	https://www.limnos.si/projekti/mojkovac-crna-gora/		
Key People *List names, affiliation and contact details of key people who have communicated important information presented in this factsheet*		*Name / affiliation*	*Contact details*
	1.	*Alenka Mubi Zalaznik*	*alenka@limnos.si*
	2.		
	3.		
	4.		

Source Type *Select from the drop-down menu*	*Interview*		
Source Author(s) *Provide the Name of the author(s)*	*Limnos Ltd.* *Anja Potokar* *Gregor Plestenjak*		
Source Title *Provide the Tile of the reference*	Interviews with public utility GRADAC d.o.o., Municipality of Mojkovac, Ministry of Sustainable Development and Tourism of Montenegro,		
Year of publication *Provide the year in the format (YYYY)*			
Editor/Publisher *e.g. Journal/Volume/Issue*			
Source Weblink *Direct weblink(s) of the reference*			
Key People *List names, affiliation and contact details of key people who have communicated important information presented in this factsheet*		*Name / affiliation*	*Contact details*
	1.	*Alenka Mubi Zalaznik*	*alenka@limnos.si*
	2.		
	3.		
	4.		