4. Cross-cutting solutions for European significant water management issues (12-15 p)

Kommenterede [EK1]: Name "cross-cutting solutions" may need to be reconsidered

Kommenterede [EK2R1]: Integrated solutions for SWMI may be better?

Contents

Key messages

- *A combination of key messages from the four sub-sections could be presented here or in a final concluding subsection on cross-cutting/integrated solutions*

4.1. Introduction

Kommenterede [EK3]: Note from Peter: A consultant is currently working on the December 2018 reporting of the progress in implementing of measures. The results will probably first be available in Autumn – and I have in the editing phase to include key messages from the study.

In the second river basin management plans (RBMPs), Member States reported on the status of implementation of the first programmes of measures (PoM). In the vast majority of river basin districts (84%) and Member States, only some measures of the first PoM could be completed. The lack of finance and unexpected planning delays were the main obstacles to the implementation, along with missing mechanisms for implementing measures (e.g. national regulations not yet adopted) and governance issues (EC, 2019).[i]

This report has so far given an overview of water management issues (Briefings) which are significant at EU scale and which need to be tackled to further progress in achieving the WFD environmental objectives. In this part of the report, certain types of solutions are discussed which are of strategic relevance at EU and national level, and can play a major role in supporting and accelerating the implementation of WFD measures.

The WFD PoM are made of basic measures (minimum requirements based on existing legislation) and supplementary measures. Many water challenges described in the European significant water management issues in this report can be addressed through **better implementation of the extensive legislative framework** on water in place (basic measures). For example, the Urban Waste Water Treatment Directive aims to reduce pollution from point sources, while the Sewage Sludge, the Nitrates or the Plant Protection Products Directives aim to reduce pressures from diffuse sources, especially from agriculture.

At the same time, European significant water management issues can be tackled by further enhancing the **integration of water policy objectives into other policy** areas such as the CAP, the Cohesion and Structural Funds, and policies on renewable energy and transport. The following sections discuss management solutions in the form of strategic mechanisms for measures implementation, funding of measures across different policies and promotion of measures which are able to deliver multiple benefits and thus help tackle more than one significant water management issue.

Kommenterede [JV4]: To discuss with Peter:
At present, this section's focus is on European strategies and their goals;
Is it useful to include also national strategies in this section, like blue belt etc? (see end of 4.2). If so, which are important?;
To avoid duplication with section on multi-benefit measures: would it be useful to merge these two sections?
Ecosystem service based management doesn't fit well in this section;
Conclusions (key messages) should probably be listed in Introduction chapter;
For me, the outcome of these sections is not really clear

4.2. High-level strategies for measures implementation (UBA)

Key messages

- *Strategies on a European level can help to improve integrated management solutions*
- *Even though a number of water related legislations needs to be considered within WFD, synergistic effects of integrated planning and implementation of measures are not sufficiently considered*
- *National strategies …*

The development of high-level strategies or action plans at EU or national scale helps set priorities and accelerate the implementation of measures to meet WFD objectives. Such strategies or action plans can directly target issues promoted by the WFD, e.g. river continuity, or aim to implement other policies, e.g. on nature conservation, whose objectives are (indirectly) supporting WFD goals.

On a European scale, a number of Directives, Regulations, or Strategies tackle measures to protect aquatic ecosystems. The Water Framework Directive (WFD) forms an umbrella for integrated water management considering other water-related Directives with synergistic effects in implementation of multi-benefit measures in particular (see section **Fejl! Henvisningskilde ikke fundet.**). These Directives are for example the Floods Directive (2007/60/EC), the Marine Strategy Framework Directive (2008/56/EC) and their respective programmes of measures but also the Habitats Directive with the national habitat conservation plans (EU 1992).

So far, there is limited harmonization between the measures of the above-mentioned legislation and the PoM under the WFD. More effective coordination is needed in the planning and implementation of measures across different policies on water and the marine environment, nature and biodiversity given their close links for the protection of Europe's ecosystems and their services.

European wide strategies on environmental management and actions increasingly include integrated approaches aiming for the protection and enhancement of ecosystems, their services but also human health and their expectations. Those strategies include measures or actions as well as solutions, which could have effects on the European significant water management issues (SWMI).

The **Green Deal** by the European Commission is a roadmap until 2050 to primarily boost the efficient use of resources by moving to a clean, circular economy, and restore biodiversity and cut pollution (EC 2019a). Under consideration of the identified European SWMIs within this report, some actions formulated in the Green Deal are highly relevant to improving the implementation of effective measures. The goals of the **Farm to Fork Strategy** until 2030 are to reduce the use and risk of pesticides by 50%, to reduce nutrient losses by 50% and the use of fertilizer by 20%, to reduce the use of antimicrobials by 50% and to increase the amount of organic farming to 25% (EC, 2020b). Furthermore, a review of the **Biodiversity Strategy** and the **Climate Adaption Strategy** were listed. In addition, a zero pollution action plan for water, air and soil, **a chemicals strategy for sustainability**, and a **circular economy action plan** will be developed in the next two years (EC, 2019).

The water-related goals of the **new Biodiversity Strategy for 2030** (EC, 2020a) include restoring at least 25,000 km of rivers into free-flowing rivers by 2030 through the removal of primarily obsolete barriers and the restoration of floodplains and wetlands. A mapping of the connectivity of 12 million kilometres globally shows, that only 37% of the longer rivers are free-flowing, and in densely populated areas, this result could be much higher (Grill, et al., 2019). Furthermore, according to the new Biodiversity Strategy, Member State authorities should review water abstraction and impoundment permits to implement ecological flows in order to achieve good status or potential of all surface waters and good status of all groundwater by 2027, and the Commission will provide technical support to Member States on their measures by 2023.

The **7th Environmental Action Program (EAP)** to 2020 aims to protect, conserve and enhance the Union's natural capital, to turn the Union into a resource-efficient, green, and competitive low-carbon economy, and to safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing (EC

2013b). The EAP included a commitment to speed up the delivery of the objectives of the Biodiversity Strategy and the Blueprint to safeguard Europe's water resources in line with the WFD in particular (EC 2012). The 8th EAP is currently being developed.

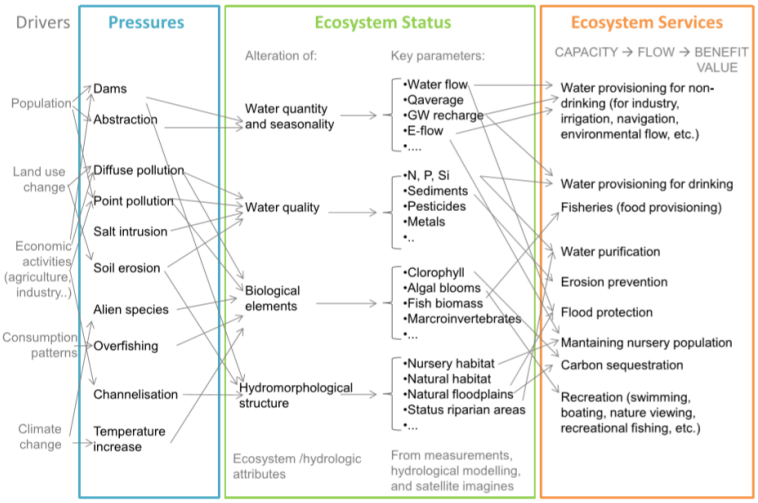
The EU-wide **Green Infrastructure Strategy** (EC 2013a) tackles land use impacts which threaten water quality and quantity as well as water flow in terms of increasing water scarcity and flood risks. The Strategy includes rivers and floodplains as important elements and aims to reconnect existing natural areas. Based on this, Natural Water Retention Measures should be developed to manage the land-use impacts as well as aquatic systems in a more integrated way (see section 4.5).

The **ecosystem service based management** is a tool to reach a more intersectoral implementation of measures. The focus is on the full array of the ecosystem, their services and link to human, like the provision of high-quality drinking water, the reduction of flood risks or recreation rather than the focus to reach environmental objectives of specific Directives. Grizzetti et al. (2016) developed an integrated assessment framework of aquatic ecosystems and their relation to ecosystem services (Figure 1). The pressures and alterations of this framework are comparable to the described SWMIs, and the ecosystem services show the benefit values especially for human. According to Hornung et al. (2019), ecosystem based management allows an integrated evaluation of the implemented measures in multiple stressed aquatic ecosystems.

Kommenterede [JV5]: This is more a concept rather an integrated management approach. It needs to be discussed, if it fits here in this section

Kommenterede [EK6R5]: I propose to delete the text and the figure on the EBM of Grizzetti.

Figure 1 Integrated Assessment Framework for ecosystem service based management



Source: (Grizzetti, et al., 2016), *no copyright*.

On a **national level**, a number of different strategies have been developed to tackle specific water management issues. This include… (blue belt, Germany; Strategies promoting free fish migration and river continuity e.g. Benelux treaty, strategies for the Rhine and Danube basins)

Kommenterede [JV7]: It needs discussion whether to include national strategies or not.

4.3. Strategies of sectors in support of sustainable water management (Ecologic, Ulf)

Key messages

- *We need to ensure that economic sectors, such as agriculture, energy and transport, adopt management practices that can keep water ecosystems healthy and resilient.*

- *Several sustainable sectoral strategies already exist which promote the growth of particular economic sectors and, at the same time, provide a roadmap for reducing the pressures and impacts of the sector's activities on water bodies.*
- *Sometimes sustainable management solutions are not yet mandatory for the entire sector on the national level, but they can be used as blueprint for rolling out sustainable action plans.*

In the EU, water bodies are used for a variety of economic activities. These include among others navigation for trade and transportation, water abstraction for human consumption, agricultural and industrial processes, creation of hydropower facilities for energy generation and aquaculture sites. From the assessment of status, pressures and impacts on European waters (EEA, 2018)[ii], it is evident that the driving forces behind the achievement or non-achievement of good status are activities in economic sectors such as agriculture, energy or transport. Recent policy reviews (Rouillard et al., 2016) have shown that there is still much scope to further mainstream environmental policy actions into sectors such as agriculture, energy and transport to reduce the driving forces behind aquatic biodiversity loss.

From an integrated water resources management approach which is at the heart of the Water Framework Directive, the status of water resources in terms of quality and quantity should be guaranteed across all stages of the water cycle and for all socio-economic activities. Therefore, we need to ensure that economic sectors, such as agriculture, energy and transport, also adopt management practices that can keep water ecosystems healthy and resilient. Managing water in a green economy means using water in a sustainable way in all sectors and ensuring that ecosystems have both the quantity and the quality of water needed to function (EEA, 2018).

Indeed, principles of sustainable water management are already being introduced in sectors which have traditionally regarded water as an infinite resource. In this respect, the introduction of the Water Framework Directive has played an important role.

Mainstreaming of sustainability practices into relevant sectors can be set up in different ways. Political institutions can encourage the integration of sustainability of business practices by specific regulations. As water authorities adopt an integrated water resources management approach with sustainability principles, private actors and businesses can make use of institutional expertise and regulation to achieve best practices of sustainability. This top-down learning process enables firms towards more sustainable business practices through the use of supportive policy and economic tools.

Box 1: Mainstreaming of sustainability practices into relevant sectors in Finland

In Finland, to prevent eutrophication, the Water Protection Program sets quantitative water protection targets for primary sectors including agriculture, industry and municipalities. This is possible because decision-making is both concentrated and decentralised. Nationally, the Ministry of Agriculture and Forestry sets guidelines on hydropower, flood protection, water abstraction and other water management sectors. The concentration of competences helps promote sustainability as a horizontal principle across water-related activities. Locally, municipalities are responsible for local water management as they own local water infrastructures. This enables them to successfully implement national regulation. The model is successful due to its comprehensiveness, as agriculture, industry and other activities need to comply with ecological standards of water ecosystems[iii]

In the following, several good practice examples illustrate how priority setting for sustainable management solutions can work in singular water-related sectors. Several sustainable sectoral strategies already exist which promote the growth of a particular economic sector and, at the same time, provide a roadmap for reducing the pressures and impacts of the sector's activities on water bodies.

Agriculture represents one of the most water-intensive sectors. Sustainable agriculture strategies are highly needed. If new water saving irrigation practices could be coupled with adequate water tariffs and state support, farmers would be incentivised to save water and reduce pressure on its ecosystems. In this way, private action can contribute to a more sustainable agricultural sector as well. Farming activities impact on water management also through indirect ways. Pesticides have become essential for agriculture, and by Directive 128/2009/EC, Member States have to develop National Action Plans to couple pesticide use with preservation of drinking water and aquatic ecosystems. Measures would be complementary to the Water Framework Directive. For one thing, they would buffer against the risk of off-site pollution, drain-flows and run-offs. Other provisions would include a lower use of pesticides in areas close to surface waters and groundwater infiltration hotspots.

Box 2a: Sustainable agriculture strategies in Spain

In Spain, irrigated agriculture alone takes up 75% of national water consumption. Its 2001 National Irrigation Plan and 2006 Shock Plan have addressed the issue of water scarcity by reducing total irrigation demand. A more efficient use of water has been brought about through resource-saving technologies and increasing reliance of groundwater.[iv] While a lot more needs to be done, the model shows that agriculture can benefit from new tools and techniques such as drop irrigation to couple environmental and economic sustainability.

Box 3b: Restriction of pesticides use in Belgium and farming programme in the UK

Belgium sets out different measures to integrate pesticides with sustainable water management. One measure focuses on restrictions in buffer zones, which are set at 2 to 30 meters depending on the size of the water and extent of land use. The United Kingdom implements a catchment sensitive farming programme. The scheme investigates impacts of agricultural practices, relevance of applied measures and draws out best practices in the sector.[v]

Mining further affects water management. It can lead to soil erosion, groundwater and surface water chemical alteration, disrupted flows and related loss of biodiversity. Its impact on water resources can be addressed through a variety of measurers. First, smart resource management is possible. Excess water can be retreated and reused. Second, the chemical impact of mining can be minimised. Reagents and chemicals with low environmental impacts can be preferred. Techniques to remove liquid particles or suspended solids such as absorption or nanofiltration also fall under this category. Finally, action on ecosystems directly can be envisaged. For groundwater, this implies barriers and drainage systems to effectively protect ecosystems.[vi] More generally, these measures constitute the bulk of Best Available Techniques (BAT) to be implemented by the extractive industry. Intervention and principles are laid out in the EU Directive on the Management of Waste from Extractive Industries 2006/21/EC, which obliges firms to issue an extractive waste management plan (EWMP) in their licensing and permit applications.

Hydropower is another crucial sector in the water management domain. Impacts of hydropower include altered flows of water bodies, disruption of river continuity and degradation of ecosystems. Considering that hydropower is a mature technology for power generation, it is likely that the number of hydropower facilities will rise to attain the EU renewable energy targets of 32% in final energy consumption by 2030 (based on the revised Renewable Energy Directive of 2018). To counterbalance this tendency, a number of large-scale strategies for more sustainable hydropower are being pushed forward.

Box 4: Sustainable hydropower strategies in Sweden, Switzerland and the Danube region

Sweden has approved a new national plan to revise hydropower licenses by sustainability criteria. An Industry Fund has been envisaged for mitigation measures to help utilities embrace the transition. Switzerland has set up mitigation targets for 2030 directly for the hydropower sector. The sources of funding in Switzerland is as an electricity surcharge to finance mitigation measures. On the large international river

Danube, the Danube Basin Plan encompasses principles for sustainable hydropower development along the river.[vii]

Another relevant sector in the water management domain is **navigation**. Sustainable navigation strategies are being introduced on the EU, national and even regional level. These call for sustainable navigation across inland waters through a variety of crosscutting criteria and measures.

Box 5: Sustainable navigation cases

Germany approved the "Blue Ribbon" programme, by which a system of environmentally sustainable waterways is being drawn. Secondary waterways are barely used for transportation purposes anymore. Commercial transport is entirely placed on the primary network, while these secondary waterways have been made the object of a series of good ecological status measures, particularly renaturalisation and flood prevention. At the same time, the Blue Ribbon programme targets the development of water-based tourism and leisure activities on the water body level. This is coupled with specific funding for biodiversity and ecosystemic restoration measures.[viii] Another good example of sustainable navigation initiatives comes from the Danube. Here the most important activities on sustainable navigation are the maintenance of existing waterways and the development of future infrastructure in compliance with standards of good water status and biodiversity among others.

Aquaculture constitutes another sector by which sustainability plans can entail ecological balance and biodiversity preservation for water bodies on several levels.

Box 6: Sustainable aquaculture strategies in Spain and Scotland

In Spain, specific sites of aquaculture have been made complementary to specific ecosystemic mechanisms in natural parks and protected areas. For instance, fish farms sites in the protected coastal marshland of Doñana were designed to restore the damage produced in original wetland areas by previous land-use. Specifically, the Doñana ecosystem provides food and water for thousands of birds during moulting time, breeding season and post-breeding migration, as well as during particularly dry interannual periods.[ix] The logic behind is that aquaculture sites not only facilitate production, but they also serve other ecosystem services. These include nutrient absorption, regular water flow and as previously mentioned provision of habitat for bird species. This creates synergies between wildlife conservation targets and production. Other than national regulation, sometimes it is the aquaculture industry itself to render its business practices more sustainable. In Scotland, the Scottish Salmon Producers' Organisation has approved a code of good practice to couple production with health and sustainability aspects. The code is audited by independent actors, which ensures compliance with reliable sustainability standards.[x]

All in all, different economic sectors have different priorities when it comes to water management. However, pressures on availability and quality of water resources have pushed public and private actors to revise their strategies in the light of sustainability. Most change appears to be on a State, top-down regulation level. Where adequate incentives are provided, private initiatives also exist. The exchange of best practices should be encouraged at a local and international level to enhance efficiency of water use and ecological standards. Both institutional and private actors need to be given the right expertise, funding and resources to attain water restoration and preservation targets. With mounting pressures of climate change and lower availability of water resources, multiple sectors and countries are engaging in the promotion of sustainability as a cross-cutting issue. Further combination of multiple policy objectives stemming from the Water Framework Directive, the Common Agricultural Policy and the Energy & Climate Package among others is needed for the sustainable transition in water-related sectors at the European level.

4.4. Funding of measures (Ecologic, Eleftheria)

Kommenterede [EK8]: PKR: I am uncertain if aspects of cross-compliance could be added as a funding aspects.

Kommenterede [EK9R8]: I decided not to include cross-compliance in the first draft – to be discussed

I have included though reference to EAFRD and rural development programmes

I suggest to wait for the advanced draft of the Water & Agriculture report and check for its content on funding WFD measures via agricultural mechanisms.

Kommenterede [EK10R8]: Suggested paragraph from Peter on CAP, not used yet in text:

- Reforms of the CAP have resulted in a general decoupling of agricultural subsidies from production and the implementation of a cross-compliance mechanism, whereby farmers must comply with a set of statutory management requirements, including those that relate to water management. A range of other measures for the improvement of water quality have also been suggested in the EU CAP and national agricultural policies and include the improvement of manure storage, the use of cover crops, riparian buffer strips, and wetland restoration. Implementation of these agri-environmental measures as part of national Good Agricultural Environmental Practice programmes could play a key role in addressing pressures from agricultural activities and an opportunity to further strengthen water protection.

Key messages

- *The implementation success of EU water policy is highly dependent on using financial instruments in other sectoral policies, or "water-mainstreaming".*
- *There is need to explore in-depth and effectively communicate further policy synergies which can be used to increase the scope of funding for WFD measures.*
- *Public funds alone will not be sufficient to support the large number of measures needed for the achievement of WFD goals. Thus, alternative innovative financing mechanisms, e.g. including the participation of industry, are needed and some have already been set up in European countries.*

Measures to tackle key pressures and impacts, which lead to failure of achieving the WFD objectives, can only be carried out with sufficient funding. Adequate financing of WFD measures is as essential for fulfilling the goals of the Directive as administrative and technical capacity, scientific knowledge and political willingness. Funding obstacles have been identified as the most common reason for delaying or not completing the implementation of supplementary measures in the first Programmes of Measures (PoM) as well as one of the key reasons causing delay or non-completion of basic measures at EU level (EC, 2019).[xi]

The sources of funding for WFD measures are a combination of EU, national, regional and municipal funds, direct financing by sectors and the general public as consumers. For financing the costs of measures in the RBMPs, the WFD relies to a large extent on the **recovery of the costs of water services** (WFD Article 9), especially via the water prices charged. Box 7 presents the example of the "water cent" in Germany which is an additional charge levied on drinking water and used to fund pollution reduction measures in agriculture.

Box 7 "Water cent" in Germany

Several German federal states have introduced the so-called "water cent" as an additional charge to the drinking water price to the consumers. The first federal state which introduced the "water-cent" did so already in the late 1980s, while several other states followed after the adoption of the WFD in 2000.[xii] The objective of this instrument is, on the one hand, to encourage the conservation of precious water resources.[xiii] On the other hand, the collected surcharges have been mainly used to compensate farmers for reducing the use of nitrogen and pesticides in order to reduce the pollution levels of key drinking water sources. In at least one state, however, plans have been announced to use the revenue from the "water cent" (whose charge to the consumer has recently been increased) also for flood protection measures.[xiv]

Concerning EU funding sources, Carvalho et al. (2019)[xv] note that the **WFD does not have its own specific EU funding for implementation**, but it is integrated into the budget of the EU LIFE financing instrument for environment and climate. LIFE funding amounts to €3.4 billion for the period 2014–2020, which can be compared to EU Regional Funds and the CAP of €350 billion and €290 billion respectively. As a result of this vast difference in EU funds, the implementation success of EU water policy is highly dependent on using **financial instruments in other sectoral policies, or "water-mainstreaming", as well as on national funding**. A common approach to water-mainstreaming has been to establish standards and certification schemes to promote best practice technologies or best management practices (e.g. Industrial Emissions Directive). Recent years have also seen the introduction of environmental safeguards and economic incentives in EU Structural and Investment Funds, including the European Agricultural Fund for Rural Development (EAFRD, funding instrument of the CAP that supports rural development strategies and projects), the Cohesion Fund and the Regional Development Fund, in a drive to reduce the environmental impact of economic development. In addition, the EU has been developing standards to further link financial investment with environmental protection (European Commission, 2018[xvi]), which could pose restrictions to investments in sectors that cause impacts on water bodies (e.g. transport, energy production).

In this context, it becomes highly important to understand **synergies of water policy with other policy areas** with regard to funding options for measures serving WFD goals. For example, the removal of barriers is part of the hydromorphological measures considered for re-establishing river connectivity and can be funded in various ways such as via the European Fisheries Fund (EFF), which may fund measures relevant to the rehabilitation of inland waters, including spawning grounds and migration routes for migratory species. In some countries, there are specific schemes funding the removal of barriers which serve a specific sector. In Denmark, for instance, many weirs were built for fish farming facilities. Removing a weir at a fish farm means that fish farmers must change their entire water circulating system and at a great cost (from flow-through to recirculated systems). To support fish farm weir removal on Danish streams and rivers, a governmental finance support scheme was set up.[xvii]

Overall, there is need to explore in-depth and effectively communicate further policy synergies which can be used to increase the scope of funding for WFD measures. For instance, there is potential for more funding synergies with the rural development programmes (link to land use issues) and the Green Infrastructure Strategy (link to the development of infrastructure in urban or rural settings).

As already noted, **national funding** also plays a significant role in funding measures. The first RBMPs were in many countries an opportunity to set up **coordinated programmes to fund hydromorphological measures**, which have been among measures requested for the first time explicitly by the WFD. For example, in Scotland, a 'Water Environment Fund' was set up to improve the physical condition of water bodies to meet WFD objectives (Box 8). In Finland, a National Fish Pass Strategy was adopted in 2012 to steer the construction of fish passages during the first three periods of water management planning until the end of the 2020,[xviii] and in Ireland, an Environmental River Enhancement Programme was developed between 2008-2012 dealing in part with river morphology enhancement.[xix] More recently, in Germany, the Blue Ribbon Programme was adopted (2016), which will fund the renaturation of federal waterways and their floodplains. The aim is to create a network of floodplain restoration along federal waterways that are no longer used for shipping. The programme will run until 2050 with a budget of 50 million €/a for the restoration of rivers and their embankments and another 12-15 million €/a for the restoration of floodplains.[xx]

Overall, however, public funds alone will not be sufficient to support the large number of measures needed for the achievement of WFD goals. Thus, **alternative innovative financing mechanisms** are needed and some have already been set up in European countries. For example, in Sweden, an industry fund (hydropower environmental fund) was set up in 2019 to fund mitigation measures in the hydropower sector related to the country's new National Plan for the revision of hydropower licenses in the next 20 years.[xxi] The fund consists of contributions from all the main hydropower producers of the country and will support mitigation measures at hydropower plants which cannot otherwise afford this type of interventions.

Box 8 UK: The Water Environment Fund in Scotland

The aim of the Scottish Government 'Water Environment Fund'[xxii] is to improve the physical condition of water bodies to meet the objectives of the WFD. The program also aims to bring wider benefits to designated nature conservation sites, local fisheries and angling opportunities, community amenity and urban green space creation.

Launched in 2008, the 'Water Environment Fund' has provided funding of more than £14 million between 2013 and 2018 around the country. It is administered by the Scottish Environment Protection Agency, who works in partnership with local authorities, land managers, fishery trusts and angling associations, local communities and volunteers. One of the objectives of the program is to build a greater understanding of the benefits of river restoration in Scotland and the techniques available to achieve it.

The program has led to river channel restoration (including re-meandering), floodplain afforestation, the removal of flood embankments, wetland and peatland restoration, the removal of culverts and barriers to

fish migration, and the elimination of non-native species along river banks. The fund also promotes catchment scale restoration and explores synergies with natural flood management.

A lot of photo material available from projects funded by WEF instrument

Source: https://www.sepa.org.uk/environment/water/water-environment-fund/

4.5. Measures with multiple benefits (UBA)

Key messages

- *Multi-benefit measures can mainly be assigned to European strategies*
- *The implementation of multi-benefit measures under consideration of the respective Directives is rather low*
- *…*

The implementation of effective measures is one of the major challenges not only in the water sector, but also in other sectors addressing ecosystems. Measures are tackled by different EU-policies: the Water Framework Directive, the Floods Directive, the Biodiversity Strategy and other legislation and regulations on nature conservation. Within all of these legal instruments, measures to increase ecosystem functioning are required, but there seems to be a gap in harmonization of the planning and implementation of measures and their multi beneficial effectiveness in particular. This could be due to the fact, that different policies relate to different sectors and institutional responsibilities, which hinder intersectoral planning, and implementation of necessary integrated measures (Moss, and Monstadt, 2008). For this, coordination between planning processes across different policy areas is crucial for enhancing and considering appropriate multi-benefit measures in integrated water management.

Multi-benefit measures can be understood as actions beneficial for the achievement of environmental requirements of more than one legally binding instrument and the improvement of one or more particular ecosystems (e.g. groundwater, surface waters, floodplain, soil). Furthermore, the joint effect can lead to improved functioning of ecosystems for example self purification, water storage or nutrient sequestration, recreation and other ecosystem services.

Several water management measures have multi-benefits even if they are implemented on a local scale. For example, buffer strips reduce nutrient input by erosion in surface waters and, on a larger scale, reduce nutrient input in marine waters as well as increase terrestrial biodiversity. Extensification of land-use reduces nutrient and pollution inflow into soil and groundwater, improves the local hydrological regime and avoids impacts of droughts. Measures of fish stocking are beneficial both for angling, but also as compensation measures for hydropower barriers. Furthermore, a number of measures relate to land use, be in relation to urban, industrial or agriculture activities. Effective land use planning and management could have therefore major multi-benefit effects on water, including pollution, interruption of river continuity (e.g. dams) or connectivity with the rest of the land (e.g. dykes or embankments).

Multi-benefit measures are named differently in different Directives, regulations, or programmes, like Natural Water Retention Measures or nature-based solutions.

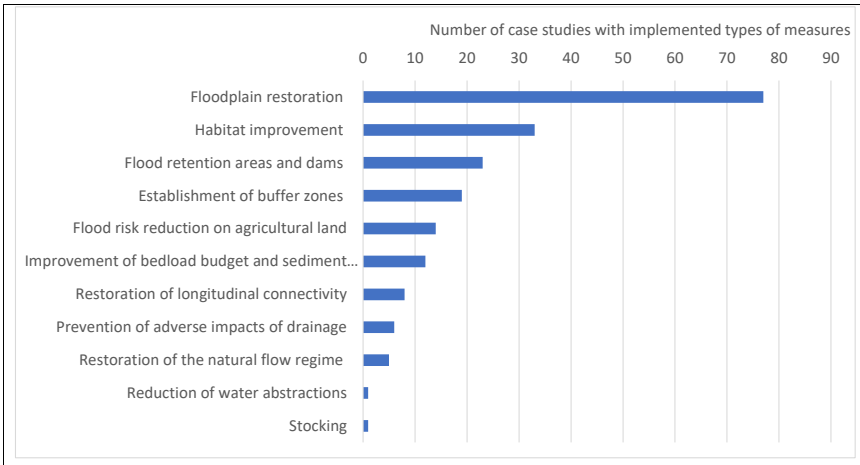
Natural Water Retention Measures (NWRM) are listed as Key Type of Measure (KTM) in the WFD. Within the Programs of Measures (PoM) as part of the 2nd RBMP of the WFD, Member States reported 230 KTM 23 – Natural Water Retention Measures (EC 2019b). NWRM are also within the scope of the Floods Directive (EU 2007), and the Habitats and Birds Directive (EC 2014b). They support the use of green infrastructure under the Green Infrastructure Strategy (EC 2013a), which is a main goal of the Biodiversity Strategy until 2020 (EC, 2011). According to EC (2014a) "*Natural Water Retention Measures (NWRM) are*

multi-functional measures that aim to protect and manage water resources and address water-related challenges by restoring or maintaining ecosystems …"([1]).

Box 9 Natural Water Retention Measures

A project of the European Commission to tackle the issues of NWRM collected some 140 case studies related to NWRM. Within these case studies, a number of different management measures were implemented, in most cases floodplain restoration, like e.g. restoration of wetlands, near-natural widening of the water body, or reforestation. But also habitat improvement in the river, enhance flood retention areas or the establishment of buffer zones. It needs to be mentioned, that in most cases more than one type of measure were implemented in a case study.

Figure 2 Number of management measures implemented in 139 different case studies



Notes. The assignment of management measures to case studies has been carried out within floodplain task (see method in documentxxx).

Datasource: http://nwrm.eu/list-of-all-case-studies

Beside the linkage of the WFD to the Floods Directive, also a link to the Marine Strategy Framework Directive (EU 2008) is required. This is mainly due to the planning and implementation of measures within the PoM as part of the RBMP to improve water quality in coastal areas. Within the 2nd RBMP some 70 % of all RBD reported a link between the two Directives and they also indicate a high number of measures listed under WFD as relevant to also reach the objectives of the MSFD, measures to reduce nutrient pollution from both diffuse and point sources as well as reduction of hazardous substances in particular (EC 2019b).

In line with the MSFD goals to reach a good status of marine waters are the objectives agreed within the Baltic Sea Action plan by 2021 (HELCOM, 2007), and the North-East Atlantic Environment Strategy (OSPAR 2010). To avoid eutrophication, the main goal is to reduce nutrient loading by 50% and selected hazardous pollutants by at least 70% by 2020, in each case compared to the reference year 1985.

Box 10 Maximum concentrations of nitrogen in transitional waters

[1] Source: http://nwrm.eu/concept/3857

In order to achieve the goals of the WFD and the MSFD, Germany has undertaken to comply with maximum concentrations of nitrogen in transitional waters. These so-called management target values are for the rivers that flow into the Baltic Seas 2.6 milligrams of total nitrogen per liter (mg / l), and 2.8 mg / l for rivers flowing into the North Sea. These targets are legally established in the Surface Water Ordinance and were adopted in the German Sustainable Development Strategy (The Federal Government, 2016).

Through Horizon 2020, the EU Framework Programme for Research and Innovation, n**ature-based solutions** are tackled. The programme includes four main goals: Enhancing sustainable urbanisation, restoring degraded ecosystems, developing climate change adaption and mitigation, and improving risk management and resilience (EC 2015). Within these four goals, seven actions were recommended to be taken into account, like the multi-functional nature-based watershed management and ecosystem restoration, or nature-based solutions for enhancing the insurance value of ecosystems. A list of some 300 different nature based solution measures and their linkage to ecosystem services shows, how diverse the use of nature based solutions and their applicability in several sectors, like flood protection, climate change adaption, sustainable urban development or water management can be (Sutherland, et al., 2014).

Box 11 Room for the river in the Netherlands

One example of the implementation of nature based solution in the context of improving risk management and resilience of aquatic ecosystems is the **Room for the river** programme in the Netherlands. The developed strategy focusses on making more space for water to better prevent floods by lowering the level of high water and to offer spatial quality to the area reconnecting people and rivers. Several projects have been carried out at 30 locations in the Netherlands, where dykes were relocated, high-water channels constructed, and floodplains lowered ([2]). For example in the area of the city of Nijmegen a 350 meters long dyke was relocated and an ancillary channel was built. This project offers multiple benefits: The reduction of the water level by 35 cm, and brings also new potential for the development of the city by the creation of an urban river park with possibilities for recreation and nature (EC 2015). The total costs are 360 million Euro.

Within the 7th EAP, multi-benefit measures are for example related to **source reduction approaches**. One objective is to manage the nutrient cycle (nitrogen and phosphorus) in a more sustainable and resource efficient way (EC 2018). This includes for example the reuse of phosphorus retained in waste water or sewage sludge and their use in agriculture.

Box 12 Reuse of phosphorus from sewage sludge

In Germany, a review of the Sewage Sludge Ordinance came into force in 2017. With the new version, the legislator would like to ban soil-related recycling in larger sewage treatment plants for reasons of precaution and oblige the operators of these sewage treatment plants to recover the phosphorus from sewage sludge and sewage sludge ash after staggered transition periods of twelve (> 100,000 PE) or fifteen years (> 50,000 PE). As part of the conservation of resources, the recovered phosphorus - in the form of phosphate - is to be used for plant fertilization. For wastewater treatment plants <50,000 PE, the possibility of soil-related sewage sludge recycling remains ([3]).

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