Council of the
European Union

Brussels, 16 December 2019
(OR. en)

15135/19

ENV 1024
CLIMA 333
AGRI 620
FORETS 65

COVER NOTE

From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	13 December 2019
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2019) 700 final - Part1/2
Subject:	COMMISSION STAFF WORKING DOCUMENT EVALUATION of the Council Directive 91/271/EEC of 21 May 1991, concerning urban waste-water treatment

Delegations will find attached document SWD(2019) 700 final - Part1/2.

Encl.: SWD(2019) 700 final - Part1/2

EUROPEAN
COMMISSION

Brussels, 13.12.2019
SWD(2019) 700 final

PART 1/2

COMMISSION STAFF WORKING DOCUMENT

EVALUATION

of the Council Directive 91/271/EEC of 21 May 1991, concerning urban waste-water treatment

{SEC(2019) 448 final} - {SWD(2019) 701 final}

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GLOSSARY

Term	*Explanation*
Agglomeration	According to the UWWTD: 'Agglomeration' means an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point. (Article 2(4)). An agglomeration can be a city or municipality, but it can also be a number of smaller cities or towns clustered together.
Biochemical oxygen demand	According to the UWWTD: In the waste water discharge, biochemical oxygen demand (BOD) needs to be reduced to 25mg/l O_2 or a minimum reduction of 70-90% needs to be achieved. (Annex I). BOD is 'the amount of dissolved oxygen used by micro-organisms in the biological process of metabolising organic matter in water. The more organic matter there is (e.g. in sewage and polluted bodies of water), the greater the BOD; and the greater the BOD, the lower the amount of dissolved oxygen available for higher animals such as fishes. The BOD is therefore a reliable gauge of the organic pollution of a body of water. One of the main reasons for treating waste water prior to its discharge into a water resource is to lower its BOD—i.e., reduce its need of oxygen and thereby lessen its demand from the streams, lakes, rivers, or estuaries into which it is released.' Britannica (2019a). BOD is most commonly expressed as milligrams of oxygen consumed per litre of samples over 5 days of incubation at 20°C – this is called BOD5 (Sawyer et al., 2003). In this text "BOD" means "BOD5".
Chemical oxygen demand	The UWWTD states that chemical oxygen demand (COD) in the waste water discharge needs to be reduced to 125mg/l O_2. Alternatively, a minimum reduction of 75% needs to be achieved. (Annex I). COD 'is a second method of estimating how much oxygen would be depleted from a body of receiving water as a result of bacterial action. While the BOD test is performed by using a population of bacteria and other microorganisms to attempt to duplicate what would happen in a natural stream over a period of five days, the COD test uses a strong chemical

	oxidising agent (potassium dichromate or potassium permanganate) to chemically oxidise the organic material in the sample of waste water under conditions of heat and strong acid.' (Woodard & Curran, 2006).
Collection system	The UWWTD defines this as a system of conduits which collects and conducts urban waste water. (Article 2(5)).
Combined sewers	In the UWWTD: The UWWTD allows for the use of combined and separate sewers. Combined sewers: 'Systems that carry a mixture of both domestic sewage and storm sewage are called combined sewers. Combined sewers typically consist of large-diameter pipes or tunnels, because of the large volumes of storm water that must be carried during wet-weather periods. They are very common in older cities but are no longer designed and built as part of new sewerage facilities.' (Britannica, 2019b).
Contaminants of emerging concern	In the UWWTD: The UWWTD does not include a reference to contaminants of emerging concern. According to the Organisation for Economic Co-operation and Development (OECD) "*Contaminants* of emerging concern (CECs) comprise a vast array of contaminants that have only recently appeared in water, or that are of recent concern because they have been detected at concentrations significantly higher than expected, or their risk to human and environmental health may not be fully understood. Examples include pharmaceuticals, industrial and household chemicals, personal care products, pesticides, manufactured nanomaterials, and their transformation products' (OECD, 2018). The Environmental Quality Standards Directive explains *pollutants* of emerging concern. Recital 26 states that 'emerging pollutants … can be defined as pollutants currently not included in routine monitoring programmes at Union level but which could pose a significant risk requiring regulation, depending upon their potential ecotoxicological and toxicological effects and on their levels in the aquatic environment.'
Diffuse sources	The E-PRTR Regulation (EC) No 166/2006 gives the following definition of diffuse sources: '"diffuse sources" means the many smaller or scattered sources from which pollutants may be released to land, air or water, whose combined impact on those media may be significant and for which it is impractical to collect reports from each individual source'. Diffuse sources include agricultural activities, some

	urban-related emissions, atmospheric deposition, and rural dwellings. Typically, they are more variable in space and time than point sources. (EC, 2012a).
Eutrophication	UWWTD definition: The enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned. (Article 2(11)).
Individual or other appropriate systems	The UWWTD states that 'where the establishment of a collecting system is not justified either because it would produce no environmental benefit or because it would involve excessive cost, individual systems or other appropriate systems which achieve the same level of environmental protection shall be used.' (Article 3(1)).
Microplastics	According to the European Chemicals Agency (ECHA), 'the term "microplastic" is not consistently defined, but is typically considered to refer to small, usually microscopic, solid particles made of a synthetic polymer. They are associated with long-term persistence in the environment, if released, as they are very resistant to (bio)degradation.' (ECHA, 2019).
More stringent treatment	More stringent treatment or tertiary treatment is the third stage of treatment and can consist of nutrient removal, chemical or physical disinfection (by lagoons or microfiltration). In the UWWTD, table 2 in Annex I lays down the thresholds for nutrient reduction.
Point sources	According to Common Implementation Strategy Technical Report No. 28: 'A point source is a single localised point of discharge of waste water containing one or more pollutant(s). The most important ones are industrial facilities, waste water treatment plants (although strictly speaking the plant itself is not the source), untreated sewage, waste disposal systems and mining sites.' (EC, 2016).
Population equivalent	UWWTD definition: '1 p.e. (population equivalent)' means the organic biodegradable load having a five-day biochemical oxygen demand (BOD5) of 60 g of oxygen per day.' This means: 1 p.e. broadly corresponds to the average pollution release of one person in one day and describes the pollution load contained in waste water.

Primary treatment	UWWTD definition: 'Primary treatment' means treatment of urban waste water by a physical and/or chemical process involving settlement of suspended solids, or other processes in which the BOD of the incoming waste water is reduced by at least 20% before discharge and the total suspended solids of the incoming waste water are reduced by at least 50%. (Article 2(7)).
Secondary treatment	UWWTD definition: 'Secondary treatment' means treatment of urban waste water by a process generally involving biological treatment with a secondary settlement or other processes in which the requirements established in Table 1 of Annex I are respected. (Article 2(8)).
Separate sewers	The UWWTD allows for the use of combined and separate sewers. Separate systems: "New waste water collection facilities are designed as separate systems, carrying either domestic sewage or storm sewage but not both. Storm sewers usually carry surface runoff to a point of disposal in a stream or river. Small detention basins may be built as part of the system, storing storm water temporarily and reducing the magnitude of the peak flow rate. Sanitary sewers, on the other hand, carry domestic waste water to a sewage treatment plant. Pretreated industrial waste water may be allowed into municipal sanitary sewerage systems, but storm water is excluded." (Britannica, 2019c).
Storm Water Overflows	A footnote in Annex I to the UWWTD contains states '*…during situations such as unusually heavy rainfall, Member States shall decide on measures to limit pollution from storm water overflows. Such measures could be based on dilution rates or capacity in relation to dry weather flow or could specify a certain acceptable number of overflows per year*.' As mentioned under combined sewers, these systems carry waste water and storm water. According to Britannica, 'because wastewater treatment plants cannot handle large volumes of storm water, sewage must bypass the treatment plants during wet weather and be discharged directly into the receiving water. These combined sewer overflows, containing untreated domestic sewage, cause recurring water pollution problems and are very troublesome sources of pollution.' (Britannica, 2019b).
Surface water	Water Framework Directive definition: Inland waters, except groundwater; transitional waters and coastal waters, except in respect of chemical status for which it shall also include

	territorial waters. (Article 2(1)).
(Total) nitrogen	UWWTD definition: Total nitrogen means: the sum of total Kjedahl nitrogen (organic and ammoniacal nitrogen), nitrate-nitrogen and nitrite-nitrogen. The UWWTD requires a reduction of total nitrogen in waste water discharges to concentrations of 15 mg/1 N (10 000 - 100 000 p.e.) and 10 mg/1 N (more than 100 000 p.e.). (Annex I). Why nitrogen: Nitrogen is, together with phosphorus, one of the main nutrients in waste water. Nitrogen becomes ammonia/ammonium, creating an additional oxygen demand. This can lead to excessive plant and algae growth, which can then prevent other organisms from living and growing.
(Total) phosphorus	In the UWWTD: The UWWTD requires a reduction of total phosphorus in waste water discharges to concentrations of 2 mg/1 P (10 000 - 100 000 p. e.) and 1 mg/1 P (more than 100 000 p.e.). (Annex I). Why phosphorus: Together with nitrogen, phosphorus is one of the main nutrients in waste water. Phosphorus becomes ortho-phosphate, creating an additional oxygen demand. This can lead to excessive plant and algae growth, which can then prevent other organisms from living and growing.
Urban waste water	The UWWTD defines ‘urban waste water’ as domestic waste water on its own or domestic waste water mixed with industrial waste water and/or runoff rain water. (Article 2(1)).

ABBREVIATIONS

Term or abbreviations	***Meaning or definition***
AMR	Anti-microbial resistance
BWD	Bathing Water Directive
BOD	Biochemical oxygen demand
COD	Chemical oxygen demand

Term or abbreviations	*Meaning or definition*
DWD	Drinking Water Directive
CJEU	Court of Justice of the European Union
CSO	Combined sewer overflow
EC	European Commission
ECA	European Court of Auditors
ECHA	European Chemicals Agency
EEA	European Environment Agency
E-PRTR	European Pollutants Release and Transfer Register
EQS	Environmental quality standards
GHG	Greenhouse gas
GWh	Gigawatt hours
IAS	Individual or other appropriate system
IED	Industrial Emissions Directive
IPCC	Intergovernmental Panel on Climate Change
JRC	European Commission Joint Research Centre
MSFD	Marine Strategy Framework Directive
N	Nitrogen
ND	Nitrates Directive

Term or abbreviations	*Meaning or definition*
NVZ	Nitrates vulnerable zones
O&M	Operation and maintenance costs
OECD	Organisation for Economic Cooperation and Development
P	Phosphorus
p.e.	Population equivalent
PIE strategic approach	Strategic approach to pharmaceuticals in the environment
RBMP	River basin management plan
REACH	Registration, evaluation, authorisation and restriction of chemicals
RTC	Real time control
SIIF	Structured implementation and information framework
SSD	Sewage Sludge Directive
SVHC	Substance of very high concern
SWO	Storm water overflow
TSS	Total suspended solids
UWWTD	Urban Waste Water Treatment Directive
UWWTD EG	Urban Waste Water Treatment Directive Expert Group
WFD	Water Framework Directive

Term or abbreviations	*Meaning or definition*
WIND	What if no Directive scenario
Water Fitness Check	Fitness Check of the Water Framework Directive, the Groundwater Directive, the Environmental Quality Standards Directive, and the Floods Directive
WTP	Willingness to Pay
WSS	Water Supply and Sanitation
WWTP	Waste Water Treatment Plant

1. INTRODUCTION: PURPOSE AND SCOPE OF THE EVALUATION

The Urban Waste Water Treatment Directive (UWWTD) was adopted in 1991. Although the Directive does not include a requirement for its own review, developments over the past three decades call for its Evaluation. The Directive was partially subject to evaluation in the Water Blueprint of 2012 (EC, 2012a; EC, 2012b), which concluded that rates of compliance with the UWWTD needed to be improved through better investment and implementation plans. Thanks to the independent Evaluation presented here, the extent to which the Directive is working effectively has been analysed in depth. As part of the Regulatory Fitness and Performance programme (REFIT), it assesses whether the Directive is fit for purpose.

As set out in the Evaluation's Roadmap (EC, 2017), the Evaluation considers the entire Directive, the full period of its implementation, and all EU Member States. The Evaluation is closely coordinated with the Water Fitness Check. It also takes into account the Strategic approach to pharmaceuticals in the environment (EC, 2019) and the Plastics strategy (EC, 2018), which require certain aspects of the UWWTD to be evaluated.

2. BACKGROUND TO THE INTERVENTION

2.1. Description of the intervention and its objectives

Contextualisation: water pollution affecting the quality of water bodies

Humans and all other living organisms need clean water to survive. Humans need clean water for drinking and sanitary purposes, as well as for economic activities such as energy production, manufacturing, transport, tourism and fishing. Water is central to most natural ecosystems, and polluted water bodies can lead to damaged aquatic and terrestrial environments no longer able to provide the ecosystem services that society depends on.

Water quality can be affected by point and diffuse pollution sources, such as industry, agriculture, transport (including shipping), households in urban and rural settings, and atmospheric deposition (*Figure 2*). In the EU, the main **point source of water pollution** is the discharge of untreated or inadequately treated urban and/or industrial waste water. Point sources are the main source of oxygen-consuming substances, hazardous chemicals and nutrients. The main **diffuse source of water pollution** is agriculture, which is responsible for the release of pollutants such as nutrients, pesticides, and faecal microbes (EEA, 2018a). Diffuse pollution from agriculture and forestry enters water bodies through the infiltration of the soil or runoff from land.

To ensure that urban waste water does not harm the environment, in the EU it is typically collected from households and some industries and treated in urban waste water treatment plants (WWTPs[1]). Some agglomerations may, for technical and/or economic reasons, have a partial collecting (or even treatment) system. Under the UWWTD, such systems are called individual or other adequate systems (IAS), which either collect waste water onsite (to be transported to a WWTP) or treat it locally before it is discharged.

[1] In Figure 2, these are referred to as MWWTPs.

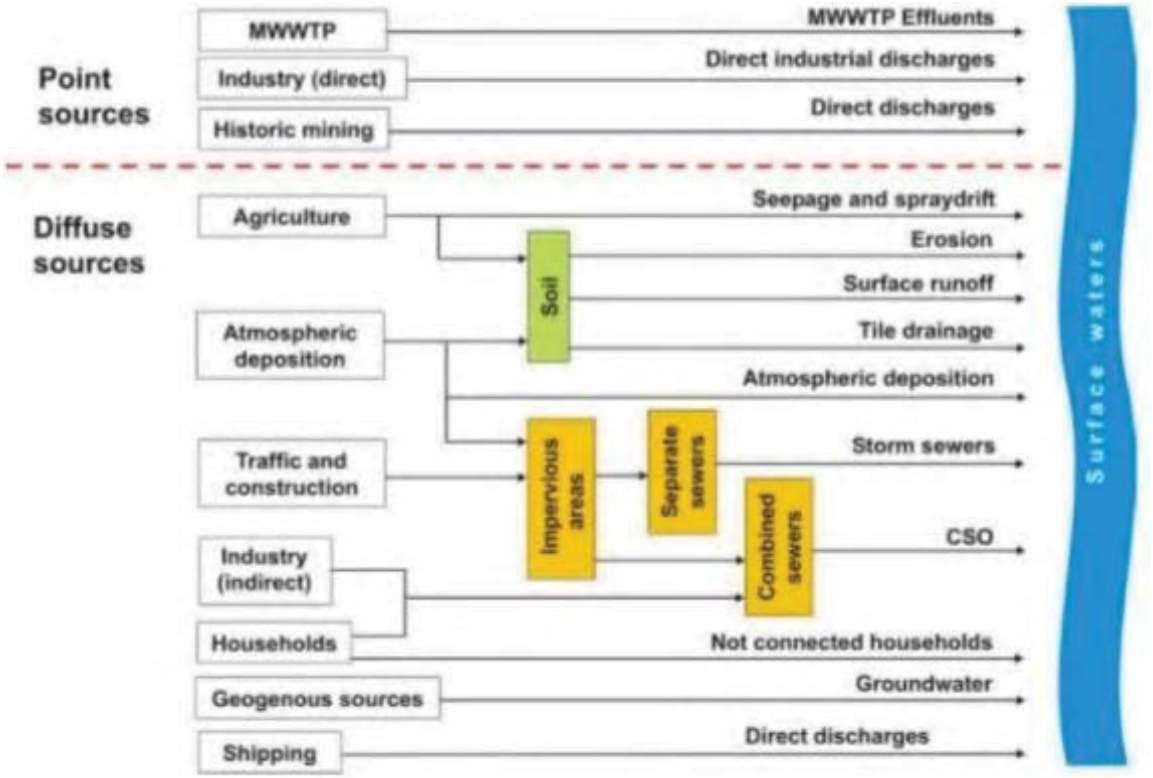


Figure 2: Sources and pathways. Fuchs et al. (2010). (MWWTP=WWTP in this text).

In EU countries, use is made both of collecting systems designed to collect both urban waste water and rainwater (combined sewers) and of separate systems that collect waste water and storm water separately. Urban runoff can enter a combined collecting system where it mixes with urban waste water, and can subsequently be treated at a WWTP, before the treated effluent is discharged directly into the receiving water bodies. After heavy rainfall, these systems typically do not convey the entire flow of runoff and waste water to the WWTP. For these instances, there are built-in overflows that allow the system to discharge the untreated, diluted rain/urban waste water mix into water bodies. Urban runoff can contain a wide variety of pollutants, including metals, urban pesticides and abrasions from tyres.

Water bodies in the EU are **seriously affected by pollution from diffuse and point sources** (*Figure 3*). According to Member State reporting, only 40% of surface water (i.e. water in rivers, lakes and coastal water bodies) is in good ecological status, while only 38% is in good chemical status. Across the EU, 38% of surface water bodies fall short of good ecological status because of diffuse sources of pollution, of which agriculture is reported to be the most significant one. Atmospheric deposition affects 38% of surface water bodies, with mercury being the main pollutant responsible for failure to achieve good chemical status. Point sources affect 18% of surface water bodies. Urban waste water is the most significant of these, directly followed by emissions from industry (EEA, 2018b).

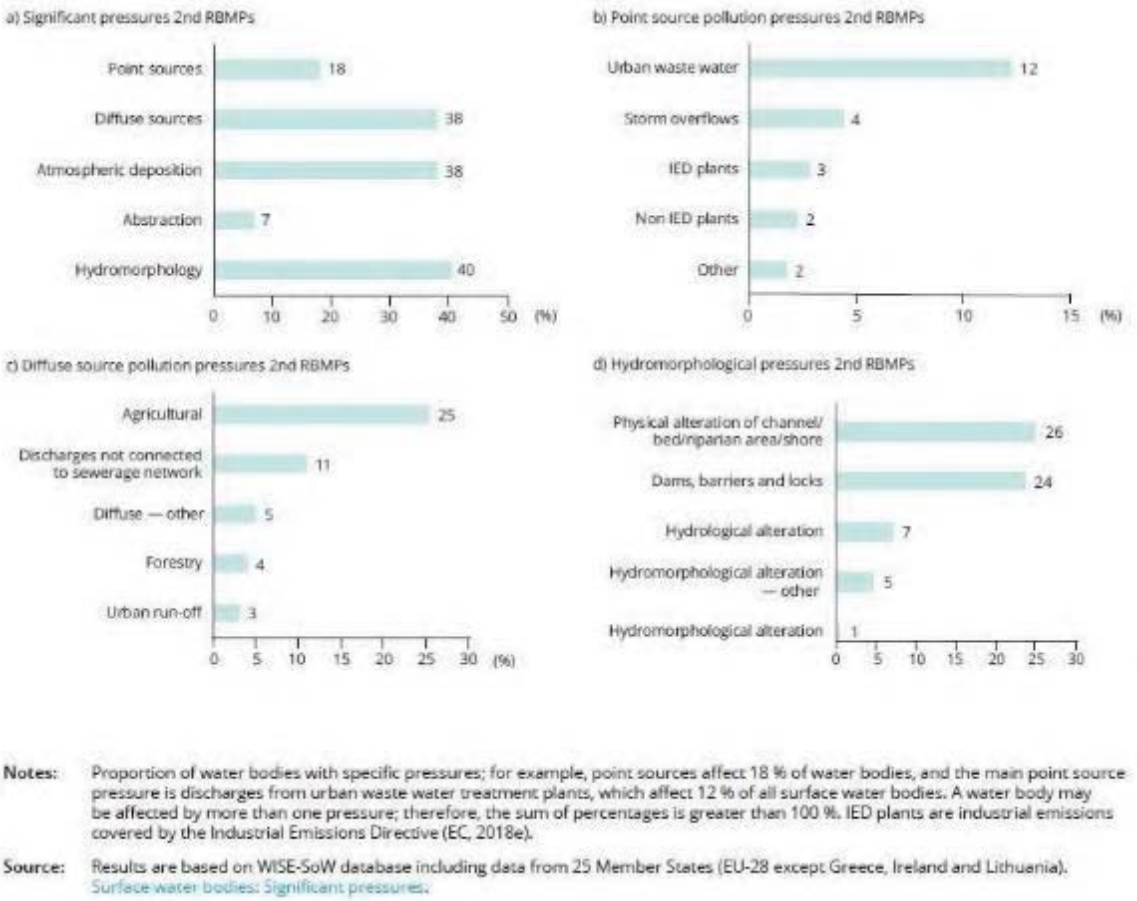


Figure 3 Proportion of water bodies affected by a) main pressures, b) detailed point source, c) diffuse source and d) hydromorphological pressures. EEA (2018b).

Agriculture and livestock account for roughly a third of the organic matter (BOD) loads entering EU water bodies: other sources include industry and forestry (*Figure 4*). The relative significance of the sources varies considerably across Member States: in those countries where urban waste water is still not dealt with adequately, it plays a relatively more significant role than in those that treat it appropriately.

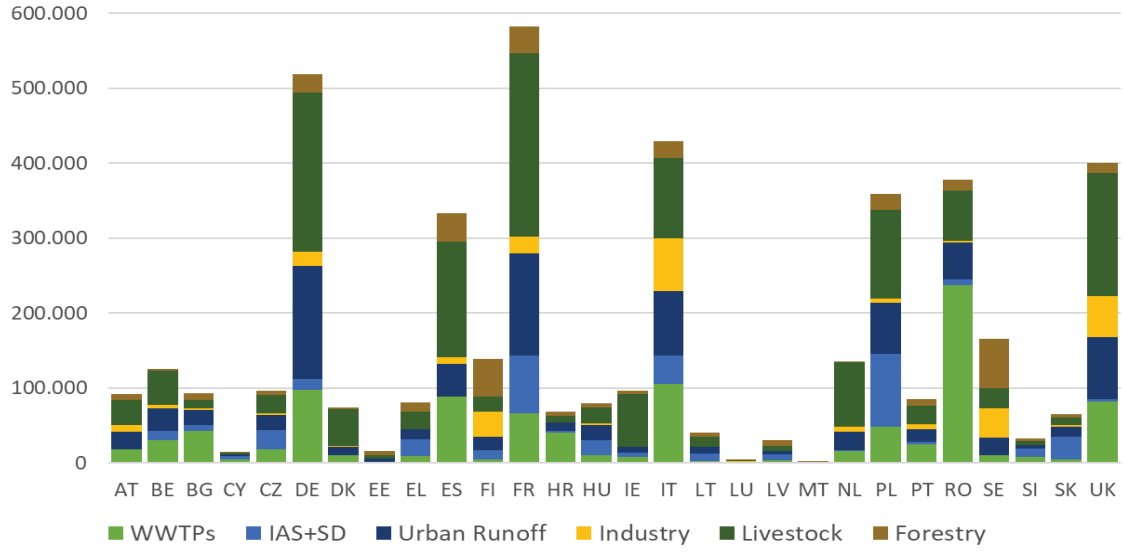


Figure 4 Loads of BOD (tonnes/year) to EU water bodies by source in 2014 (Vigiak et al., 2019); 'IAS+SD'=IAS + agglomerations <2 000 p.e.

As regards nutrients, fertiliser use accounts for about one third to a half of all nitrogen (N) loads entering European regional seas (*Figure 5*). Nitrogen loads via waste water are the main sources of nitrogen only for the Greater North Sea and the Celtic Seas, whereas in all other cases other sources predominate.

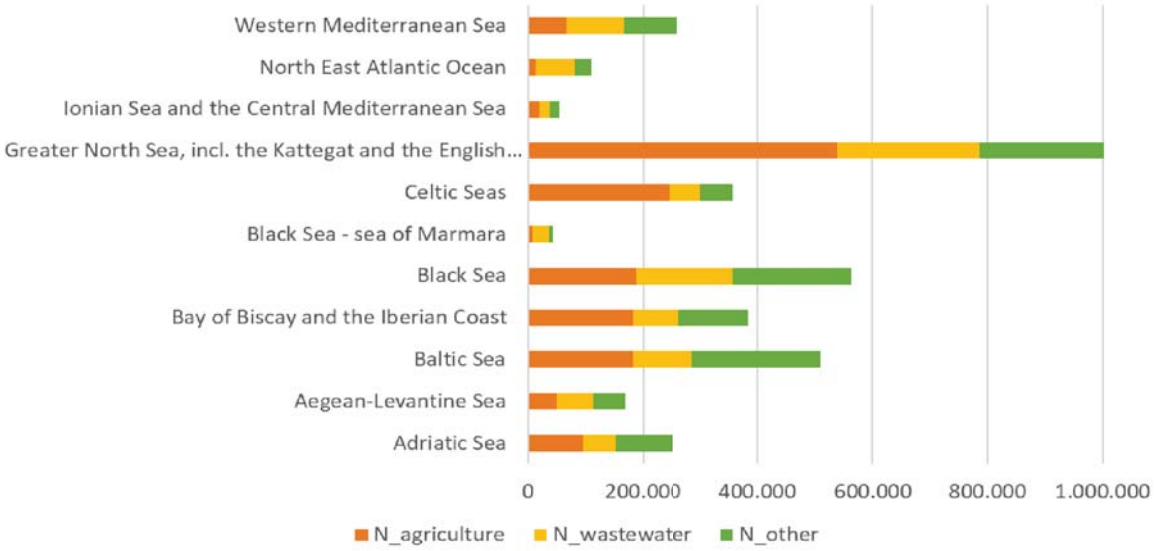


Figure 5 Loads of N (tonnes/year) to EU regional seas by source (tonnes per year) in 2014.

For phosphorus (P) the situation is slightly different from N. Waste water is still one of the main sources, and agriculture is comparatively less significant (see Pistocchi *et al.*, 2019).

UWWTD as intervention

Adopted in 1991, the UWWTD has as the **objective** protecting the environment from the adverse effects of urban waste water discharges (Art. 1). Its intervention logic is shown in *Figure 6*. Back in 2002, the Court of Justice of the European Union ruled that the objective does not only refer to the protection of the aquatic environment but also includes the wider environment and human health (Case C-280/02[2]). The Directive addresses Member States and sets out EU-wide rules for the establishment of waste water infrastructure, minimum treatment standards and requirements on monitoring, reporting and information provision.

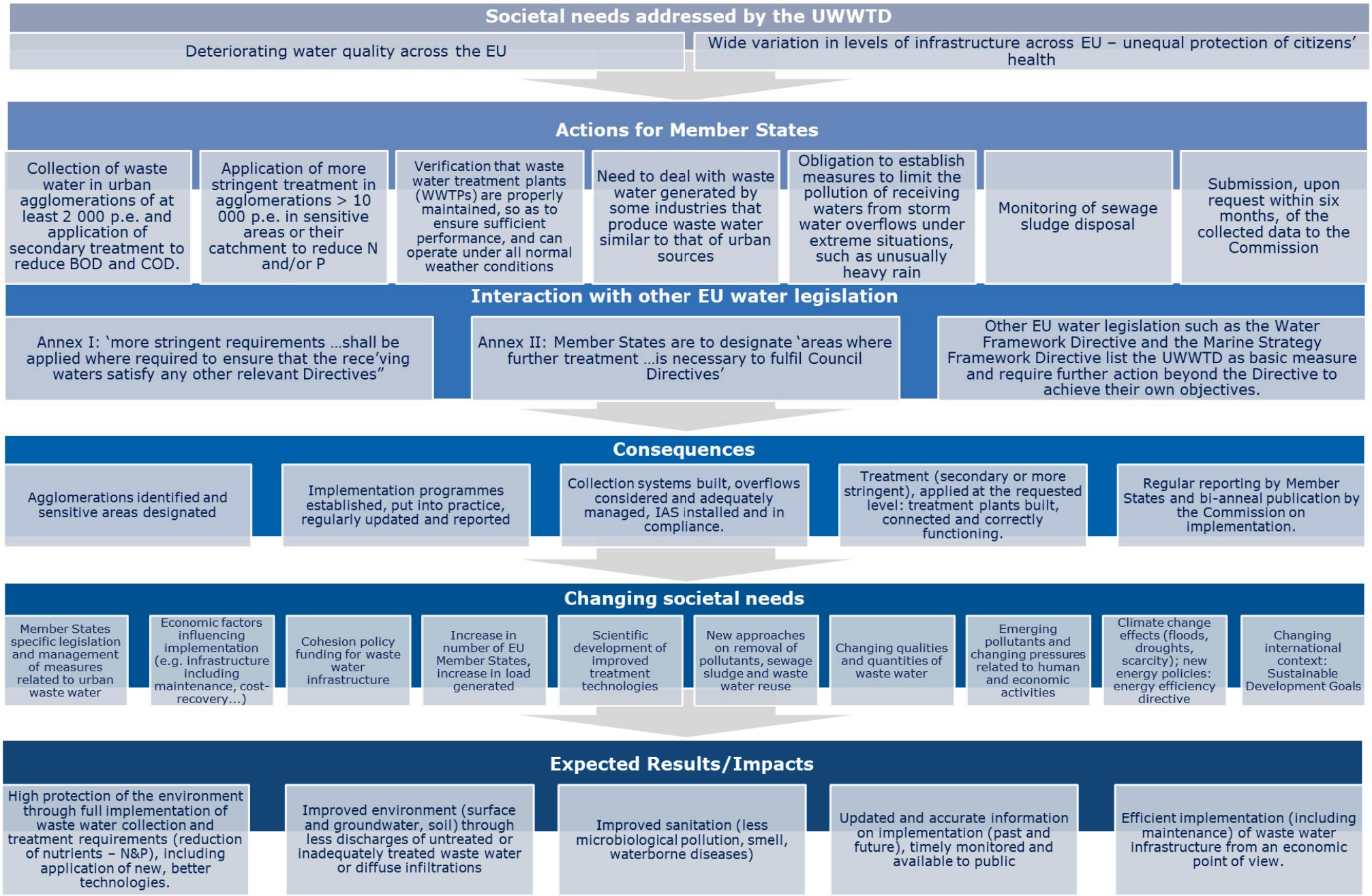
The main actions required by Member States are the collection of waste water in urban agglomerations of at least 2 000 population equivalents (p.e.) (Art. 3) and the application of secondary treatment to reduce oxygen consuming substances which are measured by biochemical oxygen demand (BOD) and chemical oxygen demand (COD) parameters (Art. 4). Member States are also required to designate sensitive areas (Art. 5). These areas can be designated according to three criteria: (a) areas that are eutrophic or at risk of becoming eutrophic; (b) surface waters that serve as catchment areas for drinking water; and, (c) areas where further treatment is needed to ensure that the objectives of other Directives are met. When discharging treated waste water in these sensitive areas or

[2] Judgment of the Court (Second Chamber) of 23 September 2004. Commission of the European Communities v French Republic. Failure of a Member State to fulfil obligations - Directive 91/271/EEC - Urban waste water treatment - Article 5(1) and (2) and Annex II - Failure to identify sensitive areas - Meaning of "eutrophication" - Failure to implement more stringent treatment of discharges into sensitive areas. Case C-280/02.

their catchments, Member States are required to apply more stringent treatment in agglomerations above 10 000 p.e. If these sensitive areas are designated under criterion (a), Member States are expected to reduce N and/or P loads (Art. 5). The reduction levels for sensitive areas designated under criteria (b) and (c) are to be derived from other water legislation, e.g. the Drinking Water Directive or the Water Framework Directive. Member States can also designate less sensitive areas in marine water bodies. They are required to review the identification of sensitive areas at least once every four years.

Member States are also required to ensure that WWTPs are properly designed, constructed, operated and maintained, so as to ensure that they perform properly. They must also be able to operate under all normal weather conditions, taking seasonal loads into account (Art. 10). Furthermore, the UWWTD states that certain industrial food processing sectors producing biodegradable industrial waste water, similar in composition to urban waste water, are to be dealt with under this Directive (Art. 13). The Directive also contains an obligation to establish measures to limit pollution from storm water overflows under extreme situations, such as unusually heavy rain (Art. 3(2)). It further requires the monitoring of sewage sludge disposal (Art. 14). In terms of reporting and information provision, the UWWTD requires Member States to submit information stemming from the monitoring provisions under Art. 15 within six months upon request. The Commission subsequently publishes an implementation report based on this data (Art. 17). Member States also need to inform the public of how they deal with urban waste water (Art. 16). The UWWTD sets out clear deadlines on the implementation of the different provisions. For Member States which joined after 2004, these deadlines were negotiated as part of the Accession Treaties (see implementation deadlines). Based on the data submitted by Member States, the Commission publishes an implementation report at two-yearly intervals[3], which covers one year of results. The 9th implementation report, published in 2017, is based on 2014 data from Member States. Publication of the 10th report, based on 2016 data, is scheduled for early 2020.

[3] European Commission (n.d.) Implementation reports 1-9: Until 1994, Member States were required by Art. 17 to communicate information to the Commission. Owing to Member States' delays in providing the necessary data, the Commission did not publish the first report until 2000 (1st implementation report).


Societal needs addressed by the UWWTD
Deteriorating water quality across the EU
Wide variation in levels of infrastructure across EU – unequal protection of citizens' health
Actions for Member States
Collection of waste water in urban agglomerations of at least 2 000 p.e. and application of secondary treatment to reduce BOD and COD.
Application of more stringent treatment in agglomerations > 10 000 p.e. in sensitive areas or their catchment to reduce N and/or P
Verification that waste water treatment plants (WWTPs) are properly maintained, so as to ensure sufficient performance, and can operate under all normal weather conditions
Need to deal with waste water generated by some industries that produce waste water similar to that of urban sources
Obligation to establish measures to limit the pollution of receiving waters from storm water overflows under extreme situations, such as unusually heavy rain
Monitoring of sewage sludge disposal
Submission, upon request within six months, of the collected data to the Commission
Interaction with other EU water legislation
Annex I: 'more stringent requirements …shall be applied where required to ensure that the rece'ving waters satisfy any other relevant Directives"
Annex II: Member States are to designate 'areas where further treatment …is necessary to fulfil Council Directives'
Other EU water legislation such as the Water Framework Directive and the Marine Strategy Framework Directive list the UWWTD as basic measure and require further action beyond the Directive to achieve their own objectives.
Consequences
Agglomerations identified and sensitive areas designated
Implementation programmes established, put into practice, regularly updated and reported
Collection systems built, overflows considered and adequately managed, IAS installed and in compliance.
Treatment (secondary or more stringent), applied at the requested level: treatment plants built, connected and correctly functioning.
Regular reporting by Member States and bi-anneal publication by the Commission on implementation.
Changing societal needs
Member States specific legislation and management of measures related to urban waste water
Economic factors influencing implementation (e.g. infrastructure including maintenance, cost-recovery…)
Cohesion policy funding for waste water infrastructure
Increase in number of EU Member States, increase in load generated
Scientific development of improved treatment technologies
New approaches on removal of pollutants, sewage sludge and waste water reuse
Changing qualities and quantities of waste water
Emerging pollutants and changing pressures related to human and economic activities
Climate change effects (floods, droughts, scarcity); new energy policies: energy efficiency directive
Changing international context: Sustainable Development Goals
Expected Results/Impacts
High protection of the environment through full implementation of waste water collection and treatment requirements (reduction of nutrients – N&P), including application of new, better technologies.
Improved environment (surface and groundwater, soil) through less discharges of untreated or inadequately treated waste water or diffuse infiltrations
Improved sanitation (less microbiological pollution, smell, waterborne diseases)
Updated and accurate information on implementation (past and future), timely monitored and available to public
Efficient implementation (including maintenance) of waste water infrastructure from an economic point of view.

The UWWTD in the context of other EU (water) legislation

EU water legislation has been in place since the 1970s, when legislation such as the original Bathing Water and the Drinking Water Directive was adopted. In the 1990s, pollution-focused Directives such as the UWWTD and the Nitrates Directive (dealing with water pollution from nitrates used for agricultural purposes) were adopted. Since then, EU water policy has been further expanded through the adoption of the Water Framework Directive (WFD) and its daughter Directives (the Groundwater Directive (GWD) and the Environment Quality Standards Directive (EQSD)). The WFD establishes a holistic approach to water management and environmental protection, with a focus on river basin planning. It states that Member States need to protect **good ecological and chemical status in their water bodies (or achieve such status)**, and preserve their water bodies against deterioration. Complementing the WFD, the Marine Strategy Framework Directive (MSFD) establishes a common approach and objectives to protect the marine environment against damaging human activities. Water policy has also been further developed through the revision of the Bathing Water Directive (BWD) and the recent Drinking Water Directive recast proposal (DWD) (2018). This EU water *acquis* was developed to deliver a comprehensive approach to the various sources of known water pollutants that were of concern at the time (*Figure 7*).

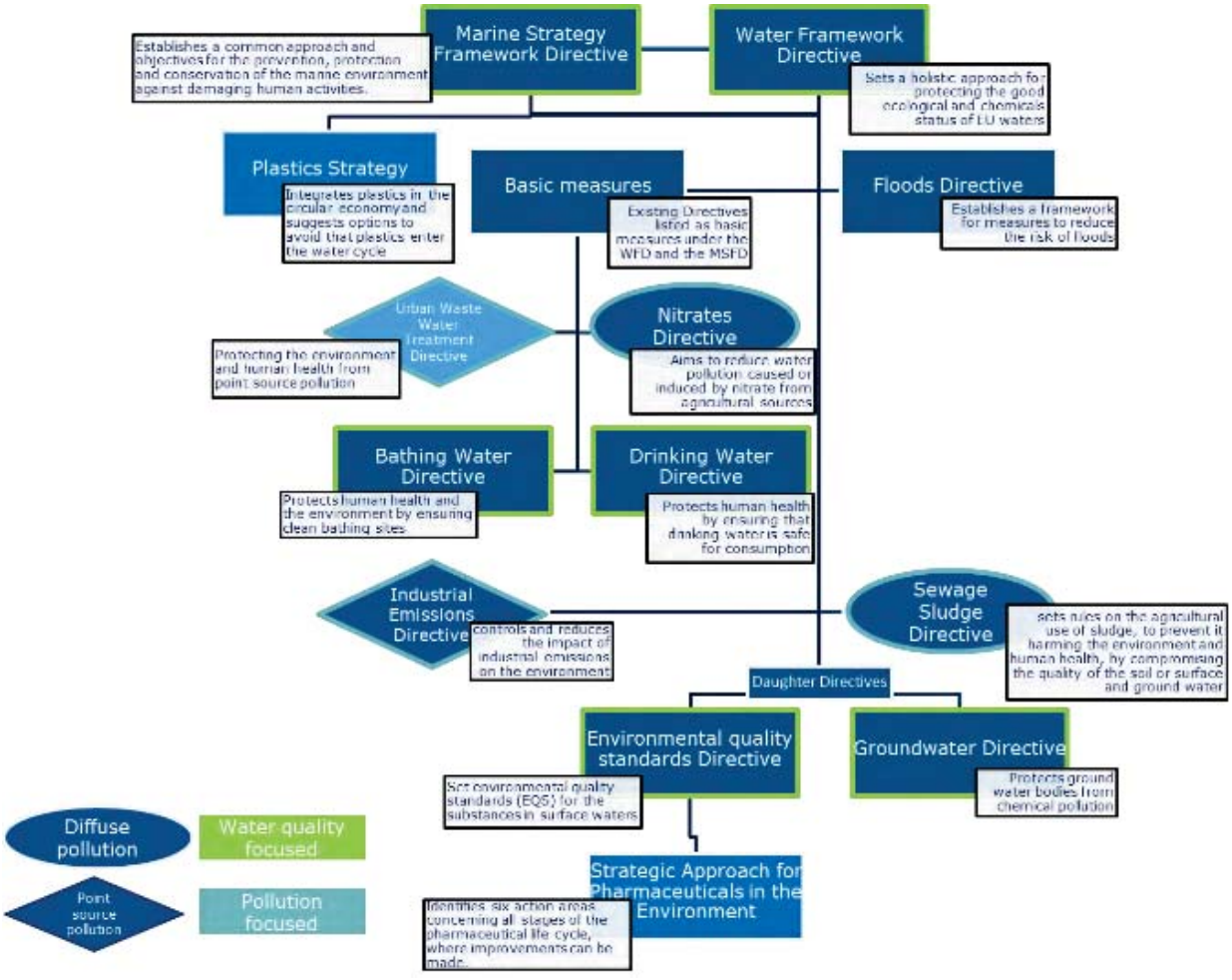


Figure 7 EU water legislation

The UWWTD plays an important role in the EU water *acquis* and lays down the minimum requirements for urban waste water collection and treatment. Annex I to the UWWTD states that 'more stringent requirements …shall be applied where required to

ensure that the receiving waters satisfy any other relevant Directives'. It further specifies that Member States need to designate sensitive areas that are subject to eutrophication or at risk thereof, that are drinking water catchment areas, or that are 'areas where further treatment …is necessary to fulfil Council Directives' (Annex II). Furthermore, the UWWTD is a basic measure under the WFD and MSFD. Both these framework directives state that if measures taken under the UWWTD are not sufficient to achieve the objectives of the WFD and the MSFD, Member States need to take other appropriate measures, such as adapting treatment levels or the way in which they deal with storm water overflows. The implementation of the UWWTD is also crucial to achieving the BWD's and DWD's objectives, as inadequately treated waste water discharges can pollute bathing water sites and drinking water sources.

The UWWTD is also important for the implementation of the Sewage Sludge Directive (SSD), which deals with the reuse of sludge for agricultural purposes. As the SSD uses one of the outputs of the UWWTD, it is very dependent on this output being appropriate for its own purposes.

More recently, the Commission adopted the European strategy for plastics in a circular economy ('Plastics Strategy') and the Strategic approach to pharmaceuticals in the environment ('PIE Strategic Approach'). These strategies highlight the potential role of the UWWTD (and waste water treatment more generally) as a means to tackle end-of-pipe contaminants of emerging concern, such as microplastics and pharmaceuticals.

Furthermore, the EU has taken action on a number of other issues relating to urban waste water discharges, in the context of its strategy to boost a circular economy. The need for sufficient water quantities is reflected in the recently adopted EU Energy Strategy and Energy Union.

2.2. Baseline and point of comparison

At the time when the UWWTD was drawn up and adopted, there was no impact assessment requirement. For this Evaluation, it was therefore necessary to develop a retrospective baseline for 1990, based on Eurostat and OECD data (Annex 4, Baseline by Member State. Following assessment, this is considered to be the best available data for the 1990 baseline. The 9th implementation report (2014 data) can be used to demonstrate the achievements resulting from the adoption and implementation of the UWWTD.

When the Directive was adopted, the levels and extent of Member States' waste water infrastructure varied widely; for example, some capital cities were not yet connected to treatment facilities. Levels of population with treatment varied between 11% and 94% (*Figure 8*).[4]

[4] Figure 7 compares OECD's 1990s figures on 'population with treatment' and Article 4 (2014 data) reporting under the UWWTD. Given that these data come from different reporting processes, they are not entirely comparable, but they are used here to give a general picture of population with treatment in different years.

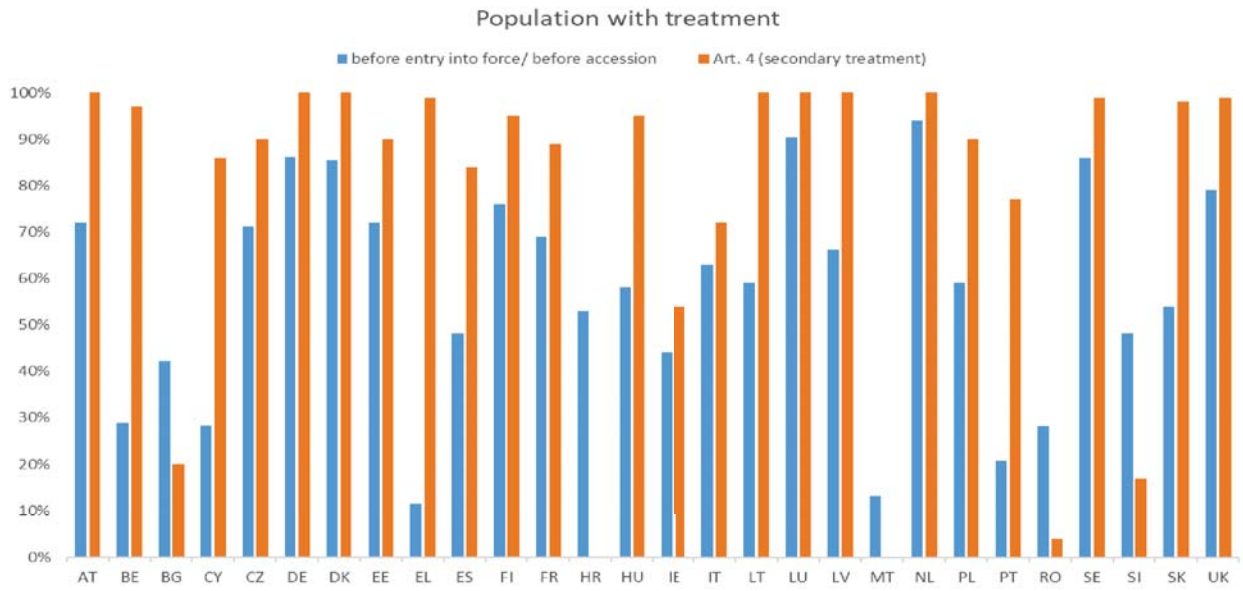


Figure 8 Population with treatment, blue = 1990s, orange = 2014

In the early 1990s, EU-level estimates for the loads of BOD in discharged urban waste water were about 3.7 million tonnes/year, N loads from urban waste water releases were about 1.0 million tonnes/year and P stood at about 0.2 million tonnes/year. These releases of pollution into EU water bodies were causing intolerable conditions and thus reducing the amenity value of rivers, lakes, estuaries and coasts. This was the background against which the UWWTD was adopted. Other EU legislation on water quality sets other standards for certain parameters, depending on the protection goals (*Table 1*), which may differ from those of the UWWTD. Assessing the UWWTD's impact on the extent to which the protection goals of other directives are met provides a measure of the Directive's success.

	Protection goal		
Parameter	**Aquatic Ecosystems (WFD)**	**Drinking Water (DWD)**	**Bathing Waters (BWD)**
N	X	X	
P	X		
BOD	X		
Microbiological	X	X	X
Chemicals	X	X	

Table 1 High level summary of water quality parameters corresponding to selected EU water legislation

In terms of the water quality situation in the early 1990s, BOD concentrations in rivers averaged almost 4 mg/l across the Member States, N concentrations were 2.5 mg/l or more, and P concentrations in rivers stood at about 0.12 mg/l, according to monitoring data provided by Member States (EEA, 2019a). As regards bathing water sites, only

about 52% of inland waters and about 80% of coastal bathing waters met the required standards in the 1990s (EEA, 2015).[5]

Since data from the 10th reporting (reported data for 2016) were not available during the Evaluation's analysis stage, the analysis is based on 2014 data. The state of play section, however, reflects some data from 2016. Baseline population figures connected to treatment (*Figure 8*) and levels of BOD, N and P have provided the basis for an assessment of whether the Directive's general objectives (load reductions and improving water quality in relation to waste water) have been achieved since the UWWTD's adoption. Thus, indicators for success are reduction of loads and achievements in terms of protecting or improving water quality.

Furthermore, two hypothetical 'What if no Directive' (WIND) scenarios were developed. The WIND scenarios represent the state in which waste water treatment in the EU would hypothetically have remained had there been no UWWTD. This involves making some assumptions about how much progress the Member States would have made with national approaches to collecting and treating waste water if there had been no Directive. For these scenarios, it is assumed that some Member States would have reached similar levels of collection and treatment as under the UWWTD, whereas others would be in an intermediate situation between the 1990s baseline and current implementation levels, depending on their specific capacity to plan, invest in, and manage WWTPs. Analysis considers the following four scenarios: 1991 baseline, 2014 reported progress and the two WIND scenarios.

3. STATE OF PLAY

According to the forthcoming 10th implementation report, based on 2016 data, there are about 23 600 'agglomerations' in the EU as defined under the UWWTD for 2 000 p.e. and above. These agglomerations generated a total load of 612 million p.e., mostly corresponding to urban waste water and runoff, but also to some from industrial sources.

To assess compliance with the Directive, the assessment currently focuses on meeting the requirements of three Articles (Articles 3-5 inclusive) at agglomeration level. Compliance with Articles 4 and 5 (treatment stages) is not possible if compliance with Article 3 (collection system) is not ensured. The same applies to Articles 4 and 5; compliance with Article 5 is not attainable unless Article 4 is implemented. Overall **compliance** with the UWWTD is now well advanced on average across the EU, with compliance rates for these three articles ranging from 80% to 100%. However, exceptions remain with lower values that need improvement, such as compliance results at EU13 level for Articles 3-5, and for Article 5 at EU28 level (*Table 2*).

Compliance rates	Article 3 (collection)	Article 4 (secondary treatment)	Article 5 (more stringent treatment)

[5] In the 1990s, the predecessor of the current BWD was in place and reporting was slightly different. Overall, Member States' compliance with the mandatory values for **coastal bathing waters** was slightly below 80% in 1990. For guideline values, it was at 68%. Compliance with mandatory values in EU **inland bathing waters** stood at 52% in 1990. The rate of compliance with guide values was slightly above 36%. Source: EEA (2015).

EU15	99 %	91 %	91 %
EU13	76 %	73 %	66 %
EU28	95 %	88 %	86 %

Table 2 Compliance rates with UWWTD according to 10th report

Figure 9 displays overall compliance rates by Member State, showing the diversity of compliance rates that is not apparent from the EU average. Clearly, many countries have implemented the Directive well by now, whereas a few others are lagging behind.

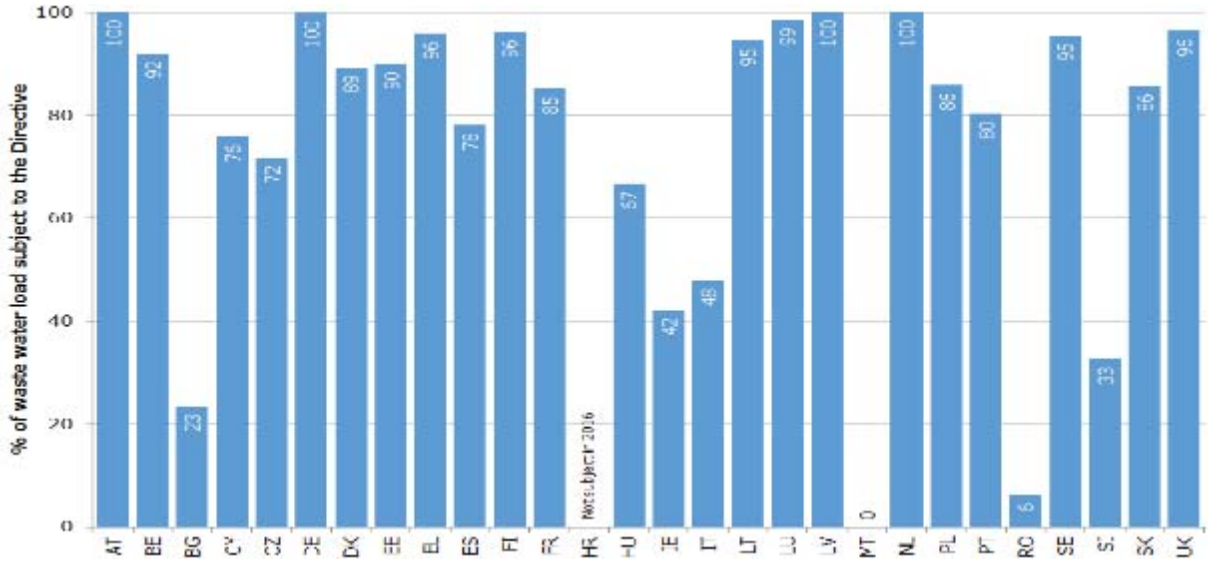


Figure 9 Compliance rates per Member States (2016).

The situation is slightly different when 'distance to target'[6] is considered, which shows good (low) rates in general (10% or below), except for more stringent treatment (*Table 3*).

Distance to target	Collection	Secondary treatment	More stringent treatment
EU15	0 %	6 %	5 %
EU13	6 %	10 %	15 %
EU28	1 %	6 %	7 %

Table 3 Distance to target according to 10th report

The EU compliance rate with **Article 3 (collection of waste water)** is high, averaging 95.1%. The rates are very high in 21 Member States (95%-100%), while three still have low rates below 70% (RO, BG and SI). Some countries (SK, EL and HU) make extensive

[6] The term **'distance to target'** means the effort needed to achieve compliance with the Directive for each requirement (by article). The target is to have all waste water collected and treated.
Collection: the **total** load of waste water **that is not adequately collected**/ addressed through IAS.
Treatment: the **total** load of **collected** waste water that is not adequately treated because the water does not meet the requirements for discharge set in the Directive.

use (above 10% of total load) of IAS. Overall, 6.2 million p.e. are not properly collected (1.2% of total EU load) and therefore not properly treated either.

88% of EU waste waters are considered to comply fully with **Article 4 (secondary treatment).** Twelve Member States have compliance rates between 95% and 100%, while five (IE, MT, RO, BG and SI) still have to make significant efforts to reach compliance, with rates below 70%. Some 46.2 million p.e. do not meet the performance requirements of secondary treatment (9.4% of the total EU collected load that requires this treatment).

More stringent treatment (in terms of the rate of compliance with Article 5) is applied to waste water discharged in areas covering more than three quarters of EU territory. Fifteen Member States apply it throughout their territory, whereas the other 13 have identified parts of their national territory as "sensitive". The compliance rate for more stringent treatment (applicable to agglomerations discharging into "sensitive" areas with more than 10 000 p.e.) is about 76%. Overall, there is still a large difference between Member States, with rates ranging from below 70% to full compliance, and only five countries between 95% and 100%. Significant efforts are still needed in several countries with rates below 70% (BG, CZ, ES, IE, IT, MT, RO and SI). This equals about 17.6 million p.e. not meeting the performance requirements of more stringent treatment (17.3% of the total EU collected load that requires this treatment).

The Commission has taken legal action with a view to ensuring correct and timely implementation of the UWWTD. Infringement proceedings have been taken against nearly all EU15 countries, with over 40 CJEU rulings[7]. More than 30 horizontal cases are pending, some of which involve the EU13 countries that joined after 2004. The most frequent issue is Member States' failure to meet the requirements of Articles 3-5 by the required deadlines.

4. METHOD

The Evaluation, which follows the Better Regulation guidelines, assessed all impacts associated with the Directive quantitatively and/or qualitatively, to the extent possible. The approach used was based on five criteria: effectiveness, efficiency, coherence, relevance and EU-added value. Analysis was based on a list of 27 Evaluation questions (see Annex 4, Overview: mapping of evaluation questions), which were outlined in the Evaluation Roadmap. The roadmap was subject to a feedback mechanism.

On the basis of feedback on the roadmap and the Commission's experience of implementing this Directive, European Court of Auditors (ECA) reports, and previous Commission studies on aspects of the UWWTD, **12 key issues** were identified that enabled the assessment of the five evaluation criteria to be substantiated. These key issues were **discussed in the early stages of the Evaluation** with a number of major stakeholders and validated in this process. The findings on the key issues are included in the report where most appropriate (see Annex 4, Overview: mapping of Evaluation questions). To avoid losing any valuable information, cross-referencing is used throughout the document.

[7] Thirty-five rulings under Article 258 and seven rulings under Article 260 (June 2018).

An external contractor supported the Evaluation by developing key issue studies and an Evaluative support study. **Unless otherwise stated, all data used in this report come from these studies. Modelling results are taken from the Joint Research Centre's Science for Policy report (see Annex 3, JRC modelling)** (*Figure 10*).

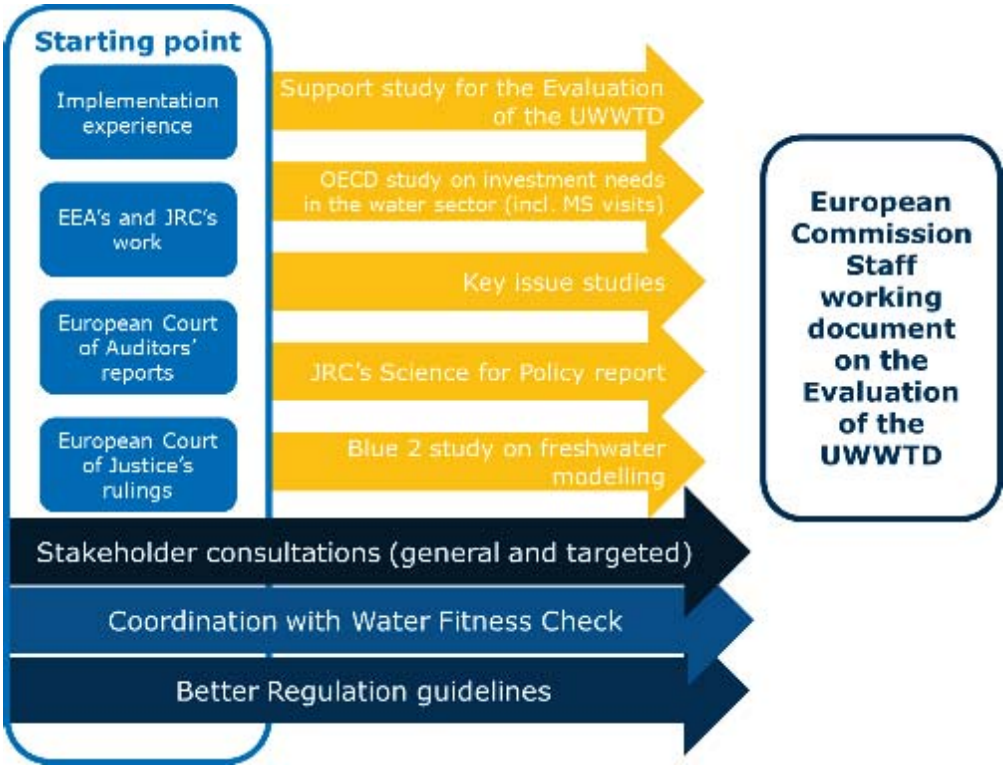


Figure 10 Evaluation process

4.1. Literature review

An extensive literature review was conducted, encompassing scientific studies, ECA reports, ongoing and past Commission studies (e.g. Blue2 (EC, 2018a), the joint OECD study on investment needs in the EU water sector), the work and databases of the European Environment Agency (EEA), the JRC's work, and national studies where available. These findings were triangulated with results from modelling approaches and stakeholder consultations.

The EEA[8] and water quality information

The EEA provides extensive information and analysis on water and the marine environment, covering topics such as industrial emissions into water, chemicals in water, and bathing water[9]. The Agency also provides access to vast amounts of information through its data and map viewers. The data viewers compile information provided by Member States reporting under the various water directives and information provided voluntarily under agreements among countries.[10] The EEA's analyses and data portals

[8] The EEA covers the EU 28 Member States + Iceland, Lichtenstein, Norway, Switzerland and Turkey.

[9] EEA (n.d.b), Water and marine environment articles.

[10] EEA (n.d.c) Water and marine environment data and maps.

provide Europe-wide overviews of water quality development over time, plus analysis on pollution sources and underlying factors for improvement.

OECD study on investment needs in the EU water sector

In 2017 DG ENV launched a cooperation project with the OECD to assess investment needs associated with UWWTD, DWD and the Floods Directive in the EU Member States.[11] This analysis provides a comparative overview of investment needs and assesses possible financing sources (i.e. tariffs, taxes, transfers). Following the analysis, joint OECD-Commission workshops were held in 9 Member States. These workshops hosted discussions among all relevant stakeholders in efforts to find solutions for the future. The analysis and the workshops have provided a wealth of information on financial needs associated with the UWWTD and on practical implementation problems. The cooperation project is due to finish in February 2020. Some preliminary findings have already fed into the Evaluation.

4.2. Stakeholder consultation

The Commission set out a joint Consultation strategy for this Evaluation and the Water Fitness Check (Water FC) (EC, 2018b). The main stakeholders identified were consulted by different means (see Annex 2, Stakeholder consultation).

Public consultation

A 14-week online public consultation was held between July and October 2018. Comprising one general section and another specifically for experts, it was available in all 23 official EU languages. There were 608 replies, half of them from citizens. The two largest stakeholder groups responding were associations and WWTP operators. Replies came from 24 of the 28 Member States, with stakeholders in Germany and Spain accounting for the lion's share.

Targeted consultation

In March 2018 **individual interviews** were held with nine stakeholders representing major stakeholder groups, to **discuss and check the key issues**.

Four **expert workshops** were held[12]. They focused on selected topics identified as particularly relevant and difficult to assess through a review of the literature:

- Pollutants of emerging concern
- Storm water overflows (SWOs) and IAS
- Costs and benefits of the UWWTD
- Technical modelling workshop on the combined sewer overflow (CSO) model.

[11] OECD/ European Commission (forthcoming) – Estimating investment needs and financing capacities for water-related investment in EU member states

[12] The minutes of the technical expert workshops and the stakeholder conference, and presentations given at these events, are available on Circabc: Evaluation Study 2018.

These workshops fed into the Evaluation as they served to identify further information, to check the correctness and relevance of the identified evidence, and to validate preliminary findings.

On 16 November 2018, a **stakeholder conference** was held on the premises of the Committee of the Regions to share the preliminary findings of the support study and some initial results from the public consultation. The conference validated the findings and some further information emerged which was incorporated during the finalisation of the Evaluation.

Participants in all stakeholder activities included Member State authorities, other institutions (e.g. World Bank, OECD), NGOs, industry associations and the scientific community.

As part of the OECD study on investment needs in the water sector, nine Member State visits were organised to discuss findings on investment needs and future financing options.

In addition to the technical workshops, **the Member States were consulted in writing** on some specific aspects of the modelling (management measures in place for storm water overflows (SWO) and information on IAS) for which limited data were available. Member States also received the preliminary results of the cost and benefit assessments. They were asked to provide feedback on findings for their country or to add to the identified information.

4.3. Modelling

Science for policy – the effects of the UWWTD

The JRC's modelling of the effects of the UWWTD for this Evaluation, described in the Science for Policy report 'Water quality in Europe: effects of the Urban Waste Water Treatment Directive', enabled the reduction of pollutant loads (BOD, N and P)[13] in treated waste water over time to be assessed. The modelling results show the effects of the UWWTD only and filter out the impact of other legislation. The modelling also estimated subsequent improvements in water quality associated with the UWWTD's effectiveness, against different water quality standards based on various other water directives that benefit from the UWWTD's existence (e.g. WFD, DWD, BWD). The JRC used the Geospatial Regression Equation for European Nutrient losses model (GREEN+ model), which was developed to estimate annual N and P loads and performed source apportionment at pan-European level. The JRC extended the model to include BOD, chemicals and coliform bacteria. This model includes both point sources (WWTPs, industries, and paved areas) and diffuse sources (fertilisers, atmospheric deposition, and scattered dwellings).

A 1990 baseline for waste water treatment for each Member State was established and used as a point of comparison the present levels of waste water treatment based on data from the 9th implementation report. The following scenarios were also modelled: full implementation, impact of individual and other appropriate systems, impact of CSO.

[13] It was not possible to model COD.

There were also two scenarios looking at what would have happened without the Directive ('What-if-no-Directive' (WIND)).

To establish the WIND scenarios, two different sets of weights were used (WIND1 and WIND2, see Annex 3, WIND). These scenarios are quantified in a simplified way as a weighted average of the two scenarios (baseline and pre-directive), as is usual in statistical data fusion.

Details of the modelling exercise are set out in Annex 3, Science for Policy, and in the Science for Policy report on the subject.

Costs-benefit assessment

Only three benefits were quantified and monetised at EU level: benefits of nitrogen reduction as a proxy for water quality and health, the reduction of micro-biological pollutants as a proxy for bathing water quality, and the cost savings of moving from individual to central collection systems. It was not possible to monetise the reduction of BOD, COD or P or the removal of non-targeted chemicals across all Member States. For the first two benefits, a damage cost approach based on a benefits transfer from willingness to pay studies was used. For the move to more collection through centralised collection systems, the costs saved by not having to maintain individual or other appropriate systems were assessed.

Benefit modelling: At the time of the Evaluation, there was no single established methodology to assess the benefits associated with the UWWTD and waste water treatment in general.

However, stakeholder consultations and research findings show that urban waste water treatment helps provide many environmental, social and economic benefits.

For both, costs and benefits, the estimates developed for this study should not be interpreted as economic reality. Rather, they provide indicative ranges of the order of magnitude of the costs and benefits associated with the UWWTD.

Further efforts should be made in future to establish a thorough benefit methodology.

To assess the **costs associated with implementing the Directive**, two separate and established cost functions were used, one for collection systems and one for the different treatment levels, derived from the FEASIBLE model.[14] The cost functions were adjusted to Member States' price levels in 2014. Costs were annualised with a discount rate of 4%, as suggested in the Better Regulation guidelines. A lifetime of 25 years is assumed for WWTPs and a lifetime of 50 years for collection systems. Costs were broken down into capital (CAPEX) and operation and maintenance (OPEX) costs.

Cost correction factors were used to ensure that only costs and benefits attributable to the UWWTD and its influence on how Member States deal with urban waste were taken into account. Results were produced for the 2014 implementation levels and for full implementation.

In response to the written consultation, Member States that have a national cost assessment and that responded to the consultation reported that the overall order of magnitude is correct, but also stressed that cost assessments are challenging even at national level.

[14] These cost functions were discussed at the cost and benefit workshop. Other institutions, such as the OECD and World Bank, confirmed that they use these functions. They are considered to be fairly stable overall.

For details of the methodology, see Annex 3, costs and benefits and the key issue report.

4.4. Limitations and robustness of findings

Water quality is very complex, as it can be characterised in different ways and is subject to many external factors (e.g. geology, catchment type). **There are many sources of water pollution. Waste water discharges are only one kind, along with pollution from industry, agriculture, and atmospheric deposition.** The impact of pollutant releases varies according to the type of water body receiving the pollution, but also depends on the ecosystems affected and the use to which the water may be put downstream (bathing sites, drinking water production, etc.) This made it difficult to **assess all environmental and health benefits** in quantitative and monetary terms. There is a lack of published sound methodologies linking improvement in water quality to quantitative effects on health and ecosystems. Although treating waste water brings health benefits (see benefits), these are indirect (improvement of raw water used for drinking water production, improvement of water quality for bathers). Moreover, they can hardly be attributed solely to the UWWTD, given the existence of other related legislation (BWD and DWD). It was also not possible to assess benefits relates to tourism and the impact on the economy.

Although the Directive has been in place for 28 years, long enough for a good evidence base to have been gathered, there is a lack of EU-wide comparable data on certain topics. Comparably sound data were found on connection rates and treatment levels. Data of limited comparability were found on IAS and SWOs, a shortcoming addressed by conducting an additional written consultation of the Member States. Extrapolations and/or assumptions, based on expert judgement, were used to complement the available evidence base. It was necessary to make a few different assumptions about the impact of the Directive compared to the baseline to model water quality and assess costs and benefits. Such differences are not thought to alter the conclusions drawn from the assessment.

Any assumptions and identified uncertainties are highlighted in this document and its annexes, and in the Science for Policy report, the Evaluative support study and the related key issue studies. Since all information and results from modelling exercises were triangulated against each other as far as possible, the overall robustness of the findings can be confirmed.

5. ANALYSIS

5.1. Effectiveness

Evaluation question: To what extent has the UWWTD reached its objectives and what factors impact on its effectiveness?

Evidence shows that, as expected, the Directive has led to reductions of BOD, N and P loads released from urban waste water point sources into the environment. Modelling results show that, between the adoption of the Directive and 2014, BOD, N and P loads in treated waste water fell by 61%, 32% and 44%, respectively. **Further reductions can be expected once the Directive is fully implemented**. The reductions achieved so far, especially of BOD and P content in water bodies, have had the expected **positive effects on the aquatic environment**. Rivers, seas, lakes, coastal zones and designated **bathing sites** have seen substantial improvement and a big part of this can be linked to the UWWTD. Furthermore, although the treatment required by the UWWTD does not directly target chemicals (other than N and P), including contaminants of emerging concern, it has substantial impact on their reduction as well.

Nevertheless**, point source pollution from untreated or inadequately treated urban waste water is still one of the main reasons for why EU waters fail to achieve good ecological status**. According to data reported under the 2nd round of river basin management plans (RBMPs), urban waste water is a significant pressure on 12% of surface water bodies, leading them to fail to achieve good ecological status under the WFD. The main factors that impact the effectiveness of the UWWTD are related to both the text of the UWWTD itself and to a lack of implementation in several Member States. These factors will be discussed in more detail below.

1. **Non-compliant agglomerations** produce a high proportion of avoidable loads and put pressure on EU water bodies. In the last decade, UWWTD implementation levels have increased across the EU on average, but some Member States took a long time to become compliant and some are still not fully compliant. The initial **deadlines** set in the Directive and those negotiated in Accession Treaties seem to have been **overambitious**. Clearly, implementing the Directive is challenging for some Member States in terms of required funding, as well as institutional and administrative capacity. However, evidence shows that some Member States have managed to implement the Directive in a rather short time (i.e. EE and LT). To advance implementation, the Commission provides support through compliance promotion activities and drives it through infringement procedures, whenever appropriate. It also supports it through funding, as implementation of the UWWTD requires substantial and continuous investments in infrastructure. Member States use a mix of public budget, taxes and water tariffs to finance implementation. Many relied, and some still heavily rely, on EU funding to build up the initial infrastructure. Only a few Member States have moved towards full cost recovery through water tariffs. Most Member States use water tariffs to have households and some industries partly pay for (waste) water services, and so the polluter pays principle is being respected to some extent. According to the analysis, the general affordability of water services is not at risk in any country, though in some countries, such as Romania and Bulgaria, the burden borne by lower income households is slightly higher than in other Member States. A number of financing and management problems were noted in some Member States, e.g. lack of effective use of funding and issues with national procurement rules.

The analysis also considered **whether unclear terminology reduced the effectiveness of the UWWTD.** Overall, the UWWTD is effective largely due to **its clarity** – including as regards implementation deadlines - and its **enforceability**. Discussions with stakeholders and other research revealed only a few terms and obligations that need further clarification.

2. The UWWTD provisions give Member States the **flexibility to use IAS** if the cost of a collection system would be disproportionate and as long as the individual system used achieves the same level of environmental protection as a collection system would. IAS can be a way of adapting to geographical circumstances. The UWWTD is not clear on how costs and benefits need to be assessed in order to ascertain whether IAS could be used, what 'sufficiently concentrated' means in the context of agglomerations or how Member States need to monitor the effectiveness of IAS use. Some Member States report high IAS use, also in larger agglomerations where a collecting system is in place. Badly designed, monitored and maintained IAS can lead to ineffectively collected waste water and can cause releases of untreated waste water affecting the environment. This is an issue of implementation, as well as of clear provisions under the UWWTD itself.

3. The UWWTD covers agglomerations below 2 000 p.e. only to a limited extent. Information from the 2nd round of RBMPs shows that **small agglomerations and non-connected dwellings** can be a factor in not reaching good status under the WFD. The impact of small agglomerations and non-connected dwellings and their discharges depends on local conditions such as the discharge point and the type and size of the receiving water body. It is expected that in many small agglomerations substantial use of IAS is made.
4. **The UWWTD addresses SWOs only to a limited extent**. Case-law has helped clarify the UWWTD's only reference to this (in a footnote), but the Court pointed out a need to develop related guidance. SWOs are mostly a problem at local level, but EEA and JRC findings show that they can

have a significant environmental impact. This pollution source is becoming more relevant with increasingly heavy rainfall and higher levels of UWWTD implementation. Related to SWOs is **urban runoff**, a component of combined sewage. The pressure created by runoff is partly covered by the UWWTD (when the runoff enters the combined sewer system) and partly by the WFD (when the runoff discharges directly to receiving waters through separate storm sewers, where Member States identify it as a pressure to meeting environmental objectives). With increasingly heavy rainfall induced by climate change and increasing imperviousness of urban surfaces, **urban runoff** may have an increasingly negative impact on water quality.

5. Although the UWWTD requires the designation of **sensitive areas under criterion A**, for those areas that are eutrophic or at risk of eutrophication, it is not very specific on how to assess eutrophication. The Court set out four criteria to assess eutrophication. Evidence shows that neighbouring Member States do not always apply the concept in the same way, however. This may lead to less improvement than what can potentially be achieved. Also designation under criteria B and C is not clear.

Note that **waste water pollution needs to be seen in the context of pollution from other sources**: in a number of cases other diffuse and point sources, such as agriculture and industry, are the dominant pollution sources. The relative significance of these sources is expected to increase under full UWWTD implementation.

The effectiveness of the UWWTD's provisions on monitoring, reporting and disseminating information has also been assessed, and is discussed below:

1. Overall, the **monitoring requirements are effective** in supporting the Commission's compliance assessments and the data provided under these requirements have been used for infringement cases. To address local conditions, a number of Member States have set stricter threshold levels for BOD, N and P, demonstrating that it is possible to achieve more than what is expected under the UWWTD. Monitoring provides only a **partial picture** of what is entering the environment via WWTPs, as few samples are required and monitoring is only required for a limited number of parameters. Further evidence is needed to understand the impact of this. Monitoring provisions are not directly required to adapt to changing external factors or new technologies. The Directive does not contain (clear) monitoring requirements for SWOs and IAS.
2. The **reported data**, which are based on the monitoring results, were essential to ensuring effective enforcement. However, the process of assessing reported data is still time-consuming and the information is not made available quickly enough. Moreover, the legal text as well as some of the parameters are not yet fully aligned with other related (more recent) legislation. Furthermore, Member States do not always provide all information in a comparable way, such as information on investments, nor do they always comply with agreed formats and data management processes, e.g. those set by the INSPIRE Directive.
3. The Directive requires that Member States provide situation reports as **information to the public**. This has led to diverse practices across the EU and it is not clear whether the information that the public is interested in is made available to them. Practices in Member States are very diverse and there is significant potential for improvement. At EU level, the Structured Information and Implementation Framework (SIIF) is a step forward in modernising the ways in which information is provided. Generally, **the public is interested in information on waste water**, especially on aspects that affect their daily lives, such as where treated waste water is discharged and associated costs. People are also interested in information on what they pay for in terms of water services. The Directive does not ensure that this kind of information is made available.

The **effectiveness** analysis considers how successful the UWWTD has been in achieving or progressing towards its objectives. Where the objectives have not been achieved, the assessment considers the extent to which progress has fallen short. The underlying reasons are discussed in the section on factors influencing the UWWTD's effectiveness.

Achievement of the Directive's objectives

As regards **pollutant loads in treated waste water**, modelling shows that the UWWTD has had a significant impact. At EU level, **organic matter** in treated waste water, **assessed based on BOD levels,** has decreased from 3.7 million tonnes per year before adoption of the UWWTD to 1.4 million tonnes per year, from 1 to 0.7 million tonnes for **N** and from 0.2 to 0.1 million tonnes for **P** (*Table 44*). Further reductions are expected once the UWWTD is fully implemented.

This decline in BOD and phosphorus concentrations due to the enforcement of the UWWTD and investment in urban waste water treatment has also been noted in the recent state of the environment publication by the European Environment Agency (EEA, 2019c).

Modelled loads from urban waste water sources (tonnes/year)				
Parameters	**1990**[15]	**2014**	**Reduction 1990 to 2014**	**Residual load under full implementation**
BOD	3,703,875	1,451,561	61%	887,022
N	1,007,511	689,626	32%	572,386
P	210,118	118,069	44%	102,123

Table 4 Reduction of loads in treated waste water (EU aggregated figures)

Stakeholders that replied to the public consultation generally agreed that the UWWTD has been either very effective or somewhat effective (46% and 42%, n[16]=345) in protecting the environment, with only 1% judging that the Directive was very ineffective and 4% judging that it was neither effective nor ineffective.

Biochemical oxygen demand

The achieved reduction in BOD loads is substantial. In most Member States, loads have halved compared to levels seen in the 1990s (*Figure 11*).

[15] 1990 accounts for all 28 EU Member States (also those who were not yet part of the EU at the time.)

[16] 'n' = total number of respondents to this question. Given that most questions in the public consultation were not mandatory, the total 'n' changes per question.

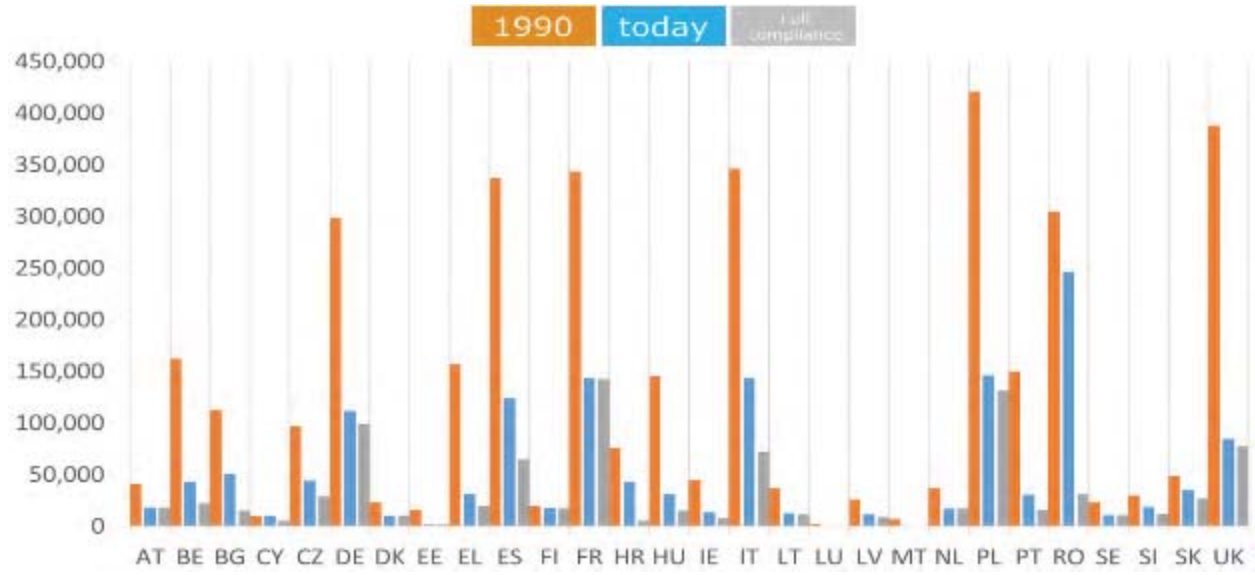


Figure 11 Reduction of BOD loads (tonnes/year) in treated waste water

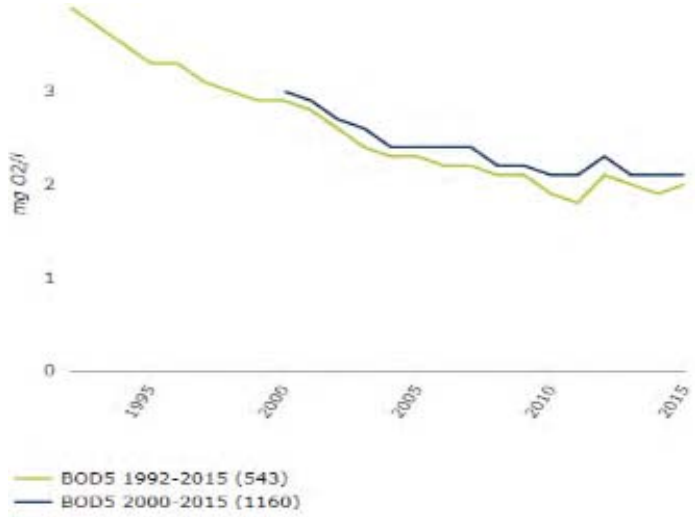


Figure 12 BOD in selected European monitoring stations. EEA (2019a).

Evidence from selected European monitoring stations shows that BOD levels have indeed reduced: since 1992, the presence of oxygen-demanding substances (measured based on BOD) have substantially decreased. The decrease is about 2.7% per year (0.08 mg O_2/l), with a significant decrease of 64% at monitored river sites (*Figure 12*) (EEA, 2019a).

Models show a clear reduction of BOD loads in water bodies, with about 4% of the river network moving up to 'good' status[17] and additional further improvement expected under full compliance (*Figure 13*). However, the EU average hides the fact that a number of Member States still have to make significant progress (notably RO, IT, ES, BG). Based on WIND results, it can be assumed that some Member States would have 10% less of their river network in good or high status if the Directive was not in place (see Annex 4, WIND results).

[17] There is no EU-wide agreed level for what constitutes 'good status' or 'high status' as regards BOD, N and P in EU water bodies. The levels that indicate 'good status' are based on an analysis of the provisions in EU legislation and scientific literature.

Figure 13 EU-28 river network conditions regarding BOD quality standards under different scenarios[18]

These findings are confirmed by stakeholder replies to the public consultation: according to 52% and 29% of respondents, respectively, the Directive has been either very effective or somewhat effective in reducing BOD. Only 1% of respondents said that the Directive was very ineffective and 5% replied that it was neither effective nor ineffective (n=343).

Nitrogen

A reduction in N released through treated waste water is also clearly visible (*Figure 14*), and was achieved due to the implementation of Article 5.

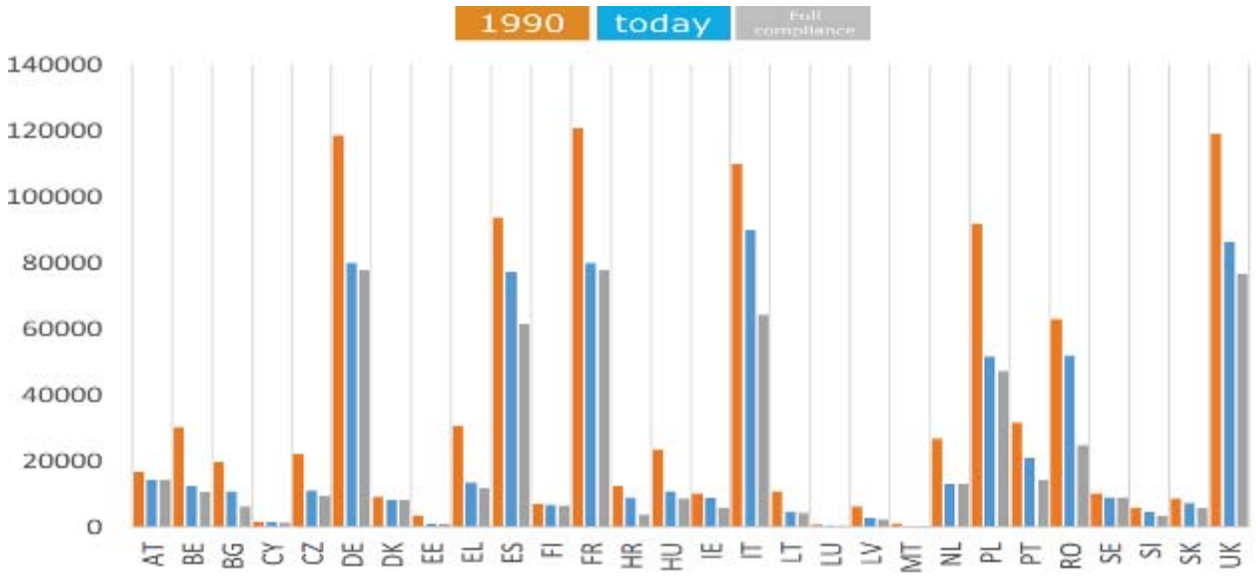


Figure 14 Reduction of N content (tonnes/year) in treated waste water

[18] All graphs showing the modelled improvement of EU water quality include results for four scenarios: 1) 1990, 2) two WIND scenarios with different weights, 3) current level of implementation, 4) full implementation.

The EEA's assessment of data from selected European river monitoring stations shows that there was steady decrease in nitrate concentrations since 1992, and links this to improved waste water treatment (and the UWWTD). On average, the nitrate concentration has decreased by 0.02 milligrams/l of nitrogen (0.8%) per year between 1992 and 2015 (*Figure 15*) (EEA, 2019a)

As shown in the state of play section and in *Figure 14,* some Member States still need to make substantial efforts to increase treatment for N. In spite of this, modelling suggests that, under current implementation levels, the UWWTD has improved the status of about 4% of the river network from below 'good' to 'good' or 'high'. Under full compliance, another 0.7% of the river network could achieve 'good' or 'high' status (*Figure 16*). Estimates of what would have happened without the UWWTD show that some Member States would not have seen any improvement in about 20% of their river network (Annex 4, WIND results).

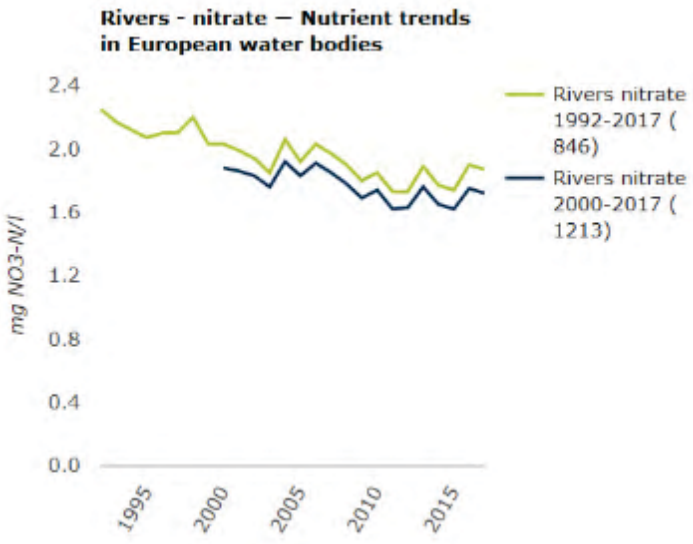


Figure 15 Nitrate in selected European monitoring stations. EEA (2019a).

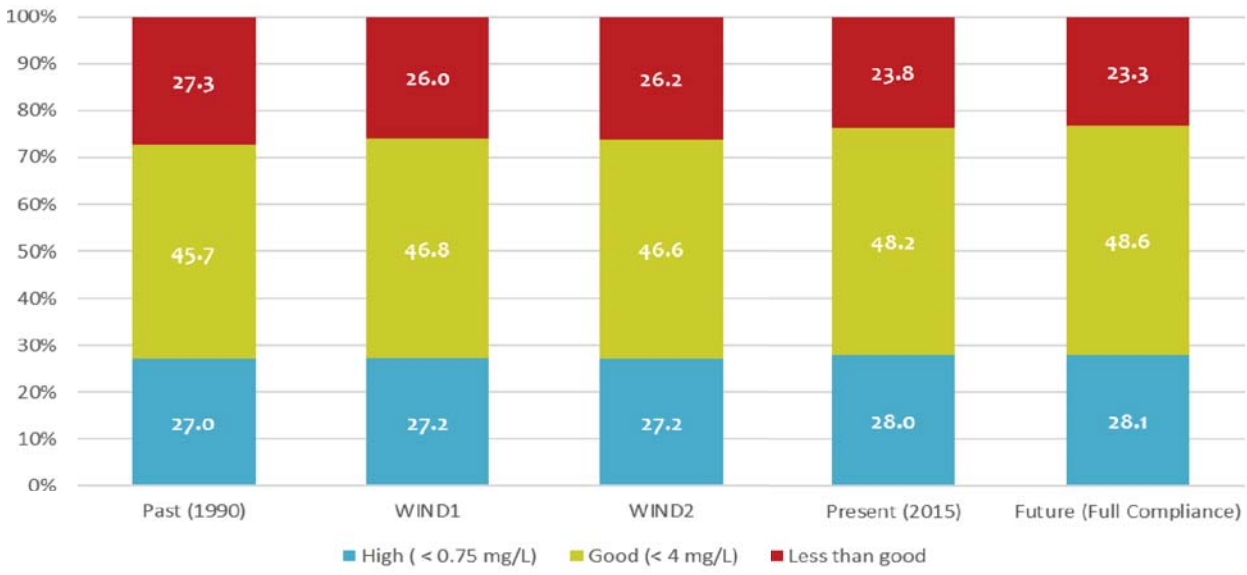


Figure 16 EU-28 river network conditions regarding N quality standards under different scenarios[19]

[19] Grizzetti *et al.*, (2017) show that the median of predicted concentrations for rivers in good status is normally about 4 mg/L for total N.

Annex II of the UWWTD refers to the requirement for Member States to ensure that surface waters intended for the abstraction of drinking water do not contain nitrate concentrations above those set out in the DWD[20]. Note that improvements appear smaller when considering higher concentration thresholds, such as those of the DWD (*Figure 17*).

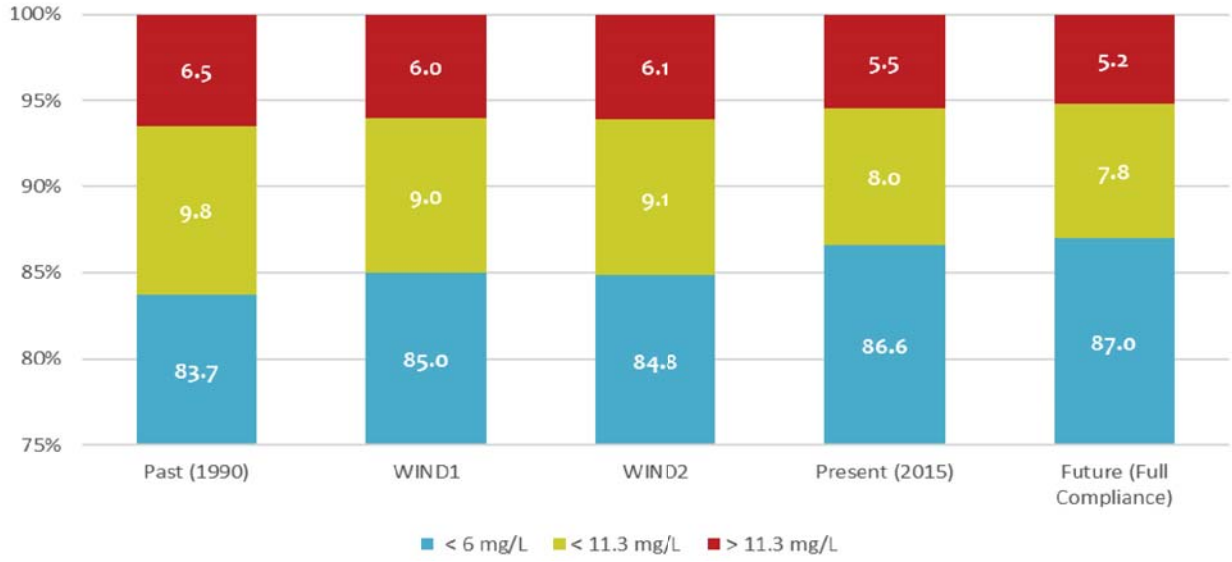


Figure 17 EU-28 river network with N limits below those set out in the DWD (11,3 mg/l) and precautionary limits applicable to children (6 mg/l).

The most significant source of N is diffuse pollution from agriculture (see the section on contextualisation). Additionally, N has a potentially long residence time in groundwater, which means that the effects of load reduction measures may only be visible after decades in the downstream surface receiving waters (Grizetti *et al*, 2017).

The public consultation results regarding the UWWTD's effectiveness to reduce N show that stakeholders are slightly less positive on N compared to BOD, with only 38% judging that the UWWTD was very effective and 36% that it was somewhat effective. Only 1% of respondents considered the UWWTD to be very ineffective, and 9% judged that it was neither effective nor ineffective (n=344).

Phosphorus

Modelling shows that there has been a significant reduction in P released through treated waste water, and that this was achieved through compliance with Article 5 (*Figure 18*).

[20] The UWWTD from 1991 makes reference to Council Directive 75/440/EEC, which has since been revised twice with a proposal on a recast of the Directive pending at the time of the UWWTD evaluation. The modelling considers nitrate (NO3) 50mg/l (11,3 mg/l as N).

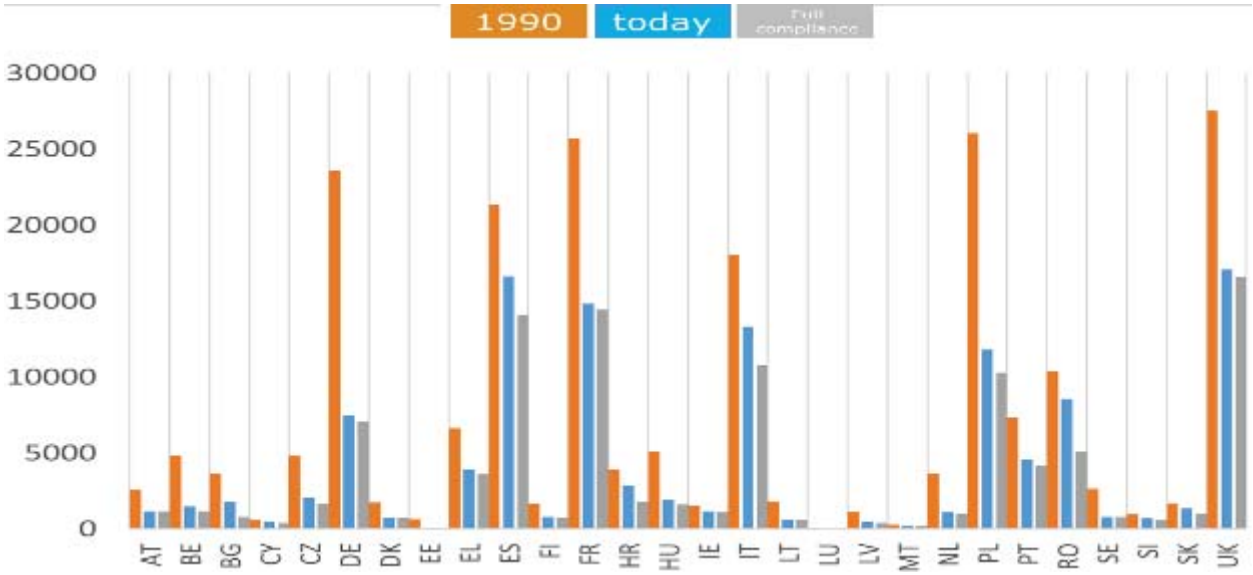


Figure 18 Reduction of P content (tonnes/year) in treated waste water

Monitoring data from rivers and lakes across the EU support this finding and show that concentrations of orthophosphate in rivers have more than halved between 1992 and 2015 (*Figure 19*). The EEA links this to the implementation of the UWWTD and improvements in the EU's regulation of P in detergents.

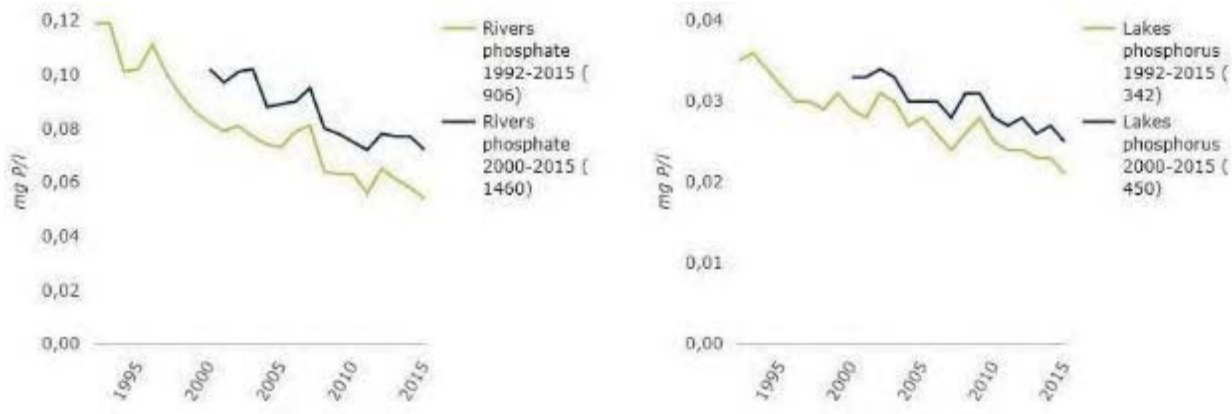


Figure 19 Phosphate in rivers and phosphorus in lakes. EEA (2019a).

According to modelling results, the status of about 10% of the EU river network improved from below 'good', to 'good' or 'high' thanks to UWWTD implementation. An additional improvement of about 1% can be expected with full implementation (*Figure 20*). Without the Directive, up to 50% of the river network in some Member States would be below 'good' status (see Annex 4, WIND results). However, when considering other sources of P in EU water bodies, urban waste water remains one of the main pressures.

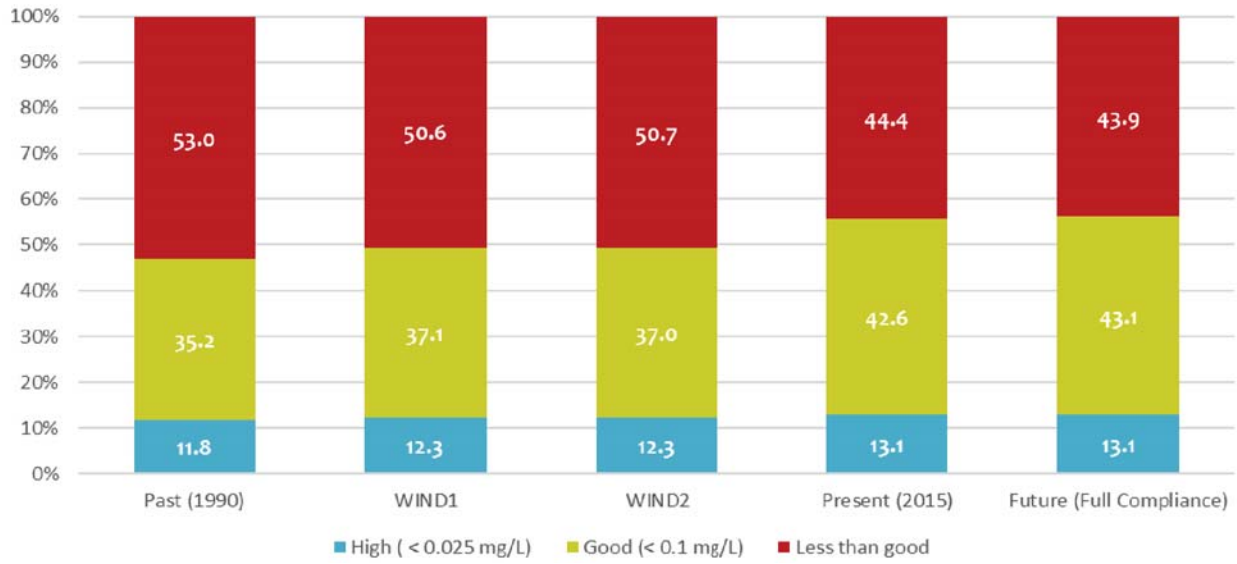


Figure 20 EU-28 river network conditions regarding P quality standards under different scenarios

In the public consultation, 37% of stakeholders held that the UWWTD was very effective in reducing P and 36% held that it was somewhat effective (n=343). Only 1% held that it was very ineffective and 10% considered it neither effective nor ineffective.

Impact of the UWWTD on bathing waters and on chemical concentrations in treated waste water

The UWWTD's effectiveness can also be assessed using bathing water quality standards for microbiological pollution. This is related to point (c) of Annex III of the UWWTD, which requires more stringent treatment when this is necessary for the attainment of objectives under other directives – in the case of bathing waters, the BWD. Some Member States have categorised areas as sensitive due to the presence of bathing water sites, and apply disinfection as the more stringent treatment required (see coherence). Removal efficiencies for coliforms of primary and secondary treatment are on average 95%. Results show that the UWWTD has had a substantial effect on improving **bathing water sites** in the EU (*Figure 21* and *Figure 22*), in accordance with the BWD's thresholds for inland and coastal bathing sites. Without the impact of the UWWTD, it is estimated that, on average in the EU, more than 25% of improvements would not have been achieved.

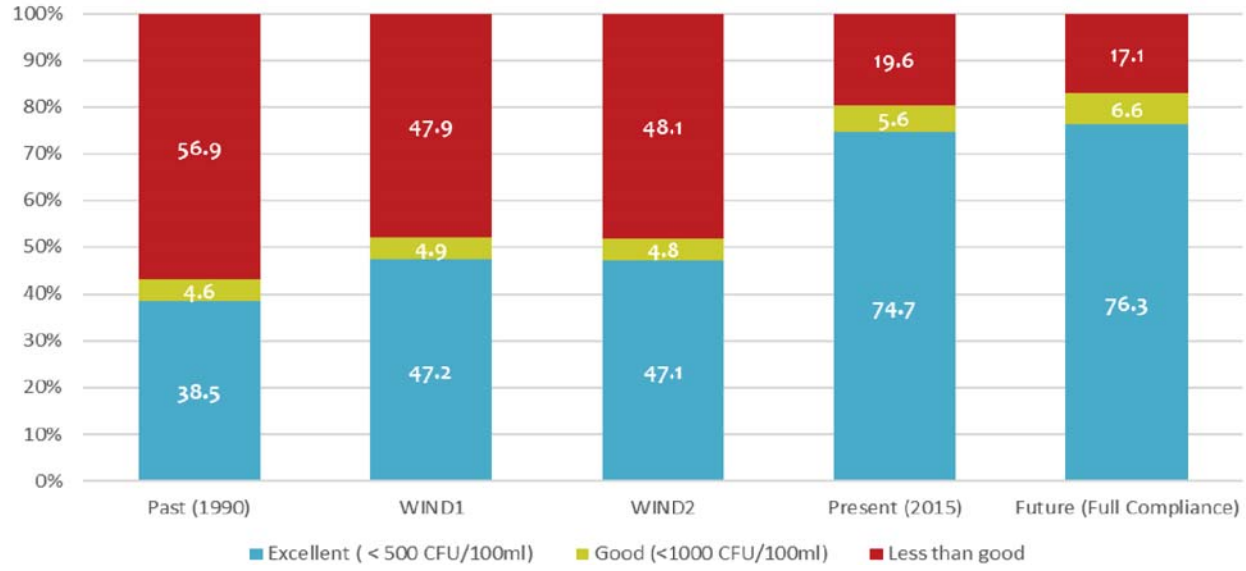


Figure 21 Conditions of EU inland freshwaters as regards bathing water standards under different scenarios.

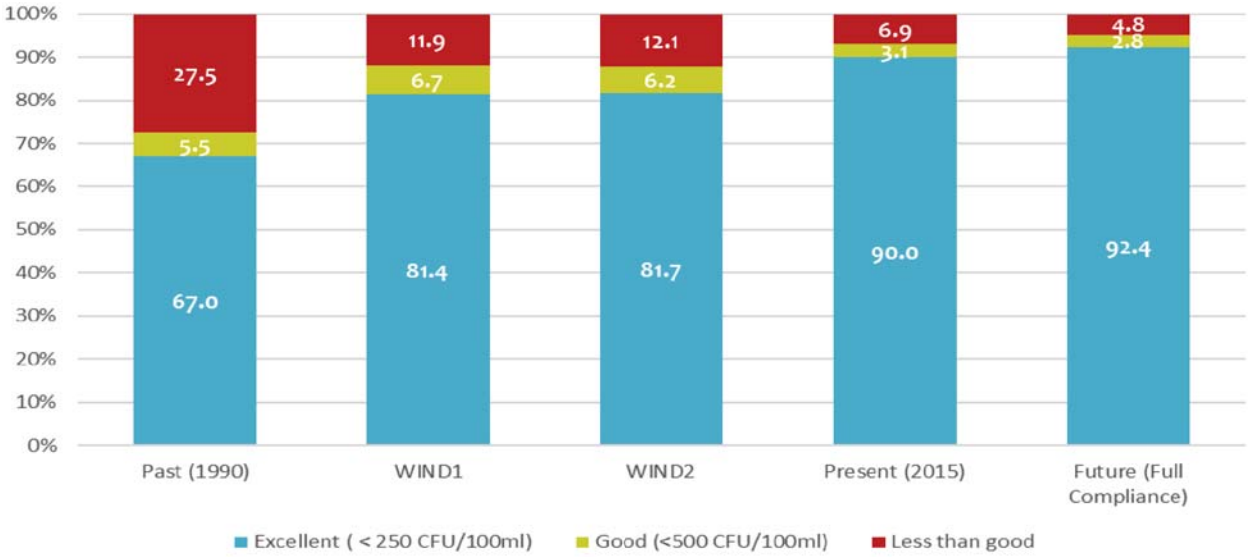


Figure 22 Conditions of European coastlines as regards bathing water standards under different scenarios.

In 2017, 96% of the EU's designated bathing sites reached the minimum quality requirements of the BWD, with 85% rated 'excellent'. This compares to 80% compliance for coastal waters and 52% for inland waters in the 1990s[21]. According to the EEA, in the past the release of untreated waste water into the environment was a primary source of pollution. Bathing water quality improved partly due to heavy investment in waste water collection and treatment (EEA, 2018c, EEA, 2019c).

Furthermore, through secondary and more stringent treatment, some **chemicals** (other than N and P), including pharmaceuticals, are partially or entirely removed depending on

[21] In the 1990s, the predecessor of the current BWD was in place and reporting differed slightly. Member States' compliance with the obligatory values for **coastal bathing waters** was at slightly below 80% in 1990. For EU **inland bathing waters,** compliance with mandatory values was 52% in 1990 (EEA, 2015).

their behaviour in the process (*Figure 23*)[22], whereas other chemicals are effectively *not* removed from the influent to the WWTP. A preliminary modelling of chemical removal during the different waste water treatment stages shows that, before adoption of the Directive:

- around 30% of the length of the EU river network was below concentration thresholds that may be assumed to correspond to good conditions in terms of chemical pollution, and
- more than 50% was below a threshold assumed to represent good conditions.

In a scenario where the Directive is fully implemented, these increase to more than 50% and 80%, respectively. Although chemicals have different behaviours and outcomes in WWTPs, this pattern can be observed for most. Thus, the UWWTD has also been effective in removing non-target chemicals. For some chemicals, however, being removed through treatment means that they are transferred to and concentrated in the sludge (for details, see Pistocchi *et al*, 2019).

Figure 23 Reduction of pollution in the European stream network with the implementation of the UWWTD: metachemical c#3, e.g. estrone (E1), estradiol (E2), bisphenol A (see Pistocchi et al, 2019 for details).

Factors influencing the effectiveness of the UWWTD

The Evaluation results have shown that, in general, the UWWTD is achieving its objectives to help protect the quality of EU water bodies. By doing so it also supports the attainment of the objectives of other EU legislation related to water. Member State reporting under the WFD, however, shows that urban waste water still results in 12% of surface water bodies failing to achieve good ecological status.

In addition, modelling shows that full compliance with the UWWTD could help avoid around 490 000 t/year of **BOD loads** being discharged from non-compliant

[22] For all metachemicals or Pistocchi et al. (*forthcoming*).

agglomerations. Additionally, 110 000 t/year of BOD loads from IAS and 210 000 t/year from SWOs could also be avoided. Though not directly covered by the Directive, the requirement to ensure the same treatment levels for loads from small agglomerations and non-connected dwellings would lead to about 230 000 t/year less BOD being discharged. Lastly, 690,000 t/year BOD could be avoided by fully dealing with urban runoff (*Figure 24*).

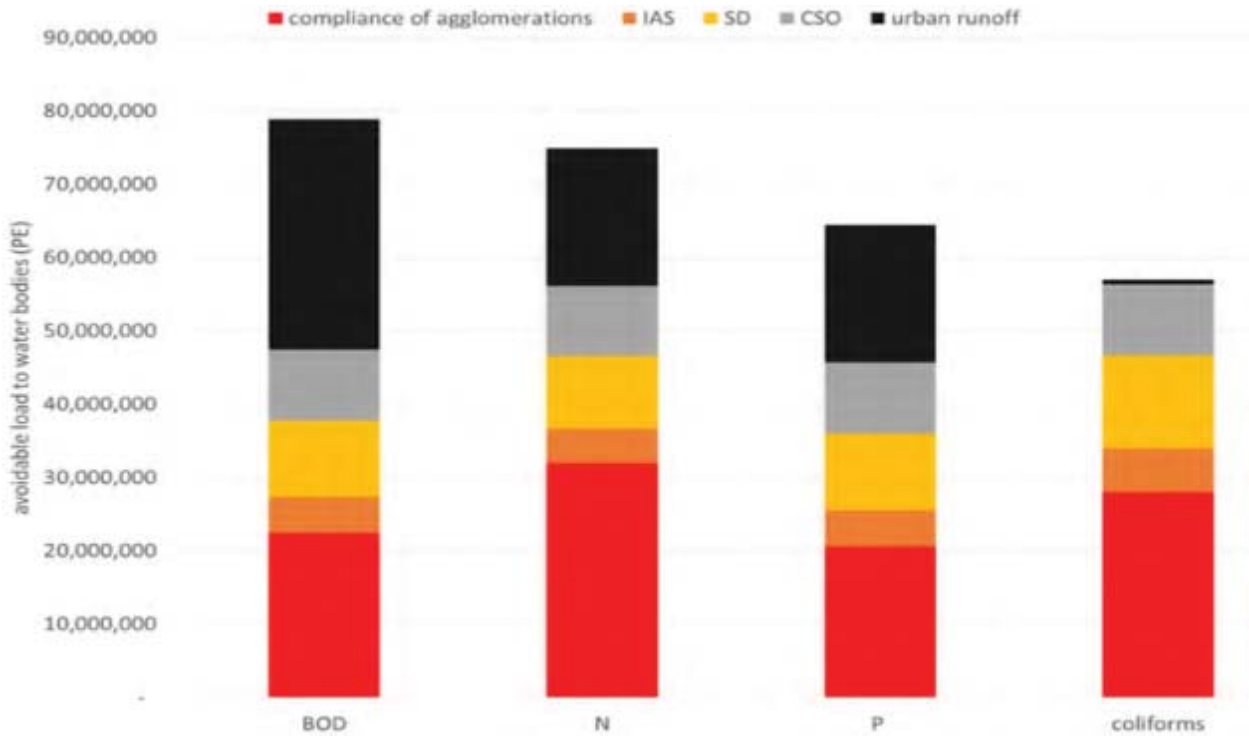


Figure 24 Remaining loads that can be avoided[23] *(SD=agglomerations below 2 000 p.e.)*

Thus, although the Directive is generally effective in reducing loads and improving water quality, a number of factors reduce its effectiveness. These factors either (i) relate to late or incomplete implementation, (ii) stem directly from the Directive's text, or (iii) arise from issues that are not (directly) in the scope of the Directive.

Late implementation: reasons behind late or incomplete compliance

One of the factors that negatively influence the UWWTD's effectiveness in terms of reducing loads and protecting water quality is that several Member States have not yet fully implemented the Directive. According to *Figure 24*, a high proportion of remaining loads comes from non-compliant agglomerations. This is in line with the findings discussed in the state of play section.

In the early 1990s, the levels of infrastructure in place for waste water collection and treatment varied across the EU-15. When the UWWTD entered into force, it set out standard deadlines by which all Member States had to meet its requirements. Even

[23] Meaning: loads that can be avoided by enforcing full compliance with the UWWTD (for agglomerations); an equivalent treatment level (for small agglomerations <2 000 p.e. = SD); full control of CSO (neglecting management measures currently in place); and effective enforcement of IAS treatment equivalent to the WWTP of the corresponding agglomeration. Urban runoff excludes the CSO component.

though over time many Member States reached good implementation levels, some EU-15 and EU-13 Member States still have not fully complied with requirements.

The high number of infringement cases that were opened against Member States, especially based on Articles 3-5, demonstrates the scale of the issue. In total, there were **29** infringement cases related to Articles 3-5 with a final ruling at the time of the Evaluation. Overall, it seems that the **deadlines** initially accepted by the 12 countries that were EU Member States when the UWWTD was adopted and were later included in the successive Accession Treaties were overambitious for several Member States. However, some Member States that joined the EU after 2004 managed to increase compliance very quickly, e.g. EE increased compliance with Article 3 from 30% in 2010 to 94% in 2014, thanks to good use of funding and strong political will. A major underlying factor for delays is financing and this is discussed separately in the section on financing UWWTD implementation.

In some Member States, there also seems to be a **lack of institutional ability and administrative and technical capacity** to implement correctly the Directive, as well as an inability to use funds effectively at local or regional level and to undertake large-scale projects. Furthermore, there are difficulties with planning the implementation of the UWWTD at national, regional and local level across the EU (see box on IT). Problems with public procurement also persist. In addition, some cases indicate that the population forecasting needed to implement the UWWTD correctly (e.g. urbanisation, changing demographics, fluctuations due to tourism) can be difficult and may delay implementation. For instance, in RO and SK there are cases of incorrect sizing of WWTPs, where the infrastructure was undersized relative to the generated load of the agglomeration (ECA, 2015).

Challenges for UWWTD implementation in Italy

Italy has a complex institutional set-up for implementing the UWWTD. Although administrative arrangements and relationships are set in the national legislation, communication and coordination between national and regional or local authorities can be slow. This is crucial, because the Italian regions are responsible for monitoring, managing and protecting water bodies, as well as planning infrastructure and enforcing law. The authorities responsible for water supply and sanitation services in Italy are the AATOs ('Autorità di Ambito Territoriale Ottimale'), which were specifically created to manage integrated water services. AATOs plan the investments necessary and then delegate the management of the integrated water services to a joint-stock company. In principle, the public authorities maintain ownership of the infrastructure, while the integrated water services may be handed over to either publicly-owned operators or privately-owned operators under contract.

There are also cases where the efforts and time needed for implementation were underestimated, or where there was a lack of political will to prioritise UWWTD implementation and channel the needed resources into implementation activities. These sorts of situations can lead to a lack of resources at local level, which is where implementation projects are typically run and where infrastructure is managed. A lack of clarity as to responsibilities between governance levels can lead to sub-optimal or delayed implementation as well. There is also evidence that overall governance difficulties impact the implementation, for instance, BE pleaded in Case C-236/99[24]

[24] Judgment of the Court (Sixth Chamber) 6 July 2000 (1) (Failure by a Member State to fulfil its obligations - Failure to transpose Directive 91/271/EEC) in Case C-236/99, Commission of the European Communities v Kingdom of Belgium. Case C-236/99

where BE pleaded that political and administrative difficulties were emerging from the process of institutional reform which it had to carry out to preserve the unity of the State. Due to these difficulties, the implementation of the Directive was delayed. Another difficulty for implementation at all levels can arise if there is opposition from the public. In EL, for instance, the public was opposed to having the necessary infrastructure installed in Eastern Attica, which led to delays in implementing the Directive in this area. In RO, as well as in a few other Member States such as SK and EL, there are cases where people do not want to connect to existing collection systems as they already have individual systems in place and a connection to the collection system is perceived as a very expensive both one-off and recurrent cost.

In the public consultation, stakeholders confirmed these findings across all categories, identifying similar barriers — lack of funding[25] and lack of political will[26] — as major issues. Almost half of the respondents held that the Directive has not been implemented effectively (one third of these being citizens), with 37% arguing that it was and 21% stating that they do not know (n=341). When considering only WWTP operators and Member State competent authorities, 42% stated that the UWWTD has been implemented correctly. Stakeholders raised concerns about different levels of ambition across regions, varying levels of industry compliance with minimum standards for effluents, unequal application of IAS requirements and the need to address SWOs more consistently.

Overall, these findings are aligned with the overall findings of the 7th Environment Action Programme Evaluation, which identified a lack of implementation, investment, information and integration as the main challenges for EU environment policy (EC, 2019b).

In parallel to these underlying factors that hinder or delay implementation, a number of **EU-level drivers** support Member States in implementing the Directive, especially EU funding which helps Member States cover the costs of implementing the UWWTD. EU funding has also led to more integrated regional development, as it required the adoption of WFD RBMPs as a precondition (*ex ante* conditionality) of receiving funding (Regulation No 1303/2013). Over the three financing periods since 2000, a total of EUR 38.8 billion of cohesion policy funding was allocated to the EU waste water sector (see financing the UWWTD implementation) (Cowi *et al*., 2019, p. 62[27]).

Acknowledging the scale of expenditure required to implement the UWWTD successfully, in parallel to the Evaluation the Commission launched a joint study with the OECD on investment needs and financing options in the EU water sector. This includes comparative assessments of Member States' investment needs and targeted Member State workshops to discuss future financing options. Aside from this study, the Commission also carries out a number of other **compliance promotion activities**. It has set up a UWWTD expert group, which typically meets at least once every two years to discuss the results of the latest reporting exercise, as well as findings from other relevant studies. It also participates in meetings with candidate/accession countries to prepare for UWWTD implementation. Additionally, the Commission carries out UWWTD-related

[25] 85% judged this as a high or moderate barrier, n=77.

[26] 85% judged this as a high or moderate barrier, n=77.

[27] Cohesion Policy Open Data Portal, accessed on 27/11/2019, completed with Cowi *et al*., (2019) data.

studies to investigate specific issues (e.g. the COD requirement and the use of IAS), publishes guidance (EC, 2001) and supports research in the waste water area through its cohesion policy funds, the LIFE programme and the Horizon 2020 financing mechanism.

Other compliance promotion programmes include technical assistance through JASPERS and the TAEIX REGIO Peer 2 Peer and TAIEX EIR Peer 2 Peer programmes. These programmes are demand-based and give Member States an opportunity to exchange experiences and learn from each other. In addition, the Commission can provide structural assistance through the Structural Reform Support Service. For instance, in 2018 the Scottish Water Industry Commission worked with the Romanian regulator through this service to analyse inefficiencies in the water sector and develop ideas for improvement.

Aside from funding, infringement procedures were also identified as an effective way to increase implementation levels. Active legal enforcement is a tool that the Commission uses to foster compliance with the UWWTD. Overall, more than 40 CJEU rulings were issued by June 2018 (*Table 5*) and this does not include infringement cases that were closed before reaching the Court. Infringements can lead to penalties, which in the past have ranged between EUR 2 million and EUR 25 million for lump sum fines and between EUR 2 800 and EUR 8 000 for each day of delay. Infringement procedures are generally rather slow, but they do drive Member States to gradually become fully compliant.

Member States	**Infringement cases per time period with final**					
	1991 - 2000	2000 - 2005	2005 - 2010	2010 - 2015	2015 - 2018	Total: 1991 - 2018
EL	1	2	1	1	0	5
ES	1	4	0	0	0	5
IT	2	1	2	0	0	5
PT	0	2	2	0	0	4
FR	1	2	1	0	0	4
UK	1	2	0	1	0	4
BE	2	0	1	0	0	3
LU	0	1	0	0	0	1
IE	0	1	0	0	0	1
FI	0	1	0	0	0	1
SE	0	1	0	0	0	1
DE	1	0	0	0	0	1
Total number of infringements cases with final ruling	9	17	7	2	0	35

Total number of referred agglomerations in the final judgments of the CJEU	168	129	255	17	0	569

Table 5 Number of Art. 258 infringement cases per Member State with a final ruling by the CJEU between 1991 and 2018. NL, DK and AT had no infringement case.

Financing UWWTD implementation

The assessment of late implementation indicated that Member States' difficulties with financing UWWTD implementation were a major cause of implementation delays. The UWWTD does not prescribe how Member States should organise their water supply and waste water sector, and Member States use different models of governance. The management models used most often are public- and delegated private management. In the first case management remains in the hands of the public and, in the latter, the public entity contracts a private company to manage operations. The infrastructure is almost always owned by public authorities (EurEau, 2018). The UWWTD also does not prescribe how Member States should finance infrastructure and the operation and maintenance of collection systems and WWTPs. However, both the TFEU and the WFD do provide indications on how water services should be financed. Article 191(2) TFEU states that 'environmental damage should as a priority be rectified at source and that the polluter should pay'. Article 9 of the WFD, under which the UWWTD is a 'basic measure', requires that Member States ensure that *adequate* contributions are received from the different water uses. This is meant to recover costs of water services based on economic analyses and by taking into account the 'polluter pays' principle. When choosing their approach, Member States should consider possible social, economic and environmental effects.

In terms of **financing**, the OECD's analysis shows that Member States use a mix of public budget and water tariffs to finance their water supply and waste water sectors (*Figure 25*). Some Member States manage to almost entirely finance their water supply and waste water sector through revenues from water tariffs (e.g. DK, UK). Others like IE, CY and LU are heavily relying on budget transfers.

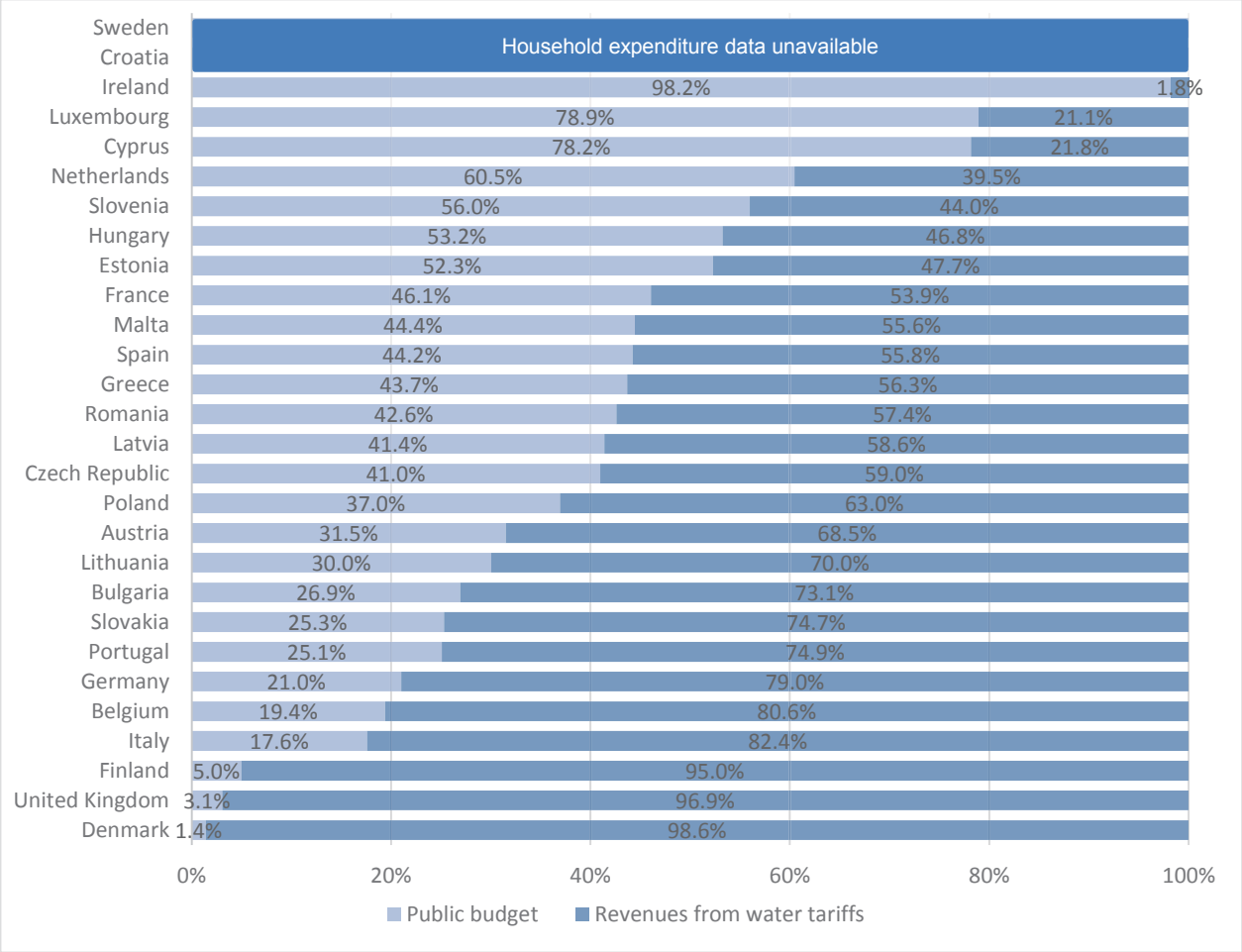


Figure 25 Sources of funding for water supply and sanitation services per Member State as annual average over the 2011-2015 period[28]*. Source: OECD (forthcoming – draft findings)*

A number of Member States have struggled to meet the investment requirements related to UWWTD implementation. For instance, Case C-293/05[29] IT pleaded that substantial funds are needed to construct the infrastructure needed and that this was the reason for delayed implementation. The Court rejected this argument. Budgetary constraints were also raised by BE as an argument for delayed implementation.

In terms of future investment needs, the OECD assessed the total additional expenditure that each Member States needs to spend to reach compliance. As shown in *Figure 26*, IT, ES and RO, but also PL, BG, PT, SK and HR need to increase their expenditure to reach compliance.

[28] The OECD notes that it is likely that there is an overestimate of supply-related expenditure (and a corresponding underestimate of sanitation) in countries where waste-water-related charges are included in the water bill.

[29] Judgment of the Court (Sixth Chamber) of 30 November 2006. Commission of the European Communities v Italian Republic. Failure of a Member State to fulfil obligations - Directive 91/271/EEC - Pollution and nuisance - Urban waste-water treatment - Province of Varese. Case C-293/05.

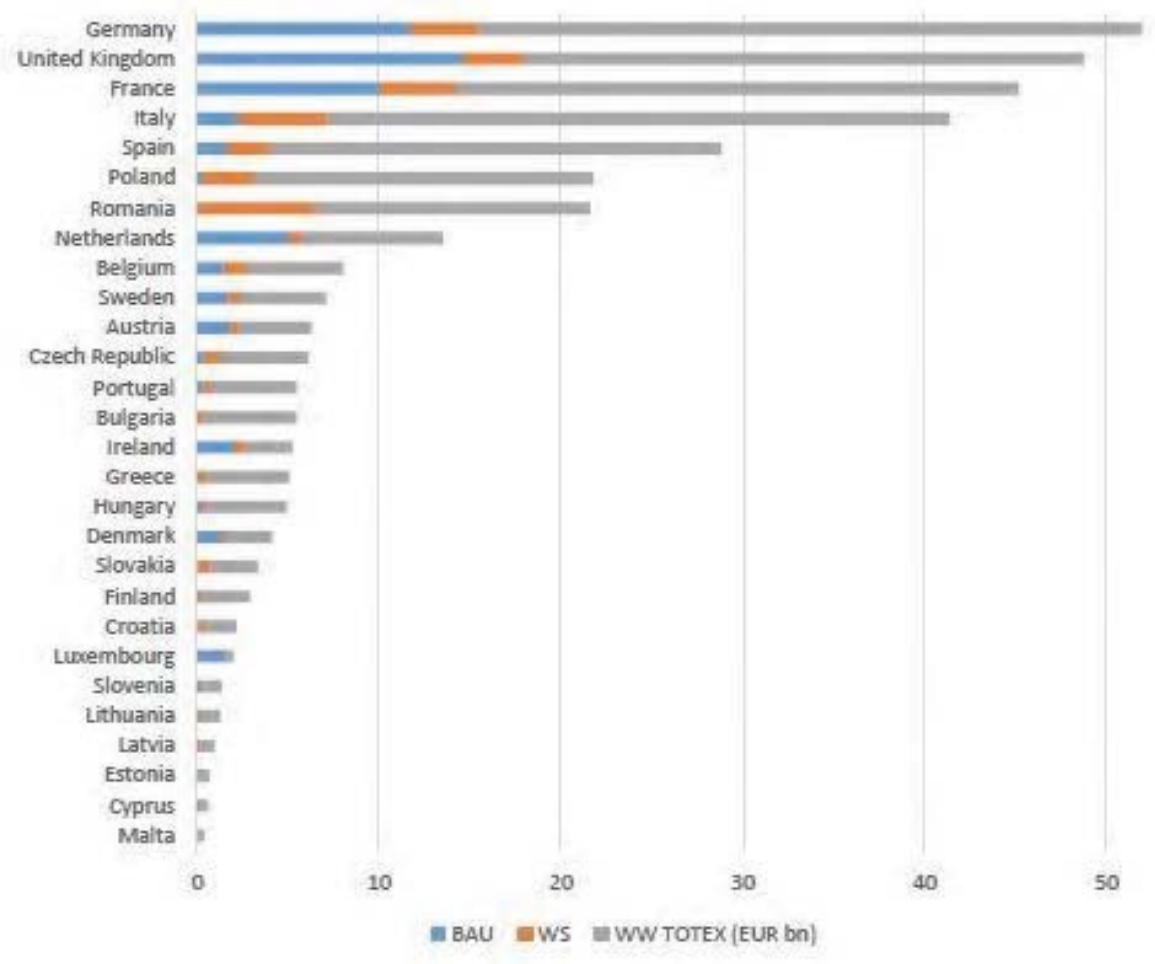


Figure 26 Total additional expenditures to 2030: Business-as-usual (BAU) + Compliance + Efficiency. Source: OECD (forthcoming – draft findings)[30].

At EU aggregate level, to reach full compliance with the UWWTD, a further EUR 253 billion would need to be spent between now and 2030.[31] The additional expenditure needed to comply with the revised DWD (and to provide more access to water and improve system efficiency) and the UWWTD can be broken down by Member State. *Figure 27* shows that, apart from DE, all EU Member States need to increase their spending by more than 25% compared to what is currently being spent (baseline level). Some Member States need to spend more than double what they currently spend (e.g. RO).

[30] Although the methodology for these estimates is considered to be stable and findings have been shared with Member States and experts, further efforts will be made to further fine-tune the assessment. This might lead to changes to the projected investment needs in a few countries, but the order of magnitude will remain the same. Overall, it is assumed that the investment needs for the waste water sector are underestimated due to shortcomings in the baseline.

[31] This is an estimate, see OECD (*forthcoming*) for details.

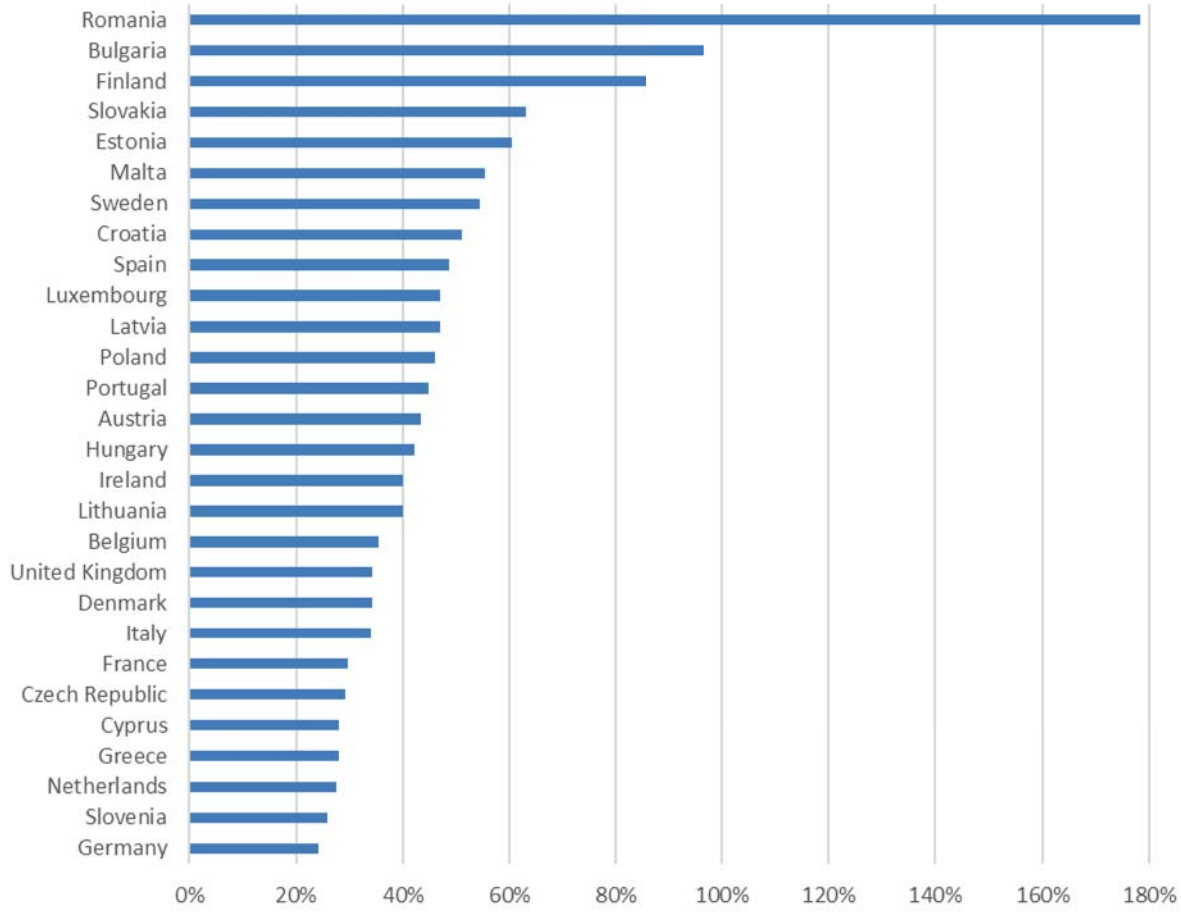


Figure 27 Annual additional expenditure needed by 2030 per Member State, as a percentage compared to the baseline expenditure level.

Member States have to not only *achieve* compliance with the UWWTD, they also have to maintain it. The patchy information on **investment in infrastructure renewal** shows that Member States are potentially not spending enough to ensure continuous compliance. According to the EU water industry association EurEau, given that collection systems can last for several decades, an annual renewal rate of 1% could be acceptable. However, this level is not met in many countries. In many Member States, water tariffs cover only operational costs and not the amortisation of infrastructure or renewal (EurEau, 2017)[32].

Under WFD reporting, there is no overview of how cost recovery is applied across the water sectors of the 28 EU Member States. In its 2nd RBMP assessment, the Commission noted that Member States have improved their general water pricing policies by fulfilling the precondition for receiving funding for water under the European Structural and Investment Funds for 2014-2020 (EC, 2019c). There is no evidence of different cost recovery strategies having a major effect on the internal market. Generally, in the cost structure of European industries, the cost of water is relatively modest compared to that of raw materials, energy and wages.

[32] The OECD noted that many of the OECD countries need to replace their ageing water infrastructure (OECD, 2009)

A mix of tariffs, taxes, and EU funding can be used to meet the investment needs required to achieve UWWTD compliance. This is supported by Article 9 of the WFD, which requires 'adequate contribution of the different water uses…to the recovery of water services'. **The 'polluter pays' principle** should be respected as regards waste water, and so households and industry, as the primary polluters, are usually charged to a certain extent. The structure of water tariffs applied to **households** varies between Member States, though often contains one fixed and one volumetric component. The actual price is often set at local level, whereas the tariff structure is often decided at national level (EurEau 2018).

Industrial dischargers are usually required to acquire installation permits if they release their waste waters in the urban waste water collection system. These are issued either under the IED for bigger industries or at local level for smaller activities. Permits usually require industrial dischargers to contribute financially to the treatment of their releases in WWTPs. Sometimes they pay based on their own assessment of what is contained in their waste water, which might not reflect the true level of pollution they cause. In other instances, regular sampling reflecting the actual pollution emitted is taken, and is verified by the local competent authorities.

The **affordability of water supply and waste water services** to households in Member States can be assessed by dividing the total costs by the number of households in the individual Member States and comparing this to their disposable income. There is no one generally agreed level of how much a household should be able to spend on water services. The results of the OECD study show that, at current levels of water service charges, only RO's and BG's lowest income households deviate from the average (*Figure 28*)[33]. Affordability issues are usually solved at national/local level, notably by introducing social tariffs, social quotas or other specific support (not covered by the OECD's work).

[33] The Commission considers a 4% affordability level as indicative, and the adequate ratio is to be set by Member States. Source: Commission reply 5(a) (European Court of Auditors (2015, Special report no 23/2015.) See also CIS Guidance Document 20 on exemptions to the environmental objectives.

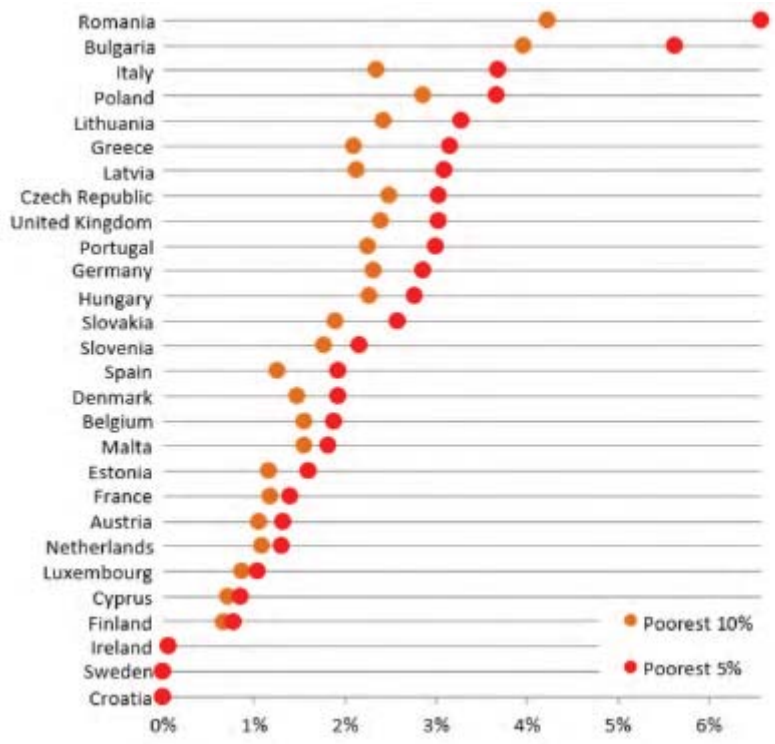


Figure 28 Proportion of water supply and waste water service expenditure in household disposable income (2011-2015 average). Source: OECD (forthcoming – draft findings).

Increasing water tariffs is often unpopular with the public, which can cause politicians, especially at local level, to keep water prices artificially low, though this is also often done to protect lower income households. In IT, the issue of potentially raising water prices not only led to constant political debates but also to the organisation of a referendum in 2011. The referendum rejected the proposed reforms related to the water sector. The required investment was estimated at EUR 61/capita/year, but the actual investment made was EUR 33/capita/year.

In terms of financing the water sector, affordability constraints can keep some Member States from make further progress, especially when expenditure related to waste water and the water supply sector is already a significant part of their GDP (*Figure 29*).

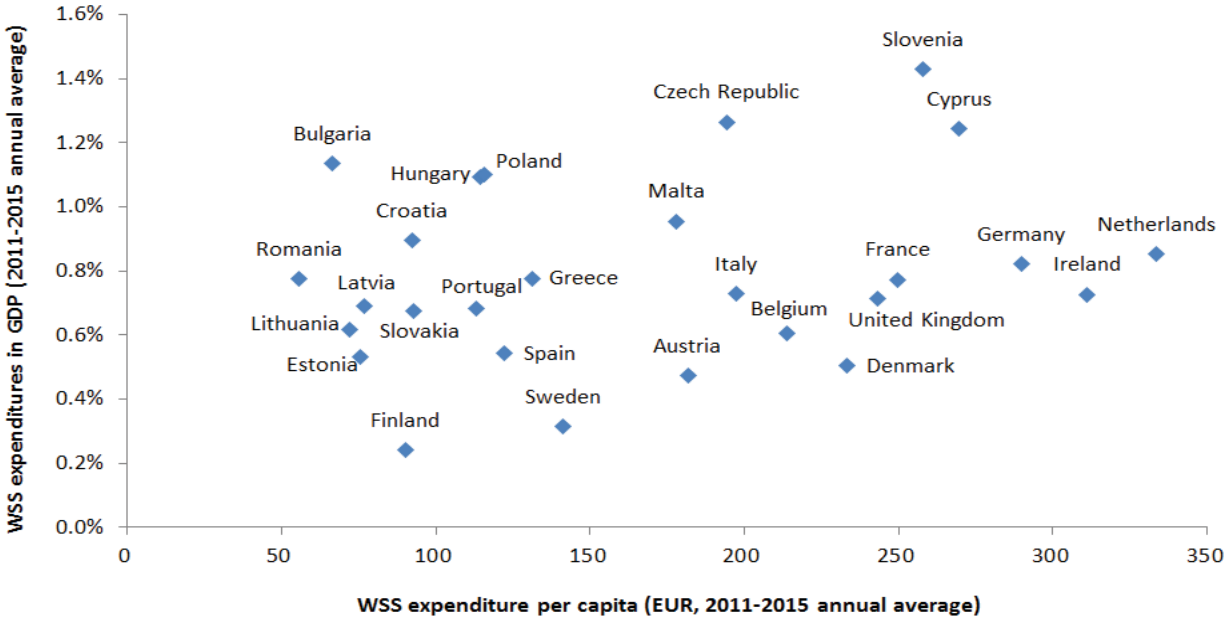


Figure 29 Macroeconomic affordability of water supply and waste water collection and treatment (WSS) in EU Member States. Source: OECD (forthcoming – draft findings).

Overall, Member States have flexibility in how to ensure sustainable financing of their water supply and waste water sector. Some rely too heavily on EU funding and need to ensure that their water sector will be financially stable when EU funding decreases. Others use high amounts of public budget transfers (which can include EU funding) and should consider increasing water tariffs, where possible, to ensure that compliance can be maintained over time.

Of the 300 replies to the public consultation question on the UWWTD's impact on the affordability of water services, only 37% indicated that it had a negative impact (with about 16% having no opinion or no answer). These 37% of respondents were mostly members of the public and public- and private WWTP operators. Over 244 replies to this question from members of the public, NGOs and water companies stressed that industry or other main polluters should pay for the needed treatment, referring to the 'polluter pays' principle.

The costs of implementing the Directive have been met with substantial **funding from the EU**. Over the past three financing periods, most environmental EU funding has been allocated to the water sector. Cohesion Policy allocations for the water sector added up to EUR 57.7 billion: on EU aggregated level, EUR 20.7 billion in 2000-2006, EUR 21.5 billion in 2007-2013 and EUR 15.5 billion in 2014-2020[34] were allocated to the water sector (Cowi *et al.*, 2019). In the 2007-2013 period, this contributed to about 7 million people in the EU being newly connected to or having improved waste water services. The decline in allocations is explained by the fact that some Member States (e.g. EE) have now met their basic needs by completing the infrastructure, and by the fact that the Commission considered that in the 2014-2020 period EU funding for basic environmental infrastructure should be focused on less developed regions (ibid.). Over the past three periods, Member States invested the lion's share into the waste water sector compared to the drinking water sector, with the waste water sector receiving EUR 38.8 billion of the EUR 57.7 billion. Over all periods, Cohesion Policy funded more than 50% of all water sector-related[35] expenditures in EE, LV and HU. EU investments funded more than 35% of all expenditures in LT, BG, MT, RO, PT and SK (ibid.). At the aggregated EU level, Member States covered about 25% of the total expenditure with EU funds.

Besides cohesion policy funding for direct investment in the water sector, EU funds (including cohesion policy funds, Horizon 2020 and LIFE funds) also supported research in the EU water sector. Between 2000 and 2017, the EU financed a total of 138 LIFE projects related to waste water treatment (EC, 2019d).

To summarise the discussion above, there are a number of financial and management issues when it comes to the economic aspects of implementing the UWWTD. **Financial issues** related to UWWTD implementation include the following: 1) full cost recovery

[34] Retrieved from Cohesion Policy Open Data Portal on 27/11/2019.

[35] COWI *et al.* (2017) explain that the water management related Directives (UWWTD and DWD) are the most cost intensive ones, but in the assessment it cannot always be factored out that a project was only linked to one of these Directives, it could also be linked simultaneously to the WFD (p. 56). Thus, comparisons between the OECD's work and the COWI *et al.* study are only possible to a limited extent.

can in some Member States be constrained by affordability, 2) Member States' economic situation and their ability to use loans, 3) national co-funding when EU funding is being used, and 4) financing sources are not sufficient for the maintenance of infrastructure. **Management** and associated issues mainly relate to 1) Member States' ability to use funds effectively, 2) the lack of financial sustainability of investments in infrastructure, 3) issues with national procurement law, and 4) the possible lack of (technically and financially) competent contractors.

Terms and obligations in the UWWTD

The Evaluation also assessed the clarity of the Directive's terms and obligations. If terms and obligations are unclear, this can lead to delayed implementation or reduce the effectiveness of the Directive. Overall, the Directive was found to be clear and straightforward in its intervention logic and enforceability. It sets out clear actions to be taken by Member States and clear deadlines for when these have to be accomplished. This clarity has supported the Directive's correct and timely implementation and its effectiveness.

Stakeholder respondents to the public consultation confirmed that the Directive is clearly drafted to a large (22%) or to some extent (66%) (n=301). Only 4% of respondents replied that the Directive is not clearly drafted and 8% indicated that they do not know.

Nevertheless, a few terms and obligations have been identified as not entirely clear. This has been noted by stakeholders, as well as through cases where the CJEU had to intervene or where further clarification through exchanges between Member States and Commission had to be sought. Such unclear terms include for instance 'storm water overflows', 'unusual situations' and 'sufficiently concentrated' in connection with 'agglomerations' (see storm water overflows and IAS, and Annex 4, terminology) and the obligations related to these. Although not mentioned in the UWWTD, the term 'tertiary treatment' was also often mentioned by stakeholders as unclear.

Aside from these specific terms, the requirements on water reuse and sludge reuse were also found to be unclear, with plenty of room for interpretation of the meaning of 'whenever appropriate' as well as lack of clarity on which requirements apply if water and sludge were to be reused and for which purposes they may be reused. The questions related to water reuse have been clarified through the Commission's proposal for a regulation on water reuse (EC, 2019d).

The main terms discussed in the Evaluation to assess impact on the UWWTD's effectiveness are 'storm water overflows', 'urban runoff', IAS, 'scattered dwellings' and eutrophication. As shown in *Figure 24*, IAS and SWOs are estimated to be a sizeable contributor to remaining loads that could be avoided.

Storm water overflows (SWOs) and urban runoff

Next to non-compliant agglomerations, storm water overflows (SWOs) and urban runoff account for a significant proportion of the BOD load. This could be avoided through full control of SWOs[36] (*Figure 23*). The UWWTD only includes a footnote on SWOs, stating that "*…during situations such as unusually heavy rainfall, Member States shall decide*

[36] In the SWO workshop on 25 October 2018, it was clarified that this means combined sewer overflows.

on measures to limit pollution from storm water overflows. Such measures could be based on dilution rates or capacity in relation to dry weather flow or could specify a certain acceptable number of overflows per year." The Directive does not define what constitutes 'unusually heavy rainfall' or an 'acceptable number of overflows per year'. It also does not require the monitoring of overflows. **Other Directives**, such as the WFD, BWD and MSFD, do not address SWOs directly either, even though their objectives can be affected by SWOs. However, as these Directives set quality standards for water bodies and require water quality monitoring, measures addressing SWOs can be taken under them. In recent cases, the Court held twice that as 'unusually heavy rainfall' is not defined in the Directive, "it is legitimate for the Commission… to adopt guidelines**"** (para. 61) (Case C-310/10[37], see also: Case C-427/17[38]).

There are discharges from SWOs in cases of heavy rainfall events, when urban runoff enters the combined system and when the downstream collecting system does not have the capacity to convey all flows, domestic waste water and the urban runoff, to treatment. Urban runoff entering the sewer can carry several pollutants, such as heavy metals, hydrocarbons, urban pesticides and litter (including microplastics), from a variety of urban diffuse sources (e.g. pollution in streets and public places). The **first flush** is often (not always) more contaminated than later parts (Gupta, K & Saul, A., 1996; Barco et al., 2008). These overflows ensure that sensitive environments, public places and property are protected from flooding and that WWTPs are not overloaded during events during which the system's normal operating system capacity is exceeded. Overloading can lead to their poor functioning and severe environmental risks.

According to information reported under the 2nd round of RBMPs, SWOs were the cause of 4% of the EU's surface water bodies failing to achieve good ecological status (*Figure 3*) (EEA, 2018b). Modelling demonstrates that a significant proportion of the remaining load, which could be avoided, comes from SWOs, though it assumes that these are not addressed adequately at the moment (*Figure 30 above*). Modelling results show that, under assumed full compliance with the UWWTD, SWOs can contribute to 50% or more of the remaining load in some Member States where there are no management measures in place. Where SWO management measures *are* in place, loads can be substantially reduced (*Figure 30 below*). Still, the aggregated loads from SWOs in one region can be equivalent to those of an entire agglomeration of tens or hundreds of thousand p.e. The pollutants for which SWOs represent a potentially significant share of the total load to the environment are those that are usually well removed in WWTPs (coliforms, BOD, to some extent P and certain chemicals) (see Annex 4, storm water overflows). More frequent heavy rainfall events under a changing climate will further aggravate this issue.

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[37] Judgment of the Court (First Chamber), 18 October 2012, European Commission v United Kingdom of Great Britain and Northern Ireland, Failure of a Member State to fulfil obligations – Pollution and nuisance – Urban waste water treatment – Directive 91/271/EEC – Articles 3, 4 and 10 – Annex I(A) and (B), Case C-301/10.

[38] Judgment of the Court (Tenth Chamber) of 28 March 2019 European Commission v Ireland; Failure of a Member State to fulfil obligations — Directive 91/271/EEC — Collection and treatment of urban waste water — Exceptional circumstances — Best technical knowledge not entailing excessive costs — Principle that the costs should be proportionate — Burden of proof — Means of proof; Case C-427/17.

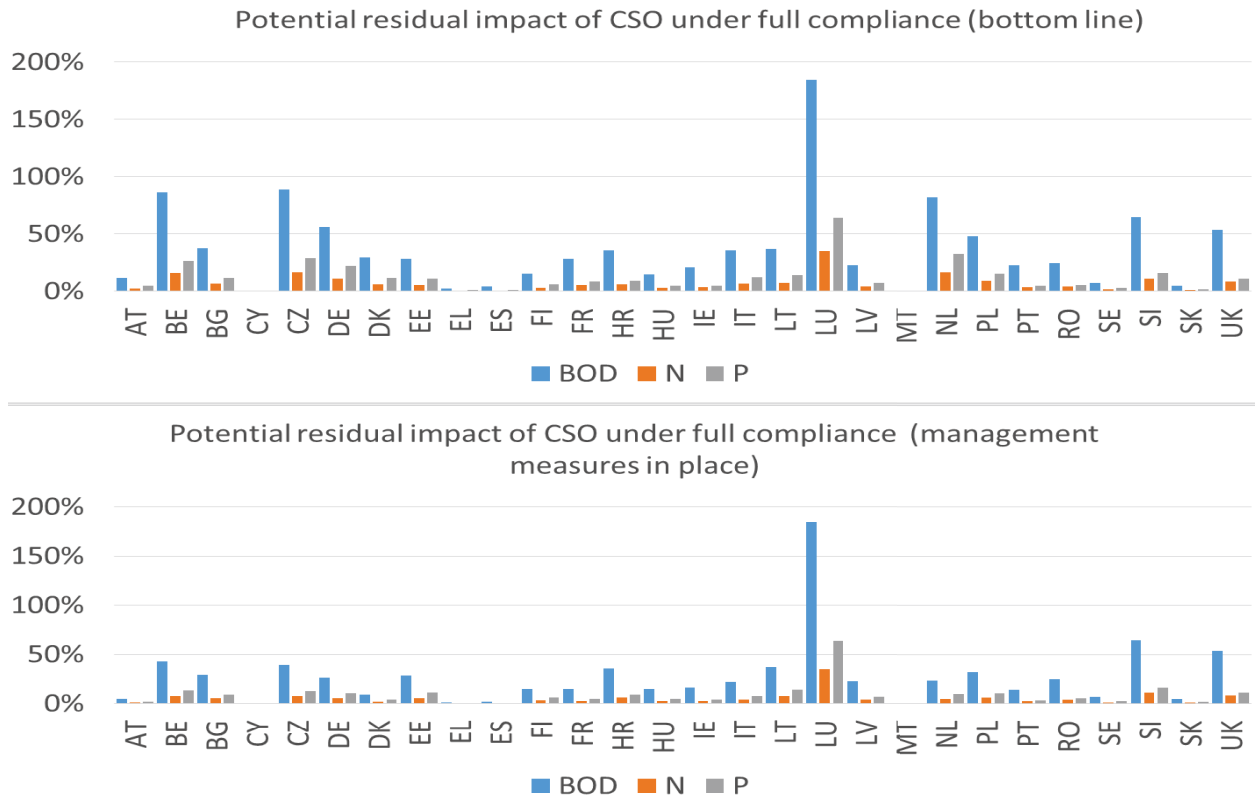

Figure 30 Modelled loads related to SWO as a percentage of the load generated from WWTPs in the EU-28.

These modelled estimates are developed at such a scale that they do not reflect the impact of SWOs at a local level. In its recent report on chemicals in European waters, the EEA identified overflows as the main pressure for a number of chemicals such as nonylphenol, metals, hexachlorocyclohexane and to a lesser extent for some herbicides. However, the EEA acknowledges that an assessment of the different sources and pathways for chemicals is difficult due to a lack of reported data (EEA, 2018f).

Member States have taken a number of measures to address SWOs. For instance, in England and Wales 'event duration monitoring' is used to determine event frequency and duration. In AT, international design practices such as mass balances are used to simulate the consequences of heavy rainfall events; where results show that WWTPs do not have the capacity to adequately deal with flows, the upstream collecting system is upgraded. ES has determined that SWO discharges need to be limited to 15-20 occurrences or to 10-15% of the yearly runoff volume. In DE, use is made of constructed wetlands that can retain peak flows, reduce suspended solids by filtration and reduce soluble particles through adsorption and biological degradation.

At 'big city' level, **Copenhagen** adopted a cost-effective approach to deal with flows that did not focus on upgrading the upstream collecting system. This integrated approach includes rainwater-harvesting systems, urban green spaces that can be infiltrated by storm water, special rooftops and diversion of rainwater into streets that can serve as channels. In **Rotterdam,** a full-scale water square that can retain up to 2 000 m^3 of rainwater was built and can be used for leisure activities in dry weather conditions (Urban Water Atlas, 2018).

From a **monitoring perspective**, new technologies to deal with SWOs include real time control (RTC) of collecting systems to maximise combined sewage retention during

rainfall events and minimise discharges going directly to receiving waters, by regulating flows. RTC systems often integrate a high number of data sources such as weather and water gauge measurements, data from surveillance cameras, and detailed hydraulic and water quality models, based on asset information.

> 'Urban stormwater is **one of the biggest problems** facing city infrastructure waterways today. Urban cloudbursts and the resulting rapid stormwaters that overflow along surfaces and in networks are more and more common in cities due to climate change, increasingly impervious surface areas, aging infrastructure and often undersized, centralised stormwater networks.'
> Urban Water Atlas (2018), p.26

Stakeholders representing Member States and industry raised the issue of the Directive's lack of clarity regarding SWOs during the public consultation, the dedicated SWO workshop and the major stakeholder conference. As an example, the lack of an EU-wide definition for 'spill' – meaning duration, volume etc. – was frequently mentioned during the workshop.

When urban runoff does not enter the sewer, it may directly enter water bodies. According to *Figure 24*, under full implementation of the UWWTD, **urban runoff** is the main avoidable source of BOD loads. The WFD does not contain a specific requirement for dealing with urban runoff, but Member States should put in place appropriate measures if they identify it as a pressure. This includes, for example: if runoff contains priority substances at levels that could result in failure to meet the environmental quality standards set for surface waters under the EQSD; if it contains priority hazardous substances whose emission to the aquatic environment should be phased out, or; if it results in the discharge of significant quantities of other pollutants that individual Member States should identify as river basin specific pollutants (EC, 2019f).

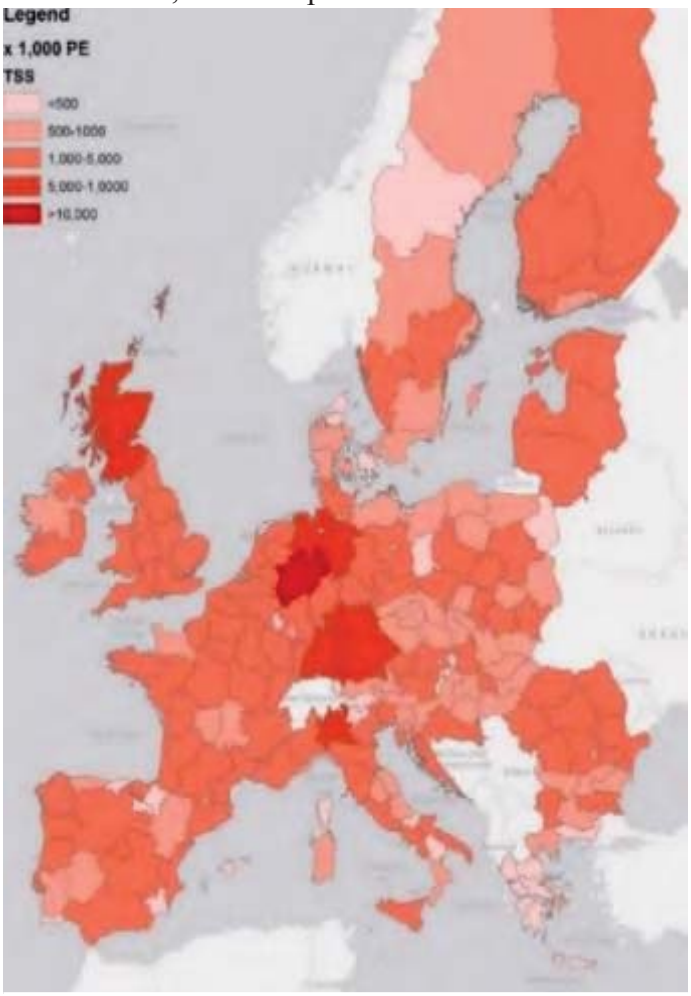

Figure 31 Urban runoff loads in terms of total suspended solids

Urban runoff causes failure of 3% of the surface water bodies in the EU to meet good ecological status according to information reported under the 2nd RBMPs (EEA, 2018). When untreated, the associated loads can be equivalent to or even higher than those of waste water from WWTPs. For instance, total suspended solids (TSS) in urban runoff can correspond to several million p.e. across the EU (*Figure 31*) (Grizzetti *et al*, 2017). In the absence of a holistic approach to cover urban water management, these kinds of loads might in the future represent a more substantial problem than waste water, especially in light of increasing numbers of heavy rainfall events in times of climate change and increasingly more impervious surfaces that do not allow the soil to absorb rain water (EEA, 2017).

Urban sources as well as agricultural runoff entering sewers were named as important sources of pollution to water bodies by 45% and 74% of the public consultation respondents respectively (n=608). Only 2% and 0.2% respectively believe that these sources are not relevant, and 16% did not provide an answer. Authorities, water industry and NGOs were more likely to state that this is an important source than citizens.

Individual and other appropriate systems (IAS)

IAS are considered to be another source of pollution, as shown in *Figure 24*. To understand whether the Directive leads to effective collection and treatment of waste water, the Evaluation assessed its provisions on IAS used in agglomerations above 2 000 p.e.[39] Article 3(1) allows Member States to use these systems as long as they ensure the same level of environmental protection as a collection system and treatment would, and if collection systems would lead to excessive costs or would not provide environmental benefits. In general, IAS are a useful alternative when, for example, collection systems cannot be built for geographic reasons. The UWWTD does not set out the extent to which IAS can be used; it is up to Member States to decide whether the conditions specified in Article 3(1) are met. Member States must report on how much of the waste water load is collected by IAS, but there is no specific UWWTD provision that obliges them to ensure monitoring of the resulting effluent or environmental impacts.

ISO standards for IAS

At technical level, the ISO EN 12566 standard prescribes rules for IAS used for up to 50 inhabitants. A few Member States adopted stricter standards to address their concerns about IAS having a negative environmental impact. In one specific instance, the CJEU ruled that these additional requirements on manufactured products introduce barriers to the correct functioning of the internal market.

Case C-100/13 European Commission v Germany.

The Directive does not define what kind of IAS technologies are adequate. 'IAS' is a catch-all term in the Directive and can cover all kinds of technological solutions. The 2007 terms and definitions of the UWWTD only require that these are contained systems that are impervious, not subject to overflow and that are regularly emptied meet UWWTD requirements. Although the 2007 guidance document discusses the use of IAS (UWWTD-rep group, 2007), implementation reports and stakeholder feedback show that there is a lack of clarity and common understanding of how to correctly implement the IAS provisions.

One recurring issue in this context is that, although the UWWTD provides a definition of the term 'agglomeration' (an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to a WWTP), there is a lack of clarity on how to actually delineate an agglomeration. Neither the UWWTD nor the 2007 guidance explicitly define what constitutes the 'sufficiently concentrated areas' mentioned in Article 2(4). Member States have used their own national ways to delineate agglomerations and decide which areas could be served by collecting systems and which areas would need to apply IAS. Furthermore, it is not further explained in the UWWTD or the guidance what 'excessive' costs are. The ECA remarked that the requirements regarding the use of IAS and ensuring that IAS achieve the same level of protection are vague (ECA, 2015, 2016). In consequence, the Commission has developed a new, more systematic legal approach to verifying IAS compliance, by checking the legal frameworks in Member States to make sure that they

[39] For a more in-depth assessment of IAS used in agglomerations below 2 000 p.e., see also: Ricardo (2019) Urban Waste Water – non-connected dwellings; funded by the EEA.

have certain specific obligations in place to regulate IAS. This approach was launched in 2016-2017, starting with a few Member States. The exercise is still ongoing, and as of yet it is premature to draw definite conclusions from this work. However, example cases point towards positive results (e.g. establishment of an IAS register in LV, new legislation being drafted in LT).

Regarding the **extent of IAS use** in agglomerations over 2,000 p.e., reporting under the UWWTD shows that Member States collect (and sometimes also treat) between 0% and 16% of their total load with IAS (*Figure 32*). Overall, about 15 million p.e. are served by IAS. In some Member States (i.e. SI, LT, CZ, SK and LV) the average load in big cities[40] being addressed by IAS is 2-5% of the total.

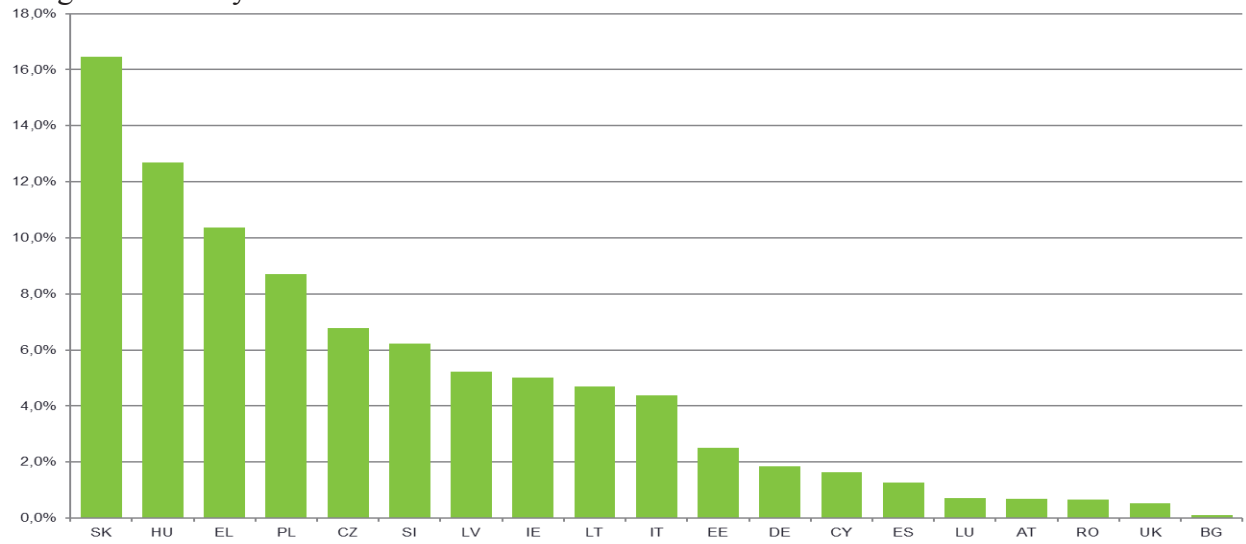

Figure 32 Share of total load in agglomerations >2 000 p.e addressed with IAS in 2014.

In terms of practices in the Member States, a variety of IAS technologies are in use, from simple units with basic filtration and/or primary treatment to more advanced solutions equivalent to individual treatment plants. Many IAS are simple storage tanks that need regular emptying; if a well-functioning system is in place, the contents of these storage tanks will reach the WWTP via trucks, thus ensuring an equivalent level of environmental protection. Overall, a well-designed and well-maintained IAS could result in similar levels of pollution reduction as UWWTPs.

However, a badly designed, maintained and unmonitored IAS **can have a negative environmental impact** when it is subject to overflows (as this can affect surface water bodies) or leaks (as this can consequently infiltrate groundwater). *Figure 33* shows the pathways that the diffuse pollution from IAS can take to reach surface and ground water bodies.

[40] Big cities are those above 150 000 inhabitants.

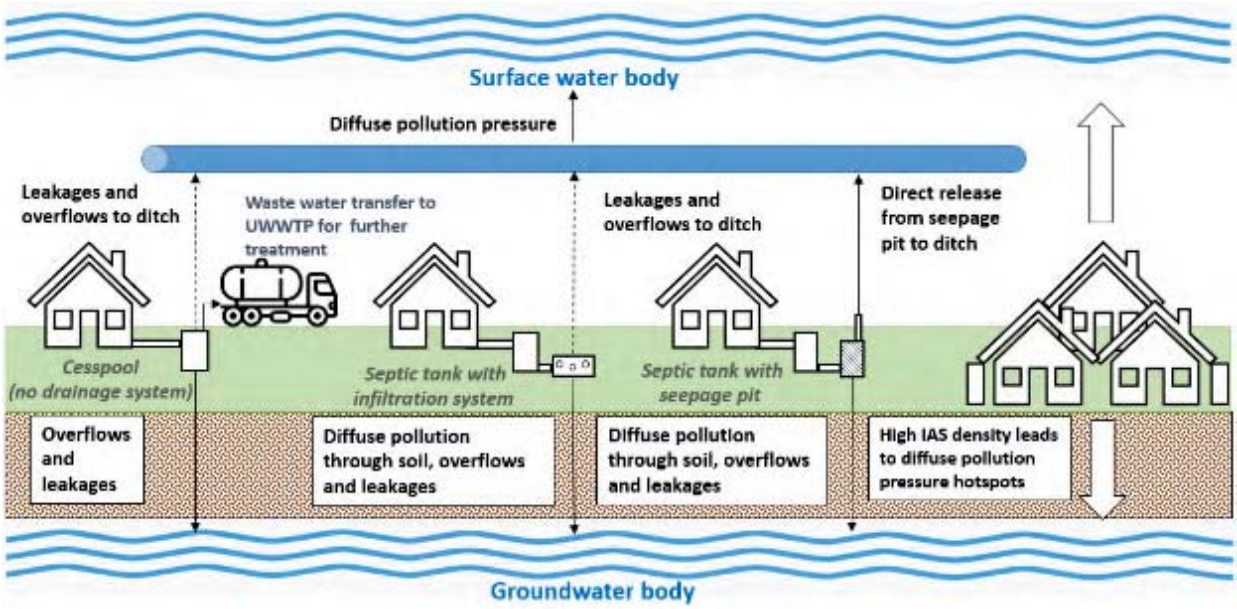

Figure 33 Pathways of diffuse pollution from individual or other appropriate systems. Source: Ricardo, (2019b) for EEA.

The JRC's modelling results show that, if all agglomerations reached full compliance with the UWWTD, the use of poorly managed IAS could account for a significant proportion of the remaining load that is potentially discharged into water bodies (*Figure 34*). In some Member States, the use of IAS would account for more than 20% of the BOD load being discharged under full compliance. For N and P, the load attributable to IAS use would be about 10% of the total. A comparison of the impact of IAS with and without management measures in place can be seen in Annex 4 on the impact of IAS.

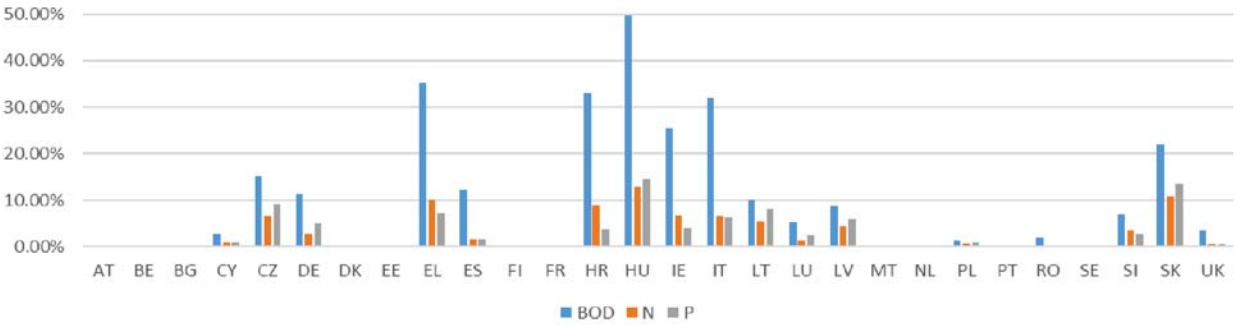

Figure 34 Potential loads assuming IAS correspond to primary treatment, as a percentage of total load, under full compliance, for BOD, N and P from waste water.

The main issue with IAS at the national level is that monitoring is difficult. For instance, in some Member States, competent authorities lack the capacity to monitor and check individual systems regularly. Furthermore, competent authorities do not always have the right to enter properties due to property rights. In addition, users of IAS do not always maintain and operate their systems correctly due to the high costs involved (Ricardo, 2019b; OECD *forthcoming* a).

Member States have a number of practices in place to deal with the problem that high IAS use might entail. The written consultation of the Member States and the IAS workshop under this Evaluation showed that some countries have strong enforcement mechanisms in place. Some Member States have established permitting systems (e.g. in CZ, SK, DE), provide trainings and certification schemes for operators of IAS (e.g. in AT), awareness raising and information campaigns (e.g. in IE and UK) as well as guidelines for the design, use and maintenance of IAS (e.g. in DK, FL, FR, RO, ES).

Some Member States have also taken action to ensure that citizens connect whenever a collection system is already in place. This can be the legal obligation to connect to the existing collection system (e.g. in AT, BE, HR, CY, CZ, DK, DE, EL and LT), special loans, and compensations as well as tax deduction to incentivise connection where this could be perceived as a financial hurdle (e.g. in CY, EL, LV, PL, SK, DK, DE, IE).

IAS use does not always entail a problem. When strong enforcement or management mechanisms are in place, it can be assumed that any IAS problems would only be significant at local level. However, not all Member States have national legislation and enforcement mechanisms in place for IAS use, and even those that do have strong systems in place can struggle with monitoring due to the extensive use of IAS in some places. Overall, it can be assumed that although some Member States have found ways to deal with IAS in general, others cannot yet ensure that all the declared systems function as needed and that they do not harm the environment.

A number of factors should be considered when comparing collection systems to IAS. Firstly, IAS can be an adequate substitute for the safe collection of waste water or even for the appropriate treatment of waste water, but if not well managed or functioning they also increase the risk of exposure and can thus have a negative health impact. Furthermore, IAS require that the owner, in some cases a non-expert, is trained in maintaining the system and ensuring its correct operation. If high numbers of IAS are used in a country, it is difficult to ensure that the authorities in charge of implementing the Directive regularly check all systems for their adequate functioning.

Overall, these findings are supported by stakeholder views: only 7% of the stakeholders (n=332) who replied to the public consultation found that the UWWTD is very effective in ensuring proper IAS application. The expert workshop on IAS, attended by representatives of Member States, academia and industry associations, concluded that IAS are an important solution that can be adapted to local circumstances but that they are difficult to monitor even with good systems in place, due to the sheer amount of them.

Small agglomerations and non-connected dwellings

Small agglomerations and non-connected dwellings are another major source of urban waste water pollution, as shown in *Figure 24*. However, the UWWTD does not require small agglomerations and non-connected dwellings under 2,000 p.e to build collection systems, nor does it require that information on such small agglomerations be reported to the Commission. Article 7 only requires small agglomerations that have a collecting system and discharge into freshwater or estuaries to apply 'appropriate treatment'. Under the WFD, Member States should adopt measures to mitigate and reduce pressures that affect good status and should therefore ensure good water quality of those water bodies that are affected by small agglomerations or non-connected dwellings

It is assumed that IAS are used in many small agglomerations that do not fall under the UWWTD. These can have a negative environmental impact if not correctly monitored, operated and maintained (see IAS). Since Member States are not obliged to report on the use of IAS in agglomerations below 2 000 p.e., there is little EU-wide information available on this. Information reported under the 2nd round of RBMPs shows that discharge from non-connected dwellings[41] is a significant source of pressure on surface

[41] Pressure 2.6 'Diffuse – Discharges not connected to sewerage network'. Main driver: Urban development. Description: Pollution resulting from urban waste water not connected to sewers and identified as a diffuse source. Source: European Commission (2016) WFD Reporting Guidance (see Annex 4, scattered dwellings).

waters, affecting 11% of them negatively and causing them to fail to achieve good ecological status (EEA, 2018). By comparison, agriculture is the cause of 25% of surface waters failing to meet good ecological status. *Table 6* shows the impact of non-connected dwellings on surface- and groundwater in several EU Member States (and NO), where it was reported that more than 10% of the ground- or surface water bodies are affected.

EEA Member countries reporting under the WFD	Groundwater	Surface water
BE	<10 %	47 %
BG	99.9 %	39 %
CZ	-	52 %
CY	81 %	<10 %
DE	-	14 %
DK	-	87 %
EE	58 %	42 %
ES	<10 %	13 %
FI	35 %	52 %
FR	<10 %	13 %
HR	-	92 %
HU	100%	-
IE	< 10 %	14 %
LV	-	25 %
NO	-	58 %
PL	-	67 %
RO	100 %	79 %
SE	61 %	29 %
SK	93 %	-

Table 6 Countries where more than 10% of surface water bodies or groundwater body area are affected by diffuse pollution and non-connected dwellings are identified as one of the pressures. Source: Ricardo (2019b) produced for EEA.

Small agglomerations under 2 000 p.e. account for about 23 million p.e. (Vigiak *et al.,* 2018). Although the current level of treatment in these agglomerations is unknown as there is no reporting required under the UWWTD in this area, it is unlikely to be less than primary treatment. Based on modelling estimates, small agglomerations contribute roughly 10 million p.e. of BOD load potentially being discharged without treatment per year (*Figure 23*). This is roughly at the same order of magnitude as SWO discharges (see storm water overflows). Considering that the modelling assumes that all agglomerations under 2,000 p.e. are without a collection system, the length of pollution pathways from these sources to the receiving water bodies is expected to be an additional factor causing natural attenuation. In addition, the environmental impact of these discharges depends on the situation at local level (flow, capacity and sensitivity of the receiving water).

In some Member States, a lack of connection might be due to geographic conditions (e.g. high numbers of small islands), whereas elsewhere it might due to a lack of investment in infrastructure for agglomerations below the UWWTD's threshold levels. Given that the Commission does not gather information on smaller agglomerations or non-connected dwellings, there is no EU-wide overview of what is happening with waste water in these agglomerations. Some Member States (e.g. DE, AT) have set much lower thresholds to capture this load, whereas others struggle to implement the Directive even in agglomerations over 2 000 p.e.

Respondents to the public consultation expressed mixed views regarding the impact of the UWWTD's lack of clarity on small agglomerations. Stakeholders highlighted that the treatment and reporting requirements for agglomerations under 2 000 p.e. are not sufficiently clear. 31% of respondents stated that this has had some adverse impact (n=320). Public authorities representing different governance levels (n=44) stated that it has had high or some impact.

Eutrophication – sensitive areas

Another UWWTD obligation that has been identified as not entirely clear and has had to be clarified by the European Court of Justice is 'eutrophication', which is linked to the UWWTD's provisions on sensitive areas. Under criterion (a) of Annex II of the UWWTD, Member States must designate areas that are at risk of eutrophication or eutrophic. The UWWTD provides only very limited indications regarding which elements need to be taken into account when designating such areas.

In practice, 15 Member States have either designated their entire territory as sensitive or generally apply more stringent treatment everywhere[42]. Sensitive areas therefore officially cover 76% of the EU's territory. *Figure 36* shows the areas that Member States have designated as sensitive in their territory, as well as whether the removal of N, P or another contaminant is envisaged there.

[42] AT, BE, CZ, DK, EE, FL, DE, LT, LV, LU, NL, PL, RO, SL, and SK.

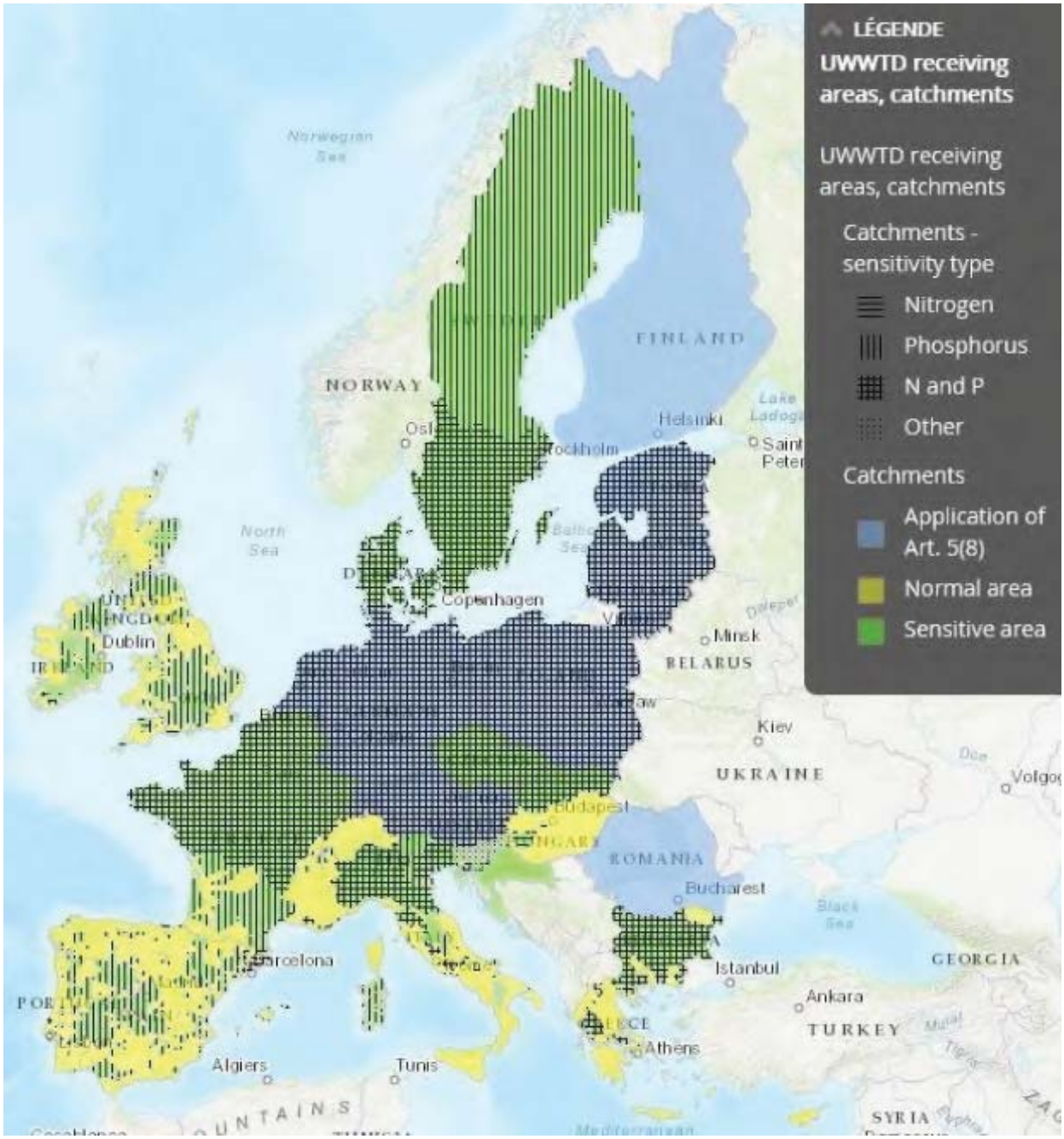

Figure 36: Designated sensitive areas across the EU and Switzerland. EEA (n.d.) Urban waste water treatment map – sensitivity type

The lack of a clear definition of eutrophication was addressed through a Court ruling, which set out four criteria and required that a cause-effect relationship be established (Case C-280/02[43]). These four criteria are: 1) the enrichment of water by nutrients, especially compounds of N and/or P; 2) the accelerated growth of algae and higher forms of plant life; 3) an undesirable disturbance of the balance of organisms present in the water; and 4) deterioration of the quality of the water concerned. The Court

[43] Judgment of the Court (Second Chamber) of 23 September 2004. Commission of the European Communities v French Republic. Failure of a Member State to fulfil obligations - Directive 91/271/EEC - Urban waste water treatment - Article 5(1) and (2) and Annex II - Failure to identify sensitive areas - Meaning of "eutrophication" - Failure to implement more stringent treatment of discharges into sensitive areas. Case C-280/02.

case dates back to 2004, pre-dating the map in *Figure 36*, which makes it unclear whether or not the Court's clarification has improved the interpretation of the UWWTD's requirements on sensitive areas under criterion (a).

It is worth noting that the areas designated as 'sensitive' under the UWWTD are considered 'protected' under the WFD. The WFD includes eutrophication indicators as one of the biological quality elements that need to be considered when classifying water bodies based on ecological status. According to the WFD, Member States should define quality elements that are sensitive to all pressures, including eutrophication. Different Member States have defined different quality elements. Next to urban waste water, agriculture is a major contributor of N releases and thus increases the risk of eutrophication. To address this source of pollution, the Commission adopted the Nitrates Directive (ND), under which Member States designate nitrate vulnerable zones (NVZs). However, there seem to be some inconsistencies between the designation of NVZs and the designation of sensitive areas under the UWWTD, as well as the assessment of ecological status. This is due to the fact that many Member States do not link the assessment of eutrophication required by the ND with the 'ecological status' concept of the WFD.

Due to the complexity of eutrophication, a guidance document on the harmonisation of eutrophication assessment was adopted in 2009 as part of the common implementation strategy under the WFD (EC, 2009). However, reporting under the ND in 2016 showed that the methodologies used for assessing eutrophication still varied widely among Member States and were often not well linked with the WFD quality elements. Efforts continue to improve coherence and synergies at Member State and EU levels. Regarding the relationship between the UWWTD and the ND, the Court clarified that the two Directives are complementary and that it is not important to define what percentage of pollution comes from waste water discharges and what percentage comes from agricultural pollution (Case C-280/02[35]). The significance of nutrient loading to a water body should be assessed based on the percentage of that nutrient's input, as well as on the absolute amount of nutrients. Consequently, the overall nutrient budget has to be considered on a case-by-case basis (ibid., EC, 2009).

As regards EU-wide improvement in reducing eutrophication, a 2016 report of the European Topic Centre (ETC) concluded that the 'low hanging fruits' had been picked and that eutrophication abatement now faces the challenge of implementing measures to reduce nutrient inputs from diffuse sources against a strong agricultural lobby. According to the ETC, the decrease in P concentration is due to improvements in waste water treatment and a reduction of P in detergents (ETC/TCM, 2016). At the time of this Evaluation, there is no comprehensive evidence on how eutrophication has reduced or been avoided since the adoption of the UWWTD, the ND and the WFD. However, it is clear that reducing N and P releases as part of waste water discharges is important, and in that regard the UWWTD has noticeably contributed to progress in this area. Overall, P in rivers has decreased in the EU, but N still represents a significant issue mainly due to emissions from other sectors such as agriculture (see contextualisation). Modelling results show that fully implementing the UWWTD (with the current threshold levels for P) would reduce P emission to a limited extent further. An additional ban on P-containing detergents would further reduce P loads, which would in turn reduce concentrations in surface waters and the costs of water treatment (Bouraoui *et al.*, 2014).

Monitoring, reporting and information provision requirements and their effectiveness

As most environmental directives, the UWWTD contains a number of provisions on monitoring and reporting to ensure that it is implemented correctly. These provisions need to be fit for purpose to ensure that the Directive is effective in reaching its objectives.

Monitoring (parameters, limit values and frequencies)

The UWWTD requires monitoring of the level of certain pollutants in the effluent so that compliance with thresholds set out in the Directive can be assessed. This is done through the following parameters: BOD, COD, and nutrients N and P where applicable (see Annex 4, monitoring requirements). The UWWTD sets out monitoring methodologies for each parameter.

A review of national thresholds shows that for **BOD**, based on local conditions, a number of Member States have set stricter threshold values compared to the UWWTD requirements (DE, CZ, SE, DK, IE, UK). To **measure BOD,** flow-proportional or time-based 24-hour samples are collected; the pass or fail results must be communicated to the Commission. This is practical for implementation and infringements. However, it does not require precise monitoring over time to detect more subtle changes. The methodology used to monitor **COD** under the UWWTD is based on potassium dichromate, which has been identified as a 'substance of very high concern' under REACH and therefore has to be phased out. A recent study reviewed this monitoring requirement and concluded that COD could be removed and replaced by total organic carbon (TOC) as an optional parameter (Umweltbundesamt et al., 2017).

As regards the nutrients: for **N,** a number of Member States have also set stricter thresholds based on local conditions (SE, AT, DK, BE, FI, UK, IE). The modelling results show that N loads could be further reduced under full compliance but the impact on water quality remains dependent on local conditions, as other sources may be more prevalent. Waste water is also a major pollution source for **P** content in water bodies, with modelling results indicating that urban waste water is one of the main sources for P impacting EU water body quality. Some Member States have set substantially stricter standards for P (FI, SE, IE, UK). It was found that lower concentrations seem to be achievable at acceptable costs. It was also found that, although the UWWTD has been effective, water quality is still suffering from high P concentrations, and that only marginal further improvements can be achieved through full implementation if current threshold levels are maintained (see effectiveness). As pointed out previously, other pollution sources, such as agriculture, also play an important role.

Evidence – and notably the levels of pollution reduction achieved (*Table 4*) – shows that the EU thresholds have helped Member States significantly reduce pollution. Member States consider them as minimum thresholds and some have applied stricter standards based on local conditions.

This is confirmed by the results of the public consultation: overall, the threshold levels for BOD, N and P are still considered to be accurate to a large extent or to some extent (*Table 7*). No clear alternative values were suggested, but many public authorities, public WWTP operators and members of the public suggested that COD be replaced by TOC.

	To a large	To some extent	To no extent	I do not know

	extent			
The limit value for BOD5 is still accurate (n=297).	46%	30%	9%	15%
The limit value for nitrogen is still accurate (n=295).	55%	26%	5%	14%
The limit value for phosphorus is still accurate (n=291)	56%	23%	8%	13%

Table 7 Public consultation results regarding the adequacy of the limit values set for BOD, N and P

As regards **monitoring frequencies**, the CJEU supported Portugal in its claim that Article 4 on secondary treatment does not refer to Annex ID (frequencies). The Court concluded that, although Article 4 requires compliance in line with the requirements in Annex IB, there is no obligation for the "purpose of proving such compliance, that samples be collected over a full year" (Case C-398/14[44]). Thus, if a Member State can submit even just a single piece of evidence proving compliance with Article 4 and Annex IB, this is deemed satisfactory for the purposes of the Court case. This has had significant effects in terms of case-law and burden of proof for Member States and the Commission. However, it is unlikely that it will have consequences at local level, where monitoring over a full year is in any case imposed under Article 15.

Overall, the Directive is fixed when it comes to monitoring to a number of parameters, frequencies and methodologies that were deemed important and sufficient for effluent quality in the 1990s. Although the UWWTD requires that competent authorities consider the receiving waters to a certain extent (either because they are sensitive to eutrophication or to meet the objectives of other Council directives), there is no provision that requires the monitoring of new or emerging substances in the influent, or the amounts of them that still appear in the effluent. Monitoring technologies have been further developed over the past 30 years and more can be detected today in influent and effluent, often online. The Directive does not directly incentivise the uptake of new technologies (see contaminants of emerging concern). The advantages and disadvantages, as well as the costs and benefits, of taking EU action based on these technological advances would need to be assessed in a follow-up to this Evaluation. It would need to be ensured that any changes to the monitoring requirements do not come at the expense of valuable information that is required to check implementation progress in the Member States.

Furthermore, the Directive does not require the **monitoring of SWOs, including the constituents of urban runoff**. Similarly, it does not require any monitoring data on the functioning and effectiveness of **IAS** even though IAS is widely used in some Member States and remains a potential significant source of pollution (see IAS).

Reporting

Reporting requirements ensure that the Commission can monitor progress on implementing the Directive. Article 15 requires Member States to make **monitoring** data available to the Commission. Article 17 requires that Member States set out a programme

[44] Judgment of the Court (Second Chamber) of 28 January 2016 European Commission v Portuguese Republic; Failure of a Member State to fulfil obligations — Directive 91/271/EEC — Urban waste water treatment — Article 4 — Secondary treatment or equivalent — Annex I, Sections B and D; Case C-398/14.

of implementation, submit it to the EEA and the Commission, and provide updates every two years. The EEA provides a platform through which the programme can be submitted and supports the Commission by checking the quality of the submitted data. Every two years, the Commission publishes an EU implementation report that goes beyond compliance checks. Working together with the Committee under Article 18, the Commission may adopt the reporting methods and formats it deems most appropriate (under Article 17(4), see Annex 4, reporting obligations). Note that the reported data have been used to take legal action in cases where Member States were not in compliance with the Directive's requirements (see the section on late implementation).

The ECA recommended that the Commission improve the reporting requirements. It found that it generally takes Member States around 18 months (and sometimes up to 30 months) to report data, and that the Commission needs another 18 months to analyse the data and publish them. It recommended that the Commission should:

1. also request reports from agglomerations over 2 000 p.e. that fall under Article 7,
2. verify any changes to agglomerations that are above or below 2 000 p.e. reported by Member States,
3. reduce the time it takes to assess and report on compliance.

In its reply, the Commission highlighted that it takes time for Member States to provide information and that the UWWTD does not include reporting requirements for small agglomerations (ECA, 2015). The Fitness Check on Environmental Reporting and Monitoring confirmed the ECA's overall findings and highlighted the following areas for simplification (EC, 2017b, Annex 6 and 8):

- aligning the legislative framework (mainly with the WFD and Sewage Sludge Directive (SSD)) to improve coherence and adapt timing and frequency of reporting as well as question the usefulness of Article 16 (see information to the public);
- improving coherence with other related reporting flows and reducing delays by making the process more efficient and prioritising or restructuring the content (e.g. separating the publication of factual results from the regular Commission implementation report).

The Fitness Check also recognised the improvements already achieved in recent years and highlighted some of the features of urban waste water reporting as good practices (e.g. the distance-to-target assessment, and SIIF and the revised Article 17 reporting decision).

This Evaluation confirms these findings and provides some more detail on the opportunities and challenges of streamlining the monitoring and reporting requirements under the Directive, e.g. the Member States' report on investment needs. However, the Commission's assessment shows that these are not comparable. The overall picture provided by the Member States is often incomplete, based on different cost assumptions and on a partial assessment of investment needs. Hence, further improvements to the effectiveness of reporting can only be realised by the Member States themselves, e.g. through investment in data quality or by making data publicly available in INSPIRE-compliant services.

Information to the public

Under Article 16, Member States have to publish a situation report on the disposal of urban waste water and sludge every two years. These reports must be sent to the Commission as soon as they have been published. The extent to which Member States make an effort to disseminate these reports to the public is unclear, as is the extent to which the public appreciates them.

In addition to national information, the Commission and the EEA also give the public access to a substantial amount of UWWTD-related information (EEA, n.d.b). The EEA compiles the information and shows it in the form of maps and overview tables. The SIIF, a pilot project focusing on the organisation and management of data, accessibility of information and compliance calculations, provides information on agglomerations, treatment plants, discharge points and sensitive areas, as well as on compliance rates and distance-to-target. It does not provide information on costs included in the water bill or investment needs, however.

A recent study on environmental governance (IEEP et al., 2019) showed the diversity and heterogeneity of water-related information made available to the public. While some good practices exist, often the information is fragmented, difficult to find, understand and reuse. Moreover, Member States are also falling short when it comes to providing more information on inspections and enforcement activities. Investments in making better information available to the public will not only improve the transparency and accountability of administrations but also help reduce administrative burden resulting from reporting.

The recent European Citizens' Initiative on right2water (Right to water, 2019) and the high response rate from citizens (about 368 000) to the public consultation on the Water Fitness Check show that water is important to EU citizens.[45] Around 60% of the water price is related to waste water collection and treatment, and most EU citizens pay their water bill without being aware of how their financial contribution is used by the authorities. However, there are no EU-wide studies showing that increased awareness and knowledge increases users' willingness to pay for water treatment. Nevertheless, there are national-level indications that including the public in decision-making processes related to water management facilitates increases ways of advancing implementation and improves treatment levels:

1) Estonia: After Estonia joined the EU, a widespread campaign informing the public about the needed changes in water management was carried out. A close dialogue with citizens accompanied this and laid the groundwork for quick implementation of the EU water industry directives. Estonia managed to increase its water tariffs to cover operational costs within 10 years, which was accepted by the public and was based on close cooperation between government, companies and public interest groups.

2) Switzerland: In Switzerland public consultations were held on increasing treatment levels in priority treatment plants to deal with micropollutants. The vote was supported by information campaigns to show the benefits of treating waste water for

[45] The response rate to the Water Fitness Check public consultation was historically one of the highest compared to all other EU public consultations.

micropollutants. The public was largely in favour (about 80%) and accepted an increase of about EUR 10 per year on their water services bill to pay for better treatment.[46]

These examples show that the public is interested in water services and that people are willing to pay more if the benefits of the increased costs are clearly communicated. These findings were confirmed by the public consultation: only about half of the respondents stated that they have access to sufficient levels of information on waste water treatment, and the respondents who answered that they do not have enough information were mostly citizens. Respondents indicated the internet as their main source of information (215 of 562 replies), next to 'other' (214 of 562) and the water bill (124 of 562). They showed an interest in having information on: 1) how costs compare to those of similar households (63%, n=608); 2) how the costs are calculated (68%), and; 3) investments in infrastructure (63%). For these three information categories, only 13%, 6% and 4% of respondents, respectively, stated that they did not have this information and were not interested in it. For all three categories, roughly 17% of respondents did not provide an answer; this figure includes operators, public authorities and trade associations.

5.2. Efficiency

Evaluation question: To what extent has the Directive achieved its objectives efficiently without imposing administrative burden?

The UWWTD brings about **many benefits,** some of them going beyond its scope. These include:

- a reduction of organic pollution, nutrients and non-targeted chemicals in waste water effluent;
- an increase in water quality overall (important for tourism and landscape, drinking water sources, recipient ecosystems);
- health benefits from improved sanitation;
- cost savings thanks to the change from IAS to collection systems; and
- a marginal increase in water and sludge reuse
- reduction of greenhouse gas emissions through increase of centralised aerobic processes
- strong and internationally competitive water sector.

Due to the lack of recognised methodologies, it was only possible to quantify and monetise a few of the **benefits** attributed to the UWWTD:

- the removal of nitrogen;
- the improvement of bathing sites; and
- increased use of collection systems instead of IAS**;**

In total, the EU-wide benefits are estimated at **EUR 27.6 billion annually at current implementation levels, and** this increases to about **EUR 30.6 billion annually under full implementation**, although this estimate is based on assumptions and is subject to some uncertainties (see Annex 3, costs and benefits).

While health benefits are more directly associated with the DWD, requiring drinking water to be safe, and the BWD, requiring bathing water sites to be safe, it is undeniable that the treatment of waste water has significant functions as regards health, as shown by WHO data on other parts of the world. It was not possible to quantify these impacts with the existing methodologies. It was also not possible to quantify and monetise the benefit achieved from reducing non-targeted chemicals.

Another benefit is the strong EU waste water sector, with internationally competitive companies exporting their technologies and services globally and employing about half a million people in the

[46] Both examples were referred to and discussed in the stakeholder conference in November 2018.

EU. The UWWTD's implementation also reduced greenhouse gas emissions in as much as it replaced anaerobic local treatment with centralised aerobic processes across the EU, thus helping to mitigate climate change.

These achievements were only possible through **large and continuous investments from Member States over recent decades** and substantial **support through EU funds**. At the current implementation level, the EU-wide costs for implementing the UWWTD are estimated to be about EUR 11.1 billion per year for collection and EUR 7.2 billion per year for treatment. Under full implementation, the combined costs for collection and treatment would increase to EUR 19.7 billion per year. On average, the total annual cost for treating 1 p.e. is EUR 31. Through the IAS provision, the Directive provides flexibility where collection systems entail excessive costs with no additional environmental benefit (see IAS). Also, the Directive is technology neutral, allowing Member States to choose the most efficient technologies to implement the Directive. The ECA found evidence of **over-sized plants** in a few Member States. However, no evidence was found that plants of an inappropriate size were a systematic problem and that they would reduce the efficiency of the Directive.

The UWWTD contains few requirements that result in **administrative burden**. Most costs are borne by Member States and their relevant local authorities, and the Commission. **These costs are marginal compared to the infrastructure costs**. No direct administrative costs to other stakeholders (i.e. businesses, NGOs etc.) or citizens were observed.

In terms of **proportionality of costs and benefits**, implementing the UWWTD entails substantial costs. Nevertheless, the benefits outweigh the costs. The Directive's monetised and annualised benefits when fully implemented are estimated, at EU level, to be worth EUR 30.6 billion against EUR 19.7 billon annualised costs. Comparing costs, for which comparatively solid information is available, to benefits that are hard to estimate is a difficult exercise, with numerous limitations.

The analysis of the UWWTD's efficiency examines the relationship between the costs of implementing the Directive and the benefits achieved. This is mostly based on the effects discussed under effectiveness. Member States are not obliged to report assessments on the cost and benefits of implementing the Directive.

Benefits of the UWWTD

The UWWTD brought a substantial number of benefits. However, only some of the benefits can be quantified and monetised. This stands in contrast to costs that can be easily quantified. The two most prominent effects of the UWWTD, namely the reduction of pollutant loads in treated waste water and the positive impact on water quality, translate into benefits: the **reduction of both targeted** and non-targeted pollutants, such as microbiological pollution and other hazardous substances (see Pistocchi *et al.,* 2019), leads to **preservation and/or improvement of (transboundary) surface and groundwater quality** (see effectiveness)[47]. Good water quality is especially important for bathing water sites and it can increase the attractiveness of the affected zones, often leading to an increase in tourism. Furthermore, having clean surface water leads to reduced costs for treating drinking water (EC, 2016). Good water quality leads also to well-functioning ecosystems overall.

[47] If waste water is not collected and treated it can infiltrate and pollute groundwater bodies. Badly maintained collection systems with leaks or non-functioning IAS can also lead to the deterioration of groundwater bodies due to waste water pressures.

Reductions of nutrients and microbiological pollution were **monetised as benefits**. Based on extrapolations from willingness to pay (WTP) studies and a benefit transfer to calculate damage costs, **N reduction was monetised as a proxy for improved water quality**. In addition, the **reduction of microbiological pollution was assessed as a proxy for improved bathing water quality**, also based on extrapolations from WTP studies[48]. N and microbiological pollution reduction as proxy benefits were chosen, as only for these underlying studies were found. As shown under effectiveness, the UWWTD's impact on N reduction is, compared to its impact on BOD and P, limited; therefore, the benefits are already underestimated due to this limitation. A low and a high benefit were derived both for N reduction and for bathing water improvement. For **N**, this is due to the underlying studies including high and low estimates for how much N needs to be reduced for a clean aquatic environment.

For **bathing waters**, the underlying study resulted in a willingness to pay between EUR 0.56-1.55 by domestic tourists, thus leading to both a low and a high estimate for the EU assessment as well. Foreign tourists potentially willing to pay for clean waters were not added to the assessment — only the resident population is accounted for. Thus, the monetised benefits from clean bathing water are potentially underestimated.

Another benefit is the **cost saving related to the change from IAS to collection systems**. This has been noted as a service level improvement as these households would no longer have to deal with full tanks nor have to arrange for tanks to be emptied or maintained.

These three benefits together lead – at current implementation levels – to an estimated aggregated cost savings **for the EU of EUR 27.6 billion annually**; this increases to about **EUR 30.6 billion under full implementation**. Benefits can be broken down by Member State (Annex 4, annual benefits), but as the benefits at times are only revealed downstream, another region or Member State may benefit downstream from the costs borne upstream[49].

In terms of non-monetised benefits, the **removal of non-targeted micropollutants** is potentially very significant as removal efficiencies can be up to 50% and more, depending on the substance. The benefits of having cleaner **drinking water sources** were also not quantifiable. However, considering that about 38% of the EU's drinking water (from large supplies) comes from surface water (EC, 2016), the impact on treatment costs can be substantial.

According to the Intergovernmental Panel on Climate Change (IPCC) guidelines on greenhouse gas (GHG) inventories, collecting and treating waste water in centralised systems can also be associated with **GHG emissions reduction** compared to non-collection and untreated discharge. The IPCC argues that 'wastewater in closed underground sewers [which is the case in most parts of the EU] is not believed to be a significant source of CH_4. The situation is different for wastewater in open sewers

[48] The WTP studies used for assessing benefits are the following: On reducing nitrogen a study on people's willingness to pay for a clean Baltic Sea was used (Sutton et al., 2011). For clean bathing water, a study on people's willingness to pay for clean Scottish beaches was used (Phillips et al., 2018).

[49] At the dedicated workshop and during the stakeholder conference, stakeholders raised concerns about the assessment of the benefits. However, methodologically no better way was found and thus a mix of quantified benefits and qualitative discussion are provided here.

because it is subject to heating from the sun and the sewers may be stagnant allowing for anaerobic conditions to emit CH_4.' (Doorn *et al*., 1997 in IPCC, 2006, p. 11)[50]. Furthermore, centralised treatment allows biogas to be captured as an energy source and sewage sludge to be used either in agriculture or as an energy source itself, in both cases decreasing the use of fossil fuels in GHG emitting processes (ibid.).

In general, implementing the UWWTD also leads to a number of public **health** benefits. Having a collection system in place reduces the risk of exposure to pathogens (Kay, 2018). Untreated waste water can contain nutrients, viruses, parasites and other harmful contaminants. These can pose a risk, especially when untreated waste water enters bathing water sites. Having secondary treatment in place substantially reduces intestinal enterococci concentrations in treated effluents. When microorganisms contained in waste water effluent are ingested, these can lead to gastrointestinal diseases, cholera, typhoid and hepatitis. Untreated waste water in water bodies leads to the development of blue-green algae, which is toxic and can lead to rashes, skin and eye irritation as well as allergic reactions (Ricardo, 2019; EEA, 2016). The WHO, in its recent sanitation guidelines, lists the following as results of non-existent or malfunctioning sanitation systems: diarrhoea, helminth infection, vector-borne diseases, and the spread of antimicrobial resistance (WHO, 2018a)[51]. According to the WHO (2018b), globally 'poor WASH[52] conditions still account for 842 000 diarrhoeal death every year'. In terms of health benefits, in those EU countries where collection and treatment levels were low before they joined the EU or before the Directive was adopted, the Directive helped to improve the levels of **service**, which comes with improvements to hygiene and the mitigation of health risks related to waste water.

Strong EU water legislation, including the UWWTD, has helped EU **companies** to become very **competitive internationally**, with 8 out of the 15 of the world's largest water companies being from the EU (see innovation). Having a strong base in the EU enables exporting opportunities to non-EU countries. Several of the world's major megalopolises have contracts with EU water companies.

According to Blue2 findings, in terms of **social benefits**, in the EU around 500 000 people are employed in the water supply and waste water sector (0.3% of total EU economy) (Spit *et al*, 2018). According to the 9th implementation report, it might even be up to 600 000 full time equivalents, generating a production value of about EUR 96 billion and an added value of EUR 41 billion each year. However, employment is only a benefit from a distributional perspective, as employing more people also leads to costs for society. Employment in the water sector also includes jobs in regions with high unemployment.

According to stakeholders replying to the public consultation, the UWWTD contributes largely to the following benefits: protection of the environment (78% of stakeholders), clean rivers and seas (78% and 70%), and health protection and the removal of pollutants (67% and 65%). Whereas about 17% of the respondents provided no answer, none indicated that the UWWTD did not result in any benefit (n=606). Almost half of the

[50] WWTPs, on the other hand, can have large carbon footprints depending of the energy source used.

[51] Not all of these are necessarily applicable in EU Member States.

[52] WASH = Water, sanitation and hygiene.

respondents (n=314) also stated that the Directive helped to create a skilled workforce in the EU.

Costs related to the UWWTD

The costs related to the Directive are more easily quantifiable than the benefits. The main Articles that can be quantified and monetised are Articles 3-5, which require the collection and treatment of waste water, and that lead directly to the achievement of the UWWTD's general objectives. To assess collection and treatment costs, established cost functions were used, leading to comparably robust results. Administrative costs are discussed separately (see administrative burden). Non-implementation can also lead to high costs, in terms of foregone benefits and infringement fines (see late implementation).

The total annual costs in the EU are estimated at EUR 18 billion (*Table 8*). Human resources and sludge treatment account for the largest part of the operational costs in WWTPs. Energy use makes up on average 13% of these operational costs (see energy). Costs can be broken down into capital (one-off), and operation and maintenance (O&M) (recurrent) costs per Member State (Annex 4, annual costs).

	Collection (EUR billion)	**Treatment (EUR billion)**
Capital costs	7.5	4.8
Operation and maintenance	3.6	2.0
Total	11.1	6.8

Table 8 Split of total EU collection and treatment costs

As the main driver for costs is the amount of p.e. to be collected and treated, the larger Member States clearly incur higher costs (e.g. DE, ES, FR, UK, IT). Member States that are currently behind in implementing the Directive have lower costs, as investments are still outstanding in order to reach full compliance (e.g. RO). Costs for waste water collection and treatment is estimated to make up 50-60% of the total costs of the water supply and waste water sector. It is estimated that the UWWTD constitutes 25-30% of the total annual costs of the sector.

Costs for collecting and treating waste water are estimated to make up 50-60% of the total costs for the water supply and waste water sector. It is estimated that the UWWTD constitutes 25-30% of the total annual costs for the sector.

In terms of efficient implementation, as discussed under IAS, the Directive provides the flexibility to make use of IAS if a collection system (which is the more cost-intensive part of the UWWTD) entails excessive costs or when it leads to no environmental benefit. The IAS must be able to deliver the same level of environmental protection. As estimated under benefits, it is assumed that moving from IAS to collection systems represents a cost saving. Given the maturity of the conventional technologies on the market, the margin to reduce costs is limited due to innovative technologies. However, the UWWTD is technology neutral and thus Member States and companies in the sector are regularly adapting to new technological developments that allow for more cost-efficient implementation.

In terms of costs, stakeholders replying to the public consultation 'strongly disagreed' and 'disagreed' (both 22%) that the legislation could be further simplified to reduce costs against only 9% who agreed it could be further simplified to reduce costs (n=299).

Also in terms of efficient implementation at treatment plant level, the ECA found that one third of the WWTPs assessed in its 2015 audit has been constructed with a significantly larger capacity than the current demand warrants[53] (ECA, 2015). Some of those plants operate at less than 50% of their capacity. In reply to the ECA, the Commission stressed that Article 4 of the UWWTD only requires the load to be calculated based on the maximum average weekly load entering the plant during the year. Member States with their regional or local authorities decide on the WWTP's size. The selected capacity of the WWTP depends on several factors, including:

- the requirement to comply with the UWWTD (including seasonal variations such as those linked to tourism or industrial activities, heavy rainwater runoff in combined systems);
- compliance with other water-related legislation;
- projected growth of the agglomeration.

Incorrect sizing of plants (oversized or undersized) can be due to a number of factors such as:

- inadequate or lacking data to sufficiently assess waste water flows;
- difficulties in assessing seasonal and future load variations;
- lack of technical and analytical capacities;
- lack of qualified and experienced teams;
- poor governance;
- lack of adequate planning for effectively and efficiently implementing the UWWTD at different governmental levels; and
- a desire to 'build big' because of financial benefits from having larger capital assets or from maximising the spend of a loan or other funds.

No evidence was found that the size of the plants (oversized or undersized) is a recurring issue in the EU that impedes the efficiency of the UWWTD.

Replies to the public consultation provided little insight on this topic, with many respondents having no opinion. From those few that replied (n=60), 12% of those representing Member State authorities considered that inadequate sizing might be a barrier to implementation.

Administrative burden costs

Administrative burden costs are associated with the monitoring, collecting, processing and transmitting of information, which are **solely** carried out due to the UWWTD's reporting requirement. Under Articles 15-17 of the Directive information is required on different levels, but some of it is gathered as part of the 'business as usual' practices of those subject to the UWWTD (see monitoring and reporting provision, see also Annex 4, administrative burden).

[53] The audit covered 28 treatment plants and was focused on implementation in CZ, HU, RO and SK.

Under **Article 15**, in order to monitor compliance, the Commission requests Member States to submit data on their progress in implementing the Directive (see monitoring). As this is data on the quality of effluents, it is most likely that WWTP operators collect and provide data to regional and national level authorities before the Member States report this information to the Commission. The administrative cost is assessed as being low to moderate, assuming that most monitoring takes place due to other UWWTD requirements and part of it would also be done without the UWWTD (ICF *et al.,* 2017).

Under **Article 16** Member States are required to publish biennial situation reports on waste water and sludge (see information provision). These reports should be short and written for the public. Member States should initially collect information and later only update it. The administrative burden cost is assumed to be low once the reports only need to be updated (ICF *et al.,* 2017).

Article 17 requires Member States to share updated information on their national implementation programmes (see reporting). This includes providing information on agglomerations and WWTPs that are compliant and information on planned investments. This requirement does not necessarily require completely new information — updated information is adequate.

Reporting was streamlined in 2014 through Commission Implementing Decision 2014/431/EU[54]. The information provided is assessed and becomes part of the Commission's biennial implementation report. The administrative costs for Member States are estimated to be moderate when there are changes to report. For the Commission the burden (in terms of costs and time) is considered to be significant as regards reviewing all information and preparing the report. It is estimated to be about EUR 126 000 per year for all Member States together (ICF *et al*., 2017). The complexity of the system provides potential for simplification – the recent DWD recast could be highlighted as an example. Any simplifications need to be assessed against the potential loss of valuable information.

Proportionality of costs and benefits

Overall, the **quantified and monetised benefits outweigh the costs on EU level** (*Figure 37*). It can be assumed that under full implementation costs would increase by approximately EUR 1.8 billion and benefits by EUR 3 billion. While the UWWTD's costs are well established, the assessment of the benefits comes with numerous shortcomings.

In some Member States that have not yet fully implemented the Directive the costs outweigh the benefits (see Annex 4, annual costs), and not all quantifiable and monetisable benefits are reaped. The benefits outweigh the costs in all those Member States that have fully implemented the Directive, except for two (Finland and Slovakia[55]).

Implementation costs are borne mainly by households connected to the collection system and a few industries covered by the Directive. Benefits are shared among all stakeholders

[54] To note: This Decision did not have an impact on the information that is required to be made available to the public.

[55] In FL most of the infrastructure needed for UWWTD implementation was already existent prior to the UWWTD, thus comparatively little of the benefits can be attributed to the UWWTD. In SK high use is made of IAS, which might lead to lower cost savings and thus lower benefits compared to a situation where less IAS are used.

that, through the Directive, are able to be connected to the collection system (higher service levels) and that profit from clean water. As is natural with (transboundary) water, the effort made in one Member State or region may lead to benefits downstream for another Member State. Whereas costs have to be accounted for now, benefits take time to materialise (see effectiveness). Member States have some flexibility regarding the establishment of collection system (see IAS). The administrative costs are deemed appropriate considering the benefits that the Directive brings, though some potential for reducing administrative burden was identified.

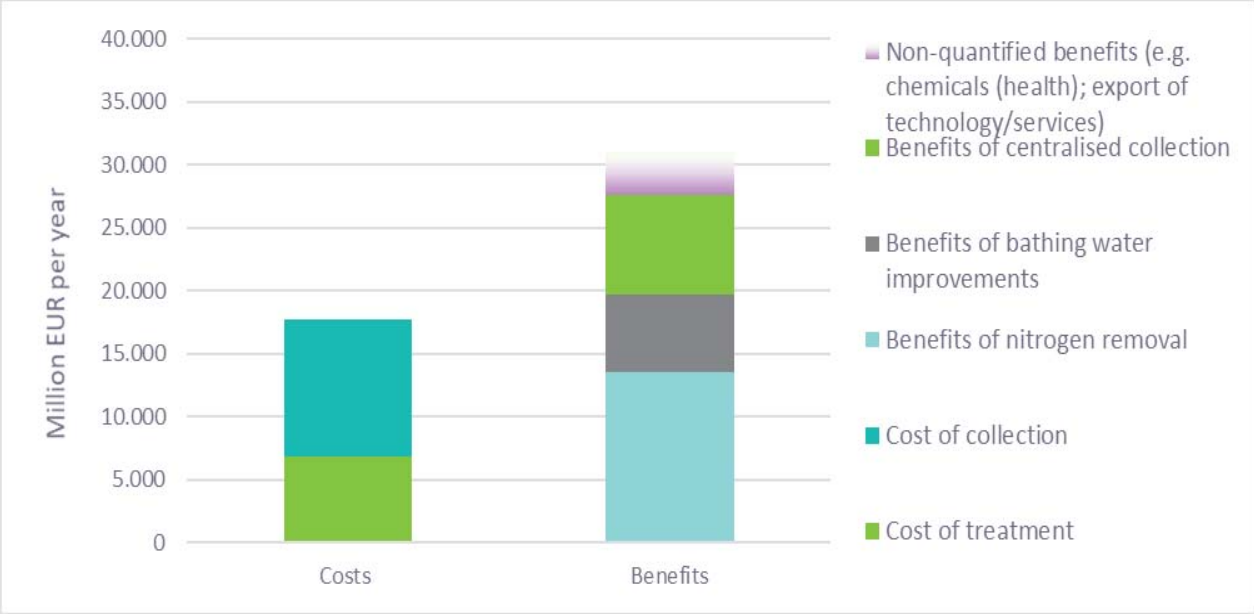

Figure 37 Comparison of annualised benefits and costs at current implementation levels

The findings on proportionality of costs and benefits were confirmed in the public consultation — 301 out of 606 respondents to the public consultation agreed that benefits outweigh the costs (89 provided no answer, and 48 indicated they did not know); citizens also concurred with this (representing 218 of the 301 replies). Similarly, operators mostly stated that benefits outweigh the costs; only a quarter of them deemed benefits and costs to be at similar level. Most respondents 'strongly agree' or 'agree' (35% and 44%, n=303) that the costs related to the UWWTD are justified, given its benefits, with citizens being the largest group being in favour. 81% 'strongly agree' or 'agree' that the costs are justified given the long-term benefits, with respondents being mostly citizens and private or public WWTP operators. 1% and 5% 'strongly disagree' and 'disagree' with this finding (n=302). Across the answer options, 9-13% indicated that they 'neither agree nor disagree' and 5-8% indicated 'they did not know'.

5.3. Coherence

Evaluation question: To what extent is the Directive internally and externally coherent?

Overall, the Directive is internally consistent and only two minor cases of inconsistency were noted by stakeholders. These concern one threshold that is set differently for industries compared to the thresholds for households and one missing link between Article 4 and the Annexes. On the latter, the Court provided a ruling and the missing link seems to have no impact on the implementation of the Directive.

The UWWTD **interacts well with other EU water and environmental law** in terms of supporting other pieces of legislation in reaching their objectives (e.g. WFD, BWD). Overall, the interaction and links

with the main water legislation - the Water Framework Directive - are clear and the Directives have been mutually supportive in reaching their objectives. Some issues were identified with the European pollutants release and transfer register (E-PRTR) and the Industrial Emissions Directive (IED), with the latter also currently undergoing Evaluation. Reporting could be further aligned with the SSD.

No major inconsistency with **other EU legislation** has been found. Many other directives seem to benefit from the UWWTD's implementation. However, given the age of the Directive, the UWWTD is no longer up-to-date with all new policy developments, and it could play a larger role in some contexts. It could play a larger role in some contexts, for instance as regards **energy**, especially Governance regulation 2018/1999 and the Energy Efficiency Directive 2012/27/EU as amended by Directive 2018/2002, and **climate change** initiatives on EU and Member State levels. This is further explored under relevance.

The **coherence** analysis assesses the Directive's 'internal' consistency, meaning the assessment of how different components of the intervention operate together, and 'external' consistency, meaning its interaction with other interventions at EU level.

Internal coherence

Internal coherence means looking at how the various components of the same EU intervention operate together to achieve its objectives e.g. the different articles of a piece of legislation.

In terms of **internal coherence**, the UWWTD consists of a rather straightforward intervention logic, setting out clear measures for Member States to take within the deadlines set out in the Directive. Only two inconsistencies were noted. One pointed out by 18 Spanish WWTP operators relates to **different thresholds** in Article 13 concerning the threshold for treatment of industrial waste waters which is for above 4 000 p.e., whereas the UWWTD generally sets thresholds for urban waste water at above 2 000 p.e. There is, however, no evidence that this led to less effective or efficient implementation. Another inconsistency is a **missing link between Article 4 and Annex ID** (see monitoring).

The public consultation results on internal coherence showed that 28% and 53% of the respondents respectively think that the UWWTD is internally coherent to a large or to some extent. Only 2% think it is not at all coherent and 18% indicated that they do not know. The comments raised were rather inconclusive overall as stakeholders pointed to issues of external coherence or consistency with new issues rather than issues of internal coherence, apart from those mentioned above.

External coherence

External coherence means that EU law and policies work together, with their objectives being complementary. Inconsistencies in objectives and actions should not exist. Apart from the objectives, coherence issues can arise from planning, monitoring and reporting obligations as well as from the practical application of the legislation.

Coherence with EU water law

EU water law is governed by the **WFD, and its daughter Directives — the Environment Quality Standards Directive (EQSD) and the Groundwater Directive**

(GWD)[56] classifying surface and ground water bodies and setting ecological and chemical quality and quantity objectives. The UWWTD sets minimum standards for collecting and treating waste water, and also classifies water bodies (i.e. sensitive areas), which are recognised as protected areas under the WFD. The UWWTD complements the WFD by setting load limits in treated waste water to protect the quality of water bodies from the adverse effect of untreated or inappropriately treated waste water discharges. These limits are uniform across the EU with additional parameters to be met when WWTPs discharge in sensitive areas (see eutrophication). Additional treatment can be required to satisfy the achievement of other directives. Similarly, the WFD requires Member States to take further action on identified pressures, which might be point sources (Article 11).

Regarding provisions for **reporting** and **diverging timetables**, these are not aligned between the Directives. Higher convergence to the lower frequency for reporting required under the WFD could lead to administrative burden being marginally reduced (EUR 84 000 annually for the entire EU under the UWWTD), but it is unclear whether there would be losses of benefits if UWWTD reporting was to be cut from every 2 to every 6 years. The existing reporting frequency is essential to regularly track progress made by Member States and ensure the UWWTD is enforced. In general, **no coherence issues** were identified in the legal texts; on the contrary, implementing the UWWTD is crucial to achieving the WFD's objectives.

Respondents to the public consultation confirmed that the WFD is to a large extent (50%) or to some extent (32%) aligned with the UWWTD (n=293). 17% indicated that they did not know.

Similarly to the WFD, the **MSFD** sets quality objectives for marine waters (which overlap with WFD waters in the coastal zone out to 1 nautical mile) and benefits from the UWWTD's implementation. It is difficult to establish how the improvement of the water quality affected fish stock, but the reduction of litter in marine water bodies should have boosted the quality of the fish. With regard to achieving the MSFD's objective — good environmental status by 2020 — it can be considered as inconsistent that, under the UWWTD, Member States can designate less sensitive areas in marine water bodies. Discharge of untreated waste water, or waste water only undergoing primary treatment, could potentially prevent Member States from achieving good environmental status for some of the descriptors under the MSFD. At the same time, this possibility is used only in two specific areas in Portugal. Apart from this, no inconsistency was found.

About half of the respondents to the public consultation (n=286) indicated that they did not know whether UWWTD and MSFD are well aligned.

Waste water is a major source of pollution for bathing sites (along with surface runoff from farms). During heavy rain events and flooding, this pollution increases due to SWOs. Heavy investments into waste water infrastructure over recent decades led to cleaner bathing sites (EEA, 2018c). This aligns with the JRC's modelling results on coliforms. The **BWD** requires bathing sites to be identified and classified. It contains two parameters to control microbial pollution in bathing water sites, whereas the UWWTD

[56] Even though the UWWTD and ND are older regarding their date of adoption, the WFD stems from the same origin – a Ministerial seminar in 1988, in which Member States called for more action to protect EU water bodies (Haigh, N. 2016).

does not directly target microbial pollution. To meet the BWD's requirements, areas should also be designated as sensitive under Annex IIA criterion (c), and WWTPs would need to ensure that the BWD requirements are met. Overall, the two Directives are aligned.

The **DWD** sets out quality standards to ensure that drinking water is safe. To meet the DWD's requirements, areas have also been designated as sensitive under Annex II criterion (b) and WWTPs discharging in those areas have to use more stringent treatment under the UWWTD. In 2018, the Commission adopted a proposal for a recast of the DWD. At the time of the Evaluation, the proposal is under negotiation by Council and Parliament (EC, 2018c). Cleaner surface water and groundwater ensure that treatment costs of drinking water are lower.

In the public consultation, stakeholders stated that the BWD and the DWD are consistent to a 'large' or to 'some extent' (19%/49% and 18%/48%, n=290), providing little explanatory information. 27% and 22% indicated that they did not know.

The **Industrial Emissions Directive** (IED) covers industrial emissions, and also emissions to water. The IED sets out in Annex I that activities within the scope of the UWWTD are excluded. Plants under the UWWTD may also receive significant amounts of industrial waste water containing a range of pollutants, but this should be subject to a permitting process. However, it is not clear what activities are exactly covered by the UWWTD regarding industrial waste water. There is also an overlap in industries covered, with both Directives addressing the food, drink and milk sector. Also, while Article 15(1) of the IED provides that indirect releases of waste water from IED installations must not result in higher levels of pollution in the environment than direct releases complying with 'best available techniques conclusions', competent authorities report difficulties in implementing this provision. Furthermore, neither the IED nor the UWWTD contain clear requirements for treating sludge in order to reuse it – which might also fall under the Sewage Sludge Directive (SSD).

Those responding to the public consultation confirmed that further alignment between the Directives is possible, with only 9% stating that they are consistent to a large extent, while 20% stated that they are not consistent at all. Most (38%) stated that they did not know (n=288).

The **European Pollutant Release and Transfer Register** provides access to key environmental data from industrial installations across the EU[57]. WWTPs >150 000 p.e. are registered in the E-PRTR. However, this threshold is not consistent with thresholds set under the UWWTD. A recent EEA report on industrial waste water noted that more quality assurance checks on UWWTD reporting need to be carried out, and that UWWTD data needs to be streamlined to be included in the E-PRTR (EEA, 2018d; ETC/TCM, 2017).

About half of the stakeholders replying to public consultation on the consistency between the E-PRTR and the UWWTD stated that they did not know whether they are aligned (n=286).

[57] + Iceland, Liechtenstein and Norway

The **Floods Directive** requires Member States to ensure that water courses and coast lines at risk of flooding are being assessed. Interaction with the UWWTD takes place on the level of urban planning and urban flooding due to heavy rainfall and consequent SWOs. For urban planning, local authorities need to balance the measures required by both Directives. Overall, no inconsistency was observed.

The **Nitrates Directive (ND)**, similar to the UWWTD, sets emission thresholds for a specific pollution source, i.e. nitrates from agricultural uses. The ND also requires the designation of areas, called 'nitrates vulnerable zones' (see eutrophication), based on pollution induced by nitrates from agriculture and the trophic status of the water. Like the UWWTD, the ND also requires reporting. No major inconsistencies were found.

Stakeholders replying to the public consultation provided mixed feedback on alignment with ND and Floods Directive: Whereas 19% and 32% think that these are not aligned at all with the UWWTD, 39% and 27% think that they are to some extent. Additional written comments indicate that for stakeholders the interaction of the Directives during planning processes is important to be considered. However, this is a national issue rather than being directly related to the UWWTD.

The **Sewage Sludge Directive (SSD)**, adopted in 1986, protects human health and the environment from the potentially harmful effects of the agricultural use of sludge. The SSD's focus is on heavy metals that can accumulate in sludge. Article 14 of the UWWTD requires the reuse of sludge 'whenever appropriate' without providing details on how reuse is meant to take place. Thus, the SSD's methodologies apply when sludge is used in agriculture. Both Directives define sludge slightly differently, with the SSD not being limited to sludge from urban waste water. The SSD's Evaluation found that the two Directives are complementary, but that there is room for alignment through clarifying links and analytical methods, and aligning reporting cycles[58]. The latter was confirmed by stakeholders who indicated that aligning reporting requirements would reduce burden and complexity as sludge is usually not dealt with by water authorities[59]. In this context, also the new **Fertilisers Regulation,** which harmonises the requirements for fertilisers produced from phosphate minerals and from organic or secondary raw materials in the EU, needs to be considered.[60] This new regulation does not affect the application of the SSD and ensures in addition to it the protection of the soil.

Coherence with other EU law and policies

The **Birds and Habitats Directive** (Nature Directives), adopted in 1979 and 1992 respectively, do not refer to the UWWTD, though controlling waste water discharges is relevant to fulfilling their objectives too. The link between the Directives is implicitly made through the WFD, which requires protected areas under the Nature Directives to be included in the RBMPs and the programmes of measures. Overall no inconsistencies were found.

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[58] Some stakeholders during the SSD Evaluation held that although suitable to separate sanitation legislation and other functions (sludge), it might be inefficient. Any treatment requirements at UWWTD level have direct consequences on the usability of sludge for other purposes.

[59] The SSD reporting requirements have recently been amended: European Parliament and Council (2019) Regulation on the alignment of reporting obligations in the field of legislation related to the environment.

[60] Council (2019). EU adopts new rules on fertilisers.

About half of the respondents to the public consultation (n=285) indicated that they did not know whether the UWWTD and the Nature Directives are aligned.

Other new policy areas that have significantly developed since the 1990s include the EU's **climate policy and energy agenda.** With a changing climate WWTPs play an increasingly important role in terms of quickly recycling water, helping to meet the challenges of increasing water quantity. Their potential was taken up in the 2018 Commission's water reuse proposal. Upgrading collection systems to deal with increasing amounts of water during heavy rainfall can be viewed as supporting EU policy on adapting to climate change. Furthermore, having centralised aerobic waste water treatment can help to achieve the EU's climate mitigation goals, as it has reduced GHG emissions compared to commonly used decentralised anaerobic systems such as sceptic tanks or anaerobic lagoons (IPCC, 2009). However, WWTPs use high amounts of energy, thus also contributing to GHG emissions. In recent years, some WWTPs have been retrofitted. They have thus become net energy producers, and now help to fulfil the objectives of the EU's energy agenda (see UWWTD and climate change). Overall, no formal/legal inconsistency was observed, but the potential for further alignment exists.

Respondents to the public consultation confirmed these findings; between 40-44% agree that the UWWTD is not aligned with the EU's climate (n=285) or energy policies (n=287), and argued in their comments that more needs to be done to reap the benefits of further alignment.

In contrast, the **UWWTD and the EU's cohesion policy** have been aligned since they came into existence. Both the European Regional Development Fund and the Cohesion Fund have over recent decades substantially supported Member States in developing waste water infrastructure. Overall, no inconsistency was found.

5.4. Relevance

Evaluation question: To what extent is the UWWTD and its intervention logic still relevant and appropriate – especially in light of new societal problems and needs?

Over recent decades, some societal needs and problems, that are addressed by the UWWTD and which influence the UWWTD's functioning, have changed and new ones have emerged.

1. There is increasing evidence that **contaminants of emerging concern** (CECs), such as pharmaceuticals and microplastics, are found in all types of water bodies worldwide. One pathway is waste water collection and treatment. The UWWTD does not contain provisions to deal with CECs. Technologies exist to significantly reduce some CECs in waste water, such as some pharmaceuticals, at treatment plant level, but this will drive up treatment costs. Due to effective capture at treatment level, some CEC can be concentrated in the sludge. Some Member States and non-EU countries have started to take action, which usually includes a mixture of upstream action as well as treatment at priority WWTPs. Any follow-up to this Evaluation should consider whether the scope of the Directive needs to be adapted to deal with these new pollutants. It is clear that costs and benefits to society of any action would need to be carefully assessed.
    a. **Anti-Microbial Resistance** (AMR) is a recognised global threat and can be transmitted via waste water into the environment. The links between AMR in the environment to human health are not yet fully clear. More research is needed to better understand the issue at hand, and the links to source control, waste water collection and waste water treatment.
2. The Directive contains provisions that could encourage **water and sludge reuse** and thus circular economy integration, but the potential for the UWWTD to be embedded in the

circular economy has not been fully exploited. The Commission's proposal for **water reuse** is a step in this direction. **Sludge reuse** can present some issues if sludge is contaminated with persistent chemicals. Many Member States have set stricter requirements or even banned reuse. Sludge used in agriculture could represent a diffuse source of pollution to the environment. Phosphorus recovery is possible from a technological perspective, but market demand for recovered phosphorus seems to be rather low at present.

3. Waste water treatment consumes a **high amount of energy** and uses about 0.8% of the total EU energy consumption. The UWWTD does not encourage any efficiency measures for energy consumption, while some WWTPs could actually be energy producers. It is not integrated to the extent possible into the EU's energy efficiency agenda.

The UWWTD is helping to achieve **SDG 6** and its targets as well as the European Citizens' Initiative's demand for access to water and sanitation. In terms of **innovation**, the UWWTD sets clear requirements in terms of parameters and threshold levels (see monitoring), but it does not contain clear requirements to take up new technologies. The EU water sector shows **business leadership** when it comes to innovation, and strong regulation on EU level can be linked to this.

Assessing **relevance** considers whether the UWWTD's intervention logic still satisfies societal needs and responds to societal problems. The assessment considers whether these needs and problems have changed over time, and to what extent the UWWTD is still fit for purpose.

The analysis so far has shown that the Directive is effective and tackles a major source of pollution to EU water bodies. A few Member States still need to make substantial progress in delivering and operating the necessary infrastructure, and the Directive is the driver for this action. By implementing the Directive fully and by upholding high compliance levels, Member States ensure that the environment and public health is protected from the adverse effects of urban waste water discharges. Apart from the need to address the remaining loads as discussed under effectiveness, the UWWTD and its operation is also considered here in light of new societal issues, including: i) CECs for which the evidence base of their existence in all forms are water is increasing; ii) the UWWTD and the circular economy; and iii) the UWWTD and climate change, by assessing the use of energy by WWTPs, in light of increasing need to consider energy efficiency in all industries.

Furthermore, the relevance of the UWWTD in the context of innovation, business leadership and changing international contexts, which are now dominated by the SDGs, is discussed.

Contaminants of emerging concern

The UWWTD does not include any definition or requirements on Contaminants of Emerging Concern (CECs), whereas the EQSD as amended by the Priority Substance Directive refers to pollutants of emerging concern in its Recital 26. Two sub-groups of CECs are currently receiving a lot of media attention: pharmaceuticals and microplastics. The Commission's PIE strategic approach and Plastics strategy require further assessment of treatment potential for pharmaceuticals and microplastics as part of this Evaluation.

CECs enter waste water collection systems and WWTPs through domestic use of household chemicals (detergents, cleaning products, textile fibres and personal care products), pharmaceuticals, disposal, as well as through urban runoff (which can contain tyre abrasions, pesticides and many other pollutants) (UNESCO, 2019). In the WWTPs, concentrations of some CECs are being reduced to a certain extent in one of the treatment steps (see Pistocchi *et al*, 2019)). From a water quality perspective, the release of chemical pollution as part of effluent into the environment was significantly reduced thanks to treatment being in place across the EU, even if chemical pollution was not directly targeted. In the **UK**, a study of over 160 WWTPs found that treatment processes achieved high standards of contaminant removal, often of 80 to 90%, but that this could still be insufficient to meet standards to protect water quality in rivers and streams (UKWIR, 2014).

As noted for nutrients, waste water is not the only source for this kind of pollution in our waters (EEA, 2018f). Although evidence at regional and Member State level is increasing in terms of what kind of CECs are in EU water bodies, there is not yet an EU-wide overview of which CECs are most often found and at what concentration levels. This is because CECs are not consistently monitored and more evidence needs to be collected.

Mercury

While mercury pollution is largely airborne and can travel long distances before being deposited, vast amounts of mercury are spread over land, seas and oceans. As mercury can, under certain conditions, be methylated into methylmercury (a highly toxic form of mercury) people could be exposed to mercury mainly through their diet, in particular by consuming contaminated seafood.

Mercury pollution, including water pollution, contains newly introduced mercury and re-emitted mercury. It results in over 40% of surface water bodies not achieving good status.

Although there is extensive monitoring of air, linking the source to the sink is a major challenge. Mercury in surface waters stems from a wide variety of sources, pathways, interactions and consequences.

Although a decrease can be seen in mercury releases to water from industry, WWTPs are still named one of the important pathway for mercury pollution. One possible source for such pollution could be dentistry (dental amalgam) whilst run-offs may also be a significant source.

Since 2018, the EU has new stricter rules on mercury use in dental amalgam and further actions are envisaged to reduce and ultimately end the use of dental amalgam. However, understanding spatial and temporal trends of mercury is crucial in assessing measures taken at EU level.

European Commission (2018d) Mercury; EEA (2018e) Mercury in Europe's Environment.

Some countries, both EU and non-EU, are taking action to deal with CECs. In 2019, the **Rhine Commission** issued its recommendation suggesting a number of upstream solutions, as well as, based on priority criteria and experience, to choose relevant WWTPs which should be equipped with an additional purification stage (e.g. ozonation, active carbon). (International Rhine Commission, 2019). Similarly, and given that EU law principally regulates the placing of substances on the market, the **German Environment Agency** argues that additional downstream measures that ensure safe disposal are

necessary. This could be done by upgrading (i.e. retrofitting) WWTPs to the fourth treatment stage. The right combination of different measures needs to be established to ensure that any investments are efficient and effective. Additionally, suitable measures to deal with micropollutants that enter water bodies through rainwater and CSO need to be found (Umweltbundesamt, 2015). In **Switzerland,** based on public consultation, it was decided that about 100 prioritised WWTPs would gradually be upgraded to the fourth treatment stage by 2040[61]. Instead of treating specific pollutants, the focus in Switzerland is on 12 proxy substances (VSA Plattform, n.d.).

Those respondents to the public consultation, who suggested topics not yet adequately addressed by the UWWTD, most often named emerging pollutants. During the stakeholder conference micropollutants were also recognised as the most pertinent future challenge.

One group of CECs, **pharmaceuticals, along with their residues**, are increasingly found in surface waters and drinking water worldwide (*Figure 38*)[62]. Though pharmaceuticals are essential for human and animal health, there is increasing concern about their impact on the environment (OECD, 2019b). The Commission's 2019 PIE strategic approach stresses that pharmaceuticals reach the environment through excreted and unused pharmaceuticals entering collection systems and WWTPs (EC, 2019a, WHO, 2017, OECD, 2019b)[63]. With an ageing society residues of pharmaceuticals are becoming an increasingly worrying issue. Another source is the spreading of sludge that potentially contains pharmaceuticals and other contaminants that have been transferred during treatment (EC, 2019a). Evidence shows that certain pharmaceuticals stay in the environment, and can be spread through water and soil[64]. Effects on aquatic life show that

Anti-microbial resistance (AMR)

AMR is recognised as a growing threat to human health, as it is rising worldwide. More and more antibiotics may be losing their effectiveness. The threat of AMR was also recognised by the EU's AMR action plan. It is estimated that AMR is responsible for about 33,000 deaths per year in the EU, as well as resulting in about EUR 1.5 billion per year in healthcare costs and productivity losses. AMR bacteria have been found downstream in WWTPs. WWTPs are reducing the amounts of bacteria in sewage, with secondary treatment already reducing parts of the bacterial load. In this regard disinfection is especially effective as a treatment. A Dutch study shows that UWWT can reduce bacteria by 100-1000 times. Overall, further research is needed to understand the risks AMR poses to the environment, the risks of discharges and to understand UWWT's role in limiting risks to the environment and human health risks. Further monitoring of data is needed to understand what technology and management options are adequate. Also, the consequences of AMR in sludge being applied to land needs to be better understood.

WHO (2019); EC (2017c); EC (2019d); Swedish EPA (2017); EEA (2019b); Schmitt et al. (2017); Bloomer & McKee (2018).

[61] Focused upgrade: WWTPs are chosen according to where they discharge (whether into sensitive water bodies or drinking water resources or if they are very large (> 80 000 pe.).

[62] The WHO concluded that based on the evidence found so far it is very unlikely that pharmaceuticals in drinking water pose a threat to human health.

[63] 'Between 30 and 90% of the orally administered dose is generally excreted as active substance in the urine of animals and humans. However, the nature and amount of medicinal residues mainly depend on the volumes and nature of the administered substances, their modes of administration, and metabolisation rates' (BIO Intelligence service, 2013).

[64] A large amount also comes from veterinary use.

some male fish exposed to the residues of the contraceptive EE2 may change sex, and fish exposed to antidepressants change their behaviour, which could affect their survival. The WHO highlights that a precautionary approach is needed in relation to long-term exposure of vulnerable groups.

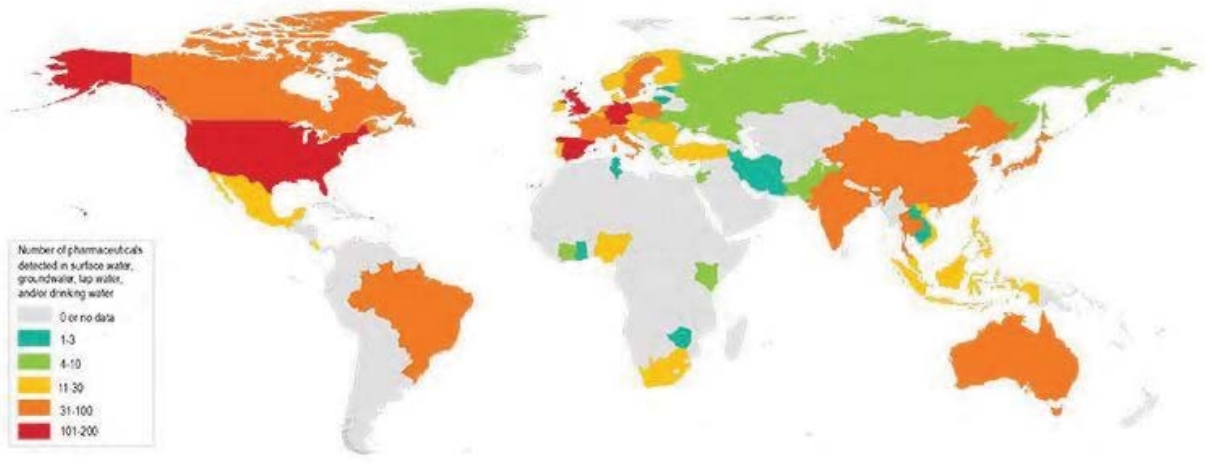

Figure 38 Number of pharmaceuticals detected in surface water, groundwater or drinking water globally. Source: aus der Beek et al., 2015, taken from OECD (2019b).

In a study of influent to and effluent from over 40 WWTPs over a year, **the UK water industry research** studied twenty substances including antibiotics, analgesics, anti-hypertensives and antidepressants. They found that the majority of substances studied were removed to a high degree. However, some were less effectively treated and were present in effluents at concentrations, which might cause concern (UKWIR, 2018a).

The **Swedish Environmental Protection Agency** found that there is a need to introduce treatment for pharmaceutical residues in waste water. Its findings identified the human excretion of residues as the largest source of pharmaceuticals in the environment. Such treatment would also reduce other hazardous substances. Given the costs involved in upgrading treatment, it is still unclear how many WWTPs need to be upgraded and which ones should be prioritised (Swedish EPA, 2017).

Another group of CECs that receive a lot of public attention are **microplastics**. The European Commission plastics strategy identified microplastics and other plastic items such as wet wipes ending up in waterways as an increasingly important issue to tackle. Evidence shows that untreated waste water can contain high amounts of microplastics (Prata, 2018)**.** One source of microplastics in waste water and water bodies are those that are intentionally added to products, meaning they stem from personal care products, detergents, paints, coatings and inks, medicinal products and food supplements (ECHA, 2019)[65]. The second source is unintentionally released microplastics that can come from clothing, tyre abrasions, and road markings, with the latter two entering the environment, via runoff (Eunomia, 2018).

When microplastics reach WWTPs they are mostly, though not completely, captured in one of the treatment steps and transferred to the sludge. ECHA estimates that primary treatment captures up to 80.5% of microplastics, secondary treatment up to 97.5% and

[65] This list is not exhaustive. See: ECHA (2019).

tertiary treatment up to 99.7% (*Figure 39*). Advanced treatment technologies such as bioreactors only have a marginally higher removal efficiency, which is not surprising as this treatment is often focused on N and P removal with limited or no additional removal of solids compared to secondary treatment.

Treatment type	Microplastic retention (%)	Reference and notes (size of particles)
Primary	83	Dris et al. (2015)
	78	Murphy et al. (2016)
	Mean 80.5	
Secondary	95	Dris et al. (2015)
	98.4	Murphy et al. (2016)
	98.3	Lares et al. (2018)
	99.6	Talvitie et al. (2017b)
	96	Michielssen et al. (2016)
	99	Magnusson and Noren (2014) cited by Talvitie et al. (2015)
	Mean 97.5	
Tertiary	99.9	Magnusson and Noren (2014) cited by Talvitie et al. (2015)
	99.9	Carr et al. (2016)
	97	Mintenig et al. (2017)
	99.4	Lares et al. (2018)
	99.7	Michielssen et al. (2016)
	Mean 99.2	

Figure 39 Microplastics retention in waste water treatment. Source: ECHA (2019).

When microplastics are removed during treatment, they end up in sludge, with the **Danish Environmental Protection Agency** (2017) reporting "a median concentration of microplastics in dewatered sludge sampled from five WWTPs of 4.5 mg/g, which corresponds with microplastics comprising 0.7% of the dewatered sludge" (ECHA, 2019) (see UWWTD and circular economy). Some EU regions have also recognised the need to tackle microplastics in water bodies and for further research (Kompetenzzentrum, n.d.).

There are also other polluting items such as biomedia - Surfrider (2018) found that biomedia, used for treatment in WWTPs, are often found in the aquatic environment, released through overflow events in tanks in which they are used, or released due to malfunctioning in the WWTP. Furthermore, a UK study found that larger items, such as wet wipes, are often inappropriately disposed of and can cause sewer blockages. These wet wipes are not meant to be flushed and consist of non-degradable material (Water UK, 2017).

Stakeholders (mostly WWTP operators and trade associations) also raised the issue of microplastics and pharmaceuticals in the public consultation and at the stakeholder conference.

The UWWTD and circular economy

The main resources coming from waste water (treatment) that are usually considered for integration into circular economy closed-loop thinking are reclaimed water, sludge, recovered phosphorus and nitrogen, and energy.

Article 12 of the UWWTD requires Member States to **reuse treated waste water** whenever appropriate. The Council and the Parliament recently agreed on a Regulation

for water reuse in agriculture (EC, 2019h, EC, 2018e). In the accompanying impact assessment, the Commission concluded that the dealing with water reuse on EU level could lead to water reuse in agricultural irrigation in the magnitude of 6.6 billion m^3 per year, as compared to 1.7 billion m^3 per year in the absence of any EU legal framework. Re-using more than 50% of the total water volume theoretically available for irrigation from WWTPs in the EU would avoid more than 5% of direct abstraction from water bodies and groundwater, resulting in a more than 5% reduction of water stress overall (EC, 2018f).

Article 14 of the UWWTD requires Member States to **reuse sludge** whenever appropriate, but this has never been strongly enforced partly due to the lack of strong EU-level standards on how to do this without endangering human health. When Member States want to reuse sludge, they need to comply with the SSD (EC, 2016b). Many Member States have set more stringent requirements on concentration limits of heavy metals, (synthetic) organic compounds and microbial content for sludge reuse (Hudcova *et al*., 2018). Data from 2014 shows that:

- 8.7 million tonnes of dry solid matter of sludge were produced in the EU, with 58% of it reused, mostly in agriculture;
- half of the P removed from waste water was reused or recycled with a value of EUR 900 per tonne;
- N was also recycled with a value of EUR 1,300 per tonne (EC, 2017d).

Sludge is also an energy source through digestion but the Directive does not encourage this (see energy). Using sludge in agriculture is the most direct way to ensure that nutrients (N and P) are recovered. Mineral N production requires high levels of energy. In the EU, there are only small reserves of P and its price has been volatile in the past. It is mainly used in feed and fertiliser in the EU. A major reason for P losses is the inefficient use of waste water (EC, 2015). Technologies exist for cost-efficient P recovery from sludge, but according to the water industry association EurEau 'access to the market is limited because of its low-quality waste image' (EurEau, 2018).

A major problem regarding sludge reuse is that many pollutants being removed from the waste water could consequently be transferred to the sludge (*Figure 40*). *Figure 40* is only indicative as no total emission data for these chemicals were available. The sludge can also contain polycyclic aromatic hydrocarbons (PAH) and perfluorinated surfactants (PFAs) (Wood *et al.,* 2019b) as well as microplastics. A recent Norwegian study sampled **microplastics** captured by one WWTP: 181,679,012 microplastic particles were transferred from the waste water into the sludge each day. They further estimated that 'between 110 000 and 730 000 tonnes of microplastics are transferred every year to agricultural soils in Europe and North America' (Niva, 2018).

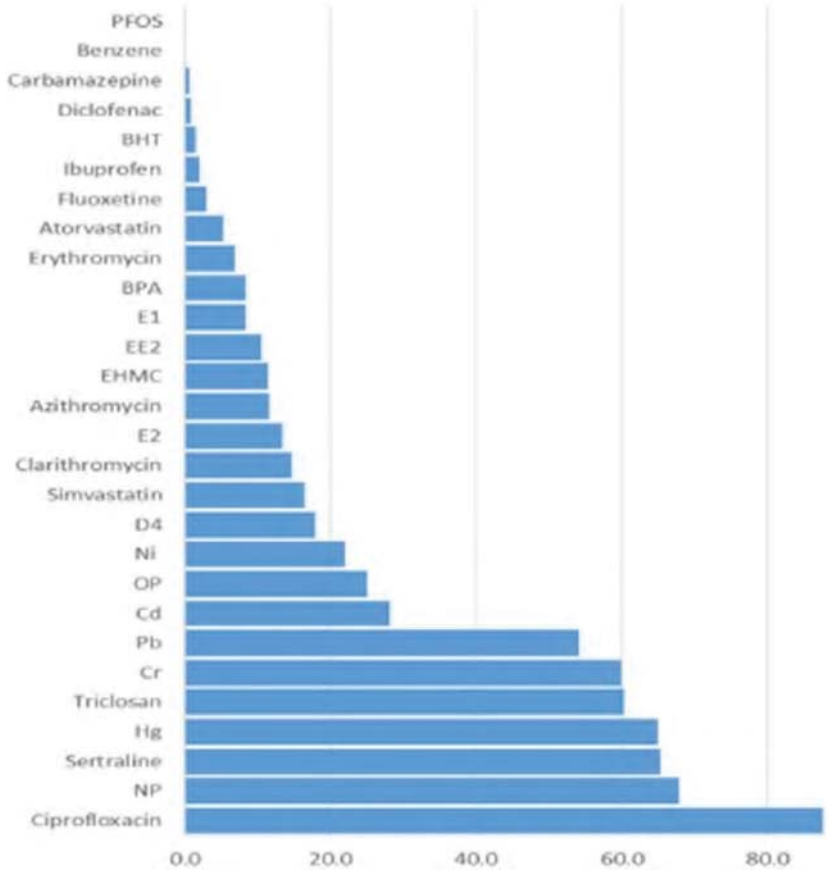

Figure 40 Modelled % of pollutant load incoming to a WWTP, which is retained in sludge, based on the assumed properties of chemicals

There is limited understanding of the behaviours of contaminants of emerging concern in sludge. A study of sludge from 11 WWTPs in the UK suggested that pharmaceutical residues in sludge should not lead to concentrations of concern in soils (UKWIR, 2018b). Pollution reduces the quality of the sludge and using it for agricultural purposes transfers the environmental problem from water to soil where it may become a source of diffuse pollution or be taken up into crops. More analysis of the actual sludge composition and more research is needed to fully understand how these chemicals behave in sludge and how they behave when sludge is reused in agriculture.

Respondents to the public consultation were rather negative when asked to assess the Directive's alignment with circular economy principles. Between 41-47% (n=297-300) believe that the UWWTD does not promote safe water reuse, sustainable approaches such as phosphorus and nitrogen recycling, and safe sludge reuse. Only 6-8% believe that it is aligned to a large extent. Replies of 'I do not know' were received by 14-17% for all answer options. On sludge reuse, academics, companies, private and public associations as well as authorities at different governance levels indicated that the Directive is not compatible with circular economy principles (n=300).

The UWWTD and climate change

Climate change has already increased and will continue to increase the number of heavy precipitation events that lead to storm water overflows and more urban run-off, which means there is a growing need to tackle these issues. They are discussed in more detail under storm water overflows.

In this context also the water-energy nexus needs to be considered: The energy generation sector is the largest consumer of water, accounting for 44% of consumption.[66] The water and wastewater sectors account for 3.5% of electricity use in the EU and that share is expected to rise.[67] At the same time, leaks account for 24% of total water consumed in the EU, representing significant wastage and a loss in terms of wasted water resources and in terms of the energy used to treat those resources.

The effective and energy efficient management of water can contribute significant energy savings. According to the International Energy Agency, 10% of global water withdrawals relate to energy production and this figure is expected to increase significantly with the promotion of several low carbon but water intensive processes, including electricity generation, biofuel production and carbon capture and storage.[68] Member States could therefore explore the potential for energy savings through the use of smart technologies and processes.

In this context, also the energy use of WWTPs has been considered. The UWWTD does not include requirements on energy consumption and/or production. Estimates show that EU WWTPs (those falling under the UWWTD) use 0.8% of all energy consumed in the EU; small plants use 42% of the total energy used for waste water treatment and large plants 58% (*Figure 41*). This roughly amounts to two power plants' worth of energy annually. Usually the higher the treatment level, the more energy is needed.

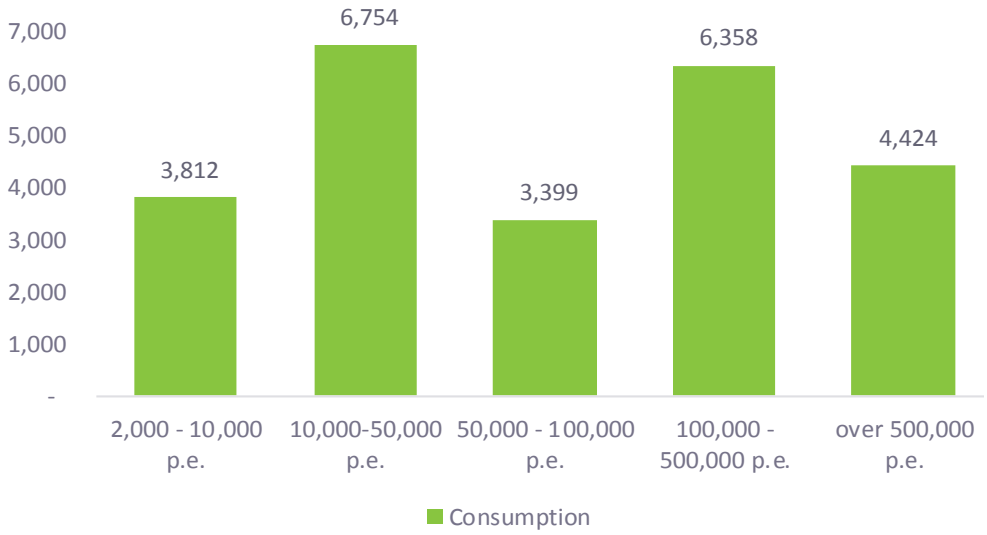

Figure 41 Energy consumption in GWh per year, estimates per WWTP-size in EU. Source: adapted from Ganora et al. (2019).

Energy costs can constitute 25-56% of a WWTP's O&M costs. These costs can make up 20% of the municipality's bill, which is estimated to cost the public EUR 2 billion per year. Shifting the least efficient plants to an average level of efficiency would enable a saving of 5 500 GWh annually, while if they complied with the standards of the most efficient plants this would save 13 000 GWh/ year (Ganora *et al*, 2019). Very little

[66] See recital 22 of amending Directive (EU) 2018/2002 and C(2019) 6621 final.

[67] See recital 22 of amending Directive (EU) 2018/2002 and C(2019) 6621 final.

[68] For further information, see the IEA's World Energy Outlook 2018.

information was available to assess energy use in waste water collection systems and potentials to reduce this use.

The collection and treatment of waste water allow for biogas to be captured as an energy source, and the use of sewage sludge either in agriculture or as an energy source itself, in both cases decreasing the use of fossil fuels in GHG emitting processes. It is estimated that treatment plants could produce energy of up to 87 500 GWh per year, which is equal to the output of 12 big power stations (POWERSTEP, 2018). Across the EU, there are several examples of WWTPs that are energy neutral or that even produce energy. For instance, the Danish Marselisborg plant produces 230% of its energy. This was achieved through process improvements, such as upgrading of sensors and thorough energy audits. The energy that is not reused within the WWTP is used for pumping and district heating. Overall, its water bill was reduced by about 20% over 2 years. Similarly, the Sofyska Voda WWTP in BG has achieved 123% energy self-sufficiency through improvements of aerations processes, anaerobic digestion of sludge, use of on-site combined heat and power co-generation (Ganora *et al*., 2018).

To achieve these energy efficiency potentials, WWTP operators need to make (potentially high) initial investments such as replacing inefficient technologies and carrying out energy audits. The potential for savings probably varies between bigger and smaller plants, with the bigger ones having higher potential to achieve more with less effort. As the waste water sector is usually in public hands, it might often be difficult to have access to funding to carry out the initial investments. Additionally, it needs to be ensured that if WWTPs were to become clean energy producers, they would be able to feed the energy into the network.

Energy savings in the water sector are also incentivised by the amending Directive (EU) 2018/2002 on energy efficiency, and can relieve municipalities' budgets. As, for example, the awareness, experience, capacities can vary largely from one municipality to the other, regional or national programmes can be useful to facilitate experience sharing, technological support and financial aids could thus increase the energy savings potential. With the entry into force of the Governance Regulation (EU) 2018/1999 and the Energy Efficiency Directive 2012/27/EU as amended by Directive (EU) 2018/2002 on energy efficiency, the 'energy efficiency first' principle applies. The water sector can be amongst the beneficiaries of this principle.

44% of respondents to the public consultation (n=285) felt that the Directive was not aligned with EU energy policies, with 7% believing that it was aligned to a large extent and 32% 'did not know'. In particular, those involved in the waste water technology industry took the opportunity to stress the need for further alignment in position papers and comment sections. Stakeholders noted that WWTPs' high use of energy is an unexpected negative impact of the UWWTD.

The UWWTD, the Sustainable Development Goals and citizens' demands

Regarding the United Nation's (UN) Sustainable Development Goals (SDGs), the one that the UWWTD is most associated with is SDG 6 'Clean Water and Sanitation' (UN, n.d.a)[69] The UWWTD, being older than the SDGs, lays the groundwork for part of SDG

[69] WHO definition of sanitation: 'access to and use of facilities and services for the safe disposal of human urine and faeces. A safe sanitation system is a system designed and used to separate human excreta from

6 to be achieved. By requiring that collection systems (e.g. transport) be established and ensuring that treatment adequately takes into consideration the sensitivity of the receiving water body, the Directive has increased EU citizens access to the collection systems and to clean water. Reaching full compliance with the UWWTD would help to achieve SDG 6.2, as according to 2014 data 10 million people in the EU were still not connected to the collection system (EC, 2017d). Globally, more than 80% of urban waste water is still discharged without being treated (UN, n.d.b) and according to the WHO more than 842 000 deaths can be related to unsafe or inappropriate water, sanitation and health conditions (WHO, 2018b).

However, the UWWTD does not contain provisions that require Member States to guarantee access to waste water services for all EU citizens, neither does it set out how exactly people can be connected to the collection system. Furthermore, as a directive, it cannot enshrine this as a human right. The subsidiarity principle needs to be respected and thus it is the Member States' responsibility to ensure that citizens have the possibility to connect to the collection system, as appropriate.

Citizens have been clearly demanding access to clean water, as shown through the first successful European Citizens Initiative 'Right2Water' and the 368 000 citizen responses to the public consultation of the Water Fitness Check[70]. More recently, a **Eurobarometer study** in 2017 showed that more than a third (36%) of EU citizens picked the pollution of rivers, lakes and groundwater as one of the four most important environmental issues in their lives[71]. SDG 6.3 also requires the improvement of 'water quality by reducing pollution, eliminating dumping and minimising the release of hazardous chemicals and materials, halving the proportion of untreated waste water and substantially increasing recycling and safe reuse globally' (UN, n.d.). As shown under effectiveness, the UWWTD strongly contributes to reducing organic pollution and hazardous chemicals from waste water (see Pistocchi *et al*, 2019), and is thus helping to protect the aquatic environment.

Respondents to the public consultation agreed that the UWWTD is aligned to some extent (n=153) with the SDGs.

The UWWTD, contribution to EU leadership on water services sector and innovation

The recitals to the UWWTD require that a 'Committee should be established to assist the Commission on matters relating to the implementation of this Directive and to its adaptation to technical progress.' Furthermore, Annex IA states that 'the design, construction and maintenance of collecting systems shall be undertaken in accordance with the best technical knowledge not entailing excessive costs' (Case C-310/10[72]).

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human contact at all steps of the sanitation service chain from toilet capture and containment through emptying, transport, treatment (in-situ or offsite) and final disposal or end use.' WHO (2018a).

[70] A large majority of the responses (from more than 368,000 citizens) were identified as being part of campaigns promoted by several environmental organisations).

[71] After climate change, air pollution and waste management.

[72] Judgment of the Court (First Chamber), 18 October 2012 European Commission v United Kingdom of Great Britain and Northern Ireland; Failure of a Member State to fulfil obligations – Pollution and nuisance

Regarding the Innovation Principle[73] it can be considered whether the UWWTD had positive or negative impacts on research and innovation capacities of the sector. The UWWTD's main purpose is to reduce pollutant loads in treated waste water, and it does not require that any particular technology is used. Nevertheless, there have been many technological advances in the context of waste water over recent decades e.g. regarding treatment, nature-based solutions and integrating WWTPs into climate change mitigation activities. These innovative solutions, which are actively implemented across the EU Member States, show that the UWWTD does not negatively impact wide-spread innovativeness and research in the sector.

This can be further substantiated by considering the patenting activity in the sector: The EU holds 41% of the internationally granted patents in the water technology sector, whereas other economic zones of comparable size hold significantly smaller amounts, such as the USA which holds 29%, or Japan which holds 17% (see Annex 4, patenting). The UWWTD's implementation also triggered the financing of a high number of LIFE projects (between 2000-2017: about 138 LIFE projects dealt with waste water treatment) (EC, 2019d). LIFE project leaders argue that 'legalisation is a key driver for development of emergent systems, without a legal requirement, industry is unlikely to find the financing to make progress with advanced techniques' (Barrat & People, 2019).

Furthermore, of the leading global water companies, 8 out of the 15 largest in terms of estimated revenues in 2015 are from the EU (GWI, 2015). The implementation of strict EU water law, including the UWWTD, can be considered as a driver for innovation and business leadership. According to the 9th implementation report the waste water sector generates a production value of about EUR 96 billion and an added value of EUR 41 billion each year. If one assumes that 1% of the global water service sector is being related to the action of the UWWTD, this translates into EUR 5-6 billion per year for businesses (see Annex 4 overview of cost–benefits). However, this is based on assumptions and no clear evidence was identified in this regard.

This mixed picture is reflected by the results of the public consultation. 42% of the respondents agree that the UWWTD has encouraged research and development (n=317); this opinion was expressed particularly by NGOs, public associations, and public authorities. Also, public and private WWTPs largely stated that the Directive has encouraged research and development (95% and 90%). 25% of respondents strongly agreed and 52% agreed that stronger links could be made with technical progress, with 9% either disagreeing or neither agreeing or disagreeing (n=296).

5.5. EU added value

Evaluation question: To what extent is it necessary to address urban waste water on EU level and what would have happened without the Directive?

The UWWTD addresses an EU-wide problem that can substantially affect EU water quality and that is still persistent today. Although the WFD is now in place, a targeted approach is very effective to address one specific pollution type.

– Urban waste water treatment – Directive 91/271/EEC – Articles 3, 4 and 10 – Annex I(A) and (B); Case C-301/10.

[73] As published in February 2016 and further outlined under Tool 21 of the Better Regulation guidelines.

Considering the **subsidiarity principle**, EU-level action was and is necessary to tackle this issue, as Member States would not have achieved the same results on their own. **Ensuring that waste water is tackled across the EU in the same time frame ensures that downstream action is not jeopardised by upstream inaction**. The establishment of the necessary infrastructure required substantial investments in the water sector, but thanks to the UWWTD Member States had access to EU-level funding. This allowed them to improve the situation without endangering affordability. The UWWTD led to improved sanitation and equal levels of protection for human health in the EU, and improved bathing water sites (increased tourism) and water bodies in general. It also helped to set up a globally competitive EU water industry.

Without this Directive, only some Member States would have achieved the same level of protection that we have today, and the benefits outlined would not have been attained.

The assessment of the UWWTD's **EU added value** considers the changes that the Directive brought about at EU level and what Member States would have done without EU-level action. It considers whether the UWWTD is in line with the subsidiarity principle, which requires that EU action only be taken when measures are better achieved at EU level and not by Member States individually.

Addressing waste water at EU level and hypothetical impacts of withdrawal

Evidence gathered under the other four Evaluation criteria assessed above, especially under effectiveness and relevance, shows that addressing waste water at EU level protects the environment from the adverse effects of waste water discharges, even beyond the Directive's objectives (see Pistocchi *et al.,* 2019). This comes with a number of benefits (see efficiency) that are shared among a large variety of stakeholders because of the transboundary nature of EU water bodies. Transboundary rivers cover 60% of the EU. Having no Directive on waste water in place, which imposes a similar rhythm of establishing waste water collection and treatment infrastructure, would likely have jeopardised the efforts made by neighbouring Member States, and thus part of the benefits described would have been lost or not have been attained. Requiring the same action to be taken across the EU on a transboundary issue ensured that citizens benefit from the same level of human health and environment protection.

Waste water services, which include collections, treatment and proper discharge, is a basic societal need that comes at a high cost regarding the infrastructure built-up and maintenance. Without the Directive, there would not have been the incentive nor the possibility of funding to do this in a relatively short time span (see costs). Having access to EU funding also ensured that affordability concerns remained marginal in those Member States where substantial investments were needed. Furthermore, the UWWTD does not prescribe to Member States how to make their citizens connect to the collection system and allows for IAS where these are more appropriate in terms of costs and are not harmful to the environment.

The UWWTD has yet to be fully implemented in many EU Member States and even Member States that are fully compliant need to be continuously vigilant in maintaining such compliance (enlargement, upgrade and maintenance of systems). It can be assumed that withdrawing the UWWTD would have negative consequences for all. EU citizens would no longer enjoy the same level of protection and Member States would no longer apply the same high standards, which could be detrimental for the environment. Furthermore, driving factors such as funding, legal action and promoting compliance would no longer exist to support Member States in developing waste water infrastructure.

Based on these findings, it can be argued that the Member States still cannot sufficiently achieve the UWWTD's objectives as:

1) the Directive has yet to be fully implemented, and analysis under effectiveness and efficiency showed that continued EU co-funding and EU legal action are needed to achieve full implementation and to reap all benefits;
2) in terms of water quality, the same level of protection cannot be attained if Member States do not apply the same standards, which thus jeopardises the efforts made downstream;
3) new societal needs have arisen within the context of waste water that make further action even more relevant, especially once the Directive is fully implemented.

Continuous action on EU level will better achieve the objectives. The UWWTD therefore complies with the subsidiarity principle.

The UWWTD also enabled waste water service and technology companies to compete on the same basis and thus helps the internal market to operate effectively. It does so by demanding the same standards across the EU. Over the past decade, the waste water sector grew substantially in size and grew from about EUR 13 billion in 2008 to about EUR 18 billion in 2016. The size is significantly larger in the EU-15 compared to the EU-13 though in terms of percentages the growth for EU-13 was 27% whereas for the EU15 it was only 15%. This might be linked to a large number of EU-13 countries having to meet the first UWWTD deadlines. Furthermore, strong water legislation has supported the development of a strong water sector, with 8 out of the 15 worldwide largest water businesses being based in the EU.

Stakeholders have also been vocal about the need for EU-level action: Two thirds of the stakeholders across all categories who replied to the public consultation (n=309) agreed that to deal with waste water EU-level action is needed to a large extent, and 86% (n=307) argued that withdrawing the Directive would have negative effects. This was reflected in the general part in which 69% of the stakeholders stated that EU law is needed in order to continue regulating the collection and treatment of waste water (n=608). Only 1% of the stakeholders stated that there is no need for regulation and 15% provided no answer. Furthermore, stakeholders, mostly citizens and NGOs, agreed that progress would not have happened without the Directive or would have happened more slowly (29% and 16% respectively), with only 7% arguing that changes would have happened anyway (n=608). Of that 7%, 44% were from Germany and 60% were citizens.

6. CONCLUSIONS

The UWWTD is one of the older pieces of EU water legislation, having been adopted in the early 1990s. The Directive works in the context of a number of pieces of water legislation and is the EU-level measure to deal with urban waste water. When the Directive was adopted, the extent of urban waste water treatment in the then 12 Member States differed vastly from today. Over the past three decades, the UWWTD's implementation has substantially progressed, with most Member States now having high compliance rates for collection and secondary treatment. Several Member States still need to make substantial efforts to be compliant, especially as regards reducing nutrients to required levels. Some of the initial 12 Member States are not yet fully compliant, whereas some Member States that joined the EU after 2004 have made remarkable progress within a relatively short time. A substantial number of infringement cases were launched over that period.

The Evaluation of the UWWTD provides a detailed assessment of the Directive's effectiveness, efficiency, coherence, relevance and EU added value. Regarding **effectiveness**, it finds that, where and when it is well implemented, the Directive led to **substantial reductions of pollutant loads being released to the environment**. These reductions have **supported the protection and improvement of EU water quality and helped to achieve the objectives of other water-related directives**. Further improvements are to be expected when Member States fully implement the Directive. Well maintained and operated waste water collection and treatment systems have protected aquatic ecosystems and bathing waters from pollution, thereby also ensuring that **human health is protected**. While treatment that is required by the UWWTD does not directly target specific **chemicals** (other than N and P) **and microplastics**, it nonetheless helped to reduce the loads of these pollutants discharged directly from WWTPs to receiving waters. WWTPs remain a pathway for mercury to the aquatic environment. Certain WWTPs receive significant quantities of industrial waste water; depending on the constituents of industrial waste water and/or the levels of pre-treatment, a WWTP may only be capable of partially treating this industrial influent.

There are some **factors that reduce the Directive's effectiveness**. It has yet to be fully implemented in some Member States, which is mainly due to lack of funding and governance issues. The Commission **promoted compliance** by providing extensive funding, research and innovation programmes, through dialogues with Member States and by steering implementation by means of infringement procedures, when needed.

The implementation of the Directive requires substantial and focused investments in infrastructure. This was supported with Member States allocating to the EU water sector **the highest amounts of all environment-related Cohesion policy funds available**. A limited number of Member States still rely on EU funding. Whereas similar types of funding are likely to continue, the amounts available are likely to decrease over time. Preliminary OECD estimates show that an additional EUR 253 billion has to be spent in the EU until 2030 to maintain or achieve full compliance. Further re-investments in existing waste water infrastructure assets (collecting systems and waste water treatment plants) will be required to maintain compliance with the Directive. This is due to the ageing of assets, changes in the composition and quantities of loads to plants etc., through the adaptation or refurbishment of existing assets, development of additional/replacement assets and the need to uptake innovative solutions. In terms of financing the water sector, a few Member States have managed to move to almost **full cost recovery** for their water supply and waste water sector, and to apply the 'polluter pays' principle by charging households and industries. The vast majority of Member States rely on a mix of tariffs, taxes and EU funding to finance the investments. In general, **affordability** is not at risk except in some vulnerable countries, such as Romania and Bulgaria (in these Member States some major investments in the waste water infrastructure are still lacking, and large amounts of EU funding are still allocated to water management). Where costs are being fully recovered through water tariffs, the picture could substantially change if these are not coupled with social support measures.

Another **positive factor** that substantiates the effectiveness of the Directive is the clarity of its provisions: one of the success factors of the Directive is its **simplicity**. Overall, the Directive's requirements are straightforward and the associated deadlines are clear, which makes it **easily understandable and 'enforceable'.** Some of its provisions are, however, not entirely clear or are limited in their scope and thus reduce its overall effectiveness. These provisions concern SWOs, the use of malfunctioning IAS, small agglomerations and non-connected dwellings and eutrophication (apart from non-compliant agglomerations). The UWWTD's requirements on monitoring, reporting and

providing information were also assessed and found to be generally adequate for monitoring compliance, with some shortcomings in terms of:

1) the time needed to make these available;
2) the level or amount of information provided;
3) the lack of progress with technological advances and innovation uptake; and
4) limitations in providing relevant and readily accessible information to the public.

As regards the Directive's **efficiency**, many of its effects (i.e. clean environment, health protection, competitiveness) directly benefit citizens, companies and Member States. However, only a few of its **benefits** can be quantified and monetised, such as: 1) the reduction of pollutants in effluent; 2) the improvement of bathing sites; and 3) cost savings related to moving from IAS to collection systems. In total it is assumed that these lead to an **annual benefit of up to EUR 30.6 billion in the EU once the Directive is fully implemented**. Note, however, that the assessment of benefits is based on assumptions, and subject to uncertainties. The Directive has also had a positive impact on the **global competitiveness** of the EU water sector — many EU water companies are strong global players and there is a high number of European water technology patents.

The costs for collection and treatment of waste water are **estimated at EUR 19.7 billion annually under full implementation**. It should be noted that the Directive allows for cost-efficient solutions: where excessive costs or lack of environmental benefits do not justify the installation of collection systems, Member States can use **individual or other appropriate systems** instead. The UWWTD contains few requirements that result in **administrative burden**. Most of the costs are borne by Member States, their competent local authorities and the Commission. **These costs are marginal compared to the costs of infrastructure**. Overall, it is concluded that the **benefits outweigh the costs**.

As regards the **coherence** of EU legislation and policies, the UWWTD **interacts well with other EU water and environmental laws** from a legal perspective, as well as in terms of supporting the implementation of other water legislation (for instance the Bathing Water Directive). Overall, the links with the main over-arching piece of water legislation, the Water Framework Directive, are clear and the directives are mutually supportive in reaching their goals. Many other environmental directives benefit from the UWWTD's implementation, with no substantial inconsistencies with other EU law or policies. Even with the adoption of the Water Framework Directive, the targeted UWWTD approach remains very effective in addressing one specific type of pollution.

The assessment also considered the UWWTD's **relevance** and whether it is still fit for purpose. It is clear that waste water remains a major source of pollution and that Member States need to continuously make efforts to address this. The Directive is a major driver of action in this area. Furthermore, a number of new societal problems were identified:

1) There is an increasing need to tackle **contaminants of emerging concern,** including pharmaceuticals and microplastics. Modern treatment technologies remove many of these pollutants substantially. Nonetheless, some of them are not captured by WWTPs and, even when captured in sewage sludge, they may cause issues when this sludge is reused in agriculture. Few Member States and non-EU countries have taken action (or consider taking action) and use targeted approaches to adapt their waste water treatment and reduce micropollutants discharged through effluent.
2) Although the Directive contains some provisions on water and sludge re-use, the potential for aligning the UWWTD with the **circular economy** has not been fully exploited, (e.g. recovery of valuable components from sewage sludge). Higher

treatment at WWTP level may transfer more pollution to the sludge, which might be consequently not adequate for re-use. Control of targeted pollutants at source would reduce treatment requirements.

3) WWTPs and collection systems require **high amounts of energy**, with waste water treatment using about 0.8% of the total EU energy consumption. The UWWTD, however, does not incentivise the efficient use of energy and thus is not in line with the EU's energy efficiency agenda. At the same time, there are many examples in different EU Member States where some of the larger WWTPs adopted innovative solutions to be energy neutral or even energy generating.

Despite not being fully integrated in the Directive, the relevance and potential of the UWWTD to foster innovation is well recognised. Furthermore, the UWWTD is also relevant tool to support Member States to reach internationally agreed objectives such as Sustainable Development Goal 6.

Considering these findings in terms of the UWWTD's **EU added value**, without the Directive only some Member States would have achieved the same level of protection of the environment and health that we have today. The UWWTD addresses a problem that is EU-wide and often transboundary. Thus, action taken on EU level is likely to be more effective than a segmented approach by Member States. As a result of the Directive, Member States have set themselves ambitious collection and treatment goals. To support their delivery, Member States had access to additional EU funding, and enjoyed benefits gained from knowledge sharing. To support their delivery they also had access to additional EU funding, and enjoyed benefits of knowledge sharing.

Based on these conclusions, this Evaluation thus notes the following lessons learnt and shortcomings of the Directive:

- **Implementation**: Urban waste water is still a pressure on EU water bodies. Though the Directive is effective, **more efforts are needed to achieve full compliance** and ensure that all urban waste water is collected and treated adequately.
- **Deadlines**: Despite high levels of implementation overall, there were also **delays**, sometimes significant, in several Member States. Reasons include Member States not planning the necessary investments in time to meet the **deadlines**, lack of a long-term financing strategy, problems stemming from governance arrangements at central, regional and local level, and in particular a lack of resources and administrative capacity.
- **Storm water overflows:** SWOs constitute a sizeable remaining source of loads, and are only addressed by a footnote in the Directive. The Court of Justice of the European Union has pointed out the need to develop guidance in this area. **Urban runoff**, which is only covered by the Directive as regards combined sewage, is also an increasingly significant source of pollution, as regards heavy metals, plastics and microplastics. These issues are likely to be further aggravated by an increasing number of heavy precipitation events under the changing climate.
- **Individual or other appropriate systems (IAS):** The Directive's provision on **IAS** ensures that Member States have sufficient flexibility to avoid excessive costs where no additional benefit would be achieved through a collection system. The analysis shows that badly managed IAS can have detrimental effects on water quality, however, and the UWWTD does not require the monitoring of IAS performance.
- **Small agglomerations and non-connected dwellings:** Agglomerations below the thresholds of the UWWTD and non-connected dwellings located outside of

agglomerations are not addressed in the Directive substantively, whilst established to be one of the significant pressures on EU surface water bodies.

- **Sensitive areas**: The UWWTD requires the designation of **sensitive areas**, but it does not prescribe to a Member State how it should monitor eutrophication in this context. The CJEU has set out four criteria for assessing eutrophication under the UWWTD. However, it is evident that, for instance, neighbouring Member States do not always consistently apply the rules on designating sensitive areas and this may lead to inconsistencies as regards the protection of eutrophic areas or those areas that are at risk. Also, consistent implementation with similar requirements under the WFD and ND is not always ensured.
- **Contaminants of emerging concern**: Pollutants not included in the **scope** of the UWWTD are receiving more attention and may be increasingly important to address; these include pharmaceuticals and microplastics. Some pollutants are removed through waste water treatment to varying degrees, while others pass through the WWTPs untreated and are discharged directly to receiving water bodies. Where treatment is successful in capturing these pollutants in waste water sludge, the reuse of this sludge for agriculture etc. is a potential issue to be considered.
- **Costs of the UWWTD**: Some Member States need to find new, sustainable approaches to finance their water sector by completely implementing the 'polluter pays' principle and acting in accordance with Article 9 of the Water Framework Directive on cost recovery. To avoid unwanted negative social impacts, they should design and put in place appropriate social measures.
- **Monitoring**: More links between water bodies' actual water quality and treatment should be ensured in the future. The UWWTD does not require or encourage the uptake of new methodologies, innovative technologies or increased monitoring frequency.
- **Reporting**: Further alignment with other pieces of EU water legislation and gains in effectiveness and efficiency (e.g. timelines) are possible, e.g. by using modern monitoring and reporting technologies, in particular at Member State level. Some coherence issues also may deserve attention (e.g. some small issues with the Industrial Emissions Directive and the related database on industrial emissions should be further investigated as well as, where relevant, further integration with the Water Framework Directive, Sewage Sludge Directive and potentially water reuse).
- **Providing information**: There could be potential for strengthening the provisions that enable better communication with the public, particularly in countries where compliance with Articles 3-5 is low.

Beyond the topics that are closely linked to the existing UWWTD, this Evaluation also provides evidence that the UWWTD does not encourage any approaches to reducing **energy** use or even producing clean energy, to harvesting the potential to reduce GHG emissions, and to aligning the waste water sector with **circular economy** principles. Moreover, the UWWTD did not promote sufficiently the uptake and deployment of innovation, though there is also no evidence that it hindered it.