Council of the European Union

Brussels, 16 December 2019
(OR. en)

15135/19
ADD 1

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 - Part 2/2
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 - Part 2/2.

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

EUROPEAN
COMMISSION

Brussels, 13.12.2019
SWD(2019) 700 final

PART 2/2

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}

Annex 1: Procedural information

Lead DG, Decide Planning/CWP references

This Evaluation is led by DG Environment. It was included as item PLAN/2017/1657 in the DECIDE/Agenda Planning database.

Organisation and timing

In 2017, a joint inter-service group for the UWWTD Evaluation and the Water Fitness Check was set up, including members from all from all relevant Directorate Generals:

- Secretariat General (SG)
- Legal Service (SJ)
- Agriculture and Rural Development (AGRI)
- Climate Action (CLIMA)
- Communications Network, Content and Technology (CNECT)
- Economic and Financial Affairs (ECFIN)
- Environment (ENV)
- Energy (ENER)
- European Civil Protection and Humanitarian Aid Operations (ECHO)
- Financial Stability, Financial Services and Capital Markets Union (FISMA)
- Health and Food Safety (SANTE)
- Internal Market, Industry, Entrepreneurship and SMEs (GROW)
- Joint Research Centre (JRC)
- Maritime Affairs and Fisheries (MARE)
- Migration and Home Affairs (HOME)
- Mobility and Transports (MOVE)
- Regional and Urban Policy (REGIO)
- Research and Innovation (RTD)

The group met three times during the Evaluation process. On a number of deliverables, the group was consulted in writing. The members of the group were invited to all events organised in the context of the consultation process described in Annex 2.

DATE	*TOPICS OF DISCUSSION*
08 Nov 2017	1st ISG meeting: discussion of overall process, roadmap
01 March 2018	Written consultation on consultation strategy
26 April 2018	Written consultation on draft public consultation questionnaire
3 April 2019	2nd ISG meeting: discussion of support study (+ written consultation on support study)

27 May 2019	3rd ISG meeting: Discussions on final draft Staff Working Document (+ written consultation on revised support study and SWD)

Table 9 ISG meeting dates and topics of discussion

Exceptions to the better regulation guidelines

No exceptions were made to the Better Regulation Guidelines during this Evaluation.

Consultation of the RSB

An upstream meeting was held with the Regulatory Scrutiny Board on 10 July 2018.

On 17 July 2019 the RSB meeting on the draft SWD was held. The RSB gave a positive opinion on 19 July and suggested a few improvements. *Table 10* shows how these were addressed.

Main considerations by the RSB	***How they were addressed***
The evaluation does not analyse reasons behind compliance difficulties in some Member States.	Further information has been added to the section on late implementation and the underlying factors as well as the following sections: SWOs, IAS, to provide further analysis of compliance difficulties. These sections have also been moved to "effectiveness" to explain how some unclear obligations of the UWWTD lead to reduced effectiveness of the Directive in terms of meeting its overall objective of protecting the environment from the adverse effects of waste water discharges.
There are many pieces of legislation and many factors that have an impact on water quality. The evaluation does not sufficiently explain the wider context and the links between overall water quality objectives and the specific measures of the Urban Waste Water Treatment Directive.	Under section 2.1. a description of the water law context was added as well as how the UWWTD fits in there. Urban waste water as pollution source has been contextualised in this section. Reference to these interactions is made throughout the revised text where appropriate.
The evaluation's conclusions do not fully reflect all of the evidence presented in the body of the report. They should also be more explicit about the issue of the new pollutants and whether it has an impact on the relevance of the Directive's scope.	The conclusions have been revised to be more aligned with the body of the report. Text has been added to clarify the issue of new pollutants and their relevance regarding the scope of the UWWTD.

Further considerations and recommendations	***How they were addressed***

The evaluation should better explain why some Member States have difficulties with compliance. It is important to distinguish between issues of legislation and issues of implementation, as well as between financial difficulties and governance challenges. The evaluation should provide more analysis of practices in different Member States and on the various compliance measures taken by the Commission.	More information on late implementation, on IAS and SWO practices was added under the respective sections. More distinction on legislation vs implementation issues added under late implementation, IAS, SWOs and small agglomerations. More information on practices in Member States was added.
It is important to present the Directive in the wider context in which it operates, taking into account how it interacts and complements other water related legislation. The report should explain how the changes in the water policy context require to put the objectives and the ambitions of the Directive into a broader perspective.	Under section 2.1. a description of the water law context is provided as well as how the UWWTD fits in there. Additionally urban waste water as pollution source has been contextualised in this section. Reference to these interactions is made throughout the revised text where appropriate.
The report could give more detail on the effectiveness of technical solutions and financing models to reach the water policy objectives.	More detail on the effectiveness of technical solutions and financing was added.
The conclusions should be strengthened to help policy makers understand how the Directive performed and the shortcomings identified through the analysis. The conclusions are introduced with a summary which focuses too much on the positive aspects. The conclusions should also address the issue of the pollutants to be targeted in the changed context of the Directive.	The conclusions have been revised to be more aligned with the body of the report. Text has been added to clarify the issue of new pollutants and their relevance regarding the scope of the UWWTD.

Table 10 RSB comments

Evidence, sources and quality

Support study

A contract study **"Evaluation Study to support the Evaluation of the UWWTD"** provided substantial support for the Commission's Evaluation of the Directive. The contract was signed on 08 February 2018. The contract was carried out by a consortium of experts led by Wood, and also comprised of IEEP, COWI, Cenia, HR Wallingford. The final report for the study contract was accepted on 07/12/2019.

Water quality modelling

The European Commission's Joint Research Centre developed a Science for Policy report "Water quality in Europe: effects of the Urban Wastewater Treatment Directive" (see Annex 3, Science for Policy – the effects of the UWWTD).

Cooperation with the OECD

A **cooperation project with the OECD** on investment needs in the EU water sector and financing options for the way forward was launched in December 2017. As part of this project, the investment needs stemming from the DWD and UWWTD implementation were assessed across all EU28 Member States. Additionally, 10 Member States were visited to discuss the findings and potential ways forward to ensure that compliance is reached, and that investments in their water sector are sustainable.

Stakeholder consultation

Stakeholder consultation was an important element of gathering all information and validating data and preliminary findings (see Annex 2, Stakeholder consultation).

Evidence from selected studies and policy documents

Additional in-house research supported the Commission's assessment and references are made throughout the text. All references can be found here: Annex 5, References.

Annex 2: Stakeholder consultation

1. Introduction

The objective of the consultations was to gather further evidence to substantiate the analysis of relevance, effectiveness, efficiency, coherence and EU added value as required by the Better Regulation Guidelines for Fitness Checks and Evaluations. The activities were coordinated with the Water Fitness Check. The consultation approach was set out in the Consultation strategy published in May 2018.

2. Stakeholder groups covered by the consultation activities

- Member State authorities (national, regional and local authorities);
- Public and private waste water operators, or associations representing experts;
- Businesses/business associations concerned by the Directive;
- Citizens;
- EU institutions;
- Academics/researchers and trade unions;
- International organisations;
- Non-Governmental Organisations and citizens' initiatives.

These stakeholders were consulted in different settings and all provided valuable input.

3. Consultation activities in chronological order

- Feedback mechanism to the roadmap of the UWWTD Evaluation,
- Key issue scoping interviews,
- Public consultation,
- Thematic expert workshops,
- Stakeholder conference,
- Written consultation of Member State experts on modelling aspects.

Feedback to the Evaluation Roadmap

The Evaluation roadmap was published in October 2017, at the same time as the roadmap for the Water Fitness Check. Both roadmaps were subject to a feedback mechanism. Apart from 3 anonymous contributions and 1 citizen reply, 8 NGOs, 4 research organisations, 1 public services association, 10 representatives from the water industry and 1 competent authority provided feedback during the consultation period.

Topics stressed as important included:

- Storm water managements;
- Pollutants of emerging concern;
- The need for sustainable long-term investments and application of the polluter pays principle;
- Assessment of the links with the Water Framework Directive and with the Sewage Sludge Directive;
- The links to the SDGs, particularly SDG 6.

This feedback fed into the development of the Terms of Reference for the Support Study and the development of the key issues.

Key issue interviews

In the initial phase of the Evaluation, scoping interviews with experts from industry associations, an environmental and a human rights NGO, and a water technology association were held. These interviews shaped the key issues and provided indications of available data.

Most immediate and prominent agreement was provided on storm water overflows (SWO), pollutants of emerging concern, individual and other appropriate systems (IAS) and energy efficiency. Mixed feedback was received on the key issues of monitoring and sizing of plants. These were kept as key issues as they had also been identified by the ECA as important topics.

Overall experts agreed that the UWWTD was crucial for ensuring the establishment of collection and treatment infrastructure. There was also strong agreement on the clarity and simplicity of the Directive. The investment that are needed for the implementation were stressed as high and sometimes as a hindering factor for implementation. Nevertheless, there was also agreement on the benefits outweighing the costs.

Public consultation

The public consultation was launched online in July 2018. The questionnaire was published in all 23 official EU languages on the Commission's website for consultations and remained open for 14 weeks. It consisted of a general part and an expert part that was structured along the Better Regulation Evaluation criteria.

In total 608 replies (606 via the online portal and two via e-mail due to technical problems) were received. **As none of the content questions was mandatory to be answered, the total number of respondents varies for each question.** Whereas main findings of the replies to the public consultation are discussed here, specific findings are included throughout the main text of the Evaluation.

More than half of the replies came from citizens (57%), and 17% from private or public WWTP operators. The remaining respondents represented public authorities, NGOs, academia, industry, private and public associations, and EU institutions. In terms of nationalities, almost all EU Member States were represented by stakeholders apart from Estonia, Latvia, Lithuania and Hungary. The largest share of respondents came from Germany (22%) and Spain (21%). One small campaign from WWTP operators in Spain was identified and their comments fed into the main analysis of the internal coherence of the Directive.

Effectiveness

As part of the expert section of the questionnaire, stakeholders were asked to judge how effective the Directive has been regarding its key provisions. Feedback varied across the provisions, showing that most provisions are judged very or somewhat effective. Stakeholders do not think that the UWWTD has been very effective to ensure proper application of IAS or that Member States deal adequately with SWOs. Across all answers, no trend was visible in terms of replies from different stakeholder categories.

Objectives	Very effective	Somewhat effectiv	Somewhat ineffec	Very ineffective	Neither effectiv	I do not know

		e	tive		e nor ineffec tive	
Protecting the environment from adverse effects of urban waste water discharges (N=345)	46%	42%	3%	1%	4%	4%
Protecting human health from adverse effects of urban waste water discharges (N=343)	31%	54%	3%	1%	6%	5%
Collecting waste waters (N=341)	46%	37%	3%	1%	8%	4%
Ensuring a proper application of IAS (Individual or other Appropriate System) (N=332)	7%	28%	14%	5%	25%	22%
Ensuring a proper use of CSO (Combined Sewer Overflow) (N=337)	6%	25%	20%	7%	23%	18%

Table 11 Replies across stakeholder categories regarding the effectiveness of a number of the Directive's provisions

Efficiency

In terms of proportionality of costs and benefits, stakeholders very or slightly familiar with the Directive strongly agree or agree that costs and benefits are proportionate, especially in the long-term. These stakeholders came from across all categories.

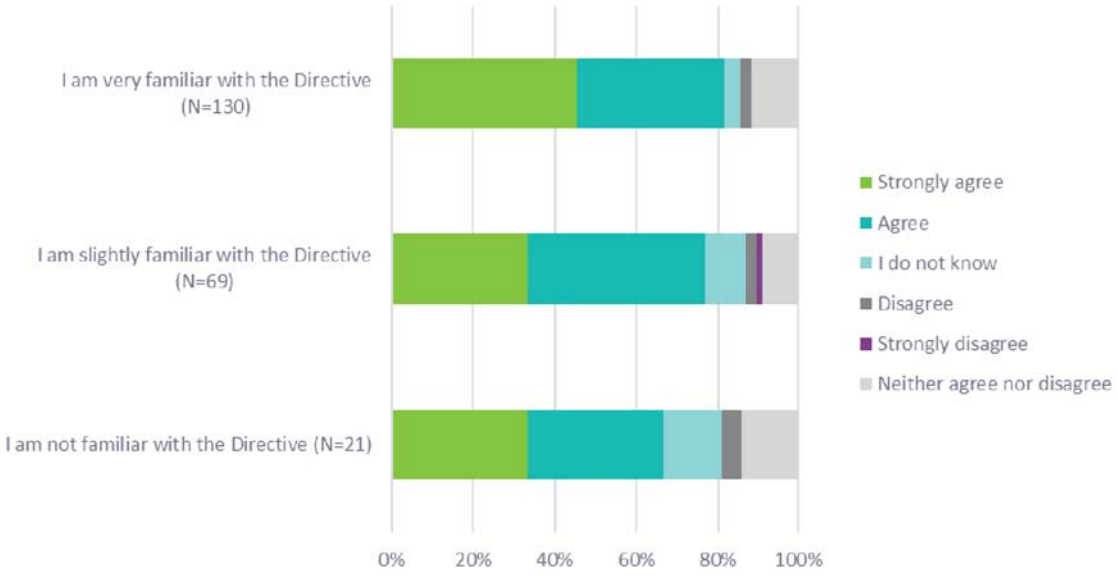


Figure 42 Stakeholders views on the proportionality of costs and benefits.

Overall 79% of all respondents agreed or strongly agreed that the costs are justified given the benefits, with a majority of respondents being citizens.

Coherence

The assessment of internal coherence led to mixed feedback with most agreeing that the Directive is to a large extent or to some extent internally coherent (27% and 53%, n=299). It was pointed out that the Directive contains diverging thresholds when it comes to industrial waste water. Reviewing comments shows that many stakeholders included

in their judgment external coherence aspects or the UWWTD's partial insufficiency to address new societal needs. Regarding external coherence, stakeholders view the UWWTD to be to some extent coherent with other water law, with many pointing out coherence to a large or to some extent with the WFD (32% and 50%, n=293).

Regarding newer policies on energy and climate, stakeholders raised that the UWWTD does not integrate sufficiently.

Relevance

Stakeholders also assessed the UWWTD's capacity to deal with new challenges and agreed across all stakeholder categories that there are problems that the Directive does not completely address. When cross-checking with the stakeholders' familiarity with the Directive, it is visible that also those very familiar with the Directive do not believe that the Directive is sufficient to deal with new challenges.

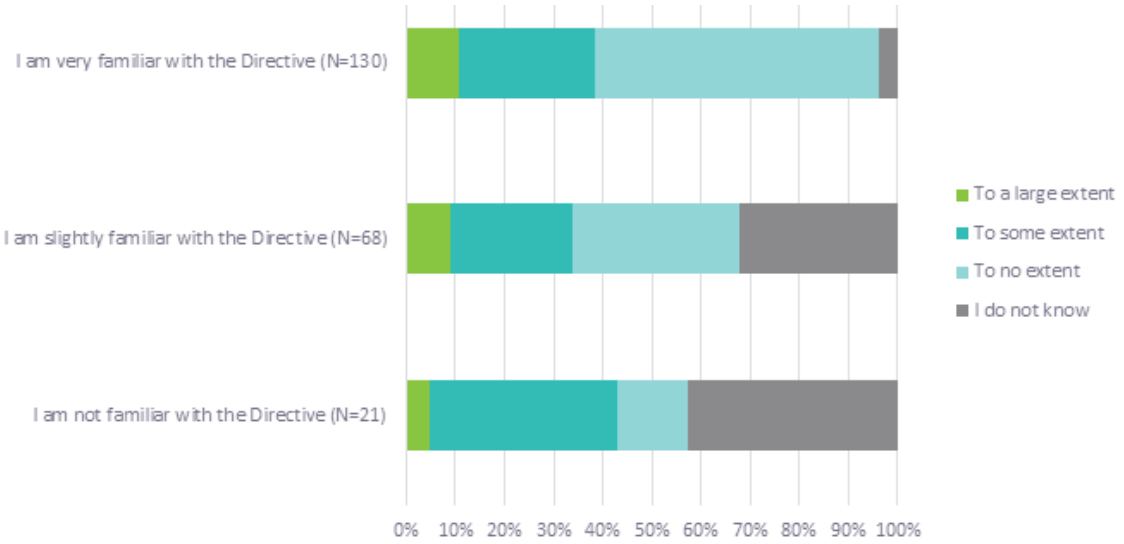


Figure 43 Stakeholders view on the capacity of the UWWTD to deal with new challenges by level of familiarity.

When asked which challenges are not addressed sufficiently by the Directive, trade associations and WWTP operators raised that it does not sufficiently deal with resource recovery, especially sludge, and that there is a need to deal with emerging pollutants.

In terms of substances that might be found in waste water and that might be of concern to stakeholders' endocrine disruptors were ranked highest (52% and 19% of all respondents are very strongly concerned and strongly concerned, and came from all stakeholder categories (220 citizens, 27 operators, 7 academics). Other substances mentioned were pharmaceuticals and industrial pollutants (48% very strongly concerned), pesticides (47% very strongly concerned), and microplastics (46% very strongly concerned) (n=608).

Asking who should pay for additional treatment to remove these substances there was a split between those saying that the initial polluter (e.g. industry) should pay (40%) and those saying that a price increase of the water bill is acceptable (25%) (n=608). Whereas only 3 replied "I do not know", 16% did not provide an answer. Those in favour of the industry paying were largely citizens, NGOs and water companies.

EU-added value

Asking stakeholders whether there is a need to continue EU level action on waste water, most agreed to a large extent (63%) or to some extent (26%). The main stakeholder group in favour of continuing EU level intervention are citizens. Most stakeholders agree that withdrawing the UWWTD would have negative impacts (86%, N=307) with only 2% thinking that a withdrawal would have positive consequences. Stakeholders argued that a withdrawal would be negative for water quality and human health. It would also reduce incentives to develop the needed infrastructure to protect the environment.

The findings of the public consultation were substantially integrated in the analysis of the Evaluative support study and underpinned the Commission's assessment.

In addition, a few position papers were received:

- **Swedish Environment Protection Agency**: Position paper provided further additions and clarifications to the EPA's replies to the public consultation. The EPA identified as shortcomings of the UWWTD its inflexibility to adapt to local conditions and its lack of ambition with regard to phosphorus.
- **Danish Environment and Technology Association**: The position paper noted that progress on treatment technologies has been made over the past decades and that the UWWTD missed the opportunity of including aspects of energy efficiency, as well as to incentivising recovery and reuse of resources in waste water.
- **EurEau**: Position papers on micropollutants, microplastics in waste water explained the extent of this problem and the challenges to deal with them. Further, a position papers on energy efficiency, on the treatment terminology in the Directive and views on the waste water treatment opportunities and challenges in regards to single-use plastics were submitted.
- **World Green Infrastructure Network**: the position paper provided insights in how green infrastructure can help addressing storm water overflows. Further, it was noted that since adoption of the UWWTD external factors such as climate change and rise of pollutants of emerging concern have led to new societal needs.
- **Xylem**: The technology provider identified the ageing infrastructure and the lack of sufficient funding as a key challenge. It was suggested to further incentivise cost recovery, and to consider new cost-efficient solutions to deal with SWOs. Additionally, the promotion of resource recovery and energy efficiency was suggested.
- **Centre for Water Security and Cooperation**: The centre provided feedback on the potential tension between access to water and cost recovery, the new challenges coming with climate change (e.g. extreme weather events leading to new challenges for sewers and WWTPs), and non-connected dwellings, pharmaceuticals and EU-added value.

Thematic expert workshops[1]

The information gathered during the workshops fed into the Evaluative study report and the Evaluation. Additionally, some of the workshops discussion served to confirm the JRC's modelling approach and the assessment of costs and benefits. All workshops were attended by experts representing Member States, academia, business association/industry, environmental NGOs and Commission staff.

---

1 Minutes and presentation can be found on circabc.

Workshop on pollutants of emerging concern jointly with the Water Fitness Check (24th October)

Objective: Assessment of the impact of pollutants of emerging concern on the aquatic environment and the assessment of WWTPs' potential to reduce the impact.

Summary: Pollutants of emerging concern cover a broad range of substances, and WWTPs are recognized as on the one hand reducing some of them through the treatment already in place and on the other hand to be considered by some as the point of release into the environment. There is not yet one individual treatment technique that could ensure that all pollutants of emerging concern are removed. For some pollutants of emerging concern their impact on the environment has been noted (e.g. Diclofenac) whereas for others it is unclear how they behave in the environment and what kind of cumulative effects they might have with other substances.

In some countries, first steps towards addressing pollutants of emerging concern have been taken. For instance, in Switzerland it was to install the fourth treatment stage in a number of priority plants.

Workshop on storm water overflows and individual or other appropriate systems (25th October 2018)

Objective: Discussion on legal and environmental aspects of storm water overflows (with strong focus on combined sewer overflows) and IAS. The JRC presented its draft modelling results on the impacts of these two topics. Stakeholders had the opportunity to discuss and validate this approach.

Summary: Storm Water Overflows: These are covered only by a footnote in the UWWTD, which some participants found to be insufficient. The terminology covers both, overflows in combined and separate systems. However, there is no definition of what constitutes a 'spill', or an 'overflow event'. The first 15 minutes of an overflow contain the 'first flush' which might contain the most pollutants. Another important problem is the content of urban runoff, which mixes additional pollutants into the waste water when it enters the sewers. Member States use different approaches to deal with overflows, including monitoring, investing in separate sewers or making use of green infrastructure/nature-based solutions, such as wetlands.

Individual and other appropriate systems: IAS are in use in agglomerations < and > 2 000 p.e., with only the latter being covered by the UWWTD. Member State experts explained different frameworks for dealing with IAS in their countries. Even with advanced frameworks in place, it is difficult to ensure the well-functioning and the adequate handling of IAS.

Workshop on costs and benefits (8th November 2018)

Objective: In this workshop results from the UWWTD Evaluation support study were compared to similar studies conducted by the World Bank (2018), by the OECD (ongoing, jointly with DG ENV) and Blue2 (ongoing, commissioned by DG ENV).

Summary: The costs functions used for the assessment of costs related to the UWWTD are known to the stakeholder community and they are considered to be fairly stable though also very data intensive. Given the costs involved with the UWWTD, a discussion on affordability, cost recovery and EU-funding cannot be missed in the Evaluation. Discussions on the benefits showed that a damage costs approach was

favoured. Overall, there was strong agreement that it is difficult to capture, quantify and monetise all benefits brought by the UWWTD. The World Bank in its study on 8 Member States accounted for different benefits as was done in the Evaluative support study, and the difference in approach leads in some scenarios to the costs outweighing the benefits in the World Bank study.

Stakeholder conference

Objective: On 16th November 2018, a stakeholder conference was held at the premises of the Committee of the Regions and was attended by around 90 participants, including Member States representatives, waste water services representatives, NGOs, international organisation and academia. The objective of this conference was to share the preliminary findings of the support study and first results from the analysis of the replies to the public consultation.

Summary: Overall stakeholders see clear progress regarding the collection and treatment of waste water in the EU. This progress is attributed to the UWWTD. SWOs and dealing with IAS are a known problem and the JRC's modelling results clearly show their environmental impact. Presentation from Member State experts confirmed that implementing the UWWTD is possible in a short amount of time and leads to improved water quality.

Regarding benefits assessment, the stakeholders agreed that the benefits are substantial and outweigh the costs. There was strong support that the UWWTD led to benefits beyond protection of the aquatic environment, as well as health and well-being benefits. It is also well known that it is difficult to assess these benefits.

Stakeholders noted as future challenges: micropollutants, reaching energy efficiency, reducing the impact of overflows and IAS as well as dealing with water and sludge reuse.

Stakeholders generally confirmed that the UWWTD aligns well with other law and is important for reaching other Directive's objectives. Considering EU law more broadly, stakeholders identified that more alignment with energy and climate policies could be beneficial.

Written consultation

Representatives from the UWWTD Expert Group were consulted in written form on information related to: 1) IAS, 2) SWOs and 3) costs and benefits. In total 20 out of 28 Member States reacted and either validated information or provided further data. This information was used to feed into the JRC's modelling and the analysis in the Evaluative support study.

Annex 3: Methods and analytical models

1. SCIENCE FOR POLICY – THE EFFECTS OF THE UWWTD

The JRC prepared a Science for Policy report in support of the UWWTD Evaluation, assessing the effects of the UWWTD. The following gives a brief overview of the approach chosen, the scenarios and the underlying assumptions and uncertainties. For a more complete overview, see Pistocchi *et al*. (2019).

Points of comparison/assessment

The aim of the Science for policy report was to assess the UWWTD's impact in terms of reaching its objectives which are the reduction of emissions of certain pollutants and through this protect the quality of EU water bodies.

The UWWTD addresses directly four parameters: BOD, COD, N and P. Removal obligations for N and P depend on the size of the agglomeration and whether the discharge point lies in an area designated as being "sensitive".

Additionally, waste water treatment also removes coliforms and chemicals. Both are not directly targeted by the UWWTD, but are relevant for other Directives such as the Bathing Water Directive and the Water Framework Directive.

In the modelling exercise, it was quantified to what extent the UWWTD supports the improvement of water bodies' quality.

	Protection goal		
Pollutant	**Aquatic ecosystems**	**Drinking Water**	**Bathing Waters**
N	X	X	
P	X		
BOD	X		
Indicator coliforms			X
Chemicals	X	X	

Table 12 Assessment endpoints, and corresponding relevant EU legislation

The Bathing Water Directive (BWD) sets threshold levels for intestinal enterococci and Escherichia coli (E.coli) in bathing water sites. E.coli is correlated in its presence to coliforms and thus coliforms were used as a proxy in modelling the effectiveness of

waste water treatment to reduce faecal contamination loads. 'Coliforms' refer to a group of bacteria that include thermotolerante coliforms as well as bacteria of faecal origin. Presence of coliforms can thus indicate the presence of faecal pollution, though this pollution can also have other sources,[2] though urban areas are the dominant source.

The proposal for a recast of the **DWD** also sets quality parameters for water intended for human consumption. Only those parameters that can related to waste water were considered.

The **WFD** sets out requirements for good ecological status that reflect conditions of nutrients and organic matter. For BOD, N and P values were derived from different sources. For nutrient concentrations there is an even higher variety and, based on a study by Grizetti et al. (2017) the predicted concentrations for rivers in good status are usually about 4 mg/L for total N and 0.1 mg/L for total P.

The **EQSD** sets limit values for 45 priority substances (some of them overlapping with DWD parameters). Those values that can be related to pollution from waste water were also considered.

Additionally, a number of **pharmaceuticals** were considered: medicines Ibuprofen, Carbamazepine, Ciprofloxacin, Fluoxetine, Sertraline, Atorvastatin, Simvastatin, antibacterial Triclosan, and Octamethylcyclotetrasiloxane (D4) used in cosmetics. For these no environmental quality standard exists. These micropollutants are often significantly affected by urban waste water treatment. No quantification of absolute loads was possible, but the relative reduction could be assessed.

Modelling approach

The model used for nutrients and BOD in this study is the **Geospatial Regression Equation for European Nutrient losses (GREEN+)** model.[3] This model was generalised to describe organic matter in rivers. For this the parameterisation of retention in rivers and lakes was made following the MAPPE model. For BOD the following were included: point sources (WWTPs) and industrial discharges, and for diffuse sources livestock, and runoff from urban and forestry areas. For N and P the following sources are accounted for in the model: industrial and domestic emissions, scattered dwellings, organic and mineral fertilizers, atmospheric deposition and nitrogen fixation, and background emissions from forestry. IAS are described in any case either as equivalent to the WWTPs of the respective agglomerations, or as primary treatments.

These are the estimated removal efficiencies of different treatment levels of BOD, N and P in wastewater treatment plants (*Table 13*):

Substance	Primary treatment	Secondary treatment	More stringent treatment

[2] WHO (1996) Water Quality Monitoring - A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes.

[3] Additional details on the model setup can be found in Pistocchi et al., 2017

N	25%	55%	80%
P	30%	60%	90%
BOD5	50%	94%	96%

Table 13 WWT removal efficiency for organic matter and nutrients

For **coliforms no specific model exists**, but the same one as for BOD can be used. Only emissions from urban waste water were accounted for.[4] Thus the model results should be seen in relative terms by comparing the scenarios, and the results not be interpreted in absolute terms. An overview of the removal efficiencies is presented in *Table 14*.

Level of treatment	**Lower removal eff.[5]**	**Higher removal eff.[59]**	**Assumed**
No treatment	0%	0%	0%
Primary	29.2%	68.4%	40%
Secondary	90.0%	99.9%	95%
More stringent	Up to 100%		99.9%

Table 14 Removal efficiencies and η_T for coliforms after wastewater treatment.

For **chemicals** the **SimpleTreat** model was used, which describes WWTPs as a combination of a primary settler, a biological activated sludge bioreactor and a secondary settler. The model allows quantifying the removal of a chemical through sorption to sludge and removal through degradation and/or volatilization. Many chemicals may not be appreciably retained in solids but can be rather persistent. The relative importance of removal through sorption and through degradation/volatilization allows categorizing 6 classes of chemicals in terms of their behaviour in WWTPs:

- Chemicals practically bypassing wastewater treatment, virtually unaffected
- Slowly removed chemicals, with limited or no accumulation in sludge;
- Moderately removed, with limited or no accumulation in sludge;
- Removed, with limited or no accumulation in sludge;
- Sorbed to sludge and slowly removed;
- Sorbed to sludge (but not appreciably removed).

Modelling considers families of chemicals (“metachemicals”) rather than real chemicals. Metachemicals are “virtual” chemicals, each representing a whole class of substances displaying similar behaviour in WWTPs and rivers. The grouping of chemicals to

[4] Other important sources are urban runoff and livestock.

[5] Range suggested for primary treatment and conventional activated sludge processes by Oakley, 2018, and Naughton and Rousselot, 2017, respectively.

metachemicals can be found in the Science for Policy Report by Pistocchi *et al*. (2019). The same model as for coliforms was used.

For **combined sewer overflows**, no systematic EU-covering information exists. The JRC thus undertook the first-ever modelling of CSO volumes at the larger scale and their interpretation in terms of pollutants loads.

Scenarios modelled

For the assessment a baseline for the current situation was established and compared to five scenarios (*Table 15*).[6]

Scenario	Short name
Present situation as per the latest WISE report (2014)	Baseline
Situation before entry into force of the Directive (circa 1990)	Pre-directive
"What-if-no-Directive"	WIND
Full Implementation of the Directive	Full compliance
Full implementation with systematically ineffective individual and appropriate systems (IAS)	IAS
Full implementation with effectiveness of IAS depending on management	IAS+

Table 15 Overview of modelled scenarios

Baseline

For the baseline in 2014, data reported by Member States under the UWWTD were used. No data on agglomerations below 2 000 pe is available. This part of the population was estimated by Vigiak et al. (2018), through a comparison of the existent population and the reported pe per Member States, assuming 1.23 pe/resident. P.e. per resident is highly variable depending on industrial activities in the area served by the treatment plant, but 1.23 p.e./resident was found to be rather stable. Overall the population living in agglomerations below 2 000 p.e is rather small in the EU, but in some EU Member States may make up about 10% of the population.

Pre-directive scenario

The same kind of data as reported by Member States under the UWWTD does not exist for the situation before 1991/before Member States acceded to the EU. However, EUROSTAT provides population at different treatment levels per country. Through this information a picture of the situation before adoption of the Directive was established.

Full compliance scenario

[6] In the main text, the baseline is the situation in 1990, whereas in the JRC report the 2014 situation constitutes the baseline.

This scenario can be established by setting all WWTPs of the baseline to the adequate level of treatment in accordance with the UWWTD. Those WWTPs already in compliance in 2014 (baseline) will remain in compliance.

What if no Directive (WIND) scenarios

This is a hypothetical scenario to present an idea of what would have happened without the Directive. For each country an intermediate situation between the pre-directive scenario and the baseline is established. It is thus based on a weighted average of the two scenarios. The weights were established through expert judgement. The discussion behind this can be found in the support study to the Evaluation.

Since progress of achieving compliance with the UWWTD is not only linked to factors driving the implementation when a Member State is already part of the EU, but also to factors before a Member State joins (e.g. accession funding etc.), two WIND scenarios were established. WIND scenarios are merely speculative, but can give an appreciation to the progress brought by the Directive.

Under WIND1 a weight of 0 is used for BE, EL, PT, MT, CY, BG, IT, IE, ES and RO, assuming thus that all progress made is due to the Directive. A weight of 1 is applied to AT, DE, DK, FI, NL, SE, assuming that given the high compliance these countries had already in the 1990s, no real progress can be attributed to the implementation of the UWWTD. The other Member States have weight=0.5. A weight of 0.5 means it would be at intermediate conditions.

Under WIND2 the 13 most recent members of the EU (EU13) are assigned a weight of 0.25, while the other members (EU15) are assigned the same weights as above.

Individual or other appropriate systems (IAS and IAS +)

Art. 3 of the UWWTD allows the use of IAS instead of building collection systems if the establishment of a collection system comes at excessive costs without additional environmental benefits. When much of the load is collected and sometimes also treated with IAS, it is unclear how Member States ensure that these are at an appropriate level of performance.

To assess the impact of IAS the full compliance scenario is compared with a modified scenario in which all IAS are assumed to be at primary treatment (**IAS scenario**). This is of course not the case in reality. Thus, under the **IAS+ scenario** it is taken into account that Member States have established mechanisms to deal with IAS. These mechanisms were researched and then consulted with Member States and based on expert judgement each Member State was assigned what level of treatment all its IAS can be assumed to be at.

The following levels of treatment were assigned for all IAS: AT, CY, DE, EE, UK have IAS equivalent to the agglomeration's WWTP, hence weight is 1; CZ is midway (50% of IAS are assumed to be equivalent to the agglomeration's WWTP and 50% equivalent to primary treatment), hence weight is 0.5; the other countries are assumed to have IAS equivalent to primary, hence weight is 0.

Combined sewer overflows

No EU-wide modelling of CSOs was attempted in the past. In a first scenario, it is assumed that these overflows take place without management measures. This

corresponds to a worst-case scenario likely overestimating the loads associated to CSO in many regions. An additional scenario assesses the loads attributable to overflows with considerations for some management measures in place in Member States. These management measures were quantified after consultation with Member States (*Table 16*). However, it is likely that the model is still overestimating loads under CSO management measures due to other conservative assumptions (e.g. on the extent of the impervious area) as discussed in the JRC report. At the time of writing this report, an extensive evaluation of the model with the participation of experts from different EU Member States is ongoing, and is expected to bring new insights on the issue in the near future (*Table 16*).

Country	Correction factor	Dilution rate	# days
AT	44%	8	
BE	50%	7	18.71[7]
DE	47%	4	17.32[8]
DK	32%	4	10
ES	44%	8[9]	
FI	100%	4	
FR	52%	4	20
EL	52%	7	
IE	78%	5	
IT	62%	6	
LU	100%	4	
NL	29%	4	10
PT	62%	6	
SE	100%	4	
UK	100%	4	
CY	100%	4	

[7] This is the geometric mean of reported values for Brussels, between 7 and 50 per year.

[8] This is the geometric mean of reported values for Land Bavaria, between 15 and 20 per year.

[9] For Spain and Czechia, d is prescribed between 5 and 8, the latter assumed to apply as the most favorable case for these countries.

CZ	44%	8[63]	
EE	100%	4	
HU	100%	4	
LT	100%	4	
LV	100%	4	
MT	100%	4	
PL	67%	4	30
SI	100%	4	
SK	100%	4	
BG	78%	5	
RO	100%	4	
HR	100%	4	

Table 16 Correction factors to apply to default CSO loads taking into account the provisions of minimum dilution rate (d) and a number of days of CSOs allowed in different Member States.

The assessment does not take into account that some CSO may be treated, it only focuses on potential loads. CSO treatment is required in some Member States, notably AT, DE, BE, SK and RO.

Uncertainties and model verification

The main uncertainties are as follows:

- All scenarios are subject to uncertainties regarding the estimations of p.e.
- All estimations are based on data submitted by Member States, which are the best available data, but also have been subject to issues in the past.[10]
- The quantification of the situation before adoption of the UWWTD (and thus before official reporting) is based on data from Eurostat, and although comparison on Member State levels are probably robust, there might be less certainty when it comes to comparisons on regional level.
- There is uncertainty of pollutant emissions to each river basin overall, and there is no real benchmark. Thus, the model cannot go beyond capturing continental trends, distributions of concentrations and hot spots.

The **models for organic matter and nutrients** were calibrated based on the information of concentrations and load data. The model has been shown to be sensitive to the efficiency of treatment and the event-mean concentrations of urban run-off.

[10] European Commission (n.d.) UWWTD implementation reports.

Predicted loads are correlated with observations and with error within one order of magnitude. Loads in catchment areas and concentrations are not as well correlated with observations.

For **coliforms** the model is not calibrated but aligned with emission and die-off parameters set out in other studies. The model neglects all other sources for coliforms and thus a general underestimation of concentrations and loads can be expected.

The approach for **CSO and IAS** modelling was presented in various workshops and discussed with Member State experts. Member State experts were consulted on management measures in place. Not all Member States were present at meetings and not all reacted to the consultation (in total 20/28 replies were received).

For **CSO** an extra workshop was held, but not sufficient evidence could be collected to confirm all estimates. Thus, the estimates need to be considered as being conservative, thus over-representing the loads of CSO as management measures are probably underestimated. Verification of the model has been launched and more fine-grained results are expected for the future.

Modelling **chemicals'** behaviour in WWTPs is very complex. The complexity was reduced by using representative metachemicals. No EU-wide emission data was available. Literature shows that there is high variability of chemical's behaviour in treatment plants. The approach chosen is meant to show possible impact of treatment on a large variety of chemicals.

2. COST AND BENEFITS

This Annex provides a short overview of the methodology chosen for assessing cost and benefits. More details on the methodology and sub-results of the assessment can be found in the external support study.

The assessment of costs and benefits of the UWWTD was discussed in a dedicated workshop with experts on 8th November 2018. Their feedback on the methodology and the preliminary findings was taken into account in the external support study.

Additionally, Member States were consulted in writing on the preliminary findings and were invited to validate these or to send in further information. Few Member States provided own assessments, with most arguing that the assessment is complex. Those that reacted to the numbers reported numbers at similar orders of magnitude.

For both, costs and benefits, it was accounted for the existing infrastructure in the Member States before adoption of the Directive or accession through cost and benefit correction factors. This allows to single out the impact of the UWWTD.

Approach to modelling costs

Three Articles of the UWWTD lead to one-off and regular operation and maintenance costs. These Articles are Art. 3-5 on the establishment of collection systems, and different treatment plants. Member States do not report on cost for the implementation of the Directive. Under Art. 17 projected capital costs for reaching compliance with the UWWTD are submitted, however, it is not always clear what is contained in these figures (e.g. maintenance, rehabilitation or only new collection systems and plants).

It was possible to monetise the costs for the three Articles per Member State, broken down into investment costs and operation and maintenance costs. The cost assessment takes into account infrastructure already existent in Member States in the early 1990s (see Annex 4, baseline). The costs levels were adapted to corresponding price levels in the Member States, and a discount rate of 4% was applied in accordance with Better Regulation Guidelines.

Two cost functions were used to assess the costs per Member Sate: one cost function for collection and one for treatment (i.e. the COWI cost function) based on the FEASIBLE model.

FEASIBLE is a software tool developed to support the preparation of environmental financing strategies for water, waste water and municipal solid waste services. The name FEASIBLE stands for: **Financing for Environmental, Affordable and Strategic Investments that Bring on Large-scale Expenditure**. The FEASIBLE model is freeware and can be obtained through the web pages of the OECD, DEPA/DANCEE and COWI. **FEASIBLE can be used to facilitate the iterative process of balancing the required finance with the available finance**. It provides a systematic, consistent and quantitative framework for analysing feasibility of financing environmental targets. Being a computerised model, FEASIBLE may be used to analyse "what if" a certain policy is changed and to document its financial impacts in a systematic and transparent manner.

FEASIBLE calculates investment, maintenance and operational expenditure that would be required to reach specific targets determined by local policy makers. The calculation of the expenditure need is based on a number of generic cost functions which are incorporated into FEASIBLE. These cost functions allow an easy estimation of the costs of alternative service and environmental targets with a limited data collection effort. They cover a number of technical measures within each sector. The cost functions have been estimated by technical experts and validated with actual costs during test applications of the model.

The model has been used by OECD to develop financing strategies in number of countries.

Source: OECD, n.d.

Collection systems

For collection the following cost function was used:

Collection type	**CAPEX: Investment cost (EUR, 2008)**		**OPEX: Annual operational and maintenance cost (EUR, 2008)**
	PE<1,000,000	PE>= 1,000,000	
Combined	$(-190.3 * LN(PE) + 2828.8) * PE$	$(-190.3 * LN(1{,}000{,}000) + 2828.8) * PE$	CAPEX * 0.03
Separate	$2.5 * (-190.3 * LN(PE) + 2828.8) * PE$	$2.5 * (-190.3 * LN(1{,}000{,}000) + 2828.8) * PE$	CAPEX * 0.03

Table 17 Cost functions for collection systems. Source COWI (2010) and Blue2 (2019) B2 report.

An asset life of 50 years assumed for both types of sewer systems.

Treatment

The following costs functions for treatment were used.

Treatment level	**Investment cost (€, 2008)**		**Operational and maintenance cost (€, 2008)**
	PE < 100,000	**PE > 100,000**	
Primary	$10^{-0.2073*\log(PE)+3.6385} * 0.2 * PE$	92	CAPEX * 0.03 + PE * 15 * Ep
Secondary (mechanical/biological)	$10^{-0.2632*\log(PE)+4.0149} * 0.23 * PE$	115	CAPEX * 0.03 + PE * 25 * Ep
Advanced with P-removal	$10^{-0.2808*\log(PE)+4.1823} * 0.23 * PE$	138	CAPEX * 0.03 + PE * 40 * Ep
Advanced with N-removal	$10^{-0.2612*\log(PE)+4.2600} * 0.23 * PE$	207	CAPEX * 0.03 + PE * 40 * Ep
Advanced with N & P removal	$10^{-0.2722*\log(PE)+4.3608} * 0.23 * PE$	230	CAPEX * 0.03 + PE * 40 * Ep
Other advanced - not specified	$10^{-0.2808*\log(PE)+4.1823} * 0.23 * PE$	138	CAPEX * 0.03 + PE * 40 * Ep

Table 18 Cost functions for different treatment levels. p.e.=population equivalent and Ep= electricity price in EUR per kWh. Source: Cowi (2010).

For WWTPs economies of scales are considered as costs go down with the amount of p.e. treated as shown in *Figure 44*.

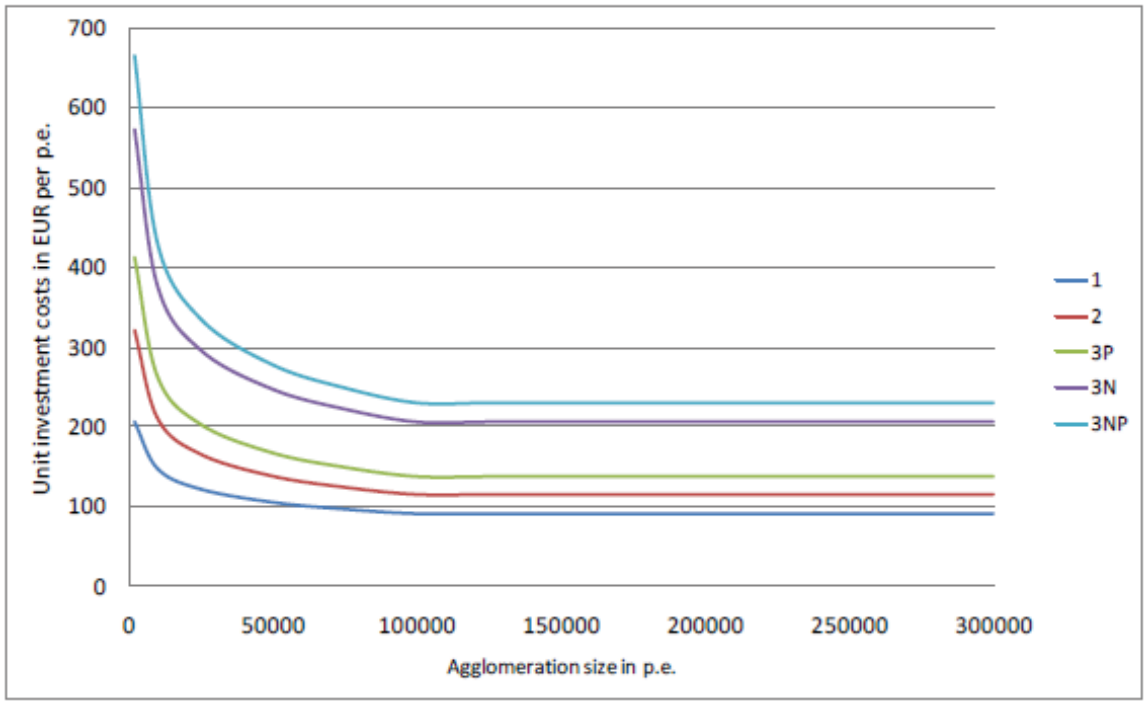


Figure 44 Unit investment costs in function of agglomeration sizes.

The COWI cost functions are also used by the World Bank and in the recent Commission study Blue2.

The amount of p.e. treated can be extracted from what is reported by Member States under the UWWTD. An asset life of 25 years was assumed. Where data was lacking, the date of compliance of a WWTP was used as the "beginning of life" date in the assessment.

As the cost assessment takes into account a baseline per Member State, meaning what existed in terms of collection and treatment infrastructure only the effects of the UWWTD are counted.

Approach to modelling benefits

Regarding benefits, a number of benefits were assessed. It was difficult to quantify and monetise these. In this section the methodology behind the quantified and monetised benefits is laid out.

For the UWWTD Evaluation the reduction of nitrogen, bathing improvements and cost savings related to the move from individual systems to centralised collection systems were quantified and monetised.

Nitrogen reduction in terms of reduction of N loads in treated waste through using a unit value per kilogram of N removed services as a proxy for water quality improvement. Less nitrogen loads in treated waste water leads to less risks of eutrophication, and can increase ecosystem services such as fisheries and drinking water provision. No site specific assessment was possible, instead the assessment was based on a study that assessed the nitrogen cycle.[11] Benefits were assessed based on Willingness to Pay to

[11] Sutton et al. (2011), The European Nitrogen Assessment, Chapter 22

remove 1 kg of nitrogen from the Baltic Sea (Sutton et al, 2011). The underlying study assumed that a 50% reduction N would be sufficient. Based on the WTP a benefit transfer for a damage cost can be derived per Member State.

For bathing water the reduction of microbiological pollution was assessed, and the willingness to pay for a clean beaches in Scotland. It was possible to estimate the benefit of improved bathing water quality by measuring the reduction of bathing waters with a 'failing' bathing water quality status, in line with the findings of the JRC. The assessment is based on a study assessing WTP to pay for clean bathing water in Scotland (Phillips et al, 2018). The underlying study assessed how much people would be willing to pay for improved water quality at Scottish beaches.

A benefit transfer approach, as exemplified by Navrud (2016)[12] was used: A benefit transfer means using the monetary valuation of a benefit estimated in one situation for estimating the benefits in another situation.

Where there in compliance with the UWWTD has been a change from individual collection systems to central collection systems, there has been a service level improvement as these households would no longer experience filled tanks and would not have to arrange for tanks to be emptied or maintained. To monetise this reduction, a conservative estimate of the costs of Individual and Appropriate Systems (IAS) provided by the World Bank (2017) has been used.

Challenges for the quantification of and monetisation of benefits were: 1) There are no studies that have previously attempted to monetise the benefits of the UWWTD; 2) Benefits are reflected in the water quality, however waste water is only one of the sources of pollution; 3) Benefits can depend on local conditions and therefore can strongly differ; 4) Benefits are also time specific.

Furthermore, monetising benefits of water quality is inherently difficult as one improvement does not necessarily immediately transform into the increase of one ecosystem service – as often other the ecosystem is influence by a high variety of factors.

For both assessments the JRC's work on the effectiveness of the Directive were used to the extent possible, which had isolated the effects of the UWWTD – thus the benefits quantified and monetised can directly related to the UWWTD. For a detailed description of how the baseline was established for collection and treatment, see the key issue report "costs and benefits".

[12] Navrud, S (2016). Possibilities and challenges in transfer and generalization of monetary estimates for environmental and health benefits of regulating chemicals, OECD Workshop on socioeconomic impact assessment of chemicals management, ECHA, Helsinki July 6-8

Annex 4: Supporting evidence

Overview: Mapping of replies to Evaluation questions

Evaluation criteria	**Sub-section under Evaluation criterion**	**Evaluation question answered**	**Key issue**
Effectiveness Overarching question: To what extent has the UWWTD reached its objectives and what are factors that affect its effectiveness?	Achievement of the Directive's objectives	E.Q.1 To what extent have the objectives of the UWWTD been achieved?	
		E.Q.8 What have been the (quantitative and qualitative) effects of the UWWTD?	
		E.Q.9 To what extent can these changes/effects be credited to the UWWTD?	
	Factors influencing the effectiveness of the UWWTD	E.Q.5. To what extent are the main targeted pollutants collected and treated in an effective way?	Late implementation Storm water overflows and urban runoff Individual and other appropriate systems Small agglomerations and scattered dwellings

		Eutrophication
	E.Q.3 To what extent are the provisions of the Directive translated into concrete, appropriate and clear requirements?	
	E.Q.2 To what extent is the intervention logic of the Directive still appropriate?	
	E.Q.16 To what extent is the UWWTD still relevant to achieve its objectives of protection of the environment from the adverse effects of waste water discharges?	
Late implementation	E.Q.4 What are the main barriers and drivers to full implementation of the UWWTD?	Late implementation
	E.Q.10 What factors influenced the achievements observed?	Late implementation
Financing the UWWTD implementation	E.Q.13 What are the main financing, investment and management issues, also with regards to EU funding for	

		implementation?	
		E.Q.14 How does compliance with the Directive impact on the affordability of water services?	
	Monitoring	E.Q.17 To what extent are the limit values for pollutants still valid?	Monitoring
	Reporting		Reporting and information to the public
	Information to the public		
Efficiency Overarching question: To what extent has the Directive achieved its objectives in an efficient way without imposing administrative burden?	Benefits of the UWWTD	E.Q.12 What are the costs and benefits associated with the implementation of the UWWTD and how proportionate are these costs and benefits?	Quantification of costs and benefits
	Costs related to the UWWTD		
	Proportionality of the UWWTD		
	Administrative burden	E.Q.15 To what extent is the administrative burden incurred by Member States and the Commission through monitoring and reporting proportionate?	

	Costs Individual or other appropriate systems	E.Q.11 Has the Directive achieved the expected results in an efficient manner, at MS and EU level?	Individual and other appropriate systems Dimensioning of plants
Coherence Overarching question: To what extent is the Directive internally and externally coherent?	Legal clarity and internal coherence	E.Q. 22 Is the UWWTD internally coherent?	Overall clarity and coherence of the UWWTD, in particular clarity of legal provisions, internal coherence and coherence with other EU water related policies and other policies
		E.Q.23 Is the UWWTD coherent with related EU water legislation?	
	Coherence with EU water law	E.Q.24 Is the UWWTD coherent with downstream legislation such as the Sewage Sludge Directive and the Bathing Water Directive?	
		E.Q.25 Is the Directive coherent with wider EU policies?	
Relevance Overarching question: To what extent is the UWWTD and its intervention logic still relevant	General relevance and remaining challenges	E.Q.2 To what extent is the intervention logic of the Directive still appropriate?	

and appropriate – especially in light of new societal problems and needs?			
		E.Q.16 To what extent is the UWWTD still relevant to achieve its objectives of protection of the environment from the adverse effects of waste water discharges?	
	Contaminants of emerging concern	E.Q.19 How are pollutants of emerging concern covered by the Directive?	Contaminants of emerging concern
	The UWWTD and circular economy Energy	E.Q.7 How well does the Directive promote a sustainable approach, for example for phosphorus and nitrogen recycling, for treatment plants to be neutral from energy / GHG emissions	Energy-efficiency, greenhouse gas emissions
		E.Q.20 To what extent is the Directive relevant to achieve a circular economy in the EU?	Energy-efficiency, greenhouse gas emissions
	The UWWTD and innovation	E.Q.18 To what extent does the Directive encourage / facilitate innovation and adaptation?	
	The Sustainable Development Goals, citizens'	E.Q.21 How relevant is the Directive	

	demands and the role of the UWWTD	in the light of the changing international contexts, such as the Sustainable Development Goals in 2030?
EU added value Overarching question: To what extent is it necessary to address urban waste water on EU level and what would have happened without the Directive?	Addressing waste water at EU level and hypothetical impacts of withdrawal	E.Q.9 To what extent can these changes/effects be credited to the UWWTD?
	Addressing waste water at EU level and hypothetical impacts of withdrawal	E.Q.26 To what extent do the issues addressed by the UWWTD continue to require action at EU level?
	Addressing waste water at EU level and hypothetical impacts of withdrawal	E.Q.27 What would be the most likely consequences of stopping or withdrawing the existing EU intervention?

Table 19 Overview interlinkages of sections, Evaluative questions and key issue reports.

Implementation

Deadlines for the implementation of the UWWTD

Date	**Objective**
30 June 1993	Transposition of the Directive [Art. 19]
31 December 1993	Designation of sensitive areas and their catchments (review – every four years). [Art. 5] Identification of less sensitive areas if there are reasons for the Member State to do so (review – every four years). [Art. 6] Discharge of industrial waste water into collecting systems and urban waste water treatment plants subject to prior regulation and authorisation. [Art. 11] Requirements for authorisation of direct discharges of industrial waste water from food processing industries to surface water in place. [Art. 13] Establishment of programme for the implementation of the Directive.

	[Art. 17]
30 June 1994	Implementation programmes communicated to the Commission (After this deadline, the programmes shall be updated by 30 June every two years, if necessary i.e. if there are changes). [Art. 17]
30 June 1995	Situation reports on collection, treatment and the disposal of urban waste water and sewage sludge in their areas are published every two years and transmitted to the Commission. [Art. 15]
31 December 1997	1st review of designation of sensitive areas, their catchments (and less sensitive areas – if appropriate); – review every four years. [Art. 5; Art. 6]
31 December 1998	Collecting systems for agglomerations >10 000 p.e. for discharges into a sensitive area and its catchment. [Art. 3]
	All discharges from agglomerations >10 000 p.e. into a sensitive area and its catchment subject to more stringent treatment. [Art. 5]
	Disposal of sludge from urban waste water treatment plants subject to general rules of registration or authorisation. [Art. 14]
	Disposal of sludge to surface waters is banned. [Art. 14]
31 December 2000	Collecting systems for agglomerations >15 000 p.e. for discharges into normal areas. [Art. 3]
	All discharges from agglomerations >15 000 p.e. into a normal area subject to secondary treatment. [Art. 4]
	Direct discharges of industrial biodegradable waste water from plants representing the load of > 4 000 p.e. to surface water subject to prior regulation and authorisation. [Art. 13]
31 December 2005	Collecting systems for all agglomerations between 2 000 and 15 000 p.e. [Art. 3]
	All discharges from agglomerations 10 000 – 15 000 p.e. subject to secondary treatment. [Art. 4]
	Discharges to freshwater and estuaries from agglomerations between 2 000 and 10 000 p.e. subject to secondary treatment. [Art. 4]
	Discharges to freshwater and estuaries from agglomerations <2 000 p.e. subject to appropriate treatment. [Art. 7]
	Discharges to coastal waters from agglomerations <10 000 p.e. subject to appropriate treatment. [Art. 7]
	Review of identification of sensitive areas and less sensitive areas. [Art. 5; Art. 6]

Table 20 Overview implementation deadlines for EU 15.

Table: Transitional periods and interim targets[1] for the implementation of UWWTD in EU-10 and EU-2

State	*Articles*	*Interim target dates to comply with **	*Final deadline of transitional period*
1	*2*	*3*	*4*
Cyprus	3, 4, and 5(2) – if sensitive areas have to be identified	31 December 2008 – for 2 aggl. (Limassol and Paralimni) with >15,000p.e. 31 Dec 2009 – for 1 aggl. (Nicosia) with > 15,000 p.e. 31 Dec 2011 – for 1 aggl. with >15,000p.e.	**31 Dec 2012**
Czech Republic	3, 4, 5(2)	01 May 2004 – for 18 agglom. >10,000 p.e. 31 Dec 2006 – 36 aggl.	**31 Dec 2010**
Estonia	3, 4, 5(2)	31 December 2009 - for aggl. >10,000 p.e.	**31 Dec 2010**
Latvia	3, 4, 5(2)	31 Dec 2008 – for aggl. with > 100,000 p.e. 31 Dec 2011 – for aggl. between 10,000 and 100,000 p.e.	**31 Dec 2015**
Lithuania	3, 4, 5(2)	31 Dec 2007 – compliance with Art.4 and 5(2) for all aggl. > 10,000 p.e.	**31 Dec 2009**
Hungary	3, 4, 5(2) 13	31 Dec 2008 – for aggl. in sensitive areas with >10,000 p.e. 31 Dec 2010 – for aggl. in normal areas with >15,000 p.e. -	**31 Dec 2015** **31 Dec 2008** – for biodegradable industrial waste water from plants belonging to industrial sectors from Annex III[2]
Malta	3	01 May 2004 – compliance for Marsa land and Gozo-Main representing 24% of total biodegradable load 30 June 2004 – for Malta South representing further 67% of total	**31 Oct 2006**

[1] Information extracted from the Accession Treaty, OJ L 236, 23.9.3003, p.809-922, Annexes V – XIV
[2] Pannontej Rt. (Répcelak); Bácsbokodi Tejuzem (Bácsbokodi); Papp Kereskedelmi Kft. Konzervgyár (Nyirtas); Vépisz Szovetkezet, Konzervuzem,(Csegold); Szatmári Konzervgyár Kft. (Tyukod); Petisfood Kft. Konzervuzem (Vasmegyer); Atev Rt. (Debrecen-Bánk); Mirsa Rt. (Albertirsa); Makoi Tejuzem (Makó); Zalka Tej Rt. (Nagybánhegyes)

Table: Transitional periods and interim targets[1] for the implementation of UWWTD in EU-10 and EU-2

State	*Articles*	*Interim target dates to comply with **	*Final deadline of transitional period*
1	*2*	*3*	*4*
Cyprus	3, 4, and 5(2) – if sensitive areas have to be identified	31 December 2008 – for 2 aggl. (Limassol and Paralimni) with >15,000p.e. 31 Dec 2009 – for 1 aggl. (Nicosia) with > 15,000 p.e. 31 Dec 2011 – for 1 aggl. with >15,000p.e.	**31 Dec 2012**
Czech Republic	3, 4, 5(2)	01 May 2004 – for 18 agglom. >10,000 p.e. 31 Dec 2006 – 36 aggl.	**31 Dec 2010**
Estonia	3, 4, 5(2)	31 December 2009 - for aggl. >10,000 p.e.	**31 Dec 2010**
Latvia	3, 4, 5(2)	31 Dec 2008 – for aggl. with > 100,000 p.e. 31 Dec 2011 – for aggl. between 10,000 and 100,000 p.e.	**31 Dec 2015**
Lithuania	3, 4, 5(2)	31 Dec 2007 – compliance with Art.4 and 5(2) for all aggl. > 10,000 p.e.	**31 Dec 2009**
Hungary	3, 4, 5(2) 13	31 Dec 2008 – for aggl. in sensitive areas with >10,000 p.e. 31 Dec 2010 – for aggl. in normal areas with >15,000 p.e. -	**31 Dec 2015** **31 Dec 2008** – for biodegradable industrial waste water from plants belonging to industrial sectors from Annex III[2]
Malta	3	01 May 2004 – compliance for Marsa land and Gozo-Main representing 24% of total biodegradable load 30 June 2004 – for Malta South representing further 67% of total	**31 Oct 2006**

[1] Information extracted from the Accession Treaty, OJ L 236, 23.9.3003, p.809-922, Annexes V – XIV
[2] Pannontej Rt. (Répcelak); Bácsbokodi Tejuzem (Bácsbokodi); Papp Kereskedelmi Kft. Konzervgyár (Nyirtas); Vépisz Szovetkezet, Konzervuzem,(Csegold); Szatmári Konzervgyár Kft. (Tyukod); Petisfood Kft. Konzervuzem (Vasmegyer); Atev Rt. (Debrecen-Bánk); Mirsa Rt. (Albertirsa); Makoi Tejuzem (Makó); Zalka Tej Rt. (Nagybánhegyes)

State	*Articles*	*Interim target dates to comply with **	*Final deadline of transitional period*
1	*2*	*3*	*4*
	4	biodegradable load 31 Dec 2005 – for Gharb in Gozo and Nadur in Gozo representing further 1% of total biodegradable load 01 May 2004 – for Marsa Land representing 19% of total biodegradable load 31 Oct 2004 – for Gozo-Main representing further 5% of total biodegradable load 31 Dec 2005 - for Gharb in Gozo and Nadur in Gozo representing further 1% of total biodegradable load 31 Oct 2006 – for Malta North representing further 8% of total biodegradable load	**31 March 2007**
Poland	3, 4, 5(2), 7	31 Dec 2005 – in 674 all. representing 69% of total biodegradable load 31 Dec 2010 – in 1069 aggl. representing 86% of total biodegradable load 31 December 2013 – in 1165 aggl. representing 91% of total biodegradable load	**31 Dec 2015**
	13		**31 Dec 2010**[3]
Slovenia	3, 4, 5(2)	31 Dec 2008 – in sensitive areas for aggl. with > 10,000 p.e. 31 Dec 2010 – in aggl. with > 15,000p.e.	**31 Dec 2015**
Slovakia	3, 4, 5(2)	31 Dec 2004 – for 83% of the total biodegradable load 31 Dec 2008 – for 91% of the total biodegradable load 31 Dec 2010 – all agglomerations > 10,000 p.e.	**31 Dec 2015**

[3] In accordance with table presented in the Accession Treaty (ref. OJ L 236, Annexes V – XIV, 23.9.3003, p.893;
Industries under points 8-9 listed in Annex III in UWWTD has to be compliance with article 13 on the date of accession (01/05/2004)

State	*Articles*	*Interim target dates to comply with **	*Final deadline of transitional period*
1	*2*	*3*	*4*
	4	biodegradable load 31 Dec 2005 – for Gharb in Gozo and Nadur in Gozo representing further 1% of total biodegradable load 01 May 2004 – for Marsa Land representing 19% of total biodegradable load 31 Oct 2004 – for Gozo-Main representing further 5% of total biodegradable load 31 Dec 2005 - for Gharb in Gozo and Nadur in Gozo representing further 1% of total biodegradable load 31 Oct 2006 – for Malta North representing further 8% of total biodegradable load	**31 March 2007**
Poland	3, 4, 5(2), 7	31 Dec 2005 – in 674 all. representing 69% of total biodegradable load 31 Dec 2010 – in 1069 aggl. representing 86% of total biodegradable load 31 December 2013 – in 1165 aggl. representing 91% of total biodegradable load	**31 Dec 2015**
	13		**31 Dec 2010**[3]
Slovenia	3, 4, 5(2)	31 Dec 2008 – in sensitive areas for aggl. with > 10,000 p.e. 31 Dec 2010 – in aggl. with > 15,000p.e.	**31 Dec 2015**
Slovakia	3, 4, 5(2)	31 Dec 2004 – for 83% of the total biodegradable load 31 Dec 2008 – for 91% of the total biodegradable load 31 Dec 2010 – all agglomerations > 10,000 p.e.	**31 Dec 2015**

[3] In accordance with table presented in the Accession Treaty (ref. OJ L 236, Annexes V – XIV, 23.9.3003, p.893;
Industries under points 8-9 listed in Annex III in UWWTD has to be compliance with article 13 on the date of accession (01/05/2004)

State	Articles	Interim target dates to comply with *	Final deadline of transitional period
1	2	3	4
		31 Dec 2012 – for 97% of the total biodegradable load	
Bulgaria[4]	3, 4, 5(2)	31 Dec 2010 – for aggl. with > 10,000 p.e.	**31 Dec 2014**
Romania[5]	3, 4, 5(2)		**31 Dec 2018**
	3	31 Dec 2010 – 61% of the load in p.e. 31 Dec 2013 – 69% of the load in p.e. 31 Dec 2015 – 80% of the load in p.e.	
	3	31 Dec 2013 – all agglomerations > 10,000 p.e.	
	4, 5(2)	31 Dec 2010 – 51% of the load in p.e. 31 Dec 2013 – 61% of the load in p.e. 31 Dec 2015 – 77% of the load in p.e.	
		31 Dec 2015 – all agglomerations > 10,000 p.e.	

[4] Accession Treaty, ref. OJ L 157, 21.6.2005, p.298
[5] Accession Treaty, ref. OJ L 157, 21.6.2005, p.169-170

State	Articles	Interim target dates to comply with *	Final deadline of transitional period
1	2	3	4
		31 Dec 2012 – for 97% of the total biodegradable load	
Bulgaria[4]	3, 4, 5(2)	31 Dec 2010 – for aggl. with > 10,000 p.e.	**31 Dec 2014**
Romania[5]	3, 4, 5(2)		**31 Dec 2018**
	3	31 Dec 2010 – 61% of the load in p.e. 31 Dec 2013 – 69% of the load in p.e. 31 Dec 2015 – 80% of the load in p.e.	
	3	31 Dec 2013 – all agglomerations > 10,000 p.e.	
	4, 5(2)	31 Dec 2010 – 51% of the load in p.e. 31 Dec 2013 – 61% of the load in p.e. 31 Dec 2015 – 77% of the load in p.e.	
		31 Dec 2015 – all agglomerations > 10,000 p.e.	

[4] Accession Treaty, ref. OJ L 157, 21.6.2005, p.298
[5] Accession Treaty, ref. OJ L 157, 21.6.2005, p.169-170

Figure 45 Deadlines for Member States that joined in and after 2004

Member State baselines 1990s/ upon accession to the EU

The baseline per Member State below is taken directly from the support study and was not modified.

The table below presents the overall score that were derived based on several indicators including:

- Date of implementation of the UWWTD
- Status on compliance with the UWWTD
- Number and length of enforcement cases
- Level of EU funding in comparison to costs

Reference date	Country code	Population with treatment (%)	Comments and Sources	WIND 1 Weight	WIND 2 Weight
before 1995	**AT**	72.0	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	1	1
before 1995	**BE**	28.9	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	0	0
before 1995	**DE**	86.1	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	1	1
before 1995	**DK**	85.4	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	1	1
before 1995	**ES**	48.1	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	0	0
before 1995	**FI**	76.0	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	1	1
before 1995	**FR**	69.0	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	0.5	0.5
before 1995	**EL**	11.4	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	0	0
before 1995	**IE**	44.0	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	0	0
before 1995	**IT**	63.0	earliest possible value for the period 1990-1995 / Source:	0	0

			OECD Wastewater treatment indicator		
before 1995	**LU**	90.4	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	0.5	0.5
before 1995	**NL**	94.0	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	1	1
before 1995	**PT**	20.9	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	0	0
before 1995	**SE**	86.0	earliest possible value for the period 1990-1995 / Source: OECD Wastewater treatment indicator	1	1
before 1995	**UK**	79.0	earliest possible value for the period 1990-1995 / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0.5	0.5
2004	**CY**	28.4	value for 2004 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0	0
2004	**CZ**	71.1	value for 2004 or first earliest year / Source: OECD Wastewater treatment indicator	0.5	0.5
2004	**EE**	72.0	value for 2004 or first earliest year / Source: OECD Wastewater treatment indicator	0.5	0.25
2004	**HU**	58.1	value for 2004 or first earliest year / Source: OECD Wastewater treatment indicator	0.5	0.25
2004	**LT**	59.1	value for 2004 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0.5	0.25
2004	**LV**	66.1	value for 2004 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater	0.5	0.25

			treatment plants]: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_ww_con&lang=en		
2004	**MT**	13.3	value for 2004 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0	0
2004	**PL**	59.0	value for 2004 or first earliest year / Source: OECD Wastewater treatment indicator	0.5	0.5
2004	**SI**	48.4	value for 2004 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0.5	0.25
2004	**SK**	54.1	value for 2004 or first earliest year / Source: OECD Wastewater treatment indicator	0.5	0.25
2007	**BG**	42.3	value for 2007 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0	0
2007	**RO**	28.3	value for 2007 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0	0
2013	**HR**	52.9	value for 2013 or first earliest year / Source: Eurostat [env_ww_con: Population connected to wastewater treatment plants]	0.5	0.25

Table 20 Baseline assumptions per MS.

Information on investments

Copy from 9th Impl. Report:

In 2014-2020, about € 10 billion, goes to wastewater treatment infrastructure, including the construction or upgrading of plants and sewerage networks, with some funding also going to sludge management.

Copy from 8th Impl. Report:

The EU dedicated a significant amount of funding under the EU Cohesion Policy funds (€17.8 billion in the 2007-2013 programming period, which is still subject to changes).

Copy from 7th Impl. Report:

Despite the significant support from EU funding, the "Fitness check of EU freshwater policy" underlined that the majority of funds necessary to implement EU water policy needs to be generated within the Member States. According to a study of 22 Member States, there is still a significant financing gap in relation to future compliance with the Directive in those Member States (COWI, 2010).

Copy from 6th Impl. Report:

In the current funding period 2007 to 2013, the planned investments into infrastructure related to collection or treatment of waste water will amount to about € 14 billion. Twenty-one Member States have allocated Cohesion policy funding to waste water treatment, the biggest share (about 98%) being used in the 'Convergence regions' (mostly EU-12 and DE, IT, PT, ES and EL)

Copy from 3rd Impl. Report:

As it is not obligatory for Member States to provide information on investments, the data received by the Commission were not sufficiently complete to be presented here. However, the European Commission study on "investment and employment related to EU policy on air, water and waste" (2000), estimates that about 152 billion Euro were invested for waste water infrastructure over the period 1990-2010. The European Commission provides support for the implementation of the Urban Waste Water Treatment Directive in Member States and Candidate States of about 5 billion Euro per year.

Austria

Austria joined the EU in 1995.

In 1995, 4 years after the UWWTD was adopted at the EU level, it is estimated that the connection of the population to collecting systems or urban wastewater treatment plants exceeded 70%. All the cities provided at least secondary treatment and many cities provided tertiary treatment (e.g. Wien, Linz and Salzburg).

The last deadlines for Austria to develop the necessary infrastructure required by the Directive expired on 31st December 2005 (last deadline also in the Directive).

Overall IAS use is very low (<1% of total generated load in agglomerations >2000 p.e.).

Austria is one of the few countries with no ruling of the CJEU related to the implementation of the UWWTD.

No information regarding EU and national funds for the implementation of the UWWTD were identified.

Belgium

Belgium is one of the founding members of the EU (EC). By 1991, when the UWWTD was adopted at EU level, it is estimated that less than 30% of the population was connected to treatment, being one of the lowest connection rates in the EU. There was no treatment in Brussels and for large shares of the population in Charleroi and Liege, and only few cities had secondary treatment.

The last deadlines for Belgium to develop the necessary infrastructure required by the Directive expired on 31st December 2005

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

Belgium has been sent to the CJEU and found in breach of the UWWTD multiple times. There have been 3 final rulings by the CJEU under Art. 258 for failing to establish collecting systems (Art.3), secondary (Art.4) or more stringent treatment (Art.5) for groups of agglomerations, as well as for failures to establish and report implementation programmes (Art.17). Belgium was also sent to the CJEU under Art. 260 for groups of agglomerations missing collecting system or tertiary treatment. Belgium has been fined with a lumpsum fine up to EUR 10 million and one penalty payment amounting to EUR 0.86 million for every 6-month period of non-compliance.

The national contribution to comply with the UWWTD was EUR 3,101 million for the period 2000-2006 and EUR 2,997 million for 2007-2013. No information for EU funds is available.

Bulgaria

Bulgaria joined the EU in 2007.

In that year, around 42% of the country's population was connected to treatment.

In the early 1990s the connection to treatment was around 35%. It should be highlighted that after entering EU the progress in treatment level has speeded up, since it reached 62% by 2015.

The last deadlines for Bulgaria to develop the necessary infrastructure required by the Directive expired on the 31st December 2014, according to the Accession Treaty signed with the Commission.

Overall IAS use is very low (almost 0% of total generated load in agglomerations >2000 p.e.).

Bulgaria has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art.258.

Through Cohesion policy and other funds, the EU committed to provide EUR 246 million between 2000 and 2006, which have partly funded the efforts to comply with the UWWTD. In the same period, the national funds allocated were EUR 4 million.

Cyprus

Cyprus joined the EU in 2004.

In that year, the existing waste water collection and treatment infrastructure was very limited, with only 28% of its population connected.

The two largest cities, Nicosia and Limassol, provided secondary treatment since the mid-1990s, but small agglomerations were mainly served by septic tanks and cesspits.

Overall IAS use is 1.6% of total generated load (in agglomerations >2000 p.e.).

The last deadlines for Cyprus to develop the necessary infrastructure required by the Directive expired on the 31st December 2012.

Cyprus has no final ruling against it by the CJEU yet.

The national contribution to comply with the UWWTD were EUR 395 million for the period 2000-2006 and EUR 1,513 million for 2007-2013 (no information for EU funds).

Croatia

Croatia joined the EU in 2013.

In that year, less than 55% of its population was connected either to collecting or urban wastewater treatment.

Overall IAS use is not available.

Croatia has not been assessed for compliance yet, because its first interim deadline expired at the end of 2018 and it still has pending deadlines up to 2020 and 2023.

Tariffs represent the largest source of financing for the sector. In 2012, water use and water protection fees represented 18% of the sector funding. Tariffs collected by utilities accounted for 57% of the total financing coming into the sector but failed to fully cover O&M utility costs.

Czechia

Czechia joined the EU in 2004.

By then, 79% of the population was connected to the collecting system and 71% to urban waste water treatment.

All its territory has been designated as sensitive.

Overall IAS use is 6.9% of total generated load (in agglomerations >2000 p.e.). The use of IAS shows mixed trends over the years.

The last deadlines for Czechia to develop the necessary infrastructure required by the Directive expired on the 31st December 2010.

Czechia has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide Czechia with EUR 397 million between 2000 and 2006 and EUR 1,344 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 177 million and EUR 4,732 million.

Denmark

Denmark joined the EU in 1973.

Before the UWWTD was adopted at EU level, the existing wastewater treatment infrastructure was already well-developed, serving over 85% of the population.

All major cities were already provided with tertiary treatment.

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

The last deadlines for Denmark to develop the necessary infrastructure required by the Directive expired on the 31st December 2005.

Denmark is one of the few countries with no ruling of the CJEU related to the implementation of the UWWTD.

No information regarding EU and national funds for the implementation of the UWWTD were identified.

Estonia

Estonia joined the EU in 2004.

By then, 72% of its population was connected to collecting or urban wastewater treatment.

The capital city of Estonia, Tallin. and the two large cities of Rakvere and K-Järve provided secondary treatment already since the 1990s.

Overall IAS use is 2.5% of total generated load (in agglomerations >2000 p.e.). The use of IAS has shown a decreasing trend over the years.

The last deadlines for Estonia to develop the necessary infrastructure required by the Directive expired on the 31st December 2010.

Estonia has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide Estonia with EUR 110 million between 2000 and 2006 and EUR 203 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 197 million and €583 million.

Finland

Finland joined the EU in 1995.

By then, the existing wastewater treatment infrastructure was already developed, covering 76% of the population.

Major cities like Helsinki, Espoo, Tampere and Turku already provided tertiary treatment since the early 1990s.

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

The last deadlines for Finland to develop the necessary infrastructure required by the Directive expired on 31st December 2005.

Finland has been sent to the CJEU and found in breach of the UWWTD once. There has been 1 final ruling by the CJEU under Art. 258 for failing to establish more stringent treatment (Art.5) for groups of agglomerations.

No information regarding EU and national funds for the implementation of the UWWTD were identified.

France

France is one of the founding members of EU (EC).

At the beginning of the 1990s, when the UWWTD was adopted at EU level, it was estimated that 69% of the population was connected to treatment.

By then, large cities such as Nantes, Anger and Colmar provided tertiary treatment, Paris provided partly secondary and partly tertiary treatment, while other cities such as Lille, Marseille and Bordeaux provided primary treatment only.

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

The default deadlines for France to develop the necessary infrastructure expired on the 31st December 2005.

However, France had to meet additional deadlines, because of the designation of new sensitive areas on its territory after 2007. The additional investments on infrastructure were implemented by 2012 and 2013. Furthermore, it has additional pending deadlines for one of its overseas territories, Mayotte (2020 and 2027).

France has been sent to the CJEU and found in breach of the UWWTD multiple times. There have been 4 final rulings by the CJEU under Art. 258 for failing to establish collecting systems (Art.3), secondary (Art.4) or more stringent treatment (Art.5) for groups of agglomerations, as well as for failures related to monitoring and reporting (Art.15). However, France has no ruling under Art. 260, which means that the breaches have been addressed effectively without reaching the stage of a second ruling for the same case. France has a pending case under Art. 258.

The total investments on infrastructure related to the UWWTD are estimated at EUR 90 billion between 1994-2004.

Germany

(West) Germany is one of the founding members of EU (EC).

At the beginning of the 1990s, when the UWWTD was adopted at EU level, the existing waste water collecting and treatment system was one of the most developed in Europe, already covering more than 86% of the population.

Overall IAS use is 1.8% of total generated load (in agglomerations >2000 p.e.).

The last deadlines for Germany to develop the necessary infrastructure expired on the 31st December 2005.

Germany has been sent to the CJEU and found in breach of the UWWTD once. There has been 1 final ruling by the CJEU under Art. 258 for late transposition of the UWWTD

(Art.5) for groups of agglomerations. Germany plead that the delay was due to the federal structure of the state, which required a separate process of transposition in each federal state.

No information regarding EU and national funds for the implementation of the UWWTD were identified.

Greece

Greece joined the EU in 1981.

By 1991, when the UWWTD was adopted on EU level, the existing wastewater collecting and treatment infrastructure was very limited in the Member State. It is estimated that half of the population was connected to the collecting system, but almost 40% of the wastewater load was discharged to fresh water and coastal areas without treatment. Less than 1% of the wastewater load received primary treatment and 10% received biological (secondary) treatment.

Major cities such as Athens, Elefsina, Aspropyrgos and Patra, provided no treatment.

Overall IAS use is 10.4% of total generated load (in agglomerations >2000 p.e.). The use of IAS has shown a steady trend of reduction over the years, but it is still very high.

Greece has been sent to the CJEU and found in breach of the UWWTD multiple times. There have been 4 final rulings by the CJEU under Art. 258 and 2 final rulings under Art. 260 for failing to establish collecting systems (Art.3), secondary (Art.4) or more stringent treatment (Art.5) for groups of agglomerations. Greece was also sent once more to the CJEU under Art. 258 for late transposition of the UWWTD (Art.19; due by 1993, but accomplished in 1997). Greece has been fined with 2 lump sum fines up to EUR 5 and 10 million each and with penalty payments around EUR 3.3 and 3.6 million each for every 6-month period of non-compliance.

Greece was also granted very high access to Cohesion policy funds both at EU-15 and EU-28 level and has used more than EUR 6 billion to construct the necessary facilities for wastewater collection and treatment. Several WWTPs for agglomerations between 2 000 – 10 000 p.e. are still pending.

Hungary

Hungary joined the EU in 2004.

At that time, the existing wastewater infrastructure allowed 62% of its population to be connected to collecting systems and 58% to be connected to urban wastewater treatment.

Budapest provided secondary treatment, and partly phosphorous removal, already from the 1990s.

Overall IAS use is 13.1% of total generated load (in agglomerations >2000 p.e.). The use of IAS has shown a steady trend of reduction over the years, but it is still very high.

The last deadlines for Hungary to develop the necessary infrastructure expired on the 31st December 2015.

Hungary has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide Hungary with EUR 493 million between 2000 and 2006 and EUR 1,536 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 1,434 million and EUR 754 million.

Ireland

Ireland joined the EU in 1973.

By 1991, when the UWWTD was adopted on EU level, 44% of the country's population was connected to urban wastewater treatment.

Dublin provided only primary treatment, whereas cities like Cork and Dundalk provided no treatment at all.

Overall IAS use 5% of total generated load (in agglomerations >2000 p.e.).

The default deadlines for Ireland to develop the necessary infrastructure expired on 31st December 2005.

Furthermore, Ireland had to meet additional deadlines, because of the designation of new sensitive areas on its territory after 2007, which is related to Art.5 provisions on the review of sensitive areas.

Ireland has been sent to the CJEU and found in breach of the UWWTD only once. There has been 1 final ruling by the CJEU under Art. 258 for failing to establish secondary treatment (Art.4) for groups of agglomerations. Ireland has a pending case under Art. 258.

However, the Member State made substantial progress in reducing the number of the above agglomerations by investing in relevant infrastructure in the following years.

Through Cohesion policy and other funds, the EU committed to provide Ireland with EUR 282 million between 2000 and 2006 and EUR 1,536 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the period 2000-2006, the national funds allocated to the UWWTD were EUR 2,147 million (no data identified for the period 2007-2013).

Italy

Italy is one of the founding members of the EU (EC).

By 1991, when the UWWTD was adopted, the population connected to urban wastewater treatment exceeded 60%.

All major cities provided at least secondary treatment in early 1990s, except for Milan, which provided no treatment at all, and Florence which provided partly primary treatment.

Overall IAS use is 4.4% of total generated load (in agglomerations >2000 p.e.). The use of IAS remains steady over the years.

The default deadlines for Italy to develop the necessary infrastructure expired on 31st December 2005.

Furthermore, Italy had to meet additional deadlines, because of the designation of new sensitive areas on its territory after 2007, which is related to Article 5 provisions on the review of sensitive areas.

Italy has been sent to the CJEU and found in breach of the UWWTD multiple times. There have been 5 final rulings by the CJEU under Art. 258 for failing to establish collecting systems (Art.3), secondary (Art.4) or more stringent treatment (Art.5) for groups of agglomerations, as well as for delays in the transposition of the UWWTD (Art. 19) and failures to ensure the necessary performance of WWTPs (Art.10). Italy was also sent to the CJEU under Art. 260 for groups of agglomerations missing collecting system or secondary treatment. Italy has been fined with a lumpsum fine of EUR 25 million and one penalty payment amounting to EUR 30.1 million for every 6-month period of non-compliance. Italy has a pending case under Art. 258 and a pending case under Art. 260.

Through Cohesion policy and other funds, the EU committed to provide Italy with EUR 228 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD.

Latvia

Latvia joined the EU in 2004.

By then, the wastewater collecting and treatment system served 66% of the national population.

Riga provided tertiary treatment already since early 1990s.

Overall IAS use is 5.2% of total generated load (in agglomerations >2000 p.e.). The use of IAS has shown a decreasing trend over the years.

The last deadlines for Latvia to develop the necessary infrastructure expired on the 31st December 2015.

Latvia has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide EUR 7 million between 2000 and 2006, which have partly funded the efforts to comply with the UWWTD (no data identified for the period 2007-2013).

Lithuania

Lithuania joined the EU in 2004.

In that year, 70% of the population was connected to collecting systems and 59% was connected to urban wastewater treatment.

Overall IAS use is 4.9% of total generated load (in agglomerations >2000 p.e.). The use of IAS shows mixed trends over the years.

The last deadlines for Lithuania to develop the necessary infrastructure expired on the 31st December 2009.

Lithuania has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide Lithuania with EUR 269 million between 2000 and 2006 and EUR 206 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD.

Luxembourg

Luxembourg is one of the founding members of EU (EC).

Before the adoption of the UWWTD, the existing connection rate to wastewater collection and treatment was already around 90%.

Luxembourg City provided secondary treatment with phosphorous removal.

Overall IAS use is very low (<1% of total generated load in agglomerations >2000 p.e.).

The last deadlines for Luxembourg to develop the necessary infrastructure expired on the 31st December 2005.

Luxembourg has been sent to the CJEU and found in breach of the UWWTD twice. There has been 1 final ruling by the CJEU under Art. 258 for failing to establish more stringent treatment (Art.5) for groups of agglomerations. Luxembourg was also sent to the CJEU under Art. 260 for groups of agglomerations missing tertiary treatment. Luxembourg has been fined with a lumpsum fine up to EUR 2 million and one penalty payment amounting to EUR 0.003 million for every 6-month period of non-compliance.

The national contribution to comply with the UWWTD amounted EUR 294 million for the period 2000-2006.

Malta

Malta joined the EU in 2004.

By then, all its population was connected to collecting systems but only 13% was connected to urban wastewater treatment, which was the lowest rate among the rest MSs that entered EU in the same year.

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

The last deadlines for Malta to develop the necessary infrastructure expired on the 31st March 2007.

Malta has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide Malta with EUR 42,5 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD.

Netherlands

The Netherlands is one of the founding members of EU (EC).

By 1991, when the UWWTD was adopted, the existing infrastructure for wastewater collection and treatment system already served more than 94% of the population.

Major cities, such as Amsterdam, Eindhoven, Rotterdam and The Hague already provided at least secondary treatment.

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

The last deadlines for the Netherlands to develop the necessary infrastructure expired on the 31st December 2005.

The Netherlands is one of the few countries with no ruling of the CJEU related to the implementation of the UWWTD.

No information regarding EU and national funds for the implementation of the UWWTD were identified.

Poland

Poland joined the EU in 2004.

In that year, almost 60% of the population was connected to collecting systems and urban wastewater treatment.

Warsaw partially provided secondary treatment already from early 1990s. Poland's whole territory is designated as sensitive area.

Overall IAS use is 8.7% of total generated load (in agglomerations >2000 p.e.). The use of IAS shows mixed trends over the years.

The last deadlines for Poland to develop the necessary infrastructure expired on the 31st December 2015.

Poland has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art.258.

Through Cohesion policy and other funds, the EU committed to provide Poland with EUR 1,254 million between 2000 and 2006 and EUR 3,164 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 2,360 million and EUR 1,529 million.

Portugal

Portugal joined the EU in 1986.

By 1991, when the UWWTD was adopted, the population connected to urban wastewater treatment was as low as 20%.

In early 1990s, there was no treatment in Porto, whereas Lisbon and Aveiro provided partly secondary and partly primary treatment.

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

The last deadlines for Portugal to develop the necessary infrastructure expired on the 31st December 2005.

Portugal has been sent to the CJEU and found in breach of the UWWTD multiple times. There have been 4 final rulings by the CJEU under Art. 258 for failing to establish collecting systems (Art.3), secondary (Art.4) or more stringent treatment (Art.5) for groups of agglomerations, as well as for failure to identify less sensitive areas (Art. 6) and prior authorisation for industrial discharges (Art.11). Portugal was also sent to the CJEU under Art. 260 for groups of agglomerations missing collecting system or secondary treatment. Portugal has been fined with a lumpsum fine of EUR 3 million and one penalty payment amounting to EUR 0.008 million for every 6-month period of non-compliance. Portugal has a pending cases under Art. 260.

Through Cohesion policy and other funds, the EU committed to provide Portugal with EUR 505 million between 2000 and 2006 and EUR 765 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 935 million and EUR 593 million.

Romania

Romania joined the EU in 2007.

In that year, the population connected to urban wastewater treatment was lower than 30%, which was among the lowest rates among the rest MSs that entered EU in the same year.

Overall IAS use is very low (<1% of total generated load in agglomerations >2000 p.e.).

The last deadlines for Romania to develop the necessary infrastructure expired on the 31st December 2018.

Romania has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide Romania with EUR 679 million between 2000 and 2006 and EUR 1,338 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 114 million and EUR 2,496 million.

Slovakia

Slovakia joined the EU in 2004.

By then, the connection rate of the population to collecting and treatment was around 55%.

The major cities in Slovakia provided secondary treatment already from the 1990s.

Overall IAS use is 16.5% of total generated load (in agglomerations >2000 p.e.). The use of IAS shows increasing trends over the years.

The last deadlines for Slovakia to develop the necessary infrastructure expired on the 31st December 2015.

Slovakia has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art.258.

Through Cohesion policy and other funds, the EU committed to provide Slovakia with EUR 259 million between 2000 and 2006 and EUR 691 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 66 million and EUR 1,433 million.

Slovenia

Slovenia joined the EU in 2004.

By then, 63% of the population was connected to collecting systems and 48% was connected to urban wastewater treatment.

Overall IAS use is 6.3% of total generated load (in agglomerations >2000 p.e.). The use of IAS shows mixed trends over the years.

The last deadlines for Slovenia to develop the necessary infrastructure expired on the 31st December 2015.

Slovenia has no final ruling against it by the CJEU yet. However, the MS has pending cases under Art. 258.

Through Cohesion policy and other funds, the EU committed to provide Slovenia with EUR 117 million between 2000 and 2006 and EUR 157 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD. In the same periods, the national funds allocated to the UWWTD were respectively EUR 390 million and EUR 321 million.

Spain

Spain joined the EU in 1986.

By 1991, when the UWWTD was adopted, 48% of the population was connected to treatment.

Already various cities like Almeria, Bilbao, Valladolid and Zaragoza provided tertiary treatment, but for instance La Coruña and Cádiz provided no treatment at all. Barcelona provided primary treatment and cities, such as Madrid, Sevilla and Valencia, provided secondary treatment.

Overall IAS use is 1.3% of total generated load (in agglomerations >2000 p.e.).

The last deadlines for Spain to develop the necessary infrastructure expired on the 31st December 2005.

Spain has been sent to the CJEU and found in breach of the UWWTD multiple times. There have been 5 final rulings by the CJEU under Art. 258 for failing to establish collecting systems (Art.3), secondary (Art.4) or more stringent treatment (Art.5) for groups of agglomerations. Spain was also sent to the CJEU under Art. 260 for groups of agglomerations missing collecting system or secondary treatment. Spain has been fined with a lumpsum fine up to EUR 12 million and one penalty payment amounting to EUR 0.95 million for every 6-month period of non-compliance. Spain has a pending case under Art.260.

Through Cohesion policy and other funds, the EU committed to provide Spain with EUR 2,968 million between 2000 and 2006 and EUR 3,108 million between 2007 and 2013, which have partly funded the efforts to comply with the UWWTD (no data about national investments were identified).

Sweden

Sweden joined the EU in 1995.

By then, the existing collecting and treatment system served more than 85% of the national population.

All major cities with more than 150,000 p.e. provided at least secondary treatment, whereas cities such as Stockholm, Malmö and Helsingborg already provided tertiary treatment.

Overall IAS use is negligible (0% of total generated load in agglomerations >2000 p.e.).

The last deadlines for Sweden to develop the necessary infrastructure expired on the 31st December 2005.

Sweden has been sent to the CJEU and found in breach of the UWWTD once. There has been 1 final ruling by the CJEU under Art. 258 for failing to establish more stringent treatment (Art.5) for groups of agglomerations. Sweden has a pending case under Art. 260.

No information regarding EU and national funds for the implementation of the UWWTD were identified.

United Kingdom

The UK joined the EU in 1973.

By 1991, when the UWWTD was adopted, 79% of the population was already connected to urban wastewater treatment.

Cities such as Dundee, Brighton, Portsmouth and Middlesbrough provided no treatment at all, whereas London and other big cities provided at least secondary treatment.

Overall IAS use is very low (<1% of total generated load in agglomerations >2000 p.e.).

The last deadlines for the UK to develop the necessary infrastructure expired on the 31st December 2005.

The UK has been sent to the CJEU and found in breach of the UWWTD multiple times. There have been 4 final rulings by the CJEU under Art.258 for failing to establish collecting systems (Art.3), secondary (Art.4) or more stringent treatment (Art.5) for groups of agglomerations, as well as for failing to ensure the necessary performance of WWTPs (Art.10). However, the UK has no ruling under Art. 260, which means that the breaches have been addressed effectively without reaching the stage of a second ruling for the same case.

The national investments to comply with the UWWTD were EUR 5 101 million in 2000-2006 and EUR 3 184 million in 2007-2013.

Sources used:

- CURIA, Court of Justice of the European Union,
- European Commission, Case Laws,
- European Commission, Implementation reports of the UWWTD
- European Commission, DG Environment, "Compliance Costs of the Urban Waste Water Treatment Directive. Final report", September 2010.
- OECD, Waste water treatment.

Effectiveness

What if no Directive results – water quality

The WIND scenarios were developed to have a hypothetical judgment of what would have happened without the Directive. Each Member State was assigned two "weights" (see baseline table for the weight). These weights are based on different expert judgment and consider the population levels connected to treatment before the Directive and take into account facts found per Member States such as funding received and number of infringement cases.

None of these reflect the reality, this is only meant to provide an indication of what, according to experts, would have happened without an EU level intervention. For a discussion of the assumptions, see Wood *et al.,* (2019), Evaluative study and Pistocchi *et al.,* (2019).

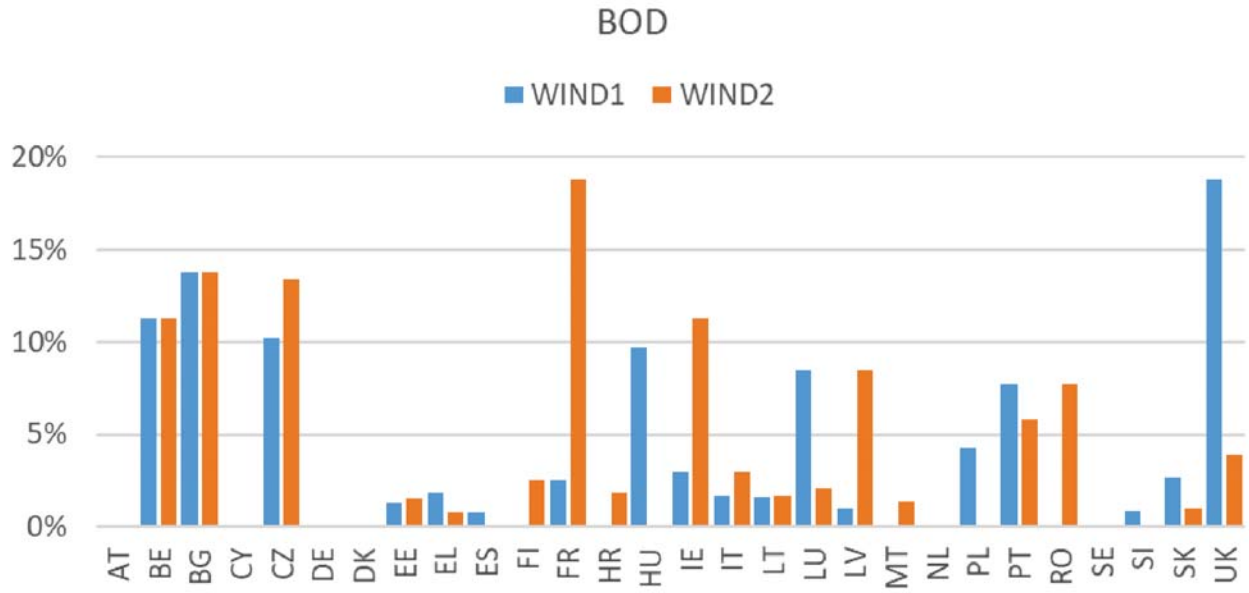


Figure 46 Hypothetical case of BOD loads reductions under 2 "What-if-no-Directive" scenarios compared to baseline (present) scenario.

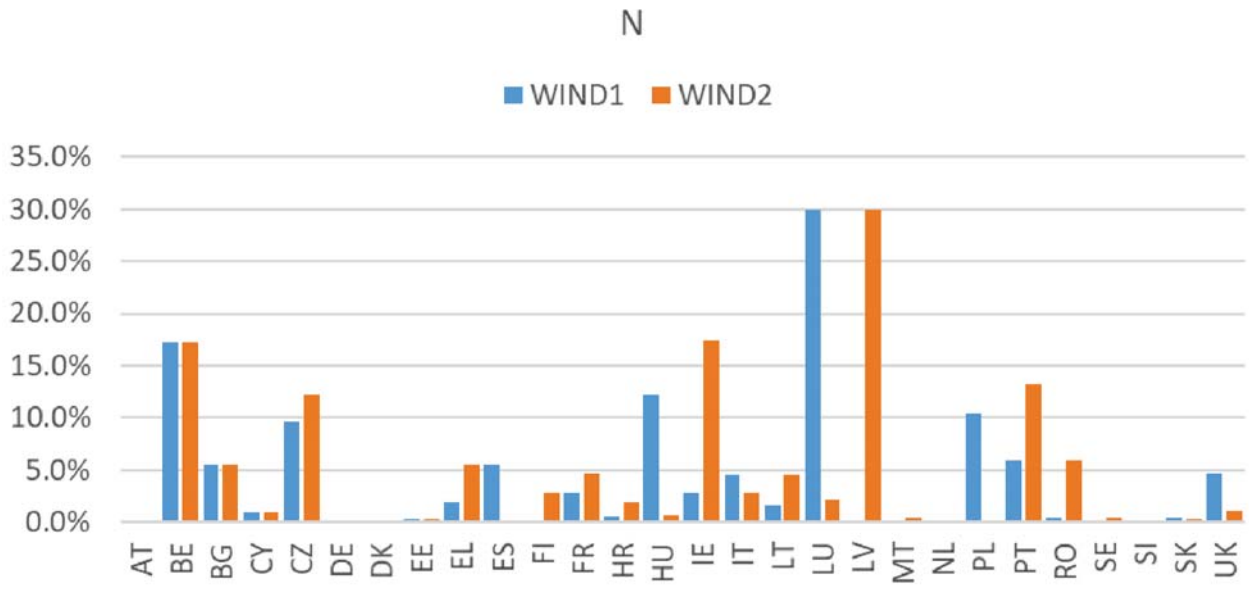


Figure 47 Hypothetical case of N load reductions under 2 "What-if-no-Directive" scenarios compared to baseline (present) scenario.

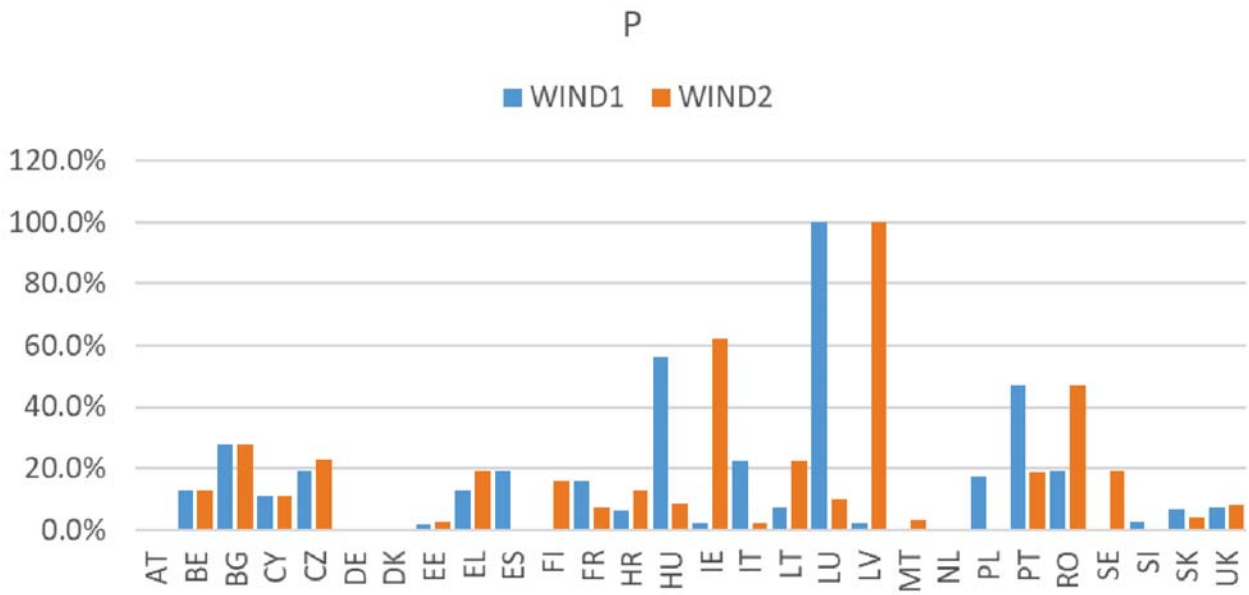


Figure 48 Hypothetical case of P emissions reductions under 2 "What-if-no-Directive" scenarios compared to baseline (present) scenario.

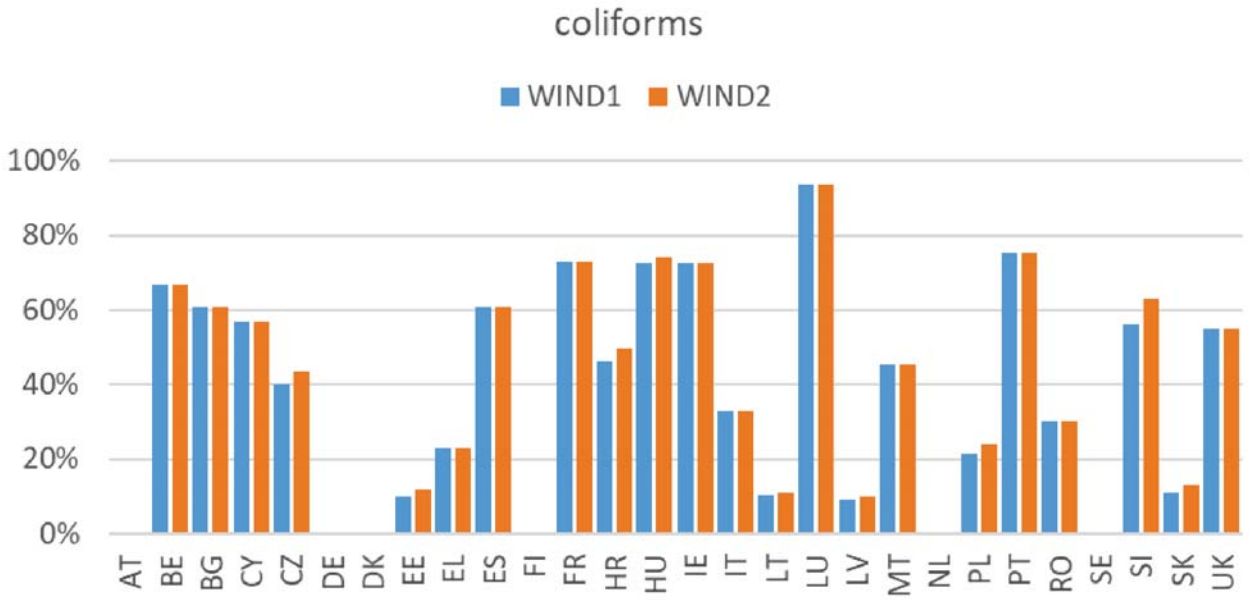


Figure 49 Percent change of river length, by country, not meeting bathing waters standards for coliforms under WIND scenario compared to baseline (present) scenario.

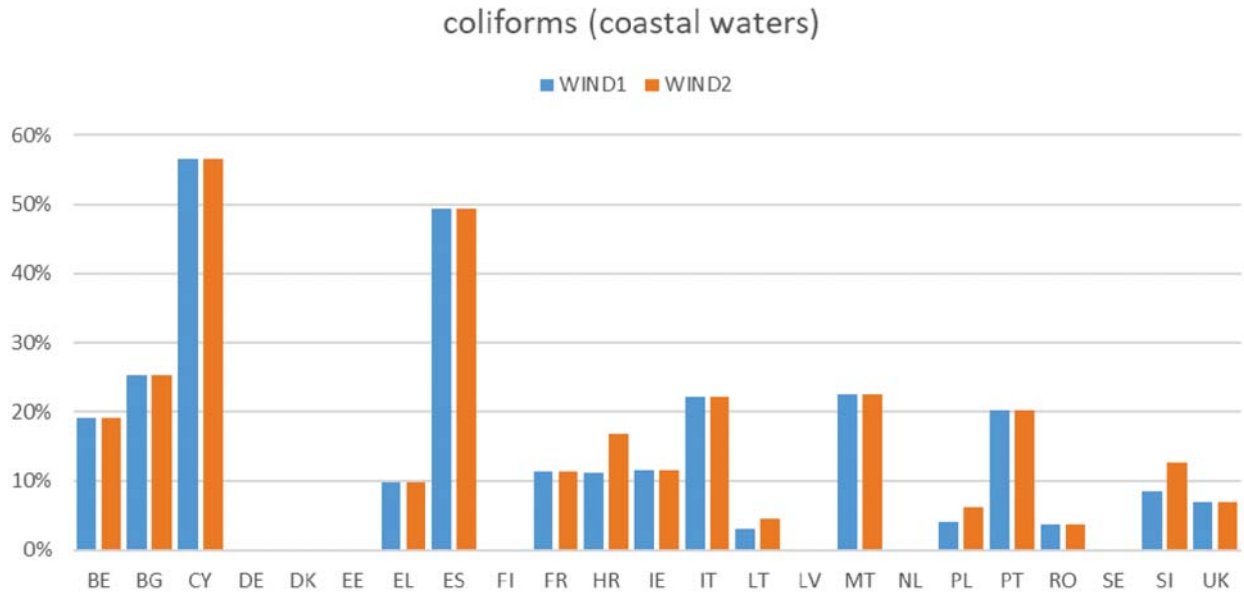


Figure 50 Percent change of coastal length, by country, not meeting bathing waters standards for coliforms under WIND scenario compared to baseline (present) scenario.

Storm water overflows

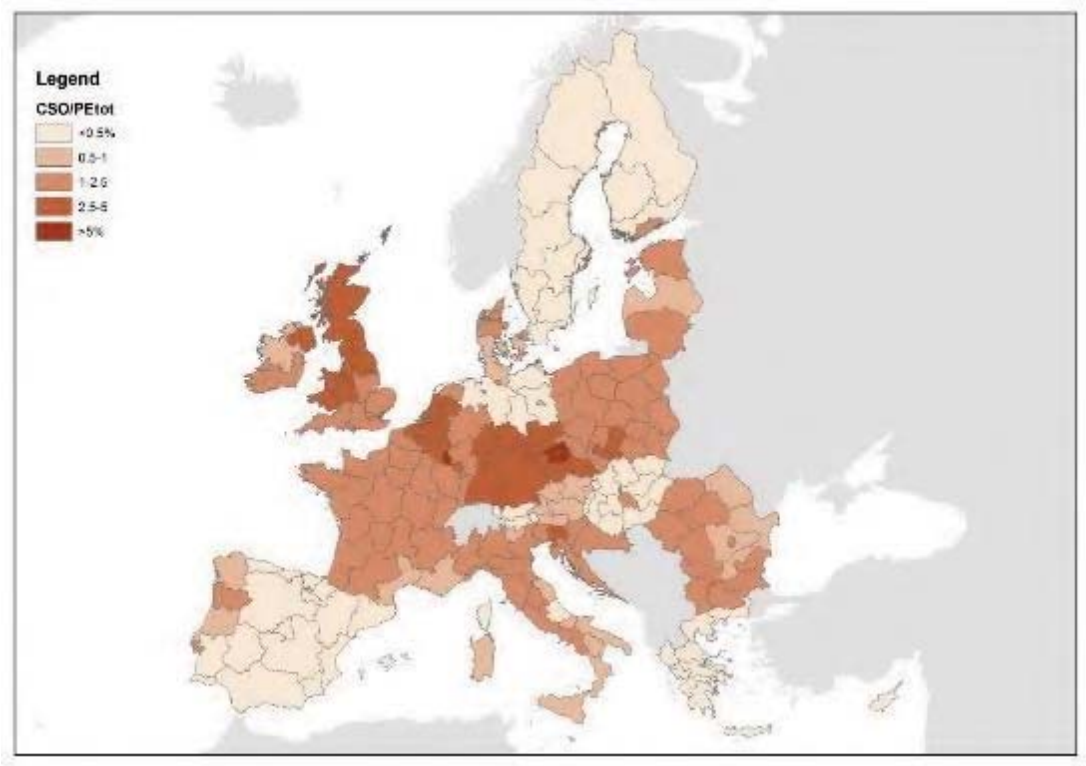


*Figure 51 Potential loads to receiving water bodies. PE of CSO with **assumed dilution rate of 4**.*

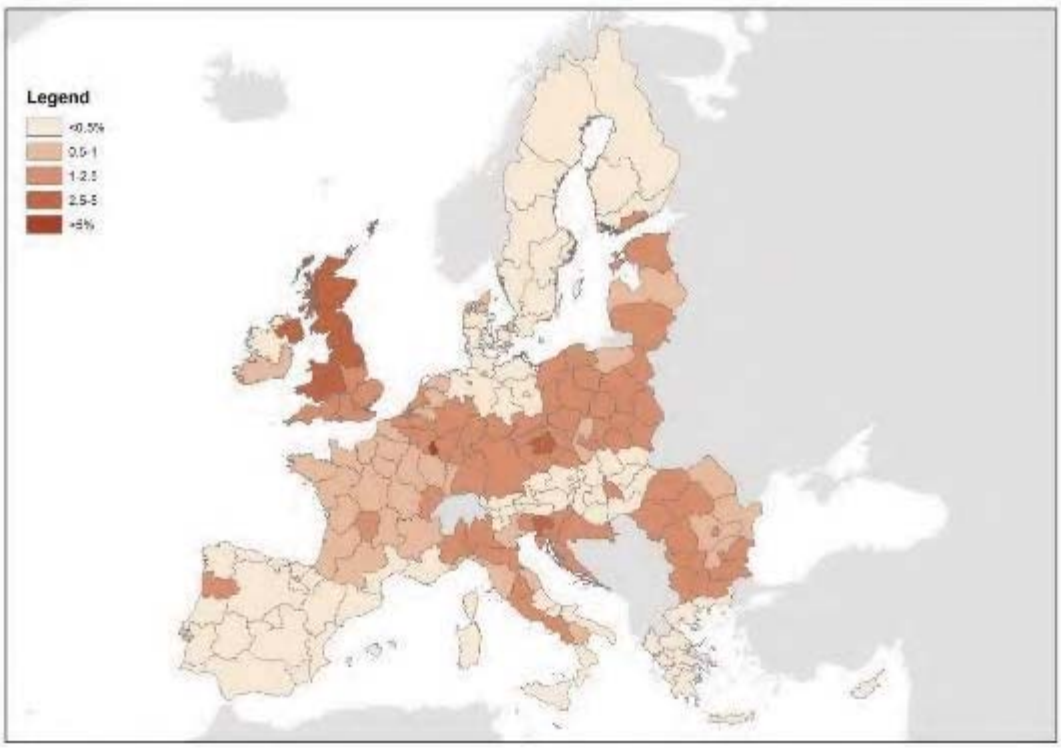


Figure 52 Potential loads to receiving water bodies. PE of CSO ***accounting for management measures****.*

Impact of IAS in terms of BOD, nitrogen, phosphorus and coliform loads

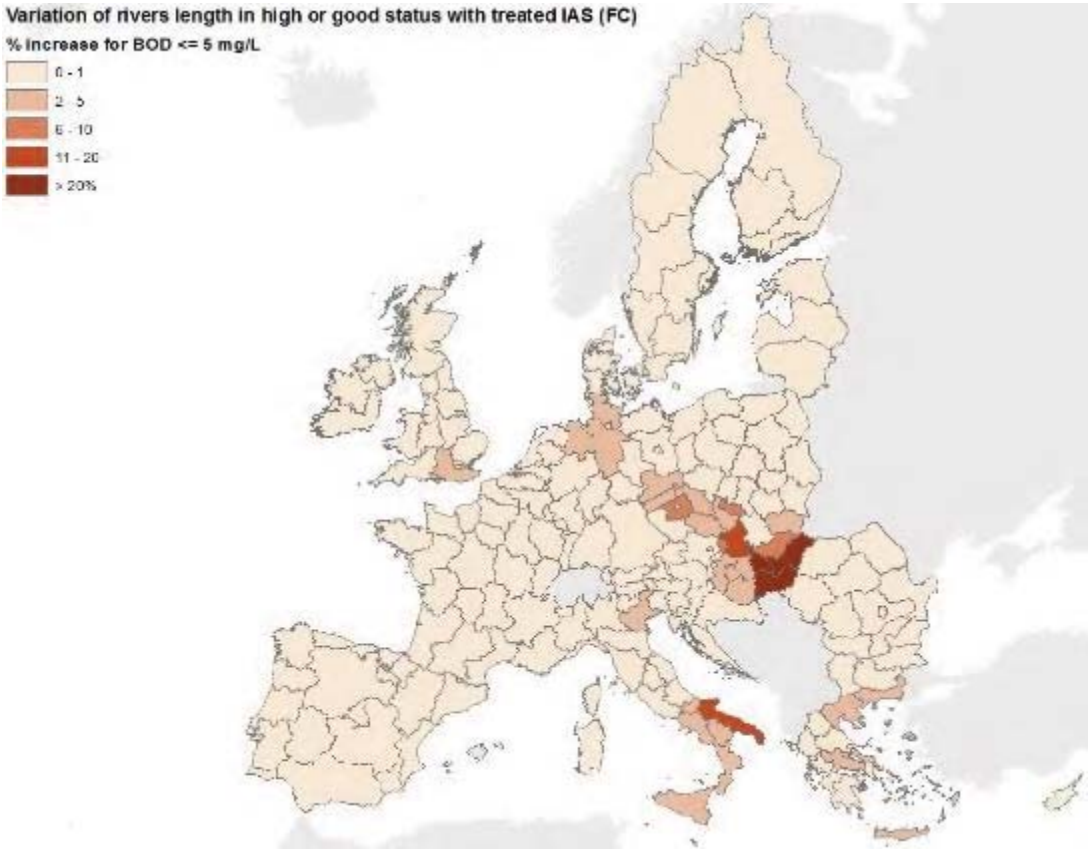


Figure 53 Percentage variation of hydrographic network in good quality under IAS (without assumptions of management measures) for BOD standards. Source: Pistocchi et al., 2019.

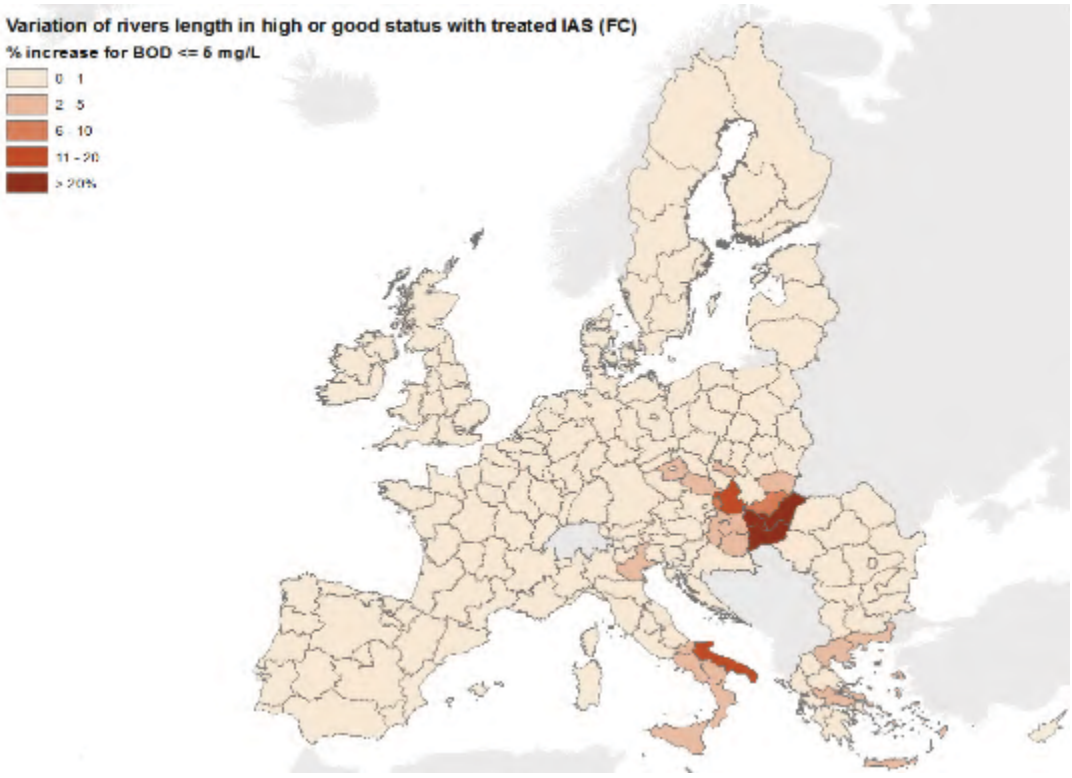


Figure 54 Percentage variation of hydrographic network in good quality under IAS (with assumptions of management measures) for BOD standards. Source: Pistocchi et al., 2019.

The impact of IAS use on receiving water bodies in terms of N is slightly smaller compared to the BOD impact with some regions increasing the length of the stream network below good status thresholds by up to more than 5%.

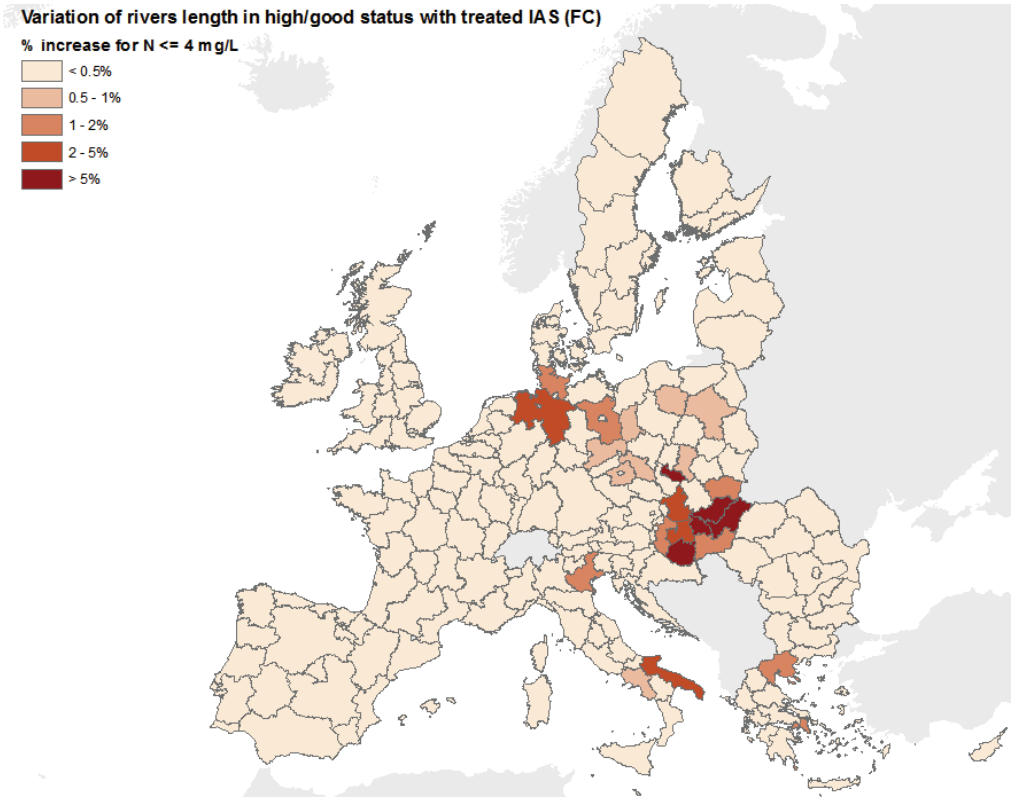


Figure 55 N: % variation of hydrographic network in good quality under IAS (without assumptions of management measures) for N standards.

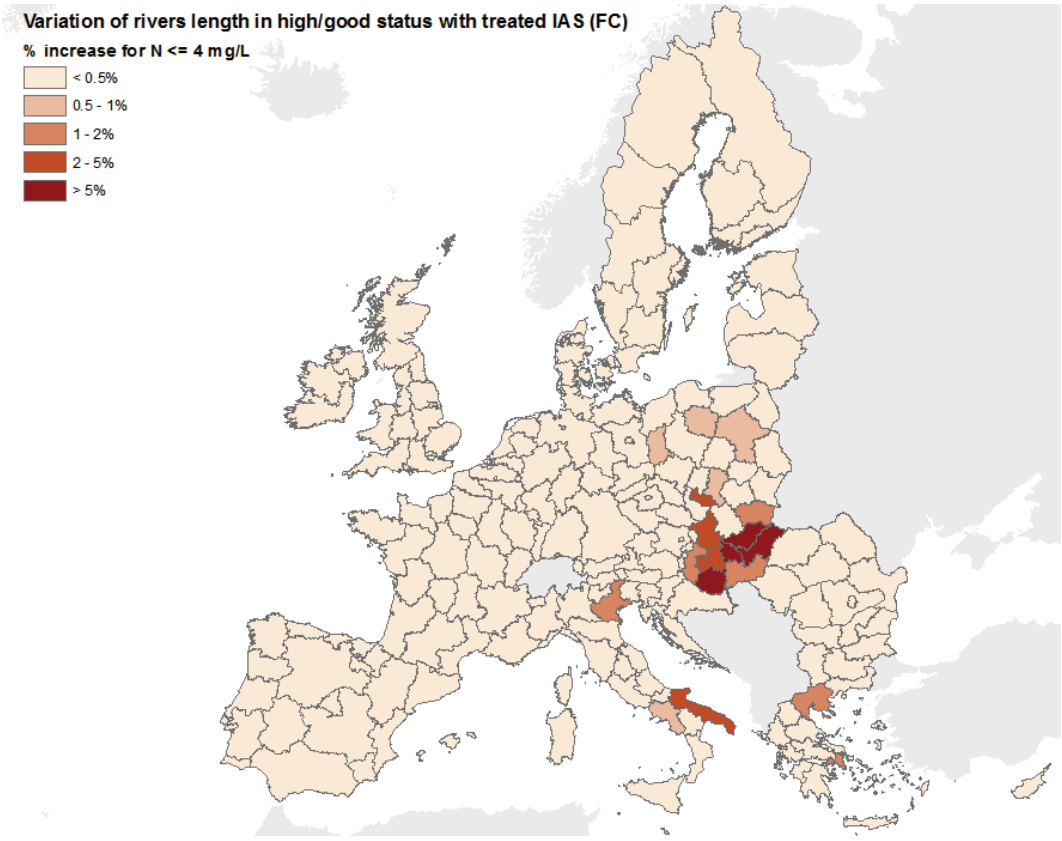


Figure 56 N: % variation of hydrographic network in good quality under IAS (with assumptions of management measures).

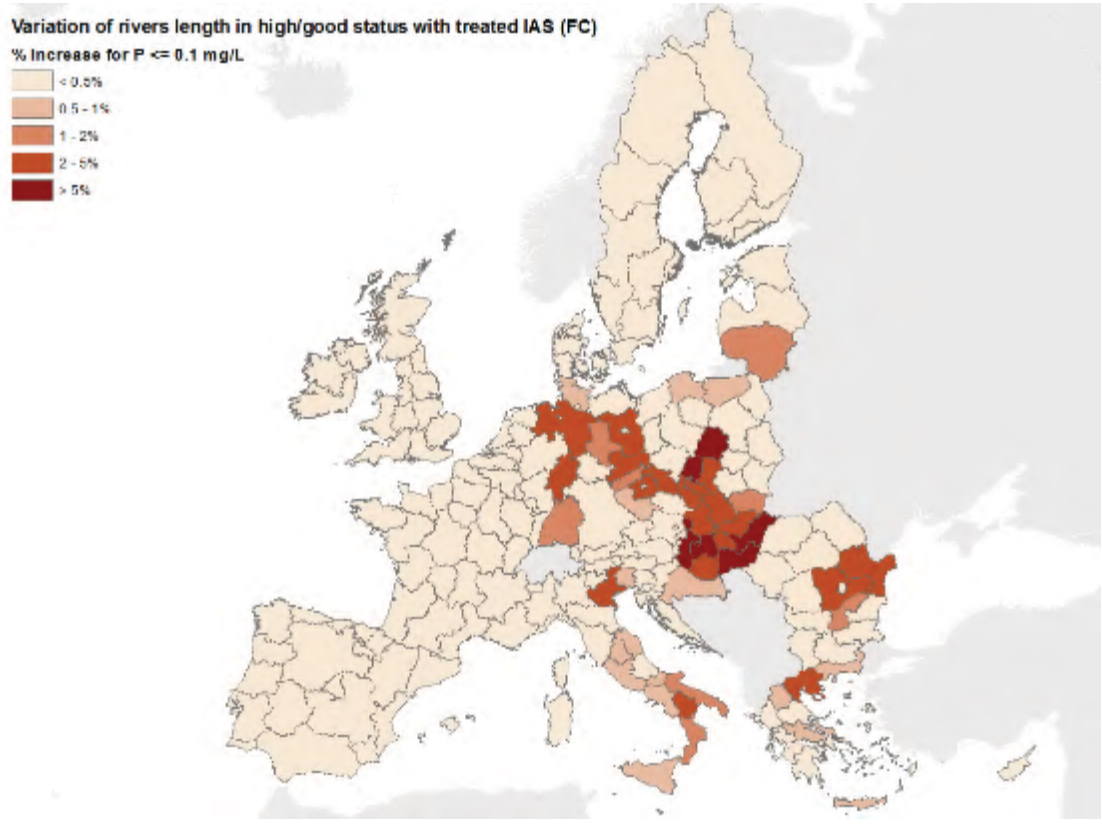


Figure 57 P: % Variation of hydrographic network in good quality under IAS

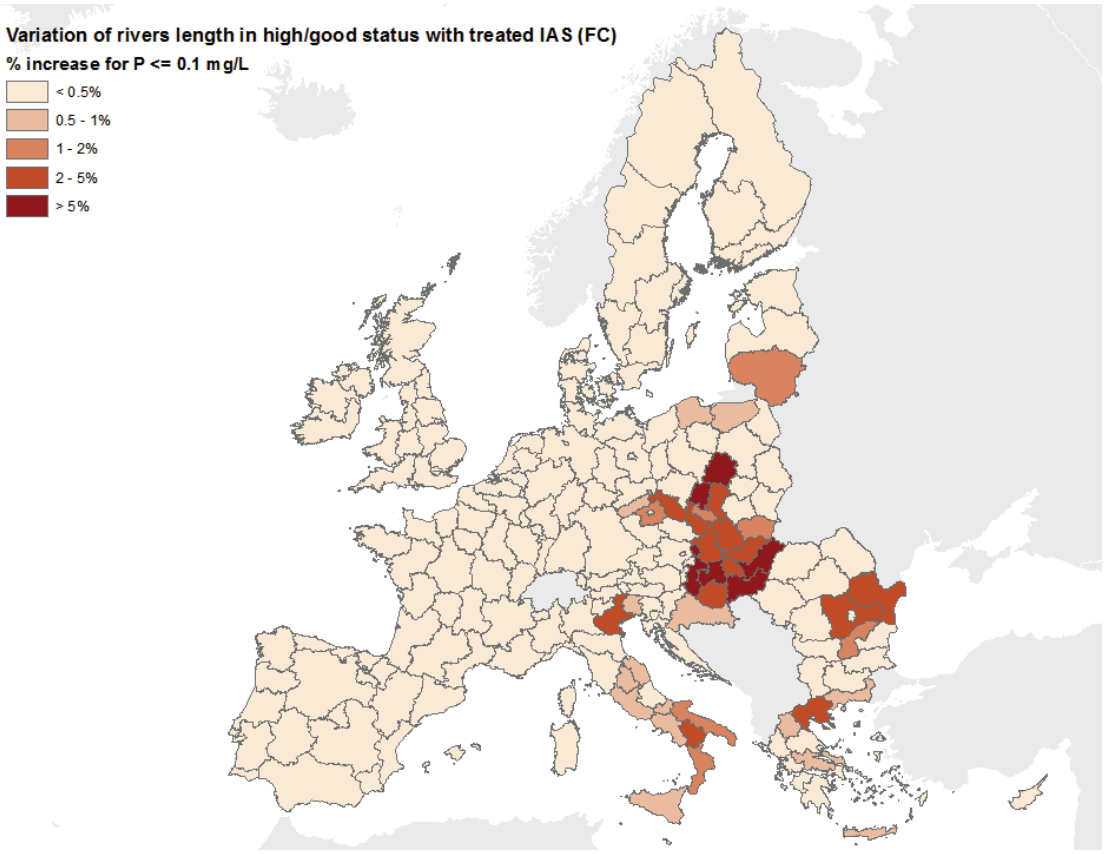


Figure 58 P: % Variation of hydrographic network in good quality under IAS with management measures in place.

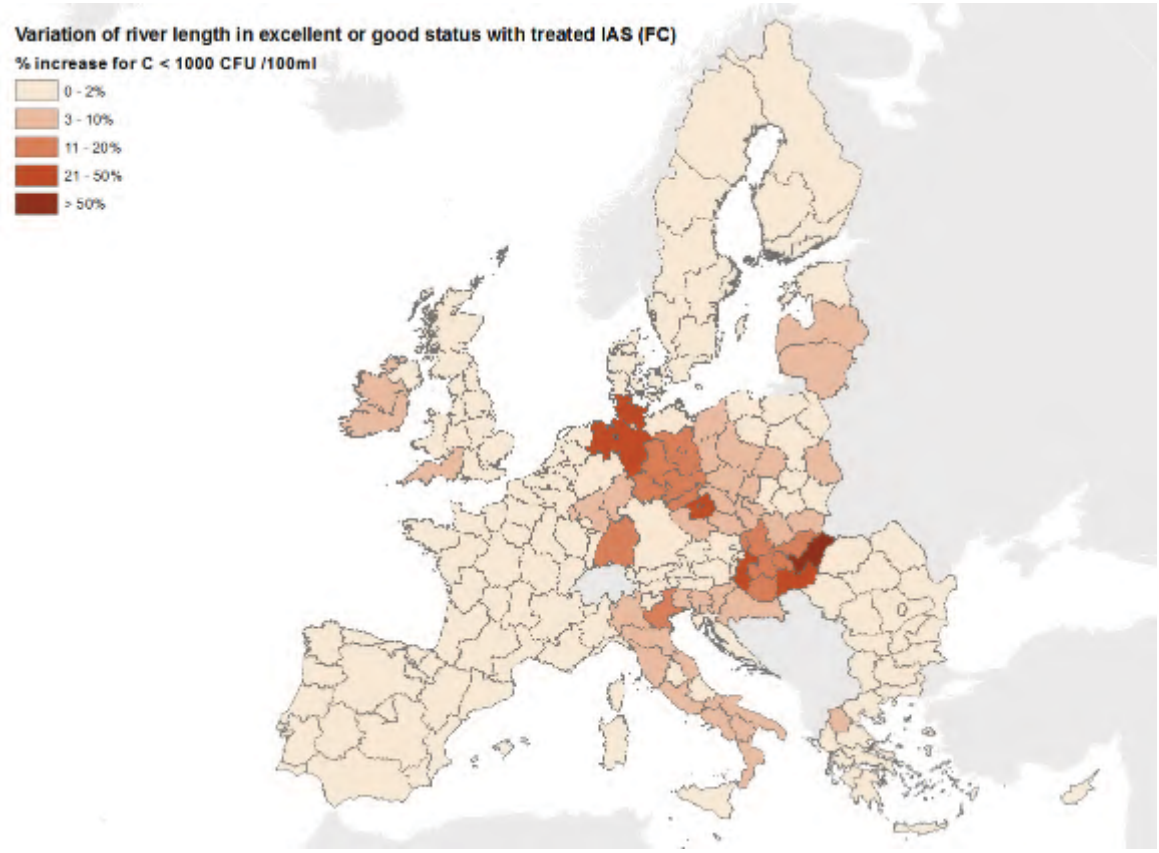


Figure 59 Coliforms: % Variation of hydrographic network in good quality under IAS in good quality under IAS (without management measures)

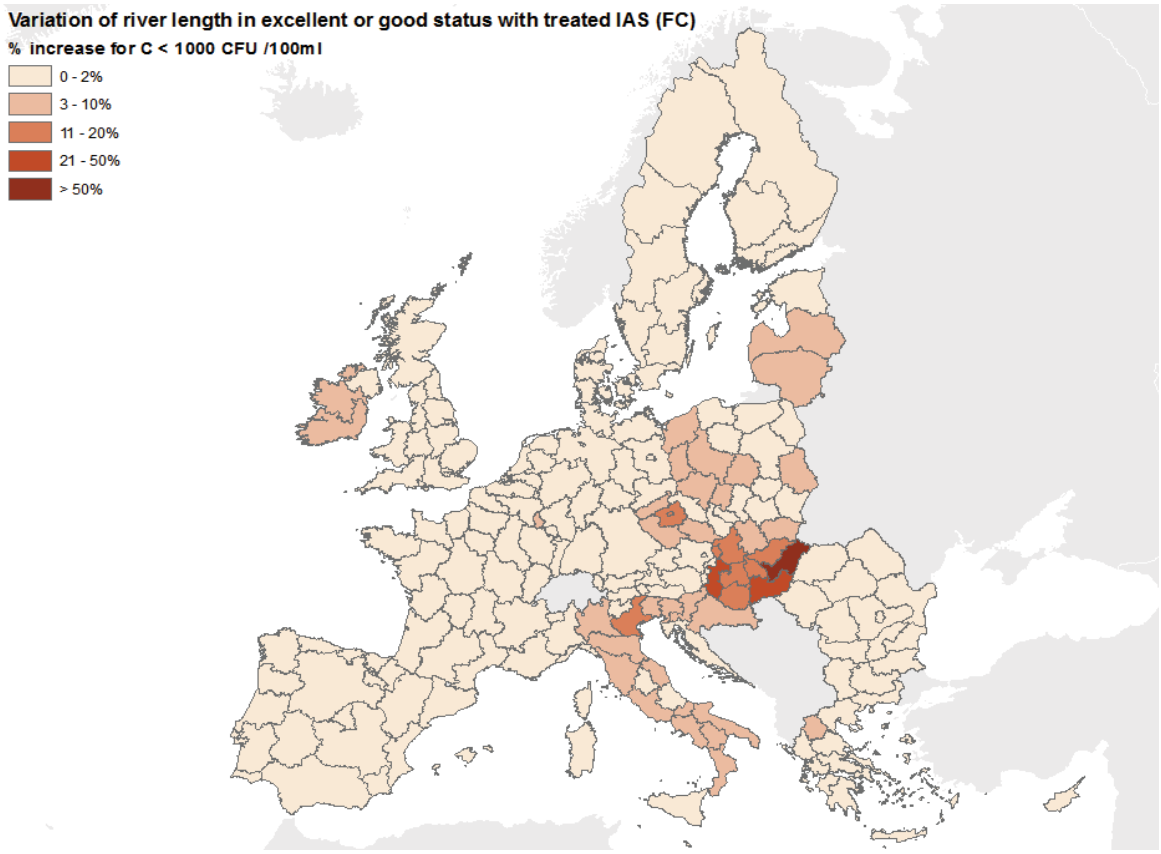


Figure 60 Coliforms: % Variation of hydrographic network in good quality under IAS (with management measures in place).

Small agglomerations, scattered dwellings and non-connection

Significant pressure or chemical substance failing	Main driver(s)	Indicators for pressure	Relevant KTM	Indicators for KTM
				Number of contaminated sites to be remediated or where preventative actions are to be taken to achieve objectives
2.6 - Diffuse - Discharges not connected to sewerage network	Urban development	Length (km)/area (km^2) of water bodies not achieving objectives because of this pressure	21 Measures to prevent or control the input of pollution from urban areas, transport and built infrastructure	Number of upgraded storm overflows required to achieve objectives
				Number of sustainable drainage systems required to achieve objectives.
		Number of discharges not connected to sewerage network that are causing the failure of objectives		Number of discharges required to be connected to sewerage network to achieve objectives

Figure 61 Pressure 2.6 Diffuse - discharges not connected to sewerage network. Source: European Commission (2016).

It is explained that under WFD as pressure type P2.6 'Diffuse – discharges not connected to the sewerage network' are reported. In the WISE State of the Environment emissions source categories this is translated into NP3 – 'Diffuse – unconnected dwellings emissions'.

The following table shows how many surface water bodies are affected by pressure 2-6 discharge non-connected to the sewerage network. This information is based on Member State reporting under the RBMPs.

	No. of surface waterbodies	**% of total**
All 'significant pressures'	115 415	100
P2 - Diffuse sources	42 734	35.6
P2-6 – Discharge not connected to the sewerage network	12 341	10.7
Member States reporting high amounts of surface water bodies with this pressure		
HR	828	53.7
DK	2 239	25.5
RO	746	24.6
FI	838	12.3
PL	1 007	17.8

Table 21 Surface water bodies affected by non-connected dwellings. Source: EEA dataviewer (2019), No of MS =26 (EL and LT not reported).

Monitoring and reporting obligations

Art. 15	**Art. 17**	**Art. 18**

1. Competent authorities or appropriate bodies shall monitor:

- discharges from urban waste water treatment plants to verify compliance with the requirements of Annex I.B in accordance with the control procedures laid down in Annex I.D,

- amounts and composition of sludges disposed of to surface waters.

2. Competent authorities or appropriate bodies shall monitor waters subject to discharges from urban waste water treatment plants and direct discharges as described in Article 13 in cases where it can be expected that the receiving environment will be significantly affected.

3. In the case of a discharge subject to the provisions of Article 6 and in the case of disposal of sludge to surface waters, Member States shall monitor and carry out any other relevant studies to verify that the discharge or disposal does not adversely affect the environment.

4. Information collected by competent authorities or appropriate bodies in complying with paragraphs 1, 2 and 3 shall be retained in the Member State and made available to the Commission within six months of receipt of a request.

5. Guidelines on the monitoring referred to in paragraphs 1, 2 and 3 may be formulated in accordance with the procedure laid down in Article 18.

1. Member States shall by 31 December 1993 establish a programme for the implementation of this Directive.

2. Member States shall by 30 June 1994 provide the Commission with information on the programme.

3. Member States shall, if necessary, provide the Commission by 30 June every two years with an update of the information described in paragraph 2.

4. The methods and formats to be adopted for reporting on the national programmes shall be determined in accordance with the procedure laid down in Article 18. Any amendments to these methods and formats shall be adopted in accordance with the same procedure.

5. The Commission shall every two years review and assess the information received pursuant to paragraphs 2 and 3 above and publish a report thereon.

1. The Commission shall be assisted by a Committee composed of the representatives of the Member States and chaired by the representative of the Commission.

2. The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148 (2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The chairman shall not vote.

3. (a) The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the committee.

(b) If the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

If, on the expiry of a period of three months from the date of referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission, save where the Council has decided against the said measures by a simple

majority.

Table 22 Overview of monitoring and reporting obligations

Annex IB and the related tables lay down how the monitoring takes place (monitoring of influent and effluent) for secondary and more stringent treatment. More stringent requirements than those in table 1 and 2 can be required to satisfy any other relevant Directives (Annex IB.4). **Table 1** lays down the reduction levels for BOD5[13], COD and total suspended solids (optional). **Table 2** lays down the requirements for the reduction of phosphorus and nitrogen. **Table 3** lays down the maximum amount of samples that are allowed to fail among numerical series of samples taken per year. **Annex ID** describes the reference methods that are to be used and how the results shall be evaluated. It is laid down by how much failing samples can deviate from the indicated concentrations, and that extreme values shall – when these are due to heavy rain – not be taken into account.

[13] BOD5 can be replaced by Total Organic Carbon or TOD if a relation can be established.

Efficiency

Annual benefits at full implementation levels

MS	Total annual benefit – central estimate (MEUR)	Annual recurring nitrogen removal benefit (MEUR)		Annual recurring bathing water quality benefit (MEUR)		Annualised one-off economic benefit of central collection (MEUR)		Annual benefit per p.e. – central estimate (EUR)
		Low estimate	High estimate	Low estimate	High estimate	Low estimate	High estimate	
AT	1,469	613	1,201	124	345	280	373	71
BE	897	248	485	52	146	370	493	78
BG	255	54	105	27	74	107	143	28
CY	79	15	30	6	18	38	51	88
CZ	231	62	121	38	105	58	78	21
DE	4,745	1,483	2,912	1,170	3,248	290	386	41
DK	771	393	781	34	94	102	137	66
EE	45	25	49	0	1	6	9	28
EL	885	324	643	21	81	300	400	74
ES	4,303	1,464	2,878	544	1,349	1,016	1,355	62
FI	142	39	76	7	16	62	83	24
FR	3,852	1,275	2,497	534	1,720	720	959	52
HR	296	72	142	18	49	133	178	47
HU	544	176	341	48	134	167	222	49
IE	447	161	319	16	45	152	202	72
IT	4,608	1,582	3,128	319	885	1,415	1,887	51
LT	64	32	62	4	11	8	11	24
LU	49	18	35	10	27	4	5	68
LV	25	12	23	1	4	4	6	13
MT	41	13	26	2	4	16	21	67
NL	628	231	455	117	326	55	73	34
PL	1,331	683	1,350	53	147	183	244	33
PT	858	291	575	51	141	282	376	61
RO	730	272	522	36	101	227	302	52
SE	389	160	313	17	48	103	138	30
SI	124	25	49	18	49	46	61	73
SK	95	35	68	6	17	28	37	21

MS	Total annual benefit – central estimate (MEUR)	Annual recurring nitrogen removal benefit (MEUR)		Annual recurring bathing water quality benefit (MEUR)		Annualised one-off economic benefit of central collection (MEUR)		Annual benefit per p.e. – central estimate (EUR)
		Low estimate	High estimate	Low estimate	High estimate	Low estimate	High estimate	
UK	2,768	932	1,820	317	814	709	945	33
EU28	30,669	10,688	21,004	3,592	9,998	6,881	9,174	47

Table 23 Annualised benefits per Member State – full implementation levels

Annual costs at full implementation levels

MS	Total annual costs (MEUR)	Annualised, one-off, investment costs (MEUR)		Annual, recurrent, operational and maintenance costs (MEUR)		Total annual cost per p.e. (EUR)
		treatment	collection	treatment	collection	
AT	1,030	326	362	145	195	50
BE	705	164	297	77	167	77
BG	200	65	92	17	26	29
CY	78	11	44	4	19	105
CZ	186	71	68	22	25	26
DE	1,940	929	388	414	209	18
DK	451	183	114	88	66	39
EE	30	15	7	5	3	19
EL	589	142	280	50	118	55
ES	3,177	742	1,456	289	690	51
FI	157	19	83	9	46	29
FR	2,899	761	1,155	347	636	40
HR	340	59	191	19	70	77
HU	513	133	253	40	88	50
IE	333	75	148	32	78	63
IT	2,900	835	1,132	353	580	39
LT	37	19	9	6	3	14
LU	19	10	3	4	2	30
LV	20	9	6	3	2	13
MT	34	6	19	2	8	67
NL	325	168	53	75	29	18
PL	802	419	192	125	66	21
PT	715	128	384	44	159	59
RO	318	144	103	39	32	25
SE	350	90	139	42	79	28
SI	103	21	52	8	22	82
SK	116	38	48	12	18	30
UK	1,405	423	530	178	273	20
EU28	19,774	6,005	7,609	2,451	3,710	34

Table 24 Annualised costs per Member State – full implementation levels

Costs and benefits increase under full implementation. Under full implementation benefits outweigh costs in all Member States apart from Slovakia and Finland. This can be due to the high level of implementation already in place in Finland before the UWWTD was adopted and the high use of IAS in Slovakia.

Administrative burden vs administrative costs

"Administrative costs" are costs incurred under an information obligation. There is a particular type of an information obligation called a "reporting obligation", e.g. the requirement for a Member State to transmit information to the European Commission as a means to demonstrate successful implementation of a legal obligation, or compliance.

"Business-as-usual costs" are costs resulting from collecting data, processing and transmitting information which would be done by an organization even in the absence of the EU legal obligation, e.g. in the process of monitoring the quality of the effluent.

Finally, "administrative burden costs" are the "marginal" part of the costs associated to monitoring, collecting, processing and transmitting of information, which is done solely because of the reporting requirement of an EU legal obligation.

To summarise: [administrative costs] = [business as usual costs] + [administrative burden costs]

Overview of costs – benefits identified in the Evaluation

I. Overview of costs – benefits identified in the evaluation									
		Citizens/Consumers		Businesses		Administrations		[Other…]	
		Qualitative	Quantitative / monetary	Qualitative	Quantitative / monetary	Qualitative	Quantitative / monetary	Qualitative	Quantitative / monetary
Cost / Benefit	**[Description:** e.g. = economic, social, environmental = one off/recurring **= Type of cost/benefit**: e.g. compliance costs, regulatory charges, hassle costs, administrative costs, enforcement costs, indirect costs Changes in pollution, safety, health, employment	[high / medium / low / negligible / unknown Sources [KPIs stakeholders??]	[e.g. increase or decrease in: time taken, person days, full-time equivalents, numbers of certificates/tonnes of CO2 equivalent / employment rate / GDP / life expectancy etc or €]						
Costs	**Annualised investment**	The estimated costs have been	EUR 4,865 billion	Some of the costs have been					

	costs – WWTP **EU 28 – 2014 data** **Based on cost function FEASIBLE**	shared by water consumers and tax payers depending on the user charge policy in each MS.		incurred by industry with own wastewater discharge Industries connected to public wastewater systems have shared part of the costs depending on the user charge policy in each MS.					
Costs	**Annualised investment costs – Collection** **EU 28 – 2014 data** **Based on cost function FEASIBLE**	The estimated costs have been shared by water consumers and tax payers depending on the user charge policy in each MS.	EUR 7,296 billion						
Costs	**Annualised operational costs – WWTP** **EU 28 – 2014 data** **Based on cost function FEASIBLE**	The estimated costs have been shared by water consumers and tax payers depending on the user charge policy in each MS.	EUR 2,008 billion	Some of the costs have been incurred by industry with own waste water discharge Industries connected to public waste water systems					

				have shared part of the costs depending on the user charge policy in each MS.					
Costs	**Annualised operation costs – Collection** **EU 28 – 2014 data** **Based on cost function FEASIBLE**	The estimated costs have been shared by water consumers and tax payers depending on the user charge policy in each MS.	EUR 3,533 billion						
Costs	**Administrative burden** **Per Member State – annual reporting requirements**					Considered to be moderate	EUR 126 000 per year for all Member States together.		
Costs	**Administrative burden** **WWTP – monitoring**	Not considered to be administrative burden as these are part of normal functioning costs. Would be necessary regardless of the reporting requirements to							

		verify functioning of the WWTPs.							
Costs	**Administrative burden – Enforcement costs**					Considered to be proportionate, variation based on specific MS	150-350 full time staff per year for EU28		
Benefit	Nitrogen removal – monetisation based on cost function and avoided damage to water. Using €/t of nitrogen removed 2014 data		EU 28 estimate EUR 9,116 – 17,916 billion						
Benefit	Improvement in bathing water quality – recreation and health based on assumed WTP survey for improved water quality		EU 28 estimate EUR 3,252 - 9,057 billion						
Benefit	Economic savings from centralised collection		EU 28 estimate EUR 6,824 – 9,099						
Benefit	Recreational benefit	Covered by the improvement in							

		bathing water quality							
Benefit	Contribution to tourism sector	Covered by the improvement in bathing water quality							
Benefit	Contribution to EU leadership on water services sector – based on assumption that 1% of the global water services sector being linked to the action of the UWWTD			Out of the top 50 companies, at least 20 water services providers are EU companies.	EUR 5-6 billion per year				
Benefit	Contribution to research and innovation			The UWWTD has led to increase dynamism for research and innovation. This has been supported by the funding provided by the EU research programmes (e.g. LIFE and Horizon)					

Coherence

Terminology

The assessment of the wording in the Directive as well as feedback from stakeholders led to the identification of a number of terms in the Directive as well as terminology used in relation to the Directive that is not completely clear.

The table below includes only terms in the Directive that were identified by stakeholders as unclear. Terms in relation to the Directive that are not completely clear are discussed below the table.

Term/obligation	**Lack of definition**
Normal climatic conditions	In Art. 10 the UWWTD requires that treatment plants are "designed, operated and maintained to ensure sufficient performance under all normal local climatic conditions". Although the word "local" makes it clear that there is room for adjustment according to Member States' needs, there might be room for doubts as to what constitutes normal climatic conditions.
Storm water overflows (SWOs)	Annex IA requires that collecting systems are designed to limit pollution of receiving waters due to storm water overflows. Corresponding footnote 1 requires Member States to take measures to deal with SWOs and lists some examples. One measure could be specification of what an acceptable number of overflows per year is. It is unclear whether this refers to combined sewer overflows or also to separate sewer overflows, and whether urban run-off needs to be considered. It is also unclear what "acceptable" means here and how it should be determined. There is evidence that Member States take very different measures to deal with SWOs. It is unclear whether this is the most efficient approach to deal with an issue that can have negative impact on transboundary waters and even impact on health (see storm water overflows). There is also evidence that Member States have struggled with implementing this provision given that it was an issue raised in Court cases.
Unusual situations	These are mentioned in Art. 4(4) "The load expressed in p.e. shall be calculated on the basis of the maximum average weekly load entering the treatment plant during the year, excluding unusual situations such as those due to heavy rain".

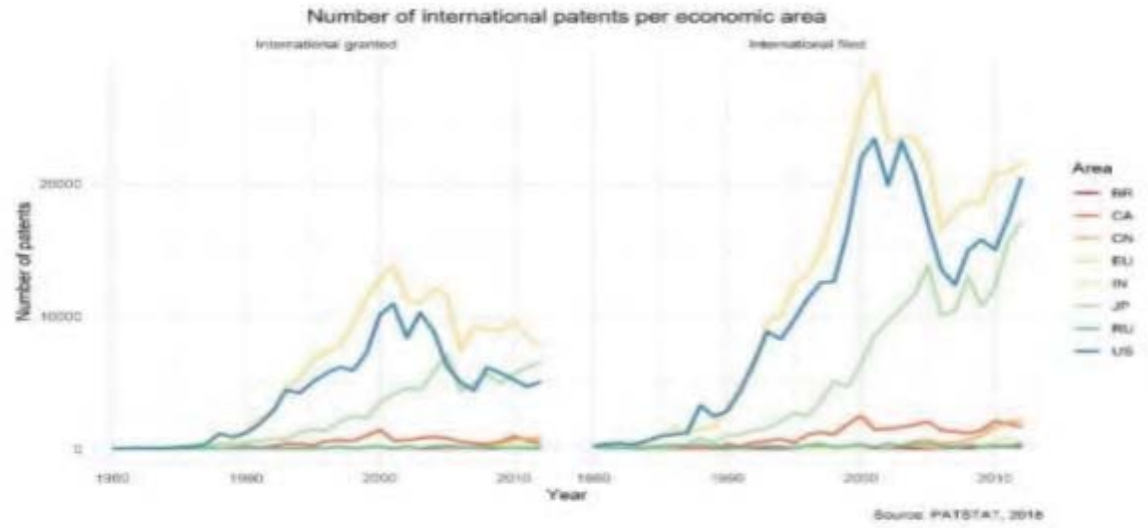
	Footnote 1 Annex I: "Given that it is not possible in practice to construct collecting systems and treatment plants in a way such that all waste water can be treated during situations such as unusually heavy rainfall, Member States shall decide on measures to limit pollution from storm water overflows." A general definition beyond the specific example of unusually heavy rainfall is missing.
Term/obligation	**Clarity of some definitions**
Industrial waste water	Requirements in the regulations/authorizations for industrial waste water discharges into urban waste water systems are vaguely defined under article 11 and Annex IC. The same applies to direct discharges under Art. 13 from biodegradable industrial waste water (Annex III)
Sludge	Sludge is defined in Art. 2(10) as "residual sludge, whether treated or untreated, from urban waste water treatment plants". This definition is not clear when seen in relation to the Sewage Sludge Directive. However, there is no evidence that this hindered the reuse of sludge.
Appropriate treatment	Art. 2(9) explains that "'appropriate treatment' means treatment of urban waste water by any process and/or disposal system which after discharge allows the receiving waters to meet the relevant quality objectives and the relevant provisions of this and other Community Directives". Under Art. 7 it is required that in those agglomerations below 2 000 p.e. equipped with a collecting system that discharge into freshwater or estuaries, that the collected waste water is subject to "appropriate treatment". It also applies to agglomerations below 10 000 p.e. discharging into coastal waters. It is unclear what kind of treatment level is referred to, however, it provides sufficient space to adapt treatment levels to needs and to new legislation, where necessary (for instance to meet the quality objectives of the Water Framework Directive or the Marine Strategy Framework Directive which were adopted later than the UWWTD).
Agglomerations	The term "agglomeration" does not necessarily refer to a city or municipality, but according to Art. 2(4) refers to "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". It is unclear what "**sufficiently concentrated**" means (no description or threshold fixed), and what methodology should

	be used to delineate agglomerations.
Individual or other appropriate systems	This term is used in Art. 3, see also IAS, and may cover a wide range of systems from storage tanks to individual treatment plant. The conditions set for using IAS in Article 3(1) are not entirely clear as they leave it up to the discretion of Member States to decide on the use of IAS.
Cold climate and high mountain region	Art. 4(2) of the Directive provides that a treatment less stringent than secondary may be applied to discharges to "*high mountain regions (over 1500 m above sea level) […] due to low temperatures*" (provided that such discharges do not adversely affect the environment). There have been discussions as to whether the reference to "high mountain region" is clear and appropriate, as low temperatures also occur at normal altitudes e.g. in Sweden and Finland. Since those countries were not EU Member States at the time of the adoption of the Directive, some criticisms have been heard that Art. 4(2) does not account for the diversity of geographic, climatic and meteorological conditions all over the Union.

Table 25 Unclear terminology.

Relevance

Number of international patents per economic area



Source: own elaboration, based on PATSTAT

Figure 62 Number of internationally held water technology related patents for major economic regions, PATSTAT (1980-2012). Left shows granted patents, right shows filed patents. Source: Blue2, (2018) Part A2.

ANNEX 5: REFERENCES

Main EU water legislation

Urban Waste Water Treatment Directive (UWWTD): Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment, OJ L 135, 30/05/1991

Water Framework Directive (WFD): Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1).

Groundwater Directive (GWD): Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration, OJ L 372, 27/12/2006.

Drinking Water Directive (DWD): Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, OJ L 330, 5.12.1998, p. 32.

Environmental Quality Standards Directive (EQSD): Directive 2008/105/EC of the European Parliament and of the Council on environmental quality standards in the field of water policy as amended by the Priority Standards Directive 2013/39/EU, OJ L 348, 24/12/2008.

Nitrates Directive (ND): Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources, OJ L 375, 31/12/1991

Industrial Emissions Directive (IED): Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), OJ L 334, 17/12/2010

Bathing Water Directive (BWD): Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality, OJ L 64, 4/3/2006

Marine Strategy Framework Directive (MSFD): Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive), OJ L 164, 25/6/2008.

Case law

Case C-280/02 Commission of the European Communities v French Republic.

Case C-236/99 Commission of the European Communities v Kingdom of Belgium.

Case C-310/10 European Commission v UK

Case C-427/17 European Commission v Ireland

Case C-100/13 European Commission v Germany.

Case C-280/02 Commission of the European Communities v French Republic.

Case C-398/14 European Commission v Portuguese Republic.

Case C-252/05. The Queen on the application of Thames Water Utilities Ltd v South East London Division, Bromley Magistrates' Court.

Case C-310/10 European Commission v UK.

European Commission documents

European Commission (2001).
Extensive wastewater treatment processes adapted to small and medium sized communities.

European Commission (2009).
Guidance document No. 20. Common implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance document on exemptions to the environmental objectives.

European Commission (2009).
Guidance Document No. 23. Common Implementation Strategy under WFD Guidance document on eutrophication assessment in the context of European Water Policies.

European Commission (2012a)
Guidance Document No.28. Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Technical Guidance on the preparation of an Inventory of Emissions, Discharges and Losses of Priority and Priority Hazardous Substances.

European Commission (2012b).
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Blueprint to Safeguard Europe's Water Resources. COM/2012/0673 final.

European Commission (2012c).
A Water Blueprint – taking stock, moving forward.

European Commission (2015).
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Consultative Communication on the Sustainable Use of Phosphorus (COM/2013/0517 final).

European Commission (2016)
Synthesis Report on the Quality of Drinking Water in the Union examining Member States' reports for the 2011-2013 period, foreseen under Article 13(5) of Directive 98/83/EC.

European Commission (2016b).
Sewage sludge.

European Commission (2016c).
WFD Reporting Guidance.

European Commission (2017).

Roadmap for Evaluation of the Urban Waste Water Treatment Directive 91/271/EEC (UWWTD).

European Commission (2017b)
Fitness Check of Reporting and Monitoring of EU Environment Policy. SWD(2017) 230

European Commission (2017c).
AMR Action Plan.

European Commission (2017d)
9th implementation report.

European Commission (2017e)
Special Eurobarometer 468/2017: Attitudes of European citizens towards the environment.

European Commission (2018a).
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A European Strategy for Plastics in a Circular Economy. COM/2018/028 final.

European Commission (2018b)
Consultation strategy.

European Commission (2018c).
Proposal for review of the drinking water directive.

European Commission (2018d)
Mercury

European Commission (2018e).
Water reuse.

European Commission (2018f).
Impact Assessment - accompanying document – proposal for a Regulation of the European Parliament and of the Council on minimum requirements for water reuse.

European Commission (2018g).
Urban Water Atlas.

European Commission (2019).
Blue2 study: Assistance for better policy-making on freshwater and marine environment.

European Commission (2019a).
Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee. European Union Strategic Approach to Pharmaceuticals in the Environment.

European Commission (2019b).
Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the evaluation of the 7th Environment Action Programme (COM(2019)233 final)

European Commission (2019c).
Report from the Commission to the European Parliament and the Council on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC). Second River Basin Management Plans and First Flood Risk Management Plans. COM(2019)95 final.

European Commission (2019d).
EU Action on Antimicrobial Resistance.

European Commission (2019d).
LIFE programme Waste water treatment.

European Commission (2019e).
Proposal for a regulation on minimum requirements for water reuse.

European Commission (2019f).
Priority substances under the Water Framework Directive.

European Commission (2019g).
Fitness Check on the Water Framework Directive, its daughters and the floods Directive. Open public consultation.

European Commission (2019h).
Water reuse: Commission welcomes the provisional agreement on minimum requirements for water reuse in agriculture.

European Commission (n.d.).
JASPERS: Joint Assistance to Support Projects in European Regions.

European Commission (n.d.).
TAEIX-REGIO Peer 2 Peer.

European Commission (n.d.).
Peer Learning for environmental authorities.

European Commission (n.d.).
Structural Reform Support Service.

UWWTD-rep group, (2007).
2007 guidance document.

European Commission (n.d.).
Energy strategy and energy union.

European Environment Agency and European Chemicals Agency

EEA (2015),

Bathing water quality.

EEA (2016).
European water policies and human health. Combining reported environmental information. Report No 32/2016.

EEA (2017).
Climate change, impacts and vulnerability in Europe 2016. An indicator-based report. No. 1/2017.

EEA (2018a).
Water use and environmental pressures.

EEA (2018b)
European Waters – assessment of status and pressure 2018.

EEA (2018c).
European Bathing Water Quality 2017. No 2/2018.

EEA (2018d).
Industrial waste water treatment –pressures on Europe's environment. EEA Report No 23/2018.

EEA (2018e).
Mercury in Europe's Environment.

EEA (2018f).
Chemicals in European water – knowledge developments. EEA report No 18/2018.

EEA (2019a).
Oxygen consuming substances in European rivers. (Voluntary reporting from EEA's 33 member countries).

EEA (2019b).
Meeting note on antimicrobial resistance and urban waste water treatment.

EEA (n.d.a)
Waste water database, based on Member State reported data of the year 2014.

EEA (n.d.b)
Water and marine environment Articles.

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

EEA (n.d.d).
UWWTD website.

ECHA (2019)
Annex XV Restriction report. Proposal for a restriction.

European Court of Auditors reports

European Court of Auditors (2015).
EU- funding of urban waste water treatment plants in the Danube river basin: further efforts needed in helping Member States to achieve EU waste water policy objectives. Special report 02.

European Court of Auditors (2015).
Water quality in the Danube river basin: progress in implementing the water framework directive but still some way to go.

European Court of Auditors (2016).
Combating eutrophication in the Baltic Sea: further and more effective action needed. Special report 03.

Scientific and other literature

Aus der Beek, T. et al. (2015).
Pharmaceuticals in the environment – Global occurrences and perspectives. Critical Review in Environmental Toxicology and Chemistry.

Barco et al. (2008).
First flush in a combined sewer system. Chemosphere 71, 827-823, p. 827.

Barrat, L. & People, C. (2019).
Ex-Post Study on LIFE and the Urban Waste Water Treatment Directive (91/271/EEC), p. 49.

BIO Intelligence service (2013).
Study on the environmental risks of medicinal products. Final report:

Bloomer, E. and McKee, M. (2018)
Policy options for reducing antibiotics and antibiotic-resistant genes in the environment.

Bouraoui, F et al. (2014).
Scenario analysis for nutrient emission reduction in the European inland waters.

Britannica (n.d.a).
Biological oxygen demand.

Britannica (n.d.b).
Combined sewers.

Britannica (n.d.c).
Wastewater treatment.

COWI et al. (2019).
Integration of environmental concerns in Cohesion Policy Funds (ERDF, ESF, CF) – results, evolution and trends through three programming periods (2000-2006, 207-2013, 2014-2020). Final report.

Eawag, Faure, F, & Spuhler, D. (2019).
Conventional Sewers (Combined sewers). Sustainable Sanitation and Water Management Toolbox.

Eunomia (2018).
Investigating options for reducing releases in the aquatic environment of microplastics emitted by (but not intentionally added in) products.

ETC/ICM (2016)
European assessment of eutrophication abatement measures across land-based sources, inland, coastal and marine waters. Technical report 2.

ETC-ICM (2017).
Emissions of pollutants to Europe's waters – sources, pathways and trends.

EurEau (2017)
Water matters. p.78.

EurEau (2018).
Water and the EU's Circular Economy. Briefing note.

EurEau (2018).
The governance of water services in Europe.

Fuchs, S., Scherer, U., Wander, R., Behrendt, H., Venohr, M., Opitz, D., Hillenbrand, Th., Marscheider-Weidemann, F., Götz, Th. (2010).
Calculation of Emissions into Rivers in Germany using the MONERIS Model. Nutrients, heavy metals and polycyclic aromatic hydrocarbons. UBATexte 46/2010, Dessau

Ganora et al (2019).
Opportunities to improve energy use in urban wastewater treatment: a European-scale analysis. Environmental Research letters 14 044028.

Global water intel (2016).
The top 50 water businesses.

Gupta, K. & Saul, A.J. (1996).
Specific relationships for the first flush load in combined sewer flows. Water research, volume 30, Issue 5, pp. 1244-1252.

Grizzetti et al. (2017).
Human pressures and ecological status of European rivers. Scientific reports Nature.

Haigh, N. (2016).
EU Environmental Policy: Its Journey to Centre Stage. Earthscan, London

Hudcova, H et al (2019).
Present restrictions of sewage sludge application in agriculture within the European Union. Soil and Water Research, 14, p. 104-120.

ICF et al. (2017).
Support to the Fitness Check of monitoring and reporting obligations arising from EU environmental legislation.

IEEP, Ecologic Berlin, Central European University (2019).
Development of an assessment framework on environmental governance in the EU Member States.

Internationale Kommission zum Schutz des Rheins (2019).
IKSR-Empfehlungen zur Reduktion von Mikroverunreinigungen in Gewässern.

IPCC (2006).
Guidelines for National Greenhouse Gas Inventories. Volume 5, Chapter 6.

Kay, D. (2018).
Presentation on health benefits of UWWTD. Stakeholder conference on the Evaluation of the UWWTD. Available here: Evaluation Study 2018.

Kompetenzzentrum (n.d.)
General information.

Navrud, S (2016).
Possibilities and challenges in transfer and generalization of monetary estimates for environmental and health benefits of regulating chemicals, OECD Workshop on socioeconomic impact assessment of chemicals management, ECHA, Helsinki July 6-8

Niva (2018).
Microplastics in agricultural soils: A reason to worry?

OECD (n.d.)
Methodology and FEASIBLE Computer Model.

OECD (2009),
Managing water for all: An OECD perspective on pricing and financing.

OECD (2018).
Contaminants of emerging concern.

OECD (*forthcoming*).
Investment needs of and financing options for the EU water sector.

OECD (2019).
Pharmaceutical residues in freshwater – hazards and policy responses.

Phillips et al. (2018),
The value of bathing waters and the influence of bathing water quality: Final Research Report

Pistocchi, A., Dorati, C., Grizzetti, B., Udias, A., Vigiak, O. and Zanni, M. (2019)

Science for Policy. The effects of the Urban Waste Water Treatment Directive. Water quality in Europe: effects of the Urban Wastewater Treatment Directive. A retrospective analysis of Directive 91/271/EEC. Joint Research Centre.

POWERSTEP (2018).
Policy brief – The potential of the waste water sector in the energy transition.

Prata, (2018).
Microplastics in waste water: state of the knowledge on sources, fate and solutions. p.262-265.

Ricardo, (2019a). EEA activity 1.5.2
Urban waste water treatment – approaches, challenges and opportunities.

Ricardo, (2019b). EEA activity 1.5.2
Urban Waste Water – non-connected dwellings.

Right to water (2019).
Water and sanitation are a human right, reference to OPC WFD FC

Sawyer, C., McCarty, P., & Parkin, G. (2003).
Chemistry for Environmental Engineering and Science (5th ed.). New York: McGraw-Hill.

Schmitt H, Blaak H, Kemper M, van Passel MW, Hierink F, van Leuken J, de Roda Husman AM, van der Grinten E, Rutgers M, Schijven J, de Man H, Hoeksma P, Zuidema T (2017).
Sources of antibiotic resistance in the environment and intervention measures.

Swedish Environmental Protection Agency (2017).
Advanced wastewater treatment for separation and removal of pharmaceutical residues and other hazardous substances -Needs, technologies and impacts.

Sutton et al. (2011).
The European Nitrogen Assessment, Chapter 22

Spit et al. (2018).
The Economic Value of Water - Water as a Key Resource for Economic Growth in the EU. Deliverable to Task A2 of the BLUE2 project "Study on EU integrated policy assessment for the freshwater and marine environment, on the economic benefits of EU water policy and on the costs of its non- implementation".

Stauffer, B & Spuhler, D. (2019).
Separate sewers. Sustainable Sanitation and Water Management Toolbox.

Sutton et al. (2011),
The European Nitrogen Assessment, Chapter 22

Surfrider (2018).
Biomedia pollution.

UKWIR (2014),

Chemical investigations programme: Volume 1 – Main report. Report Ref. No. 13/EQ/01/6.

UKWIR (2018a),
The national chemical investigations programme 2015-2020. Volume 2 monitoring of substances of emerging concern. Report Ref. No. 18/EQ/01/13.

UKWIR (2018b),
The national chemical investigations programme 2015-2020, Volume 1 part 1 (2015-2017) Monitoring of sewage effluents, surface waters and sewage sludge: Annex A CIP2 Sludge Investigations. Report Ref. No. 18/EQ/01/12.

Umweltbundesamt (2015).
Organische Mikroverunreinigungen in Gewässern. Vierte Reinigungsstufe für weniger Einträge. p.8.

Umweltbundesamt et al. (2017).
Support to the implementation of the UWWTD – COD substitution scoping study.

Umweltbundesamt (2015).
Organische Mikroverunreinigungen in Gewässern. Vierte Reinigungsstufe für weniger Einträge. p.8.

Umweltbundesamt (2017).
Wastewater management in the Danube region. Challenges and opportunities of EU accession.

UNESCO (2019).
Emerging pollutants in water and waste water.

United Nations (n.d.a)
Sustainable Development Goals. Goal 6: Ensure access to water and sanitation for all.

United Nations (n.d.b).
Clean Water and Sanitation: Why it matters.

Vigiak, O., Grizzetti, B., Zanni, M., Dorati, C., Bouraoui, F., Aloe, A., Pistocchi A.,
Estimation of domestic and industrial waste emissions to European waters in the 2010s, EUR 29451 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-97297-3 , doi:10.2760/08152, JRC113729.

VSA-Plattform (n.d.)
Verfahrenstechnik Mikroverunreinigungen

Water UK (2017).
Wipes in Sewer Blockage Study. Final Report.

WHO (2017).
Drinking Water Parameter Cooperation Project. Support to the revision of Annex I Council Directive 98/83/EC on the Quality of Water Intended for Human Consumption (Drinking Water Directive). Recommendations.

WHO (2018a).
Guidelines on sanitation and health.

WHO (2018b).
WHO water, sanitation and hygiene strategy 2018-2025, p.5.

WHO (2019).
A global health guardian: climate change, air pollution, and antimicrobial resistance.

Wood, IEEP, COWI, Cenia, and HR Wallingford (2019).
Evaluative study on the Urban Waste Water Treatment Directive.

Wood et al., (2019).
Digestate and compost as fertilisers: Risk assessment and risk management options.

Woodard & Curran Inc (2006).
Industrial Waste Treatment Handbook.