Assessment of impact of storm water overflows from combined waste water collecting systems on water bodies (including the marine environment) in the 28 EU Member States

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1 INTRODUCTION

Overview

This final report summarises key results and proposals for next steps for the project on the *Assessment of impact of storm water overflows from combined and separate waste water collecting systems on water bodies (including the marine environment) in the 28 EU Member States*.[1] The final reports for the four tasks of the project as well as a layman's summary for each of them are sent in separate documents.

The main objective of this project is to provide the European Commission (DG Environment) with an overview of the impacts of storm water overflows and how these are regulated at EU and Member State level. One of the actions proposed in the Blueprint to Safeguard Europe's Water Resources[2] is to improve compliance rates on waste water treatment by 2018 and the reduction of storm water overflows appears essential to the achievement of this objective. The ruling of the CJEU in case C-301/10 against the United Kingdom confirms that Member States are obliged to avoid spills from storm water overflows, except in exceptional circumstances or when they show that the costs involved would be disproportionate to the improvement of the state of the environment. In this context, more information is needed on storm water overflows – the way these are regulated at the international, United States, EU and Member State level, the number of occurrences, volume discharged and costs to achieve compliance with the UWWTD requirements, as well as the impacts on environment and health (Task 1.4).

The project was carried out in four tasks:

- *Task 1.1 - Assessment of the relevance of storm water overflows in relation to the different relevant EU Regulations, Communications and international Conventions and Commissions. Rough analysis of the relevant legal framework in the USA in comparison with the EU legal framework.*
- *Task 1.2 - Assessment of the specific regulations and guidance documents developed in each Member State regarding this issue including legal and guidance documents established for the implementation of relevant EU legislation (WFD, MSFD, BWD ...).*
- *Task 1.3 - Compliance assessment of provisions regarding storm water overflows in MS legislation in relation to requirements in EU legislation referred to in chapter 1, with main focus on the UWWTD.*
- *Task 1.4 - Assessment of the impacts of polluted storm water overflows developed through national scientific publications and developments of a specific chapter for the potential related risks for human health and livestock.*

[1] Specific Contract No. 070201/2014/SFRA/693725/ENV/C.2

[2] 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/2012/673.

2 MAIN FINDINGS AND CONCLUSIONS

This section provides the project's main findings and conclusions. Section 2.1 summarises EU law and policy regarding storm water overflows[3], and section 2.2 describes key provisions from international law and policy, found in documents prepared under Europe's regional sea conventions and river basin conventions. Section 2.3 then provides an overview of Member State regulations and guidance on storm water overflows, while Section 2.4 describes key lessons learned from the U.S. approach. Section 2.5 summarises the risks of storm water overflows in the EU Member States. Section 2.6 reviews scientific and grey literature on the health risks that can arise from overflows.

2.1 EU legislation and policy

Legislation

No single piece of legislation at EU level is specifically designed to regulate in detail storm water overflows and their impacts on the environment and human health. The most important document in this regard is Directive 91/271/EEC, the Urban Waste Water Directive (UWWTD), which is the only piece of EU legislation that refers expressly to storm water overflows.[4] There are nonetheless several other European environmental directives and regulations for the water sector which may regulate these issues in a direct or indirect manner.

Other Directives addressing water pollution, water quality and habitat conditions do not have express references to storm water overflows, but are implicitly relevant: these include *inter alia* provisions of the Water Framework Directive (WFD, 2000/60/EC), Bathing Water Directive (BWD, 2006/7/EC), the Groundwater Directive (GWD, 2006/118/EC) and the Environmental Quality Standards Directive (EQS, 2008/105/EC).

These pieces of legislation contain provisions that set *quality objectives* for water bodies – indeed, these are present in most of the directives and regulations analysed, including the UWWTD, WFD, BWD and Marine Strategy Framework Directive (MSFD). Naturally, rules requiring the achievement or maintenance of a quality status or establishing standards for the concentration of certain pollutants will require that storm water overflows, when they endanger that status or prevent the compliance with those standards, are managed and controlled.

The legislation setting water quality objectives also requires the *monitoring and/or assessment* of the parameters that are part of those objectives, including the impacts of pollution on water bodies. Thus, when relevant, storm water overflows need to be monitored and taken into account in the assessment of impacts on water bodies. This is also the case for impacts on species and habitats, as per the requirements of the Habitats Directive.

[3] A storm water overflow is an outlet from a combined sewerage system designed to relieve the system of excess flow collected as a result of heavy rain. The excess flow, also known as the storm water overflow, bypasses the urban waste water treatment plant and discharges untreated to receiving waters. Storm water overflows, carrying debris and pollutants directly into our waters, can compromise the environment and human health.

[4] Another express reference on storm water overflows is contained in Directive 2010/75/EU, the Industrial Emissions Directive (IED), with respect to waste incineration plants and waste co-incineration plants: this does not, however, cover urban sewerage and waste water treatment.

These Directives require in addition that Member States take measures for the *conservation* or, where necessary, for the *restoration* of the environment, including the status of water bodies or protected habitats. Where storm water overflows are assessed as having an important adverse impact, measures for the conservation or restoration of the environment will require action to tackle storm water overflows.

Likewise, several directives and regulations can regulate the *emissions* of pollutants. The WFD, the Groundwater Directive and EQS Directive call for measures to reduce emissions of polluting substances where required to attain good water body status: this can entail the regulation of storm water overflows. The UWWTD sets mandatory limits for specific polluting substances and specific requirements for storm water overflows. These and other legislation also require the *monitoring and/or the assessment of emissions to water* – for example, the EQS Directive calls for an inventory of polluting sources – and storm water overflows may need to be addressed.

Policy documents

No policy documents produced at EU level specifically address storm water overflows. However, some of the Commission communications in the area of the environment, and in particular those for the water sector, can be considered relevant for storm water overflows. These include namely the communications on Environment and Health (2003), on the Blueprint for to Safeguard Europe's Water Resources (2012), on Green Infrastructure (2013), and on the European Citizens' Initiative "Water and sanitation are a human right! Water is a public good, not a commodity" (2014).

Green infrastructure in cited in several of these documents, including the 2013 Communication: it can provide additional storage capacity for storm water and along with natural purification, thus reducing storm water overflows and their impacts. These are basic measures that can be implemented in all agglomerations in order to reduce the need of more expensive and heavy infrastructure. In this context, a policy document on Natural Water Retention Measures[5] has been adopted which highlights that in urban areas, natural water retention measures can mitigate the impact on intense rainfall and improve the quality of storm water discharged to receivers. A European website has been created to disseminate best practices on Natural Water Retention Measures[6].

The Communication on the European Citizens' Initiative "Water and sanitation are a human right! Water is a public good, not a commodity!" calls for the full implementation of EU water legislation, including the construction of missing of missing waste water infrastructure (collection systems and treatment) better management of storm water overflows.

The table provides an overview of the EU legal and policy documents reviewed, indicating where they contain obligations related to emissions and obligations for the management of water bodies.

[5] https://circabc.europa.eu/sd/a/2457165b-3f12-4935-819a-c40324d22ad3/Policy%20Document%20on%20Natural%20Water%20Retention%20Measures_Final.pdf
[6] http://www.nwrm.eu/

Table 1 - Overview of EU legislation and policy documents containing references potentially relevant for storm water overflows

	Obligations for emissions			Obligations for water bodies		
	Water quality standards	Monitoring & Assessment	Reduce emissions	Water quality objectives	Monitoring & Assessment	Restoration & Conservation
Legislation						
UWWTD	X	X	X	X	X	X
WFD	X	X	X	X	X	X
MSFD	X	X	X	X	X	X
BWD		X	X	X		
DWD			X	X		
GWD		X	X	X	X	
EQS		X		X	X	
Habitats			X	X	X	X
Birds			X	X		X
Floods					X	
EIA		X			X	
Farmed animals			X	X		
Reg. 854/2004		X		X	X	
Reg. 1881/2006						
Policy documents						
Blueprint for water	X	X	X	X	X	X
Water scarcity and droughts						
Green infrastructure			X			X
ECI			X			
Environment & Health				X	X	
Soil strategy			X			

2.2 International legislation and policy

The study reviewed regional sea conventions and river basin conventions in Europe, as well as the recommendations and guidance documents issued by the commissions for these conventions. The conventions reviewed do not specifically refer to storm water overflows. They do, however, contain provisions related to the protection and management of freshwater and marine waters. Three documents prepared by the relevant commissions explicitly mention storm water overflows. These are: the Marine Litter Regional Actions Plan[7] produced by the OSPAR Commission and two recommendations issued by the Helsinki Commission (HELCOM).

HELCOM Recommendation 23-5[8] (adopted in 2002) aims at reducing the discharges of pollutants from urban areas by the proper management of storm waters and limiting the oil present in storm water. In particular, the Recommendation states that for combined sewer systems, no more than on the average 10 overflow events per year should be allowed (several overflow occasions during one single day are regarded as one). Alternatively, storm water overflows are to be limited to 10 per cent of the total load conveyed in the sewer system in a specific period. In addition, HELCOM Recommendation 28E-6, adopted in 2007, promotes good practices for small-scale waste water treatment plants (e.g. for settlements up to 300 p.e.); one is to avoid the flow of storm water to such plants.

2.3 Member State regulations and guidance

Storm water overflows are mentioned in two places in Annex I of the UWWT Directive. The first is in Part A on collecting systems, which states that:

> *The design, construction and maintenance of collecting systems shall be undertaken in accordance with the best technical knowledge not entailing excessive costs, notably regarding:*
> - *Volume and characteristics of urban waste water*
> - *Prevention of leaks*
> - *limitation of pollution of receiving waters due to storm water overflows*

The study found that nearly all Member States had transposed this provision well, and eight Member States provided further elements that went beyond a literal translation.

In addition, a footnote to Part A provides further indications on addressing storm water overflows. Here, 11 Member States had not transposed the footnote.

The study also looked for national standards and guidance addressing storm water overflows. It found that 16 Member States have national standards that regulate this issue, and another 8 Member States have standards that cover only one part of storm water issues, are non-binding or cover only part of the country. In addition, 11 of 28 Member States have guidance documents that directly address storm water overflows.

These national provisions set different types of requirements for storm water overflows. Prominent among them are the following approaches:

- Limits on the number of overflows: examples where these are used include the Flanders Region of Belgium, Poland and Portugal
- Minimum requirements for dilution rates, seen in Bulgaria, Czech Republic and Estonia

[7] www.ospar.org/documents/dbase/decrecs/agreements/14-01e_rap_marine_litter.doc+&cd=1&hl=pl&ct=clnk&gl=pl
[8] http://helcom.fi/Recommendations/Rec%2023-5.pdf

Other requirements include limits on the total volume of overflows or the maximum number of days of overflow events.

This review found that all Member States address storm water overflows on some level: for example, those with incomplete transposition of the UWWT Directive's provisions nonetheless have standards or guidance that mention the issue. Nonetheless, the review found that the majority of Member States do not have a national definition for key terms, including 'storm water overflows' themselves. This could be expected to hinder actions to address overflows: these definitions as well as a more structured approach will be necessary to ensure compliance with the approach set out in the CJEU's ruling regarding storm water overflows in case C-301/10 (see the box below).

Case C-301/10 Commission v United Kingdom

In this case, following an infringement procedure initiated by the European Commission against the UK, the Court of Justice of the European Union ("CJEU") was asked to rule on the scope of Member States' obligation concerning storm water overflows. In its judgement, the CJEU has established a two-step test to determine whether a Member State is in breach of the Directive in terms of storm water overflows:

1. Whether the discharges from the collecting systems or the treatment plants of the agglomerations are due to circumstances of an exceptional nature,
2. If that is not the case, whether the Member State has been able to demonstrate that the conditions for applying the concept of 'best technical knowledge not entailing excessive costs' were met.

The key for deviating from the absolute obligation that the Directive prescribes in Article 3 and 4 regarding discharges is for a Member State to prove that the discharges from the collecting systems or the treatment plants are due to circumstances of an exceptional nature. In this case, the Commission presented the Court with information in regards to the frequency of the discharges and their intensity in the UK. The high number of occurrence showed that it was not linked to exceptional circumstances, but rather it was seen as a normal occurrence. In fact, the above was not contested by the UK.

In regards to the second step of the test, the UK, in the first case, did not demonstrate to the "required legal standard that the costs of works to increase the capacity of the collecting system were disproportionate to the improvement in the state of the environment".

2.4 Lessons learned from the US approach

The United States has a comprehensive policy and legal framework to control storm water from combined sewers, and also a framework to address storm water in separate sewer systems. About 15% of the US population live in communities with combined sewer systems: these are found in particular in the northeastern part of the country, including in large cities such as Boston, Chicago and New York (many cities have both combined and separate systems – in New York City, about two-thirds of inhabitants live in areas with combined systems). The two frameworks are important elements of US efforts to reduce water pollution and ensure good water quality.

In 1994, the US Environmental Protection Agency (US EPA) introduced the Combined Sewer Overflow (CSO) Control Policy. Originally not a legislative document, the CSO Control Policy was in 2001 added to the Clean Water Act via a legal amendment. The CSO Control Policy requires all discharges from combined sewer systems, i.e. all outflows, to be covered by a single or coordinated permit. The permit-holders (usually municipalities or their water service companies) must undertake several steps. These include the implementation of 'nine minimum controls':

- proper operation and regular maintenance programmes
- maximum use of the collection system for storage
- control of solid and floatable materials in CSOs
- review and modification of pre-treatment requirements for industrial and commercial facilities to assure CSO impact are minimised
- maximisation of flow to treatment
- prohibition of CSOs during dry weather
- pollution prevention
- public notification of the location of CSO discharge points, occurrences of CSOs, their possible health and environmental effects of CSOs and any recreational or commercial activities (e.g., swimming and shellfish harvesting) that should be curtailed as a result of CSOs
- monitoring

Permit-holders must also develop and implement long-term control plans to bring their systems into compliance, defined via one of two alternative approaches:

- *Presumption* – average of 4 + 2 overflows per year *or* treatment of at least 85% of total volume during precipitation events; or
- *Demonstration* – show that the plan and its investments are adequate to meet water quality requirements under the Clean Water Act.

These long-term requirements do not appear to incorporate elements such as 'not entailing excessive cost', an approach included in the UWWT Directive and cited in the CJEU ruling on storm water.

The US states play a leading role in the implementation of the CSO Control Policy, as they do for other aspects of US water policy. Their work is overseen by US EPA, which can launch legal proceedings against states and also against individual municipalities to enforce this policy and other provisions of the Clean Water Act.

The US policy and legal framework to address combined sewer overflows in the US has required considerable time and effort. In 2008, for example, US EPA estimated that the total capital costs needed to prevent or control overflows in the US stood at 63.6 billion USD (equivalent to 79.5 billion USD or approximately 73 billion EUR in November 2015); more recent estimates were not found. Thus, after more than 20 years of the CSO Control Policy, its objectives have not yet been fully attained and cost estimates have increased. US EPA informally sees the CSO Control Policy as reaching the end of its first, 'implementation' phase. In this phase, EPA has checked (in sequence): how many systems have permits; if technology-based requirements are in place; and then, how many systems have long-term plans, also addressing water quality standards. Once all these elements will be in place in all communities with CSOs, the Policy will enter a 'compliance' phase. In recent years, the US has started to given greater attention to green infrastructure as a cost-effective measure to address combined sewer overflows (this tool was already a prominent measure for separate sewer systems).

2.5 Risk of storm water overflows in Member States

The occurrence of storm water overflows in EU Member States depends on a number of interrelated parameters, including the type of sewer system (combined or separate), the technical design of the combined sewer system (in particular the storage capacity), the rainfall variability, the impervious area that is connected to combined sewer systems, the sensitivity of the receiving water body and the legal and policy framework. Local impacts of polluted storm water overflows from combined storm water overflows can be important, in particular on bathing waters, sensitive areas and shellfish waters. Downstream impacts, including coastal areas, can be important for persistent substances such as litter, heavy metals and persistent organic pollutants.

The study reviewed EU-wide data on several parameters that could be used to measure the extent of storm water overflows. These include:

- Number of heavy rain events
- Number of flood events
- Impervious surface area
- Total generated waste water load

These data provide potentially useful indications, but also some contradictory results. Overall, more detailed information would be needed to estimate the risks of storm water overflows with some accuracy.

The analysis also reviewed Member State information on the occurrence and extent of storm water overflows. This shows that eight MS and regions had a good or excellent knowledge base: Flanders (BE), Denmark, the German regions assessed (North Rhine-Westphalia and Bavaria), Ireland, Sweden and England and Wales in the UK. While good information was found across most Member States on the extent of combined versus separate sewer systems, less information was obtained on overflow structures. The results suggest that in many Member States there is only a limited knowledge base at the national and regional level on the occurrence of storm water overflows. In 15 Member States, no publicly available information on the occurrence of storm water overflows was found. Although water utilities are likely to carry out some type of monitoring, it is not clear what data are provided to government bodies.

The review also showed that, in addition to a limited understanding on the occurrence of overflows, also limited data is available at Member State level on the underlying drivers of storm water overflows, i.e. rainfall variability, design characteristics of sewer and overflow structures and the area of impervious area that is connected to a particular combined sewer system. The latter parameters could be used as a proxy to estimate the occurrence of overflows.

These results highlight the need to improve the knowledge base, both at EU and Member State level: this is discussed further in section 3.1 below.

2.6 Potential health risks of contaminated storm water overflows

Storm water overflows from combined sewers occur during moderate or heavy rainfall, when the capacity of treatment facilities is exceeded, and result in the discharge of untreated sewage into surface waters or groundwater. Storm water overflows are typically associated with combined collection systems. Often, storm water overflows is one of the many sources of pollution that discharge into water bodies. While all sources of pollution need to be addressed, in this document the focus is on the impact of storm water overflows. This paper will not compare the impacts of storm water overflows with the impacts of other sources of pollution (this is highly context-specific).

Storm water overflows contain chemical and microbiological pollution, hazardous substances and litter which are a risk to human health, animal health and aquatic life. Some impacts of storm water overflows, as a consequence of a heavy rainfall event, are generally known. Examples are the closure of bathing waters associated with a temporarily bad water quality, massive fish kills related to a depletion of oxygen and the esthetic pollution of river banks or beaches with plastic litter.

Based on a literature review, it appears that the impact of storm water overflows on the receiving water body is not well researched and depends on various factors. The following overview provides some of the conditions under which storm water overflows may have significant impacts:

- Medium and small water bodies and in stagnant or slowly moving waters are more at risk for

storm water overflows, as they are more prone to disturbance in water quantity and quality as a consequence of a storm water overflow.

- The period in between storm water overflows is lower than the period required for the self-purification of water bodies. When there is a high frequency of overflows, the concentration of pollutants are less diluted than when there is a limited number of overflows
- For pollutants such as waste that contributes to marine litter, the impact of the cities downstream in the seas is primarily linked to the volume of storm water overflows. For a similar percentage of volume discharged without treatment large cities generate a larger volume as compared to smaller agglomerations, hence their impact is more significant.
- Storm water overflows that occur after a dry period lead to a so-called first-flush pollution. Pollution that accumulated in the sewer during the dry period will be flushed out with the first rain.
- The presence of human activities (e.g. bathing and other water leisure activities, drinking water consumption, fish and shell fish production areas) near storm water overflows discharge points increases the risk of substantial impacts. Also storm water overflows will have a bigger impact when the receiving water body is designated as sensitive to eutrophication.

Human exposure to polluted water is the other key factor determining health risks. The European Environment Agency's 2014 Report on European bathing water quality states that major sources of pollution responsible for faecal bacteria and poor quality in bathing waters are the pollution from sewage and water draining from farms and farmland, in particular under conditions of heavy rain and floods. In most cases, the incidents causing short-term pollution occur after periods of heavy rain when a mixture of surface water and sewage is discharged to the environment via combined sewer flows. The literature review indicates that bathers can be at risk from faecal pathogens as well as from toxic cyanobacteria, from dermato-toxins that irritate the skin and though ingestion or inhalation of other types of toxins. In contrast, exposure via drinking water is much less of a risk, as most European citizens have access to safe water supply.

Poor water quality could also affect downstream water uses, such as livestock watering and irrigation of food crops. These latter impacts have much in common with the use of (untreated or partly treated) wastewater for irrigation, for which good references are available elsewhere. Finally, persistent (non-biodegradable) pollution discharged by storm water overflows may end up in the marine environment. These include plastics and toxic substances, including the emerging issue of endocrine disruptors.

In the future, the impacts of storm water overflows could be influenced by several factors: climate change, which is expected to bring higher temperatures in Europe and higher rainfall in parts of the EU, as well as contribute to the reduction of river streams during the summer season, which will result in higher storm water overflow impacts; ongoing urban development, which is created more paved areas, resulting in higher rates of run-off and thus greater risks of storm water overflows; and emerging diseases, including diseases such as malaria whose occurrence in Europe may increase with climate change.

The assessment of the impacts of storm water overflows is complex and depends on many parameters for which large uncertainties exist. The review identified three broad areas where action could be taken to improve the knowledge base and better assess the impacts of storm water overflows:

- Better understanding of the impact of storm water overflows on the quality of the receiving water body
- Better assessment of health risks, based on the exposure of human activities to contaminated water
- An approach to monitor storm water overflows

These knowledge gaps are discussed further in section 3.1 below.

3 POSSIBLE NEXT STEPS

Storm water overflows in Europe are an important concern for water quality and thus for human health and the environment. The study has found, however, that there are important gaps in the EU's knowledge base. Section 3.1 reviews key areas for further development. At the time, the EU policy and legal framework for storm water overflows could be strengthened. Section 3.2 identifies key areas for attention in this regard.

3.1 Further development of the knowledge base

The study has gathered a broad range of information on policies and actions to address storm water overflows, both across EU Member States and in the United States, as well as on the impacts of these overflows. The study has also identified areas where the knowledge base could be strengthened: three main areas are presented here.

Better understanding of the occurrence of storm water overflows and their impacts on the quality of receiving water bodies

The study found that data on the occurrence of storm water overflows – including their particular volumes, duration and frequencies – is sometimes collected at local level but not often aggregated at regional or national levels. Monitoring does not always address all parameters, and even where there is attention, many aspects of overflows may be estimated rather than measured. In many cases, better data is needed at local level: includes the inventory and further development of data on rainfall variability, the extent of impervious surface areas, the types and sources of pollution, the capacity of the sewer system and the waste water treatment plant.

More information is needed on the pollution loads discharged during storm water overflows, including both chemical and micro-biological parameters – these are key aspects to understand the impacts of overflows on human health, animal health and the environment.

To understand the impacts, further information is needed on the sensitivity of water quality in receiving bodies to storm water overflows. In particular, it would be valuable to assess how long the impacts of storm water overflows last in different types of water bodies, as well their spatial extent. Monitoring the concentration of micro-organisms over time in receiving water bodies is crucial for the assessment of health risks.

In addition to further monitoring and research, data then needs to be aggregated and published at regional and national levels – and also made available at EU level.

Identify cost-effective measures to address storm water overflows

A variety of measures can reduce the occurrence and impacts of storm water overflows: these range from end-of-pipe solutions such as building water storage capacity to optimising the use of the waste water treatment plant and sewer system (for example, using sewer networks for additional storage and optimising pumping operations); to reduction of clean storm water entering a sewer system, for example by de-connecting impervious areas from combined sewer systems. Green infrastructure (or more specifically, Natural Water Retention Measures, NWRM) are potentially cost-effective measures to reduce storm water – examples include green retention basins, infiltration trenches and urban sustainable water drainage measures.

Information could be provided on the costs and benefits of different approaches, drawing on results in Member States and in the US. These costs and benefits depend greatly on the characteristics of individual cities and their sewer systems. Nonetheless, better information at EU, together with resources for further work, could inform Member State officials and stakeholders on ways forward. By

promoting Natural Water Retention Measures and their multi-benefits, the Commission has started to do that.

Better assessment of health and environmental risks

While a number of studies and reports discuss health and environmental impacts related to storm water overflows, relatively few distinguish these from other pressures, such as poorly working waste water treatment plants and agricultural runoff. Further research is needed to pinpoint the risks and impacts on human health and environment. This work can inform both public information activities as well as long-term actions to address overflows.

Public information on storm water overflows

While Member States are already required, under the BWD, to inform the public in case of short-term pollution of bathing waters, including impact of storm water overflows, this obligation could be extended to other areas. Drawing on the example in the US, the obligation to inform the public of the occurrence and the possible health and environmental effects of storm water overflows could cover as well recreational areas (e.g. for nautical sports) and commercial activities (e.g. for the harvesting of shellfish).

3.2 Strengthening the EU policy and legal framework

The review of the EU policy framework, the comparison with the US approach, the overview of potential health risks and the identification of major knowledge gaps provide a basis for identifying possible policy options. This section provides an initial set of issues to be considered.

Guidance to support implementation of the provisions on storm water overflows in the UWWTD

The UK case (C-301/10) affirmed the need for Member States to implement the provisions on storm water overflows in the UWWT Directive. The UWWT Directive indicates that collection systems are to be designed in accordance with the best technical knowledge not entailing excessive costs. In case C-301/10, the CJEU underlined that Member States should demonstrate that they have followed this provision. EU guidance could be developed and could clarify several concepts and principles cited in the Directive, in case C-301/10 and in discussions of storm water responses. For example:

- What are "normal climate conditions" under which the occurrence of storm water overflows would be non-compliant?
- What are "circumstances of an exceptional nature" under which storm water overflows may be acceptable? In particular, how would "exceptional rainfall" be defined?
- Could quantitative objectives and standards be set to control and reduce the occurrence and impact of storm water overflows? The latter could refer to the required dilution before discharging storm water overflows into the receiving water bodies and the acceptable number of overflows per year, relative to the type of the receiving water body. Objectives and standards may be differentiated for normal areas, for sensitive areas to eutrophication, for production areas for fish and shellfish and for bathing waters.

Guidance on applying this provision would help to ensure that Member States follow common approaches to address storm water overflows, including how to quantify in monetary terms the effects on the environment and health of untreated discharges. **But the review carried out for this study has shown that not only many Member States have already established standards and guidance for storm water overflows, but they also have different collecting system situations and local climatic conditions. Therefore, it could be difficult to reach an agreement between 28 Member States on a common European approach that is sufficiently strong to meet the requirements of the different European regulations.**

Promote Member State planning

As Task 1.1 has shown, Member States are already (directly or indirectly) required to integrate storm water actions with other planning under the UWWT Directive (the implementation plans to be submitted under Article 17), the Water Framework Directive (the river basin management plans), the Marine Strategy Framework Directive (programme of measures) and others. However, they would greatly benefit from EU guidance on the scope and content of storm water action plans.

EU guidance could present a common approach for the development of these action plans. The action plans could include monitoring provisions for the assessment of impacts of storm water overflows (local and downstream), standards for collection systems and treatment plants to attain and measures to meet such standards. Guidance could also provide information on the costs and effectiveness of different measures to reduce storm water overflows and their impacts.

Strengthen the EU knowledge base on storm water overflows and their impacts

This study has sought data on storm water overflows in EU Member States; however, the information available varies greatly across Member States. As discussed in Section 3.1 above, there are significant knowledge gaps.

For this reason, it would be valuable for the EU to gather further, comparable information on the extent of storm water overflows. An EU-wide database could be developed in phases and should cover at least the following elements:

- Inventory of the locations of overflow structures starting with agglomerations of more than 100 000 p.e.
- Inventory of functioning of the overflow structures starting with agglomerations of more than 100 000 p.e.
- Inventory of sewage storage capacity structures starting with agglomerations of more than 100 000 p.e.

Strengthening reporting on short-term pollution events under the Bathing Water Directive (98/83/EC) could further support this information base.

The EU could also support research or collect best practices related to storm water overflows, for example via Horizon 2020.