CIWEM Chartered Institution of Water and Environmental Management

RIVER WATER QUALITY AND STORM OVERFLOWS

A systems approach to maximising improvement

CONTENTS

Image courtesy of The Rivers Trust

INTRODUCTION

Sewage pollution of rivers from storm overflows is big news. In England, government has set out a range of requirements which target improved performance by water companies to stop this pollution from happening so frequently. But whilst water companies are central to the problem – and its solutions – they're not the only actors in the system which is driving it.

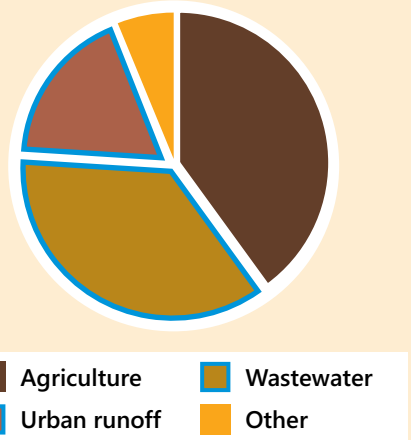
To get the most beneficial and lasting solutions, we need to look across this system to understand where action will be most effective and importantly, most affordable so more can be done for less. This report sets out the problem, why it's complex, and where action should be prioritised.

What condition are our rivers in and why?

Only 14% of rivers in England are classified as being in 'good ecological status' under the EU Water Framework Directive[1]. None of them meet recommended standards for chemical status[2].

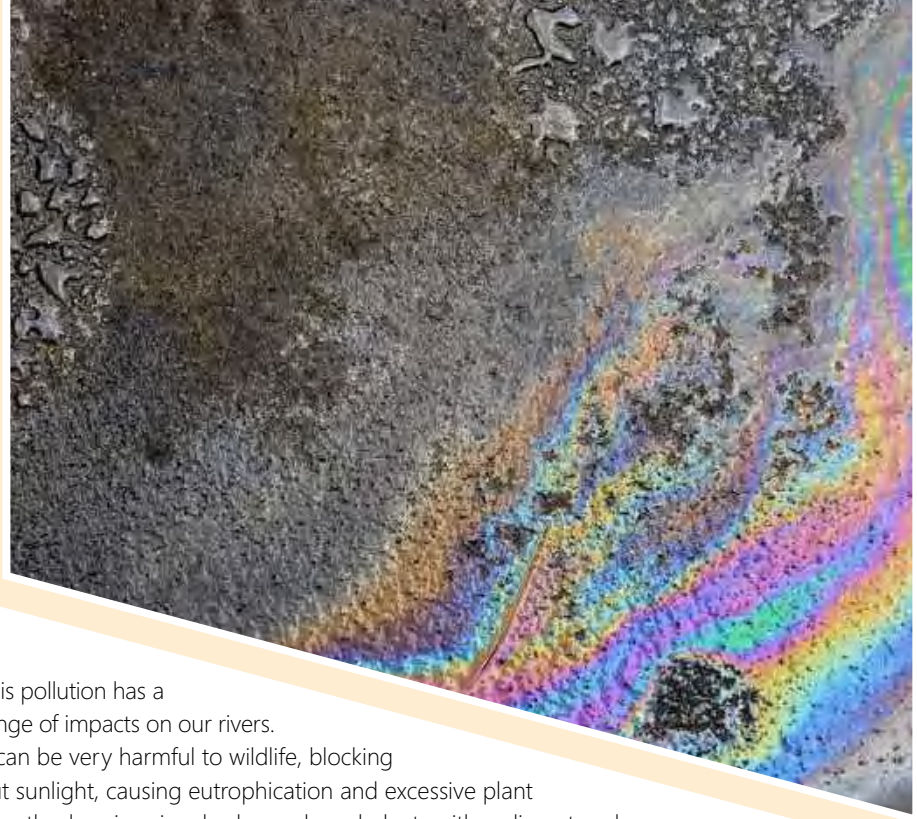
Whilst pockets of healthy, diverse riverine habitat exist, most are in a poor state and there are a range of reasons behind this. Rivers are being polluted by a "chemical cocktail" of substances[3]. This pollution is largely coming from a combination of three main sources: farming, the urban environment and the water industry.

Sources of water pollution to UK rivers and inland waters



Sources of pollution in rivers:

- **Agriculture** – in pesticides, fertilisers, farm slurry and soil washed off the land
- **Urban runoff** – in hydrocarbons, metals, microplastics, faecal matter and plastics
- **Water industry** – pollution from treatment works, sewer infrastructure and storm overflows releasing pathogens, phosphorus, ammonia, pharmaceuticals, microplastics and other anthropogenic pollutants



This pollution has a range of impacts on our rivers. It can be very harmful to wildlife, blocking out sunlight, causing eutrophication and excessive plant growth, clogging river bed gravels and plants with sediment and sewage fungus, removing essential oxygen from the water, and being directly toxic to fish and invertebrates.

Awareness of the fragile state of nature globally is rising and in 2018 government committed to being the first generation to leave the environment in a better state than we found it, setting out ambitions for cleaner water and nature in recovery[4]. These ambitions have been reflected in many components of the Environment Act 2021[5] and action to tackle pollution from storm overflows within the Act was heavily informed by the Sewage (Inland Waters) Bill 2019-21[6].

Polluted water can be harmful to human health. Contact with water either directly or in the form of aerosols can result in exposure to pathogens such as E. coli, making water users sick. As more and more people seek the health and wellbeing benefits of using rivers recreationally, this risk will increase. This use is also making people more aware of the poor state of health many rivers are in, and why this is happening.

Finally, pollution in our rivers makes them look bad. They can smell of sewage. This means people are less likely to use them for their important mental health and wellbeing benefits, and understand the breadth and diversity of nature which lives in them and provides important services to us as a society and economy.

WHAT ARE STORM OVERFLOWS?

There are hundreds of thousands of kilometres of sewers in England, draining a constantly changing volume and mixture of water from our homes and businesses, villages, towns and cities to sewage treatment works, rivers and the sea. These have always discharged effluent into receiving waters. Since the dawn of 'modern' wastewater management following the 'Great Stink'[7] of 1858, the aim has been to ensure that sewage is transported and disposed of as quickly as possible, causing minimal harm both to public health and to the environment.

For much pre-1960s development in our towns and cities, sewers remove the 'foul' sewage we put down our toilets and drains, along with rainwater from roofs, driveways and other hard surfaces in the same pipe – a 'combined sewer'. This mixture of effluent is taken to wastewater treatment works and treated before being discharged – to a quality agreed and set under permit by the Environment Agency (EA) – back into rivers or the sea.

This approach brings with it a risk: When it rains, the volume of rainwater in the network of combined sewers and sewage treatment works increases. The volume of this resulting effluent can exceed the designed capacity of the sewers (these are typically designed to handle up to six times their usual dry weather flow) and treatment works (which commonly can handle 3 times their dry weather flow, or two hours of peak flow into them).

This capacity has historically been sized to balance the financial cost of building very large sewers and treatment works, against the likelihood of pollution if capacity were exceeded during particularly heavy rain.

Exceedance of capacity is always a possibility in extreme weather events, so when combined sewers were built there was a need to include an ability for excess effluent to escape the network. This prevents effluent backing up and causing flooding through peoples' toilets and other drainage points into the network, once the sewer's capacity is reached.

This is where storm overflows come into play, operating as those 'pressure relief valves'. They exist either as overflows for sewage treatment works, used when the flow through the works exceeds the capacity of its storm tanks. Or, they exist within the sewer network itself as combined sewer overflows (CSOs) to prevent infrastructure being overwhelmed and / or sewers backing up and flooding homes and businesses with sewage. There are 15,000 in England, of which 13,350 discharge into rivers[8].

A function of how these overflows work is that they discharge untreated sewage into the environment. Whilst untreated, the principle in their being *storm* overflows is that at times when they are discharging, the sewage is diluted with large volumes of rainwater.

Normally in such storm situations the receiving watercourse would be also swollen with rain and at high flow, providing additional dilution and further reducing the impact on water quality and ecosystems.

There may also be a broad expectation that people would typically not be using such receiving waters recreationally in storm conditions so would not be exposed to this pollution (though recreational use is not a consideration for permits on rivers currently, but is a factor behind user groups seeking bathing water designations for inland waters).

It is, however, becoming evident that some overflows are discharging in dry weather – the negative impacts of which are significantly higher – and the degree to which others are discharging is having an unacceptably negative impact on the environment and river users.

Newer sewer networks have separate foul and surface water drains. This should stop sewage being discharged directly into rivers, though sometimes they can connect to combined networks downstream, and polluted urban runoff can still be discharged through surface water drains straight to watercourses with minimal treatment. And, development can be mis-connected so that foul sewage is connected into surface water drains (this is common following modifications to buildings). Separate sewer networks are no guarantee of zero pollution.

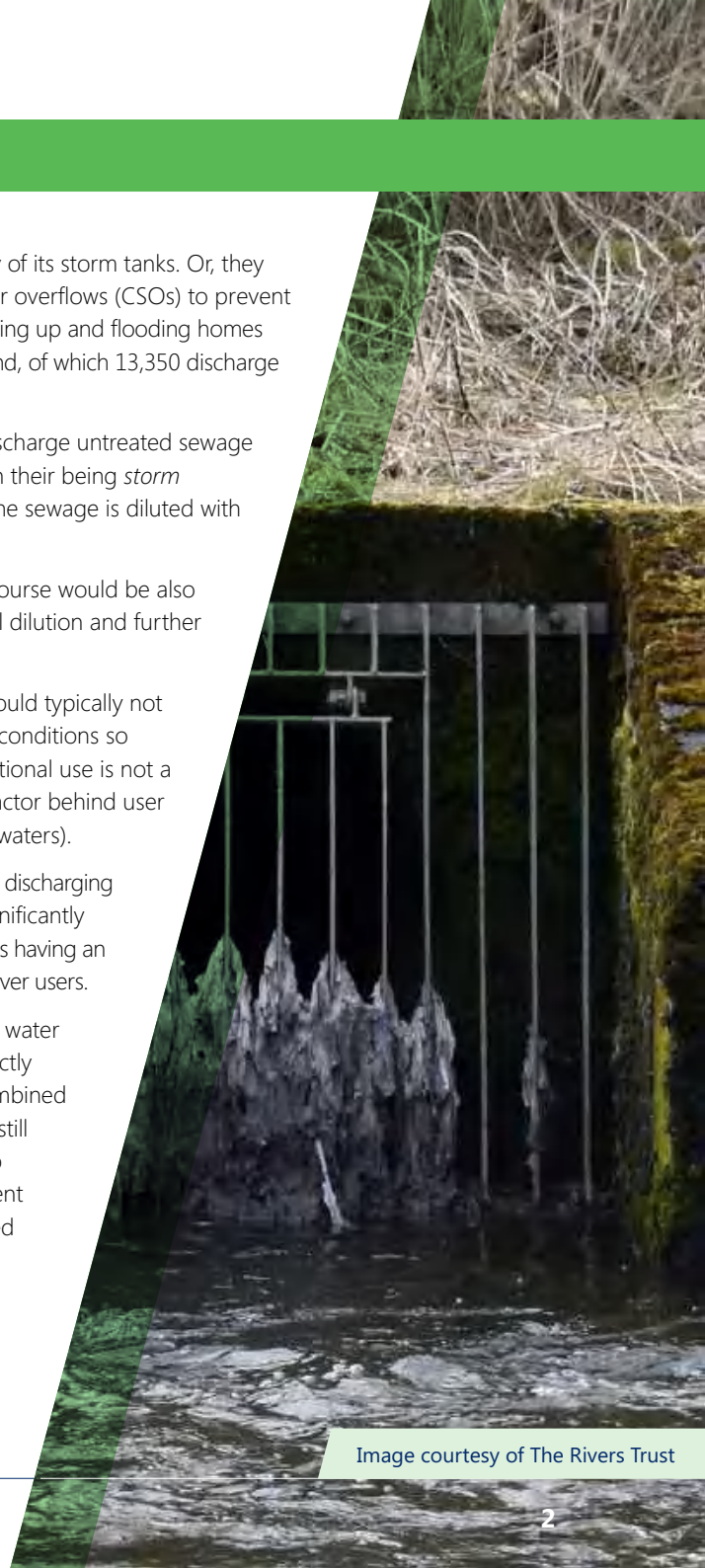
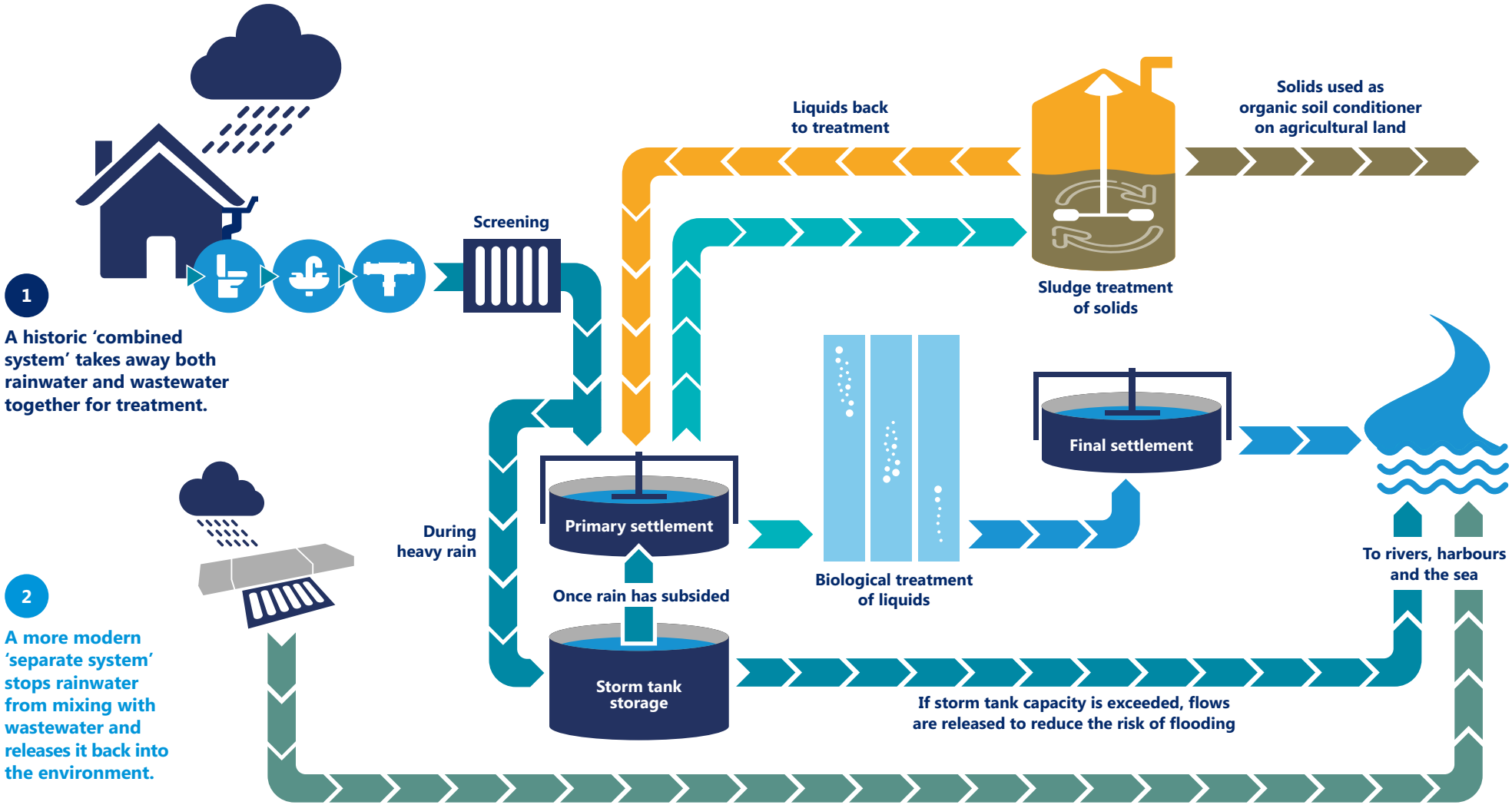


Image courtesy of The Rivers Trust

HOW DO THEY WORK? WHY DO WE HAVE THEM?

There are two types of sewer system...



HOW MUCH DO THEY CONTRIBUTE? WHY ARE THINGS GETTING WORSE?

The extent of storm overflows discharges has only become apparent in recent years as 'event duration monitors' (EDM) have been added to around 80% of storm overflows and have started to produce data on how frequently, and for how long, they are discharging.

Additional assessment of the capacity of sewage treatment works and whether they are treating the volume of sewage required under their EA permits before their storm overflows spill (known as flow to full treatment) will shed greater light on the extent of the challenge. Storm overflows have been identified as the factor behind reasons for not achieving good status (RNAG) in 402 water bodies.

The picture is a worsening one. The primary reason for this is that the number of overflows being monitored is still increasing as the EDM programme is completed and more data points are being added. However evidence identifies a history of increasingly frequent and visible pollution and declining wildlife[9].

Urban expansion

As the population has grown and in turn our towns and cities have expanded and become more densely developed, two things have happened:

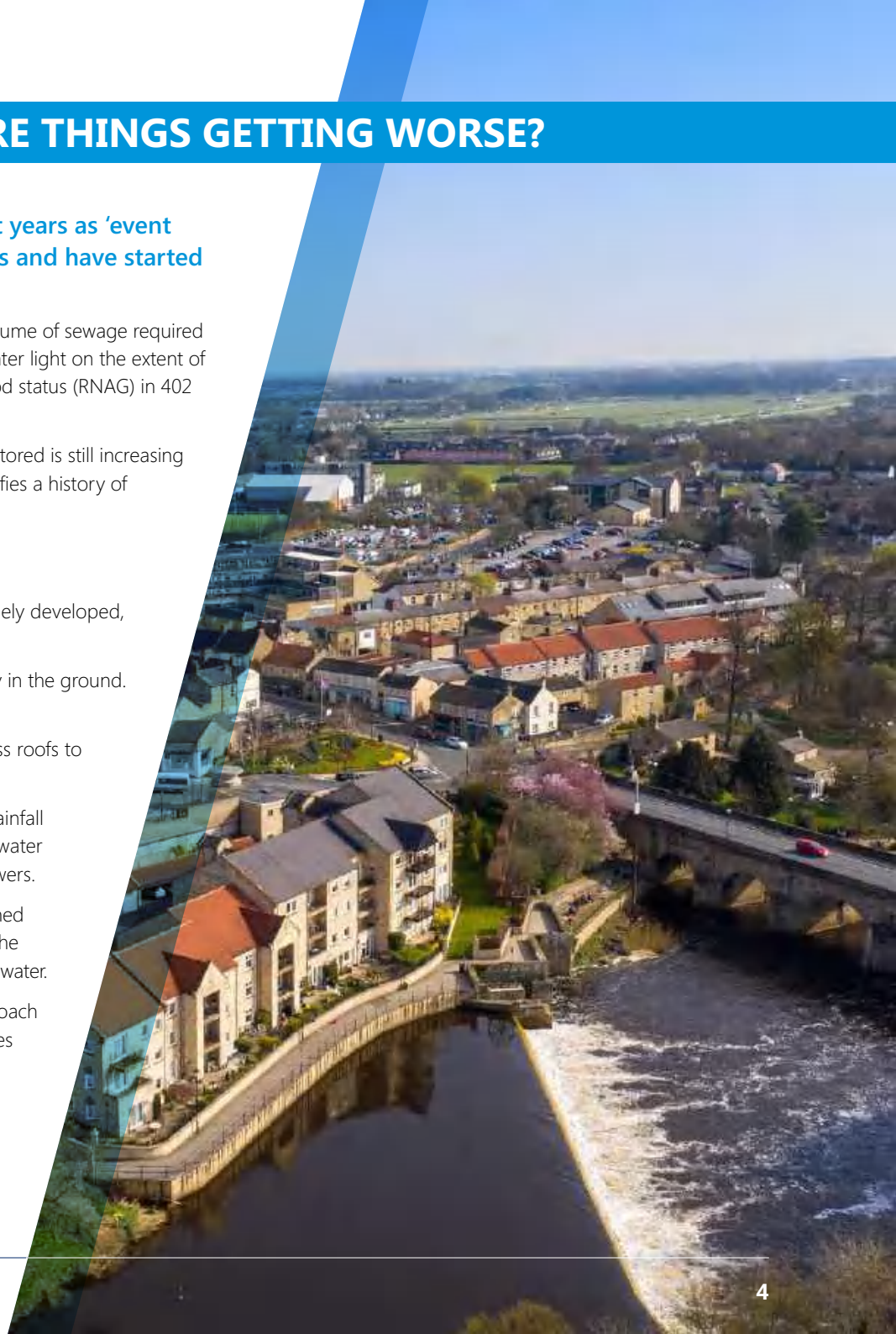
- Firstly, more people and more homes equals more toilets being connected to sewers that are already in the ground. This means more foul sewage in the sewer.
- Secondly, this expansion of development brings with it more hard surfaces. From house and business roofs to more roads, car parks, driveways, schoolyards, patios and so-on.

This hard surface transforms the ground from a natural, absorbent surface that can soak up plenty of rainfall before it gets saturated and the rain runs off the surface into a nearby drain or stream, into one which water cannot penetrate. On hard surfaces, rainfall will quickly run off into gutters and drains, then into the sewers.

Most towns in England date back beyond the 1960s and are therefore likely to have at least some combined sewers serving them. Often these are at the bottom of what is called a 'sewer catchment', as this is often the oldest, topographically lowest part of the network feeding into a treatment works and near to a receiving water.

Newer developments at the outer peripheries of these catchments may feature the more modern approach of separated sewers but can often feed into the older, combined ones. So, when new development takes place on a sewer network which has some combined part to it, more stress is put on the sewers and treatment works downstream.

Other factors can play a part too. Some sewers are in poor condition and prone to groundwater entering through joints or brickwork (infiltration). This inflow of water further reduces spare capacity in sewers.



Climate change

Our climate is changing. This is bringing increasing risks from its impacts, including surface water flooding associated with more intense summer rain storms that are projected to become up to 20% more extreme by government's climate change advisers[10], and more rainfall entering combined sewers.

Over 3 million properties in England are at risk of surface water flooding and we saw the impacts of this in London impacting homes, transport and hospitals and other parts of the country in the summer of 2021. Aggregate insured losses from this single flood event are expected to exceed £100m[11]. Managing surface water effectively in a changing climate will be critical to reducing storm overflow discharges.

Water company infrastructure maintenance and upgrades

Water and sewerage companies (WaSCs) have limited influence over the location and type of development that will generate more inflow into their sewers. They are statutory consultees on local plans, strategic infrastructure plans and site allocation planning, but not planning applications themselves.

WaSCs have a legal duty to maintain and extend the public sewer network to ensure that their areas are "effectually drained"[12]. They are expected to plan for maintenance and upgrades to their networks to meet current and future demand. In doing so they consult with other interested parties and take account of local development plans.

Provision has been made by Ofwat – the water industry's economic regulator – for WaSCs to maintain their wastewater and sewerage infrastructure and upgrade it to deal with additional sewage and surface water from new development, as part of the 5-yearly water industry investment planning rounds.

There is some conjecture over whether, and how much use has been made of this provision or indeed whether it has been adequate to cope with the scale of development or the pace of physical deterioration.

Various reviews[13,14] and government policies[15,16] dating back two decades have pointed to the problem of growing pressures on the sewerage system, the need for adequate investment in upgrades[17] and alternative ways of managing the surface water entering combined sewers and the consequences of failing to do so.

There has been widespread media and campaigner attention over the extent of WaSC profits since privatisation in 1989 and whether the balance between these and investment in infrastructure upgrades has been appropriate.

Government has moved to set stronger priority on storm overflows clean-up to Ofwat in its latest strategic guidance[18] to the regulator in advance of the next investment plans in 2024. Ofwat has written to WaSCs recommending that executive pay should be linked to environmental performance[19], and to require them to produce plans by April 2022 on reducing their impact on river pollution[20].

The EA has also been criticised for the limited number of prosecutions it has brought against WaSCs over the years for both breaching their discharge permits and more serious pollution incidents. Its water quality monitoring has been criticised[21] as being inadequate and too reliant on self-monitoring by WaSCs themselves. It has pointed at resource cuts since 2010[22] as limiting its ability to properly enforce regulations and tackle the pollution problem, whilst emphasising the challenges in bringing forward cases to court. In November 2021 the EA and Ofwat launched an investigation into discharge permit compliance at more than 2000 sewage treatment works[23].

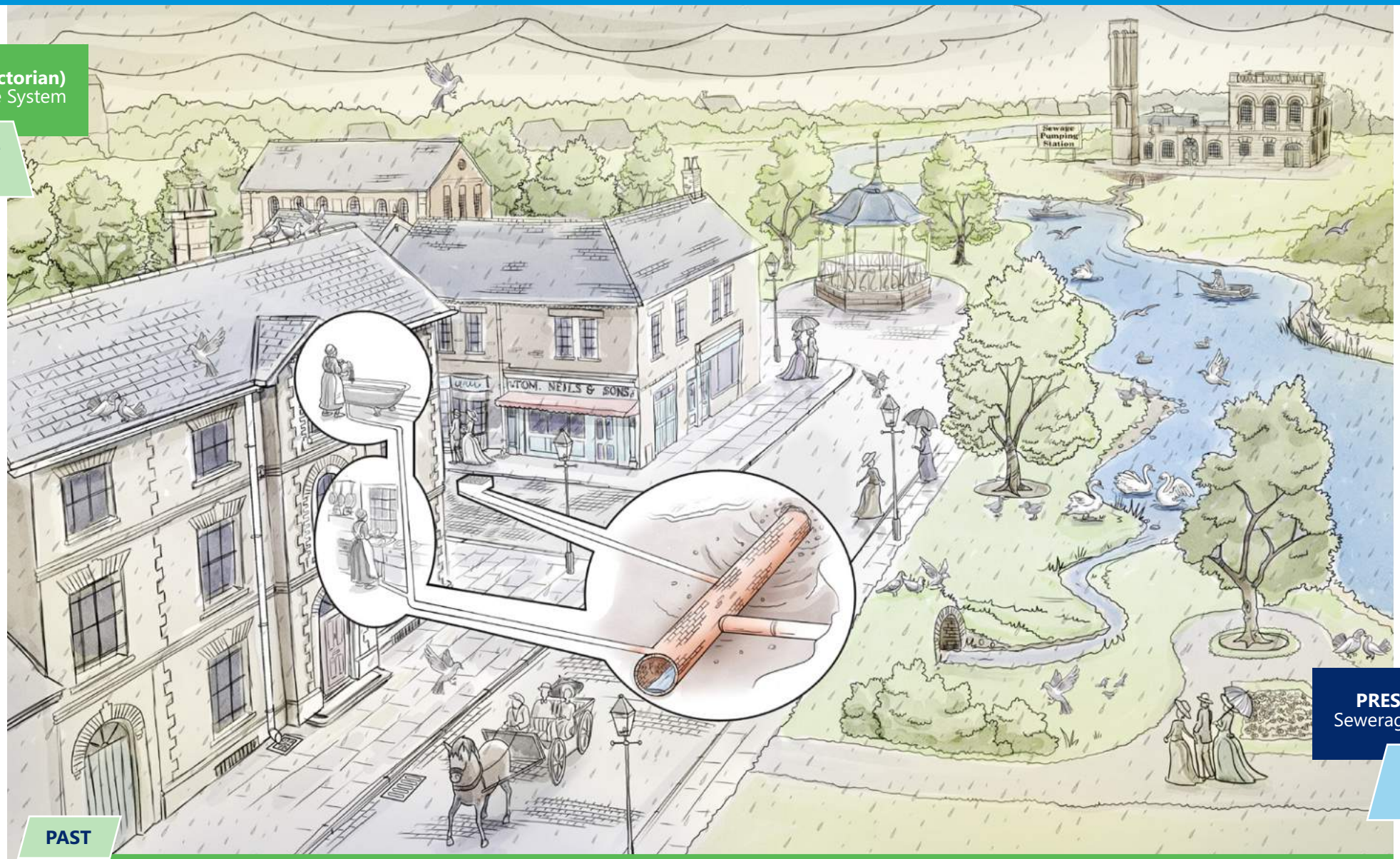
Sewer blockages

Disposal of wet wipes and other sanitary products which do not break down in the sewer, as well as fats, oils and greases can cause blockages which make storm overflows more likely to spill. These materials can harden into blockages (often referred to as 'fatbergs') which cause sewage to back up and overflow. WaSCs spend around £100m a year removing these blockages. These products can also cause extensive litter pollution in rivers and often contain plastics, contributing to microplastic pollution.

GROWING PRESSURE ON COMBINED SEWERS

PAST (Victorian)
Sewerage System

Click here to view



PRESENT DAY
Sewerage System

Click here to view

PAST

When sewerage systems were originally designed, towns and cities were smaller and less densely developed. People bathed less and there were less water-using appliances. Sewers carried foul sewage and surface water to treatment works and were designed to accommodate some urban expansion. Storm overflows existed but didn't spill too often.

WHAT ARE THE SOLUTIONS?

There are various ways to tackle this challenge. These involve:

- re-engineering existing infrastructure and landscapes to reduce the amount of surface water which enters combined sewer networks (using SuDS);
- optimising ways in which water flows are managed within the existing network ('active system management' using telemetry and remotely controlled structures);
- reducing the amount of groundwater infiltration through sewer repair;
- building additional storage tank capacity within the network and at treatment works;
- treating discharges from overflows in wetlands, which use natural processes to store and treat the effluent prior to onward discharge to the receiving water;
- preventing the problem of blockages from 'unflushable' products such as wet wipes and fats by tackling these problems at source is an obvious area for attention;
- improving engagement and data sharing between WaSCs and local authorities on local planning and infrastructure modelling, delivery and maintenance, and
- a further option – separating combined sewers into separate foul and surface water drains – is a particularly major and costly undertaking.

Various considerations will apply when assessing the most appropriate solution for any given location, sewer and overflow involving factors of topography, development, sewer condition and so-on. Levels of cost, disruption, carbon and the ability to achieve wider benefits including on climate resilience and amenity will inform decisions.

An assessment[24] of potential costs of a limited range of options scenarios has indicated remediation costs between £18bn and £600bn depending on extent of spill reduction and how targeted or blanket solutions were. The public appetite for investing in improvements will need to be understood, set alongside other household affordability pressures.

There is enormous scope within such a range to both prioritise action on the worst performing overflows initially and to achieve efficiencies through synchronising works with other utilities.

Additionally, combining funding streams where multiple benefits can be achieved for different risk management authorities (particularly flood risk management grant-in-aid for the management of surface water flood risk) could enable more cost-effective delivery at the local level.

Image courtesy of Susdrain

Sustainable drainage systems (SuDS)

Sustainable drainage mimics natural processes and reduces flooding by managing rainfall close to its source and wherever possible at, or near the surface. By building in permeable paving, channels, green roofs, swales, soakaways or ponds, SuDS can slow, store and treat water that could cause damage.

Planning policy currently requires SuDS to be delivered in major developments, mitigating the impact of new development on storm overflows but with limited impact on urban infill. SuDS therefore also need to be retrofitted into streets, public open space and private properties by WaSCs, highways authorities and others to prevent surface water drainage to combined sewer networks.

Many SuDS techniques use planted solutions which achieve a wide range of benefits: Treating and improving highway runoff water quality, reducing local surface water flood risk, providing habitat for nature, reducing the impacts of heatwaves in urban areas, improving air quality and enhancing amenity value of their location. Modelling locations to understand where SuDS would most effectively deliver this range of benefits could enable costs to be shared, e.g. between local authorities looking to reduce surface water flood risk and WaSCs reducing storm overflow spills.

Active system management (ASM)

A combination of monitoring current and recent sewer conditions, forecasting rainfall and proactive manipulation of pumps, storm tanks, weirs and control gates within the sewer network can help to maximise the available capacity to store water before a storm overflow spills. It can also help to maintain self-cleansing flows in sewers during normal operating conditions.

Increasingly, modelling, machine learning and AI are able to create digital twins of networks to understand the impacts of different forecasts and inform the best management of the sewer system to minimise the risk of storm overflow spills. The approach relies on utilising the existing capacity of the network, rather than creating new storage. It can be used effectively alongside other approaches which create new capacity but its ability to achieve significant improvements within the network itself are ultimately limited by existing capacity.

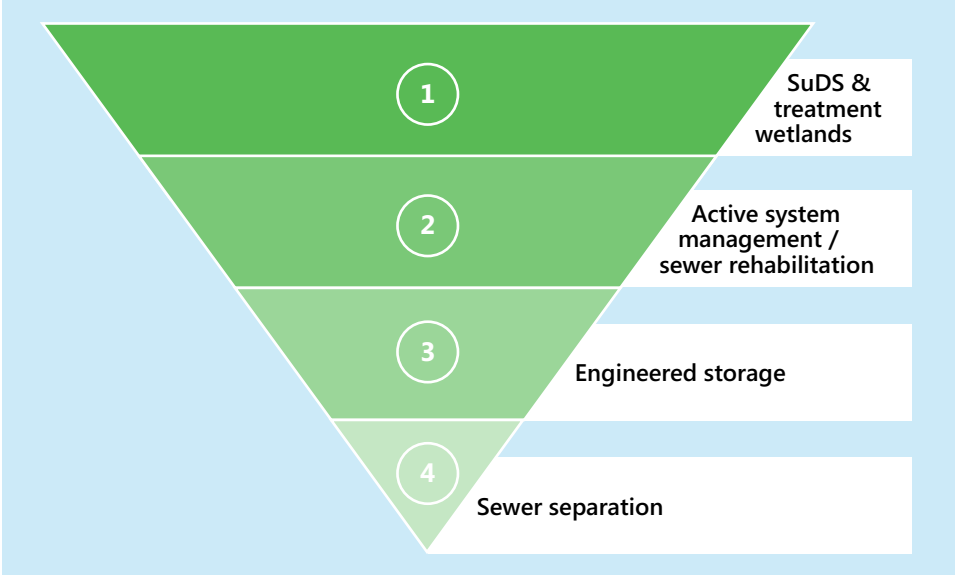
New engineered storage

Historically the approach to managing peaks of stormwater within drainage networks and at treatment works has been to build storage tanks to temporarily hold back water to prevent flooding, releasing it gradually once a storm has eased.

The approach provides high certainty of performance, but depending on the required location and hydraulic characteristics of the network, can involve disruption associated with construction, ongoing energy and carbon costs associated with pumping, and does not deliver any of the wider benefits of SuDS storage. Additionally, being buried such solutions may be harder to adapt and expand in future than surface-based systems.

A hierarchy of solutions

It is likely that there will be scope to use various combinations of these approaches depending on context. However in view of the desirability of achieving wider climate resilience (including flood risk management), nature and amenity benefits alongside those to water quality, the use of retrofitted SuDS is recommended where possible. Broadly, a sustainable hierarchy of solutions would involve:



Images courtesy of Hydro International

EASING PRESSURE ON COMBINED SEWERS

FUTURE

Particularly problematic combined sewers have been separated. Other networks have storm tanks added, are actively managed and have been repaired, and treatment works capacity has been increased. A wide range of SuDS have been retrofitted in streets and public space, 'greening the grey' and keeping rainwater out of combined sewers. Wet wipes don't contain plastic and people know not to flush them. Storm overflows spill rarely. People and nature are happier and healthier.

WHAT'S BEING PROPOSED?

In response to increasing media focus, local and national campaign group activity and growing public engagement with storm overflow pollution, government established a Storm Overflows Taskforce[25] in 2020 to consider what might be done to tackle the problem.

The Taskforce comprises government, its regulators and agencies, water companies and non-governmental organisations. Its purpose is to consider technical, societal and economic factors including the scale of the problem, proposals to significantly reduce the frequency, impact and harm caused by overflows and specific issues around data transparency and legislative requirements.

Measures in the Environment Act 2021

Government's existing proposals are encapsulated by a range of measures in the Environment Act 2021. This sets out a range of legal requirements on various parties:

Government must produce a Storm Overflow Discharge Reduction Plan by September 2022 (published for consultation in the spring), setting out how discharges (frequency, volume and duration) and their impacts will be reduced.

It must then report on progress against this plan in 2025 and every five years thereafter.

- It must also produce a report by September 2022 on the actions needed to completely eliminate storm overflows, together with the costs and benefits of doing so.
- WaSCs must produce annual reports on storm overflow discharges which have occurred in their networks.
- The EA must also report annually on storm overflows which have been made by WaSCs wholly or mainly in England.
- WaSCs must report all discharges from their storm overflows within an hour of them occurring, in a publicly accessible and understandable format.
- WaSCs must continuously monitor water quality for a range of parameters, upstream and downstream of storm overflows.
- WaSCs must secure a progressive reduction in adverse impacts of storm overflow discharges on the environment and public health.
- WaSCs must also produce Drainage and Sewerage Management Plans (DSMPs), setting out their long-term strategic position on how they will develop and maintain their wastewater and sewerage infrastructure, with these informing their 5-yearly investment plans approved by Ofwat.

Images courtesy of Windrush WASP

Reviewing provisions on sustainable drainage systems in new development

Outside of new legislation and the duties it creates, government has also committed to reviewing whether Schedule 3 of the Flood and Water Management Act 2010[26], passed into law more than a decade ago but never implemented, should now be commenced.

Schedule 3 set out a mechanism through which SuDS would be delivered to mandatory standards in new developments, and then adopted (owned) and maintained by an appropriate authority.

In 2014 government decided not to commence this requirement and to instead encourage SuDS delivery on major new developments via the planning system[27]. Whilst this approach has ensured that most such developments do feature SuDS, these are too often poorly designed and installed, so fail to deliver the multiple benefits which SuDS can provide, and do not have a secure arrangement in place for their adoption and maintenance.

As the pressures on networks grow, government has agreed it is appropriate to review these arrangements – which were implemented in Wales from 2019.

Images courtesy of Susdrain

Stronger government policies and programmes for WaSCs

Government sets out its strategic priorities to Ofwat every five years, covering where it wants to see the regulator prioritise WaSC investment in its subsequent business planning rounds. The latest priorities[28], published in early 2022 provided a clear steer: "*We expect companies to significantly reduce the frequency and volume of sewage discharges from storm overflows, so they operate infrequently.*" This marked a more explicit tone from government on sewage pollution, which should be reflected in the guidance Ofwat in-turn issues this summer to WaSCs.

The Water Industry Natural Environment Programme (WINEP) is the primary vehicle through which the EA, as the environmental regulator, prioritises investment by water companies to reduce the number of water bodies failing to achieve 'good status' under the EU Water Framework Directive.

For the period 2020-2025 it set out a £5.2 billion programme of monitoring, investigations, infrastructure improvements and catchment measures[29]. A consultation[30] in summer 2021 recognised the "*increasingly complex environmental challenges*", proposing a greater role for WaSCs in the developing a co-designed, co-developed and co-funded process with wider partners. Recognising the systemic nature of many 'good status' failures, it pointed towards wider use of nature-based solutions and tackling issues at their source.

IS THIS ENOUGH?

The measures in the Environment Act were hard-won additions to the legislation by campaigners and MPs. At the same time critics have argued that there was already sufficient legislation in place, in the Water Industry Act 1991's requirement for WaSCs to "effectually drain" their areas. They suggest the problem needs not more legislation, plans and monitoring but more concerted regulation and enforcement.

This example illustrates that there are many actions required to deliver improvements on storm overflows. Strong legislation and policy *and* stronger regulation and enforcement will be necessary, and more besides. This is why for a complex issue with many contributory and compounding factors, a systems-approach is particularly appropriate.

Images courtesy of Susdrain

A systems approach

Systems-thinking is not new in water management. Integrated water management, which recognises that multiple factors influence what happens to water in the environment and reflects this in solutions delivery, has been understood by practitioners for decades. It is reflected in a range of water management approaches, from the Catchment Based Approach (CaBA)[31] and the Water Framework Directive, to regional water resources planning and, internationally, concepts such as Water Sensitive Urban Design[32].

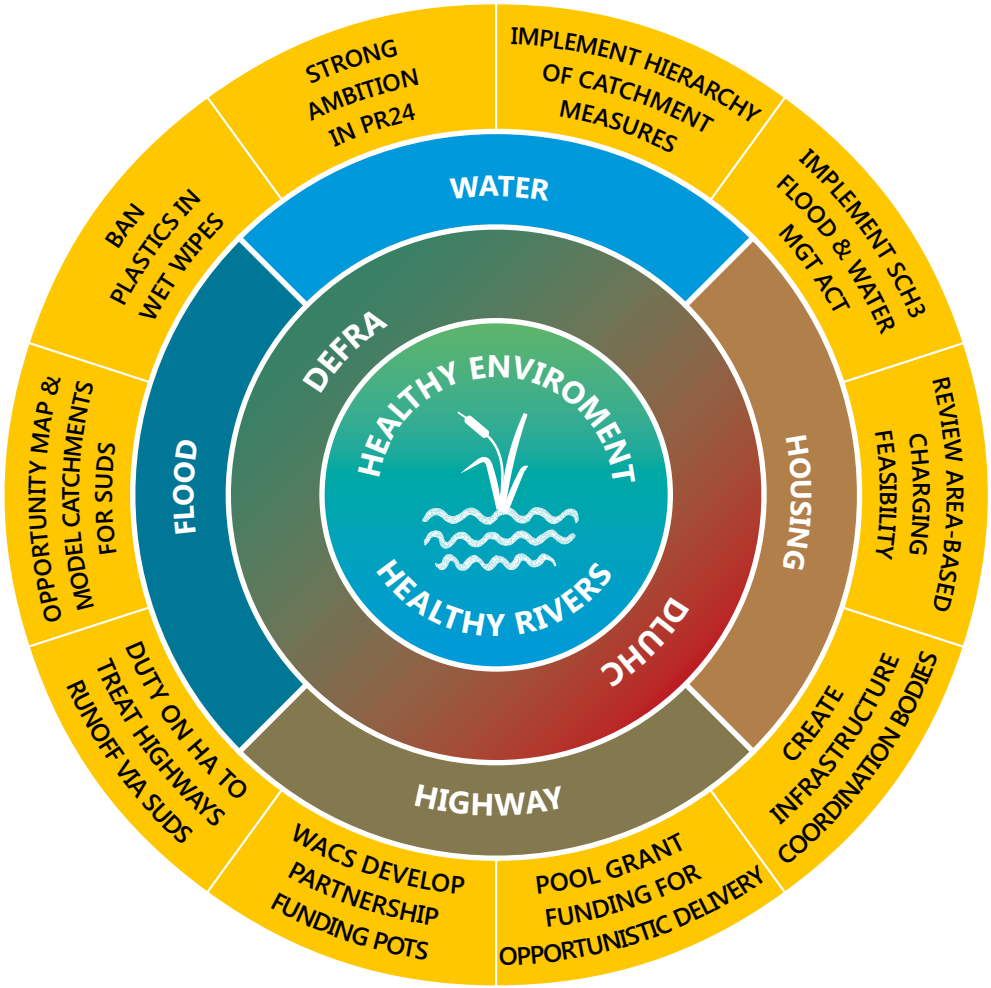
Because WaSCs do not control everything which influences storm overflow discharges (particularly development and surface water), solutions which focus mainly on WaSCs and their direct areas of responsibility risk failing to achieve the best improvements, in the most cost-effective and lasting way. Moreover, opportunities to also achieve climate resilience, nature recovery and place-making benefits in parallel could be missed.

This work engaged a range of stakeholders with detailed understanding of different dimensions of the challenge. Through workshops, these experts – from the water sector, local and national government, regulators, highways authorities, community groups and non-governmental organisations – identified and assessed how these dimensions interact and relate with each other in a systemic way to either enable or frustrate progress. They identified areas where constraints needed to be resolved and where opportunities for improved outcomes or efficiencies might be secured.

Systems experts from the Imperial College Centre for Systems Engineering and Innovation used workshop outputs to map the wider system impacting on storm overflow discharges, identifying reinforcing and balancing relationships, sub-systems for specific sectors and how they interacted with other sector systems. This identified areas of activity which potentially exacerbated problems and therefore pointed towards areas for intervention in the system to leverage[33] improvements.

RECOMMENDATIONS

Based on the outputs of expert workshops, systems mapping and identification of optimal opportunities for intervention in the wider storm overflows system, we propose the following recommendations:



1. Water companies to deploy a hierarchy of catchment-wide measures to reduce storm overflows, prioritising nature-based solutions and active system management over underground storage.

Retrofitting SuDS into urban areas with combined sewer networks offers the opportunity to reduce surface water entry to the network, slow the flow to manage flood risk, increase evapotranspiration and urban cooling, provide water quality, nature, place-making and health and wellbeing benefits.

Distributed SuDS spread individual small measures across catchments to achieve demonstrable benefit.[34] Treatment wetlands or natural storage areas at sewage treatment works can also help. ASM can help to optimise in-network flows, making best use of existing capacity before the need for hard-engineered solutions with associated operational energy and carbon costs and minimal wider benefits. These measures should be set out in DSMPs and aligned with local flood risk management strategies.

2. Government to implement Schedule 3 of the Flood and Water Management Act 2010, including mandatory multifunctional SuDS standards, a conditional right to connect development to public sewers and a route to adoption and long-term maintenance.

The current approach to implementing SuDS through the planning system too often results in poorly designed and delivered SuDS. These can fail to achieve benefits to water quality, quantity, amenity and biodiversity and have no secure arrangements for their future maintenance.

Schedule 3 sets a clear framework for unlocking SuDS' potential to enable more sustainable development. Over ten years on from its original enactment, this legislation is being reviewed by government. This should ensure the framework is workable in 2022, with responsibilities, funding and capacity suited to delivering against a range of government's environmental priorities, including minimising storm overflow discharges.

3. Strong regulation by Ofwat and the Environment Agency for PR24 and beyond

Stakeholders and the wider public have expressed concern over past performance by water companies, the balance between environmental outcomes and keeping customer bills low by Ofwat, and the capacity of the EA to hold polluters to account. Stakeholders want stronger ambition and leadership and regulators to regulate effectively.

We call on Ofwat to strongly recognise the emphasis placed on significant improvement on storm overflows as it sets out guidance to water companies in advance of their next investment plans. And we call on government to recognise the importance of healthy rivers to the public by ensuring the EA has the capacity to robustly monitor and enforce the levels of performance society wants to see.

4. Government to ban plastic in wet wipes

So-called 'unflushables', particularly wet wipes and other sanitary products containing plastic fibres meaning they do not break down in the sewer and worsen litter and plastic pollution, exacerbate storm overflow discharge frequency.

Combining with fats, oils and greases from food waste disposed of down sewers, they cause blockages which cost around £100m per year to remove and can make sewage back up and overflow. A 'fine to flush'[35] standard exists for wet wipes, which enables effective performance without plastic content. Given the combined challenges of pollution from storm overflows and plastic, it has no place in such single-use products and we urge government to ban plastic in wet wipes on sale in the UK.

5. Government to review the barriers and feasibility to implementing area-based charging for surface water drainage

Rain water, as surface water runoff, is a major component of the effluent which typically is discharged through storm overflows. This comes from the roofs and other hard surfaces within properties, as well as from highways. Whilst highway drainage charges to customers[36] are a fairly arbitrary, flat fee, there is scope for WaSCs to charge variable fees for surface water drainage depending on the size of impermeable area within a property.

Ofwat considers site area-based charging (ABC) to be the fairest approach[37]. Despite this there has been limited appetite amongst WaSCs to embrace it, with only four currently charging in this way. Given the need to significantly reduce surface water runoff into combined sewers and aligned with the polluter pays principle, we recommend that WaSCs should examine the potential to move forward with ABC as part of their DSMPs.

We also recommend Ofwat to review whether any additional directions within its methodology for PR24 could encourage greater use of ABC to incentivise SuDS use amongst the non-residential customer-base.

6. WaSCs and lead local flood authorities to hydraulically model key catchments to identify optimal opportunities to retrofit distributed SuDS

There are opportunities to potentially achieve both surface water and sewer flood risk benefit, alongside reducing pressure on combined sewer capacity to reduce storm overflow spills and pollution at the same time.

In urbanised areas with space constraints, individually small SuDS features, distributed across a sewer catchment may represent the only opportunity to effectively remove surface water from sewers. Where the primary driver is flood risk, it can be hard to secure flood and coastal erosion risk management grant-in-aid (FCERM GIA) because individual tree pits or raingardens will not demonstrate sufficient benefit to qualify.

The London Strategic SuDS Pilot Scheme (LSSPS)[38] was developed to demonstrate whether retrofit SuDS of this kind installed at various points in a catchment could collectively demonstrate an effective surface water flood risk management solution. It found that by hydraulically modelling the catchment-wide benefits of distributed SuDS, alongside valuing the wider benefits they delivered, it was possible to create a robust case for collaborative funding, with strong benefit: cost ratios.

Defra's Boosting Action on Surface Water project also funded a number of local authorities to undertake more detailed surface water mapping. Use of such approaches in DSMPs and local flood risk management strategies, to demonstrate catchment-wide benefits from distributed SuDS, should be used widely to underpin business cases and funding applications.

7. Government to review funding sources and rules to enable grant funding to be pooled and drawn down opportunistically over a period of time

The evidence, timescales and overall process involved in putting forward applications for FCERM GIA to deliver small-scale SuDS retrofit can discourage and preclude local authorities from being opportunistic and entrepreneurial in their delivery by partnering with other organisations.

The LSSPS noted that *"Proactive flood risk management needs to find partners for delivery in order to capitalise on opportunities to collaborate"*. Many organisations make regular investment in maintenance or other activity in the proximity of where SuDS might be delivered, potentially offering efficiency savings associated with excavation or infill costs.

These may be highways or local authorities undertaking work in streets, parks or in social housing. Such works may be planned or emergency, but commonly are undertaken with limited lead-in time to enable them to be synchronised with projects where FCERM GIA funding may need to be sought or investment programmes developed to deliver SuDS.

We encourage greater flexibility in the way that FCERM GIA funds can be used to support distributed SuDS retrofit schemes, where benefits are modelled and demonstrated at an average level across a catchment, enabling delivery to be undertaken opportunistically within that catchment, over an agreed timescale.

8. WaSCs to create partnership funding pots for use with LAs on retrofit SuDS schemes where flood risk is not the primary driver

The ability for risk management authorities to make the best use of FCERM GIA for schemes which are not prioritising flood risk management relies on their ability to secure significant partner contributions under government's partnership funding rules. The LSSPS emphasises that "*distributed SuDS free up significant capacity within the sewer network, helping to reduce spills from combined sewer overflows*".

We recommend that WaSCs and local authorities should establish long-term partnership funding arrangements, so that where there is a flood risk management benefit in delivering surface water schemes in areas where there are also challenges with storm overflow discharges, partnership funding is readily available to support non-flood optimised GIA applications.

9. Establish a legal duty on highways authorities to seek opportunities to manage highway runoff through SuDS when undertaking other infrastructure or renewal works

Recognising the potential savings associated with opportunistically coordinating street and other appropriate groundworks with SuDS construction, and the volume and water quality impacts of highway runoff on sewer networks and receiving waters, we propose that highways authorities could do more to deliver small-scale SuDS when undertaking other works. These can be incorporated into regular footway or highway maintenance activities, construction of traffic calming or other infrastructure such as cycle lanes.

Highways authorities have historically not been proactive in seeking opportunities to manage the water quality impacts of their runoff, despite its often heavily polluted nature. To drive improvements in this area we recommend that government uses forthcoming levelling-up and regeneration legislation to introduce a legal duty on highways authorities to seek opportunities to manage highway runoff through SuDS when undertaking other infrastructure or renewal works. This should be supported by a review of the design standards for highway drainage to deliver improved performance on both water quality and quantity.

10. Local authorities to develop infrastructure coordination services to enable syncronised and coordinated delivery, including of SuDS.

Infrastructure coordination teams, such as that run by the GLA in London[39], may offer potential to achieve more collaboration and synchronised delivery of SuDS alongside other works. A stated objective of the team is to *"help coordinate their activities across many layers of London's infrastructure, identifying interfaces and seeking alignment in shared outcomes towards the Mayor's priorities"*.

The GLA team includes SuDS amongst the types of infrastructure whose delivery it seeks to align, alongside utility, transport, streets, public realm, parks, ecological corridors and others in a concept it describes as *"complete streets"*. It is developing data and innovation tools, an infrastructure coordination service and supporting policies to enable this approach. Lessons should be sought from this experience and if effective, government should seek to encourage similar approaches in authorities nationwide.

Images courtesy of Susdrain

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