Drainage and Wastewater Management Plan

Technical Summary:
Storm Overflows Regional Discharge Reduction Programme

April 2023
Version 1.0

1. Executive Summary

This document sets out our plan for implementing the Government's Storm Overflow Discharge Reduction Plan, published by Defra on 26 August 2022. It provides an overview of our approach to storm overflow improvements.

Our storm overflow reduction plan is to deliver the Government's targets by reducing the number of spills from storm overflows and reducing harm to the environment.

Our initial focus has been to develop the programme for AMP8 (Asset Management Plan 2025 – 2030) based upon the Environment Agency's guidance for AMP8. Our plan is to deliver:

- For rainwater driven discharges: a combination of SuDS (Sustainable Drainage Systems) solutions and some traditional storage based on the non-permeable area calculated for each catchment and the modelled calculated volume of storm discharge
- For groundwater driven discharges: lining of private and public sewers and wetlands sized for each overflow based on population size.

In total, our preferred plan is to improve 155 storm overflows in AMP8 at a capex (Capital Expenditure) cost of £775m.

Overall, our storm overflows programme will deliver the statutory milestones and:

- Deliver the recommendations from **AMP7 investigations** on storm overflows
- Reduce spills to **Shellfish Waters** to less than 10 spills on average per year by 2030. This is the main focus for our AMP8 programme
- Ensure no more than 3 spills per **Bathing Water** by 2035 (2 for Excellent waters) during the bathing water season. This is the focus for AMP9 (2030 – 2035)
- Ensure no **environmental harm** to waters by 2045. This is the focus for the investigation programme to assess harm / spill frequency
- Deliver actions to ensure **<10 spills per year** on average across all overflows by 2050 (we are targeting 2035)
- Improvements of the **30 highest spilling overflows** in our region by 2030, and all overflows spilling more than 60 times per year on average by 2035.

2. Introduction

2.1 Background

Our wastewater systems are increasingly under pressure from the effects of climate change and greater urbanisation. Changing rainfall patterns and intense rainfall can overwhelm drainage systems and cause both surface water and sewer flooding. The risks from sewer flooding are managed and reduced through storm overflows which prevent homes, businesses, schools, and roads from flooding.

Storm overflows are part of the design of the sewer systems. Storm overflows are not manually operated, they work automatically to release excess water, for example after heavy rain has filled the sewers. They are usually a concrete weir within the sewer system so that when water levels are really high, the water automatically spills over the weir and through a storm overflow pipe to the local river or the sea. They work like an overflow in a bath or sink where the water goes into the drain through the overflow rather than spilling onto the floor.

Storm overflows are designed and permitted by the Environment Agency (EA) to operate only once a certain level of dilution is achieved and with a limit to the number of spills so that they do not cause harm to the water environment. This means that a typical overflow is designed to spill approximately 40 times a year.

Releases from storm overflows are permitted by law when they are in accordance with the permit issued by the EA. We report all spills to the EA. Any spill from a storm overflow which is not in accordance with the permit is reported to the EA and, depending on the severity, we may then receive a fine.

Storm overflow spills are usually heavily diluted (up to 97% is rainwater) and they may also be screened to remove litter. The water is otherwise untreated, so spills introduce contaminants and pathogens directly into the water environment which can affect the health and safety for water users and the ecology of plant and animal life.

2.2 The Government's Storm Overflow Discharge Reduction Plan

The UK Government published a Storm Overflow Discharge Reduction Plan (SODRP) for England on 26 August 2022. The plan sets out a mandatory programme of storm overflow improvements which is estimated to cost £56 billion over 25 years. It will enable water companies to seek additional funding from customers to invest more than ever before to reduce releases from storm overflows. The Government's plan is the largest infrastructure project to restore the environment in water company history.

This Technical Summary to our Drainage and Wastewater Management Plan (DWMP) sets out our regional investment needs in storm overflows to reduce the discharges in accordance with the Government's SODRP between 2025 and 2050.

The new statutory requirements apply to all permitted storm overflows including:

- Combined Sewer Overflows (CSOs) on the sewer network
- Storm discharges at pumping stations
- Inlet CSOs at Wastewater Treatment Works (WTW)
- Storm Tanks at WTW.

We will make the case for the funding required to deliver the first 5 years of our regional programme for AMP8 in our AMP8 business plan.

2.3 Background from previous AMPs

The focus for investment in reducing discharges from storm overflows in previous AMPs was to improve water quality for bathing and shellfish waters. During AMP7 (2020 – 2025) we completed investigations for several bathing waters and shellfish waters and identified the need for improvements. We also completed work in line with the Storm Overflow Assessment Framework (SOAF) issued by the EA.

We have also invested in the installation of Event and Duration Monitors (EDMs) which count the number of spills from storm overflows and have installed an EDM at around 90% of our storm overflows with a target for 100% coverage by the end of 2023.

2.4 Water Industry National Environment Programme

The EA develops a national programme for investment by water companies to protect and enhance the environment, known as the Water Industry National Environment Programme (WINEP). The EA issues guidance to water companies to use in the development of actions to be included in their WINEP. Water companies follow the guidance to identify the investment needs to propose to the EA for inclusion in the WINEP.

The WINEP guidance for the period 2025 – 2030 on reducing storm overflow discharges identifies five specific investigation (INV) drivers and improvement (IMP) drivers that have been aligned to address the Government’s Storm Overflows Discharge Reduction Plan, see table 2-1

Table 2-1: WINEP drivers for Storm Overflows (extract from the EA Guidance)

Driver	Description	Obligation Date
EnvAct_INV4	Investigations to reduce storm overflow spills to protect the Environment so that they have no local adverse ecological impact.	Investigations into storm overflows that will have an EnvAct_IMP2 scheme in PR24 or PR29. Investigations to inform PR24 EnvAct_IMP2 schemes should be completed by 30 April 2027. Other investigations should conclude by 30 April 2027.
EnvAct_IMP2	Improvements to reduce storm overflows spills to protect the Environment so that they have no local adverse ecological impact.	WaSCs should include this driver for PR24 as early contribution to building their programme to achieve the Defra consulted target dates to achieve no local adverse ecological impact of: • 75%+ storm overflows discharging in or close to high priority sites by 2035. • 100% overflows discharging in or close to high priority sites by 2045. • all remaining storm overflow sites by 2050. For storm overflows impacting shellfish waters the target is 2030.

Driver	Description	Obligation Date
EnvAct_IMP3	Improvements to reduce storm overflows that spill to designated bathing waters to protect public health.	WaSCs should profile this driver over PR24 and PR29 and include this driver for PR24 at their own discretion as early contribution to building their programme to achieve the Defra consulted target date of 2035. Newly designated, bathing waters at poor status and storm overflows previously improved but not meeting current design objectives should be prioritised for PR24 at WaSC discretion.
EnvAct_IMP4	Improvements to reduce storm overflows spills so that they do not discharge above an average of 10 rainfall events per year by 2050.	WaSCs should include this driver for PR24 to achieve the target of at least: • 38% of high priority storm overflows by 2030 and • 14% of the total stock of their storm overflows by 2030
EnvAct_IMP5	Improvements to reduce storm overflow aesthetic impacts by installation of screens.	WaSCs should include this driver for PR24 where the storm overflow qualifies and has another improvement driver assigned for PR24.

Some storm overflows have been identified for investment through other WINEP drivers. These include Shellfish Water and Bathing Water drivers.

We have used the EA WINEP guidance to develop our regional storm overflows programme, for AMP8 and through to AMP12, to meet the targets set out by Government (as shown in table 1).

2.5 Our Clean Rivers and Sea Task Force

To support our approach, and to provide the evidence and case studies required, we set up our Clean Rivers and Sea Task Force in November 2021 to focus our efforts and investments on driving down the use of storm overflows. Our taskforce created a ‘Pathfinder Programme’ to take practical action now in AMP7 (2020 – 2025) on reducing storm overflow discharges in six specific problem locations - Deal, Margate, Swalecliffe (Whitstable), Sandown on the Isle of Wight, Fairlight and the pan-parishes around Andover.

2.6 The Scale of the Problem

There are approximately 20,000 spills in a year from the 979 storm overflows across our operating region in the South East of England. In 2020 and 2021, the average number of spills was 20 spills per overflow. Our aim is to make significant reductions in the number of discharges from storm overflows as quickly as possible.

The need for investment in storm overflows has been identified through our DWMP BRAVA (Baseline Risk and Vulnerability Assessment) risk assessment on storm overflows, the AMP7 investigations and through the development of our storm overflows discharge reduction plan’s analysis of spill data from 2020 and 2021. We have built our storm overflow discharge reduction plan using EDM data from 2020 and 2021.

We used modelling to analyse our 2020 and 2021 spill data from our storm overflows to determine the root cause of spills:

- 65% are caused by rainwater
- 25% are caused by groundwater infiltration
- 10% are caused by other, often complex, issues.

Rainwater in combined and foul systems causes many issues including discharges from storm overflows. Our DWMP identified that up to 97% of the water in sewers in a 1 in 20 year storm is rainwater, mainly from paved areas, such as roads, and roofs.

Infiltration is where groundwater gets into public and private sewers and uses up some of the capacity in the sewer.

Other issues include blockages and operational issues such as electrical supply failures or mechanical breakdowns. We are targeting investment now to reduce the other issues that lead to discharges from storm overflows. These are often operational issues that need to be fixed fast.

2.7 Stakeholder Engagement

We ran a public consultation on our draft Drainage and Wastewater Management Plan between June and September 2022. In our draft DWMP we identified the investments needed to reduce discharges from storm overflows. This was based on the information available in the Government’s consultation on storm overflows published on 31 March 2021. We considered the estimated cost of achieving the three policy options being considered by the Government, and the potential impact on customer bills.

During our consultation period, the Government published its Storm Overflows Discharge Reduction Plan. We are finalising our DWMP to take on board the Government's plan and we will set out our approach for storm overflows and the investment needs in our final DWMP.

We received 152 responses from our customers, pressure groups, Councillors and partner organisations to our DWMP. We explained in our DWMP that Defra is considering changing the requirements on water companies to address storm overflows, and we asked which of the three policy options under consideration would our customers support. The most popular policy option was to protect the environment from the impact of spills, with 47% of responders choosing this option.

The responses to our DWMP consultation showed huge support for a more sustainable approach to tackling the issue of discharges from storm overflows. 94% of all responders agreed or strongly agreed that rainwater should be separated from foul wherever possible to reduce flooding and overflow spills. Furthermore, 70% of all responders agreed or strongly agreed that nature-based solutions should be prioritised over traditional engineering approaches to reduce the risks from storm overflows.

We established a Southern Water Storm Overflows Task Force in 2021 to investigate how we could tackle the problem in a different way. We set ourselves an aim to significantly reduce the number of discharges from storm overflows by 2050. Our task force created five pathfinder projects (see section 2.5 above) with the purpose of working with partner organisations to test, explore and deliver solutions to reduce the number of discharges from storm overflows. The task force is continuing to engage and work with partner organisations in delivering improvements in AMP7. We will continue to build these relationships, so they are in place in readiness for AMP8 programme delivery, and pave the way for securing partnership funding contributions from organisations and potentially from flood and coastal risk management grant in aid funding.

The focus of our Task Force is to drive changes and more sustainable approaches that will stand the test of time and continue to perform into the future even with the changes in our climate.

3. Our Storm Overflows Programme

We have prioritised our storm overflow improvements to comply with the storm overflows WINEP driver guidance and the government's targets. Our storm overflows programme for AMP8 is therefore dominated by overflows that discharge into shellfish waters, which need to be improved by 2030 under EnvAct_IMP2. Similarly, our AMP9 programme will contain a large number of storm overflows that affect bathing waters, which need to be improved by 2035 under EnvAct_IMP3.

We will, where possible, deliver storm overflow improvements on a wastewater system-by-system basis as this will enable us to maximise the opportunities for delivering catchment and nature-based solutions. This means we will look at a complete wastewater system to identify and deliver solutions that reduce the storm overflow risks within the whole system and will provide wider benefits across all 14 of our DWMP Planning Objectives. Tackling storm overflows in this way will be more cost effective overall and be more efficient in reducing the number of wastewater systems in Band 2 (very significant risk) under Planning Objective 5 on storm overflows. We can then show our progress getting towards risk Band 0 (not significant).

Our AMP8 (2025 – 2030) storm overflow reduction plan is:

- For rainwater driven discharges: a Combination of SuDS solutions and some traditional storage based on the non-permeable area calculated for each catchment and the modelled calculated volume of storm discharge
- For groundwater driven discharges: lining of private and public sewers and wetlands sized on each overflow based on population.

We have identified needs under all five of the WINEP Storm Overflow drivers for AMP8 using the average number of spills from each asset taken from our Event and Duration Monitors (EDM) data on storm overflow discharges during the calendar years of 2020 and 2021. This period was one of good coverage of reliable EDM data.

Our Regional Plan for storm overflows looks beyond AMP8 to deliver the full requirements set out in the Government's plan by 2050. The long-term investment needs will be set out in our DWMP and programmed across multiple AMP periods in line with the delivery requirements.

3.1 Applying WINEP Guidance for AMP8

We applied the EA WINEP guidance to develop the first five years of our storm overflows programme. The most relevant drivers for the initial investment to achieve the targets by 2030 are:

- **EnvAct_IMP2** – This requires improvements to be made to all storm overflows impacting shellfish waters by 2030. There are 87 overflows that qualify for this driver and the associated improvements constitute the majority of the proposed WINEP improvements programme for AMP8.

- **EnvAct_INV4** – This requires investigations into storm overflows that will have a possible EnvAct_IMP2 scheme. There are 382 overflows that qualify for this driver and the associated investigations need to be completed by 30th April 2027.

Each storm overflow can be applicable for one or more of the WINEP drivers, or none at all. For example, storm overflows that require investigations and improvements fit under more than one driver. We identified a primary driver for each storm overflow, according to the required delivery priorities, and the number of storm overflows in each driver, see Table 3-1.

Table 3-1 Number of storm overflows qualifying under each driver for AMP8

Driver	Number of qualifying storm overflows (note: many overflows qualify for more than one driver)	Number of storm overflows with this primary driver	Number of storm overflows for each driver put forward for AMP8
EnvAct_IMP2	87	87	84
EnvAct_IMP3	49	33	1
EnvAct_IMP4	472	374	64
EnvAct_INV4	210	192	210
EnvAct_IMP5	761	235	0
None	56	56	0
		TOTAL = 979	TOTAL = 359

Our approach to assigning each of these drivers to specific storm overflows is detailed below.

EnvAct_IMP2 and EnvAct_INV4 (Adverse ecological impact and shellfish waters)

EnvAct_IMP2 requires reductions in storm overflow spills to protect the environment so that they have no local adverse ecological impact. For the purposes of this driver, 'no local adverse ecological impact' is defined as 'achieving the Urban Pollution Management (UPM) Fundamental Intermittent Standards (FIS) or 99 percentile standards for Ammonia and Dissolved Oxygen downstream of the discharge point' (*Storm Overflow Discharge Reduction Plan, p31*).

To prioritise the appropriate overflows, we identified all storm overflows discharging into or within 50m of a sensitive water feature in one of six categories:

- Reasons for Not Achieving Good (RNAG)
- Storm Overflow Assessment Framework (SOAF)
- Sites of Special Scientific Interest (SSSI)
- Internationally designated sites: SAC / SPA / RAMSAR
- Chalk streams
- Sensitive areas (eutrophic).

Or local priority issues as identified via RNAG or SOAF investigations.

Overflows for which UPM analysis has been conducted and the results indicate that further improvements are required are prioritized under the EnvAct_IMP2 driver.

Overflows for which no UPM analysis has been conducted require further investigation and are therefore included under the EnvAct_INV4 driver to establish the local requirements to meet the 'no impact' criteria.

As EnvAct_INV4 investigations are completed the list of 'to be improved' storm overflows (EnvAct_IMP2) will be updated to add overflows where a tighter than <10 spills solution is required. Where a <10 spills solution is appropriate these will be included in EnvAct_IMP4.

SOAF investigations in AMP7 are currently ongoing. We have identified 61 sites in the draft reports due for completion in Spring 2023. These sites have been included in our programme under the EnvAct_IMP2 and IMP4 drivers. Where the need for a tighter requirement than 10 spills is identified in the final investigation reports, then the relevant sites have been allocated to the EnvAct_IMP2 driver.

Storm overflows discharging into a shellfish water, or less than 1km upstream in hydraulic continuity, with an average annual spill frequency higher than 10 (average based on EDM data from 2020 and 2021) have been identified. These overflows are prioritized under the EnvAct_IMP2 driver regardless of whether they are shown to cause adverse ecological impact. If, after the submission of the WINEP, any overflows affecting shellfish waters are also confirmed to cause adverse ecological impact (following the conclusion of the EnvAct_INV4 investigations), the spill reduction target for these overflows will be adjusted accordingly.

AMP7 shellfish investigations have identified the need for actions at 20 storm overflows. These fall under the WINEP shellfish drivers due to the tighter than 10 spill requirements due to the agglomerations.

We have included the need to reduce discharges under this driver for our highest spilling storm overflows that have not already been included under this or other drivers. These are discretionary, rather than statutory, but are included because we, and our customers, want to target reductions in the high spilling storm overflows, and concerns have been raised by customers about those storm overflows that have very high numbers of spills.

Targets and obligation dates:

- No adverse ecological impact for 75%+ storm overflows discharging into or close to a sensitive water feature by 2035.
- No adverse ecological impact for 100% overflows discharging into or close to a sensitive water feature by 2045.
- No adverse ecological impact for all remaining storm overflow sites by 2050.
- For storm overflows impacting shellfish waters the target of 10 spills/year must be met by 2030.

EnvAct_IMP3 (Bathing Waters)

EnvAct_IMP3 requires 'improvements to reduce storm overflows that spill to designated bathing waters to protect public health'.

The following process has been applied to determine the applicability of this driver for each storm overflow:

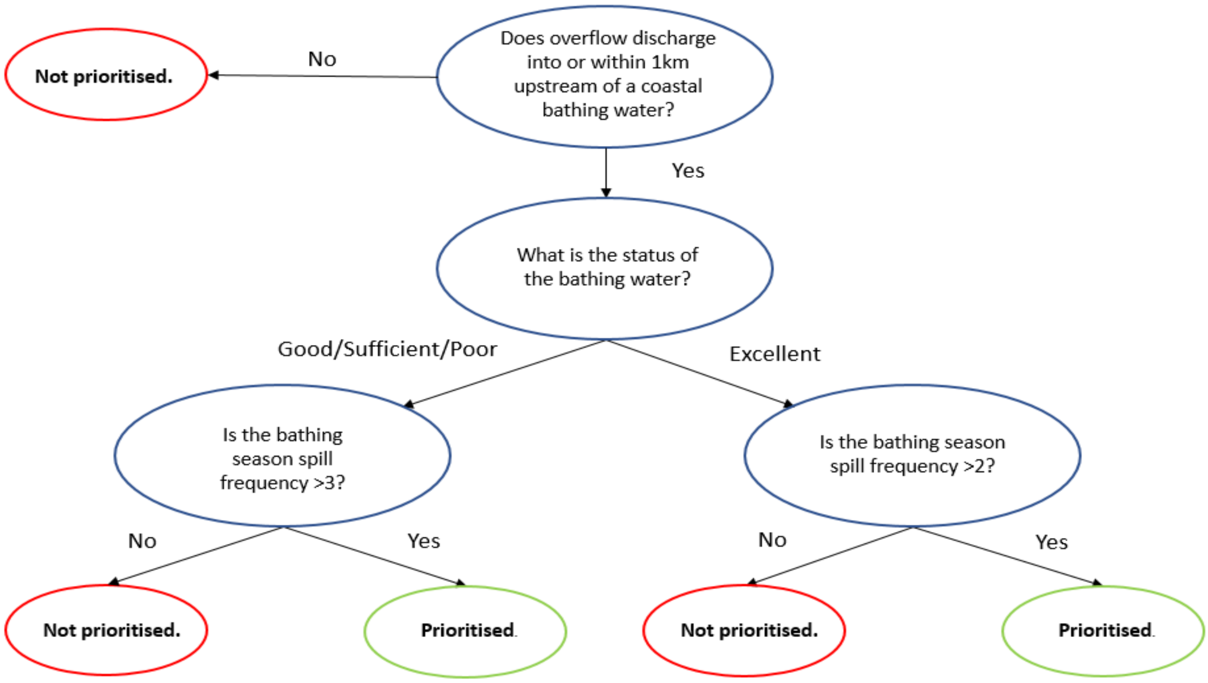


Figure 3-1: Process for determining which storm overflows to prioritise for the EnvAct_IMP3 driver

Target and Obligation Dates:

- Water companies need to profile this driver over PR24 and PR29 and include this driver for PR24 at their own discretion as an early contribution to building the program to achieve the Defra target date of 2035.
- Newly designated, bathing waters at poor status and storm overflows previously improved but not meeting current design objectives should be prioritised for PR24 at water companies' discretion.

We have identified options and costs to improve bathing waters at up to 10 bathing waters under the WINEP drivers for bathing waters. Most of the options are to address spills from storm overflows by 2035, although the impact on bathing water is low. Our proposal for WINEP in AMP8 is to focus on the wider (statutory) storm overflow driver as a priority. We will continue to improve bathing water quality using targeted surveys, resolving misconnections and sewer repairs, and see what improvements are achieved through these actions, and the storm overflow discharge reductions, before investing further storm overflow reductions in AMP9.

EnvAct_IMP4 (Spill Frequency)

EnvAct_IMP4 requires improvements to reduce storm overflows spills so that they do not discharge above an average of 10 rainfall events per year by 2050.

Qualifying overflows have been identified using EDM data averaged over the years 2020 and 2021.

Water companies need to include this driver to achieve an indicative overall delivery profile as follows~~:~~

- 14% of the 'to be improved' storm overflows by 2030
- 28% of the 'to be improved' storm overflows by 2035
- 52% of the 'to be improved' storm overflows by 2040
- 76% of the 'to be improved' storm overflows by 2045
- 100% of the 'to be improved' storm overflows by 2050

The 'to be improved' storm overflows is the list of overflows requiring improvement for any of the core storm overflow drivers IMP2/IMP3/IMP4**.**

EnvAct_IMP5 (Screen Improvements)

The EnvAct_IMP5 driver requires improvements to reduce storm overflow aesthetic impacts by installation of screens. Screening controls are defined as 6mm solids separation, which is separation from the effluent of a significant quantity of persistent material and faecal and organic solids, greater than 6mm in any 2 dimensions. Screens should be designed to operate effectively up to the 1 in 5-year flow rate.

Any overflows that do not have screening in compliance with these requirements have been identified for screen improvements. These improvements will be delivered at the time of the improvements to the storm overflow under the other drivers, although there are some exceptions. Screen improvements where the EnvAct_IMP5 driver is the only requirement have been programmed between 2030 and 2050.

Our Storm Overflows Programme for AMP8

Our programme for AMP8 will reduce discharges for 155 overflows. We will achieve this by separating rainfall from combined sewers, or attenuating rainfall through sustainable drainage systems (SuDS). We estimate that we will need to do this across over 500 hectares of urban areas. Activities will include creation of SuDS (includes 350km of roadside SuDS), disconnecting 72,000 downpipes and 2,000 driveways, creating 50 hectares of wetlands, and re-lining over 300km of sewers. There are wider local economy benefits arising from these green solutions, including making space for nature, greening cities, supporting climate adaptation, as well as supporting mental and physical health and wellbeing, potential house price increases and creating local jobs. But we recognise that some traditional grey storage will be needed to meet customer expectations for the pace at which the storm overflows need to be reduced and the government targets.

Table 3-2 sets out our preferred option and the least cost option for the first five years of our programme for AMP8. Further details of the AMP8 programme under the storm overflow WINEP driver guidance from the EA are provided in appendix A.

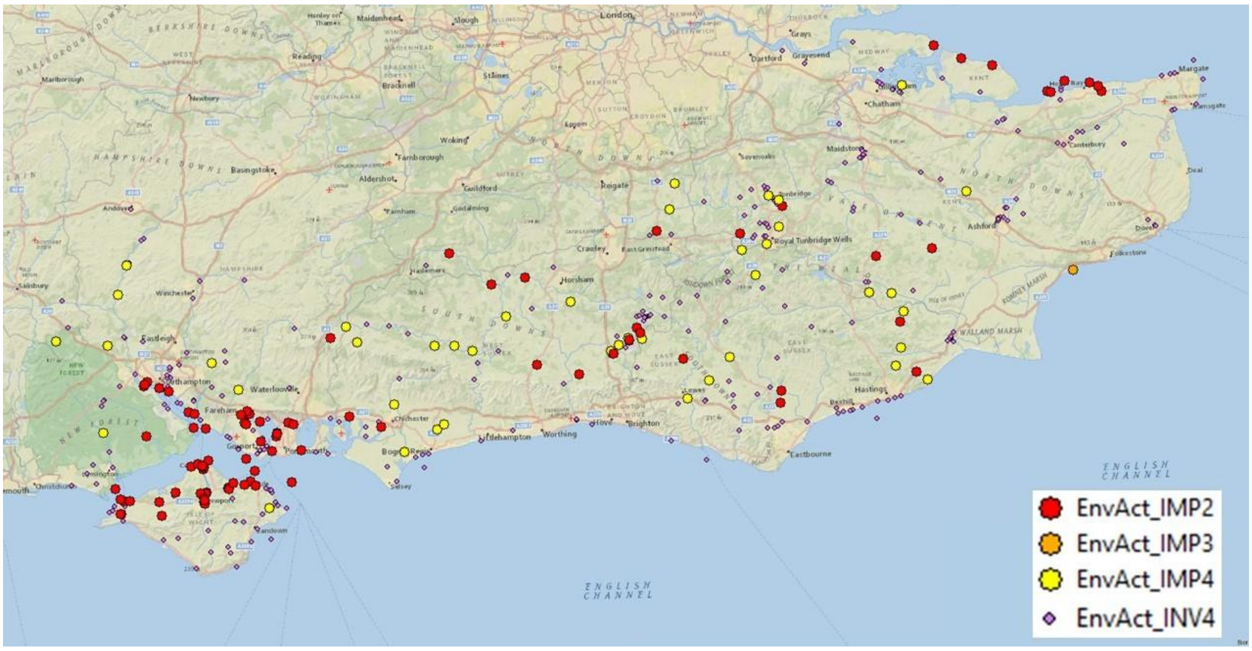
Table 3-2: AMP8 submission summary

Option	Scope	2025-30 (capex)	Average annual spills for overflow by 2030
Preferred option (green/ grey mix solutions)	**155 overflows addressed through**: • Over 500 hectares of impermeable area managed with SuDS (includes 350km of roadside SuDS, 72,000 downpipes and 2,000 driveways)* • Around 50 Ha wetland • Over 300 km sewer relining • More than 100,000 m3 of storage** **210 storm overflows investigated**	£775M	15.5 (Circa 4600 spills avoided)
Lowest Cost (traditional grey solutions)	**155 overflows addressed through**: • Around 20 hectares of impermeable area managed with SuDS (includes 13km of roadside SuDS, 2,000 downpipes)* • Around 50 Ha wetland • Over 300 km sewer relining • More than 170,000 m3 of storage** **210 storm overflows investigated**	£575M	15.5 (Circa 4600 spills avoided)

* There are wider local economy benefits beyond these (house price increase and local jobs)
** This is the worst case: through an adaptive pathway we would first deliver SuDS, monitor and then build grey infrastructure (including storage) sized accordingly (but very likely to be smaller than estimated)
Capex = capital expenditure (Government rules define what can be considered as capital investment e.g. creation of new assets)

A map of our storm overflows programme for AMP8 is in figure 3-2. The concentration of red dots for AMP8 illustrate the focus on shellfish waters in the Solent and along the north Kent coast.

Figure 3-2: Geographical spread of AMP8 overflows programme



Our Storm Overflow Programme

Our proposed investment needs for storm overflows from 2025 to 2050, to meet the government's SODRP are shown in Table 8.

The needs are subject to the government delivering other aspects of their SODRP (such as enabling rainwater to be discharged to the nearest watercourse), the EA enabling the investment needed to by including it within the Water Industry National Environment Programme, and Ofwat accepting our proposals in terms of efficiency and impact on customer bills.

Table 8: Our Storm Overflows Discharge Reduction investment needs and outputs

	AMP8	AMP9	AMP10	AMP11	AMP12	Total
	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050	
Preferred option Capex cost (£M)	775	593	562	510	517	2,957
Number of storm overflows improved (spills reduced)	155	50	97	136	151	589
Number of storm overflows improved (including screen replacements)	155	63	97	267	325	907

Spills analysis (average per year based on 2020–21)						
Spills avoided	4633	4,445	3,395	1,482	427	14,382
Average spills per overflow	15.5	11	7.5	6.0	5.5	

There is significant uncertainty on the average cost for tackling storm overflows. We estimate that to achieve the target of less than 10 spills on average for all storm overflows is £2,925 million over the next 25 years.

4. Developing our storm overflows programme

This section sets out how we developed the options for delivering the storm overflows discharge reduction programme.

4.1 Identifying Needs and Developing Options

We have developed our regional storm overflows plan based on a high-level options development and appraisal approach set out below.

Options Development Process

The options development process for each overflow is summarized in Figure 1. The three steps are:

a) Step 1. Confirm the environmental risks and issues to address the root cause.
b) Step 2. Develop constrained options list and assess the potential for each option category to address the root causes. Assign constrained options to each storm overflow.
c) Step 3. Develop feasible options lists. Identify, size and cost the least cost and preferred options. Calculate benefits for least cost and preferred options and calculate Net Present Values.

Figure 1-1: Regional Plan process for developing constrained options

STEP 1	STEP 2	STEP 3
DETERMINE DOMINANT ROOT CAUSE OF SPILLS AT EACH OVERFLOW **A** Operational **B** Storm rainfall **C** Groundwater inlfuenced infiltration	**ASSIGN CONSTRAINED LIST OF SOLUTIONS LINKED TO ROOR CAUSE** A - operational improvements (not WINEP) B - Storage (grey) only AND hybrid storage / SuDS (grey-blue-green) C - Wetland with reduced infiltration	**SIZE AND COST CONTRAINED OPTIONS** Volume of storage (cubic metres) to increase capacity of wastewater network Impermeable area (Hectares) contributing runff to wastewater networks in wet weather that is managed using SuDS techniques Area of constructed wetland (Hectares) used to treat groundwater caused storm overflow. Length (km) of public/private wastewater network relined to make more resilient to groundwater ingress

The constrained list of options for each overflow was created by screening an unconstrained list of possible solutions. The constrained list is made up of (in most cases) a preferred option and least cost option, each considered to be technically feasible and deliverable. This is a first pass of the process to develop the size and scale of our programme.

Once funding is secured and we commence the delivery, we will further assess the local opportunities for maximising the use of green and blue infrastructure, including SuDS, in each specific location by working in partnership with other organisations and landowners to identify specific locations and sites from which we can reduce rainwater getting into foul and combined sewers.

The generic options categories enable us to identify unconstrained options and then follow a screening approach to develop constrained, feasible and then preferred options.

Step 1 – Environmental Risks and Root Cause Analysis

In this step we determined the root cause of the spills which are primarily rainfall-driven or groundwater-driven or for operational reasons.

We used the spill reporting data for 2020/21 to identify storm overflows and the number of spills. The root cause of the spills for each overflow was then assessed using data analytics. This integrates the EDM data with rainfall patterns and seasonality to determine the most likely root cause of the spills. Where a modelling analysis was unavailable, an estimate of the root cause was made using available catchment datasets and characteristics. Overflows were assigned one of the following possible root causes:

- Storm – spills are primarily a response to rainfall from impermeable surfaces

- Infiltration – spills are primarily a response to groundwater ingress to the wastewater network
- Complex – spills do not correlate well with either of the above options and are considered likely to be a function of multiple factors including operational problems.

Table 4-1: Summary of root cause analysis

Root Cause	Overflow Count	Spill Count (2020/21 average)
Rainwater	728	12818
Groundwater	115	4869
Complex/Unknown	136	2121
Total	**979**	**19807**

Step 2 – Develop Constrained Options

The root cause analysis formed the first part of options development. This was used to narrow down the unconstrained options to a shorter list of constrained options based on the cause of the discharges. For example, sewer lining was not considered where the cause of discharges was rainwater getting into the sewers from roofs and roads.

The constrained options were developed based upon the type of interventions that would be effective at each location. For example, where the root cause was determined to be rainwater run-off, the feasible options are storage or a combination of storage and rainwater management (separation and attenuation) using SuDS. Likewise, where the root cause was determined to be groundwater ingress, the constrained option was limited to the only technically feasible solution which is to ensure that the wastewater network is as watertight as is reasonably possible and, in conjunction, manage residual storm overflow discharges through treatment in constructed wetlands.

We have prioritised catchment-level and nature-based solutions in our plan, where possible, to deliver best value to customers, enhance the environment and increase the resilience of our wastewater system. Where rainwater is determined to be the root cause of spills, then the preferred solution is rainwater separation and attenuation. This can be achieved through a hybrid combination of SuDS, with network storage as part of the solution if required in order to meet the regulatory timetable.

Network storage

Network storage remains an important option to reduce storm overflow spills. Our least cost plan uses it on its own and it is used in combination with SuDS in our preferred plan. In practice, the range of constrained options for delivering network storage will vary from simple above ground facilities at wastewater treatment works, large buried tanks in networks, oversized sewers, the re-instatement of some abandoned assets and the smart utilization of existing storage through methods such as real-time control. Where root cause information is contradictory or ambiguous and not obviously operational in nature, network storage is used as a default solution pending future refinement.

Sustainable Drainage Systems (SuDS)

The best long-term option for reducing discharges from storm overflows where the cause is rainwater entering the sewer network is to remove or separate the rainwater at source. There is strong support for this range of constrained options from our customers and partner organisations.

We plan to reduce the volume of rainwater entering the combined sewer network through a wide range of measures, including creating separate surface water sustainable drainage systems (SuDS) and other surface water management devices in the catchment. These measures will either separate the rainwater and divert it to local rivers and streams or attenuate the rainwater to 'slow the flow' in the urban environment – our equivalent to the EA's slowing the flow in river basin catchments to prevent flooding downstream. This will have a major effect on reducing the impact at storm overflows in wet weather and bring a wider range of benefits to the communities we serve too. In practice, the constrained and feasible options will consist of a range of measures (tools) from those available as part of the suite (or menu of options) for creating SuDS.

We plan to significantly reduce the amount of rainwater in combined sewers, although we recognise that this is very challenging and removing all rainwater could increase the number of blockages – so a 100% target is unwise and impossible to deliver. Defra's Storm Overflows Evidence Project (SOEP) in 2022 suggested that "The complete separation of wastewater and stormwater systems (eliminating storm overflows) would cost between £350 billion and £600 billion. This could increase household bills between £569 and £999 per year and is also highly disruptive and complex to deliver nationwide".

We considered and tested a range of targets for rainwater separation to remove or significantly slow the flow. A realistic target to commence this new journey is 30% of the total impermeable area that currently connects to our combined sewer system. We believe that this percentage value is feasible, has a significant impact in reducing the need for sewer capacity increases and delivers a range of co-benefits which, when monetised, offset the higher costs of delivering hybrid solutions.

We are testing retrofit SuDS approaches in our Pathfinder projects, but considerable uncertainty remains about their effectiveness when applied at scale and when applied in different parts of catchments. We suspect that design assumptions applied in hydraulic modelling might be conservative and that the SuDS could be more effective that we are planning for, further reducing the need for network storage enhancement. Our preference is to embrace these uncertainties within an adaptive pathway approach that commences with SuDS, closely monitors their effectiveness at reducing spills and then fine-tunes any residual necessary sewerage enhancement using buried infrastructure.

Wetlands and Sewer Lining

The provision of additional storage is not an appropriate mitigation for overflows that have a clearly identified groundwater cause. This is because the prolonged nature of the spills at these locations cannot easily be attenuated. Within these catchments, we intend to enhance the watertightness of our sewer network by lining approximately 30% of the total length[1]. We estimate that intervention is required on a length of public-private sewer equivalent to 30% of length of public sewer in catchments. Lining can be selectively done in groundwater dominated catchments. Sewers in condition grade 4 and 5 are routinely inspected and relined as part of our normal operational and maintenance activities and are funded from base operational expenditure. However, our experience and evidence from our sewer rehabilitation programme shows that sewers in a condition grade 1 and 2 are hydraulically efficient but can allow significant ingress from groundwater. Sealing sewers will improve the sewers beyond normal Grade 1. Private laterals will need to be tackled as well in order to reduce infiltration. Therefore, we will need to carry out work outside of the normal maintenance requirements and seek agreement through the WINEP to enable us to fund this work.

We also plan to eliminate any residual spills at related overflows by providing Integrated Constructed Wetlands (ICWs) to treat any overflowing water before discharge to the environment. The wetlands will be surface flow wetlands, providing secondary treatment to any spill flow that utilises it, and discharging to the receiving watercourse. Where located at existing treatment works, we anticipate that the final effluent could be used to sustain the wetland in periods of no spills from the storm overflow (otherwise the planting in the wetland could die during drought conditions).

We have held initial discussions with the EA about using wetlands to treat discharges from storm overflows. These are part of a wider solution of infiltration reduction to ensure that action is taken to tackle the problem at source where possible, as part of the source-pathway-receptor approach and hierarchy. We will need to ensure that wetlands do not increase the risk of groundwater pollution (for example, by using liners), and we need to consider how we provide a sustaining flow for the plant health in drought conditions.

Step 3: Develop Feasible Options

We determined the feasible options by sizing and costing options using a variety of methods depending on the solution and our understanding of the storm overflow's current performance.

During this step we considered a range of data sources and issues:

[1] This does not include private laterals

Climate change

The solutions are scoped for a 2050 design horizon and hence include allowance for future population, water consumption and climate change. Climate change affects the pattern of rainfall events, and the industry standard tool (UKWIR's REDUP) has been used to determine 'future rainfall' for the 2050s, a scenario that is common to both RCP8.5 (business as usual) and RCP2.6 (high level of CO_2 control)

Hydraulic models

Many storm overflows requiring improvements are in catchments where we maintain hydraulic models. These models have been used to design storage needs to achieve target spill frequencies. Where no models were available, storage needs were estimated based on statistical models linking EDM spill frequency and duration to catchment characteristics.

Source Measures: SuDS and Surface Water Management

Introducing SuDS within catchments reduces the need for network storage in pursuit of target spill frequencies. The exact relationship differs from catchment to catchment, but we have drawn on published relationships linking the two from the Defra commissioned Storm Overflow Evidence Project. This factors in storage depending on the percentage of impermeable area managed. Our analysis has shown that a 30% level is achievable and beneficial, and we have completed an analysis for each catchment, informed by our Pathfinders, showing the combination of different SuDS measures which would be necessary to achieve this level of control – for example, a certain combination of rain planters, water butts and highway measures.

Customer engagement during our Storm Overflows Pathfinders programme has indicated a general acceptance and willingness among the public to consider installing water butts, raised planters and other similar measures on domestic and non-domestic properties. These measures help slow the flow from the roofs of properties by, for example, intercepting it within property downpipes before it passes into the combined sewer network.

We have been working with partner organisations, including local councils, in developing our DWMP. We are also partnering with local authorities as part of our Pathfinder programme to deliver roadside raingardens, pocket basins and tree pits designed to intercept rainwater before it passes into the combined sewer network. These measures will be installed on streets and within parks and green spaces throughout our region to reduce storm overflows and enhance the aesthetics and biodiversity of the area.

We plan to implement these solutions in over half of our wastewater catchments, affecting 405 storm overflows. In total, we expect the associated raingardens, basins, planters and water butts to manage flow from up to 3000 hectares of impermeable area across the region. This includes 380,000 property roofs and over 1800km of road.

We have assigned a number/quantity of SuDS devices to each qualifying overflow within a given catchment in proportion to the size of the spill volume at each overflow. This has enabled us to estimate the cost for spill reduction at each storm overflow.

For costing purposes, we have developed CAPEX and OPEX costs per hectare of impermeable area managed with SuDS, assuming a typical 'basket of SuDS' of different types.

Pathway Measures: Buried infrastructure

The storage volume needing to be constructed is calculated from hydraulic models or estimated using the methods previously described.

For costing purposes, we developed CAPEX costs per cubic meter of storage provided and made assumptions about OPEX associated with new maintenance requirements and additional pumping and treatment costs.

Overflows requiring screen improvements

Table 2-2 provides an overview of screen improvement requirements for the whole storm overflow programme (not just for AMP8).

Table 2-2: Summary of screen improvement requirements

Overflow category	Overflows requiring screen improvements	Overflows not requiring screen improvements
Overflows with other improvement requirements	391	194
Overflows with no other improvement requirements	285	109

The WINEP driver guidance says that the EnvAct_IMP5 driver should be included for PR24 where the storm overflow qualifies and has another improvement driver assigned for PR24, any overflows. Hence storm overflows requiring screen improvements in PR24 under EnvAct_IMP5 will have this as a secondary driver to the other improvement driver (IMP2/IMP3/IMP4) and will receive screen improvements at the same time as the other planned improvements.

For costing purposes, we have developed CAPEX costs per new screen and included these within overall scheme costs per overflow.

Receptor Measures: Wetlands

We have considered wetlands at 65 overflows across 48 of our wastewater systems. These have been prioritised based on the strong relationship between groundwater and spills in these catchments.

As wetlands are a nature-based wastewater treatment technology, the required size and cost of a wetland is determined by the contributing population. We have calculated the total wetland area to be created at just over 150 hectares. At this stage, although we know which wastewater systems we expect to target with these wetlands, we do not yet know how the wetlands with multiple storm overflows to be improved will be sized at each location. For the purposes of WINEP planning, we have therefore assumed that the size (and cost) of wetlands with more than one qualifying overflow is proportionate to the size of the annual spill volume at each overflow.

For costing purposes, we developed CAPEX and OPEX costs per new wetland based on population served and hence the area (hectares) required to provide adequate treatment to flows.

4.2 Option Selection

The only viable option in situations associated with groundwater infiltration driven problems is wetland treatment and selective re-lining.

We rejected options, such as rainwater butts, raingardens and other types of SuDS that just will not work in cases where the groundwater is causing the issue. Network storage is not an option as the groundwater will fill the storage tank and potentially keep it full for months.

At each overflow a benefit cost analysis has been developed showing a monetised Net Present Value of the different options. These are added together at a programme level to show the Net Present Value of the collective least cost and preferred options.

For rainwater driven overflows, the preferred option addresses rainwater problems with a combination of retrofit SuDS and network storage. We will adopt an adaptive pathways approach where the final solution will be informed by ongoing monitoring and learning through programme delivery. Our best current knowledge is that managing 30% of impermeable area draining to our systems, and adding network storage on top, is the optimum strategy, but we anticipate there will opportunities to resolve issues with SuDS measures alone and will be flexible and responsive to changing circumstances with this approach.

Our DWMP shows that this approach provides significant wider benefits in terms of catchment-wide flood reduction. In our analysis we have monetised a range of further benefits in the WINEP categories of Natural Environment, Net Zero, Access/Amenity/Engagement and Catchment Resilience. We also recognise a wider set of qualitative positive economic benefits associated with locally based contractors that are more likely to be engaged in SuDS delivery.

The detailed options and the exact size and location of actions will be determined once we know that our overall programme and approach is supported by the EA and is in the WINEP programme. We will work with the Lead Local Flood Authorities, Local Councils, Highway Authorities and other partner organisations to develop SuDS schemes for targeted areas where rainwater problems are the known root cause of storm overflow spills. Many of the specific actions will be dependent upon landowner permissions and access, hence there is a delivery risk associated with catchment and nature-based solutions.

We have developed a solutions menu to support our delivery programme and engagement with customers, landowners and partner organisations. There are two menus, one each for:

a) Roadside SuDS, and

b) Property SuDS.

For roadside SuDS, the menu includes:

Solution	Surface level footprint	Base construction cost for diversion of single road gully	Target Context	Typical Example (image references included in subsequent slides)
Verge soakaway	1.2m x 3.8m	£3900	Residential streets with grass verges	
In-Road Raingarden	1.5m x 2.8m	£3800	Wider residential streets with potential for traffic calming measures	
Pocket Basin	2.8m x 2.8m	£2600	Small green spaces such as road junctions	
Paved Tree Pit	0.8m x 0.8m	£6200	Urban areas with minimal green space	

These are small SuDS measures that will be retrofitted in large numbers across targeted areas. The idea includes diverting flow from road gullies, ‘slowing the flow’ and infiltration into the ground. Sizing of SuDS solutions is designed to be flexible and adaptable to specific contexts. Initial reference sizes are based on a 200m^2 drainage area (typical gully connectivity) and 10mm rainfall depth.

These types of measure provide wider environmental outcomes by creating green spaces in urban environments. These green spaces could be incorporated into a climate adaptation strategy for communities to provide open spaces for recreation, tree shading to create cooler areas during heat waves, and greater resilience to floods and droughts. The green spaces could also support exercise, recreation and mental wellbeing. These types of measures are lower use of embedded carbon and help us towards net zero.

For property-based SuDS our options menu includes:

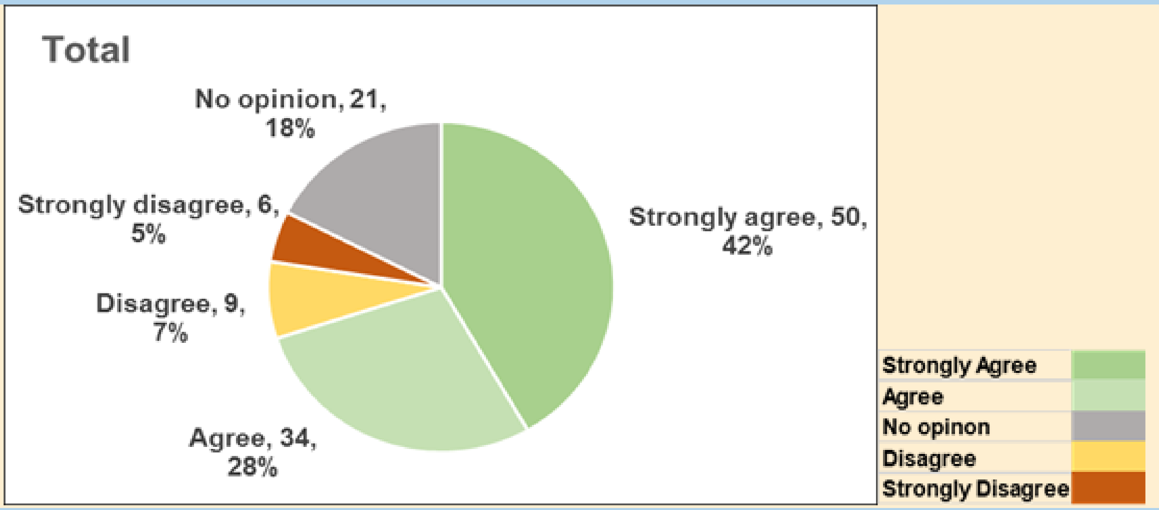
Solution	Initial estimate of total cost	Target Context	Typical Example (image references included in subsequent slides)
Smart Water Butt	£1800 for one side of property (£2300 for full property roof)	Properties with exposed downpipes & limited space. Gardening customers keen to conserve water.	
Raised Planter	£1400 for smaller unit	Properties with exposed downpipes & space adjacent to the building. Gardening customers.	
Garden Soakaway	£2300 for standard soakaway £1300 for overflow soakaway	Solution is not visible once installed. Minimal impact to customer.	
Property Raingarden	£1500 for full property roof	Encourage customers to use permeable surfaces rather than impermeable	
Permeable Driveway	£4000 for resin bound driveway	Areas with limited on-street or garden opportunities	

These are small SuDS measures to be retrofitted in large numbers across targeted areas. These will slow (or divert) the flow from property downpipes (or driveways) before it goes into the sewer. Our menu includes a range of solutions that are flexible and adaptable to different property contexts and customer priorities. All are widely applicable, and can be adapted to business/industrial properties, and also to schools. The cost estimates are based on typical property sizes. The cost per m2 of roof or driveway area drained varies between £20 and £70 to supply and install.

There are delivery risks associated with blue/green options and catchment and nature-based solutions (C&NBS) – most notably the land requirements, the maintenance of SuDS, and their effectiveness. Traditionally water companies deliver storage solutions as these options are known and can be modelled and designed to deliver a performance standard. They can provide the certainty required to achieve regulatory dates. Conversely, green solutions are less certain, difficult to model, require implementation in large numbers to make a difference, require land or infrastructure owners to re-design their infrastructure (for example, road side rain gardens). There is therefore a delivery risk and also a risk whether they will provide the performance improvements required. Due to these risks, we will adopt an adaptive management approach and seek to revert to delivering more storage solutions if the outcomes cannot be achieved through rainwater separation and SuDS.

Findings from our DWMP public consultation

We asked stakeholders if catchment wide and nature-based solutions should be prioritised over traditional engineering approaches. This is what they told us:



Of the 120 responses, 70% agreed or strongly agreed that nature-based solutions should be prioritised over traditional engineering approaches to reduce the wastewater risks. 7% disagreed and another 5% strongly disagreed with 18% not offering an opinion.

We were told that:

- Nature based solutions are seen as the best value in the long term and will deliver additional environmental and social benefits that would not arise from traditional engineering solutions.
- However, the most appropriate solution or a mixture of grey-green approaches may be required to provide the best possible results. We should invest in whichever systems are the most effective in preventing flooding and pollutions.
- Land in the South East is at a premium and there are multiple pressures on it. It is unclear whether the amount of land required for NBS is available.
- A holistic integrated catchment approach is needed to develop resilient systems as opposed to fixing one thing at a time that may cause an issue further along the system.

Case Study

Haven Street - An exemplar for reducing CSO discharges

Havenstreet is a small inland village of 4,000 people on the Isle of Wight. It is situated within a nationally designated Area of Outstanding National Beauty and UNESCO Biosphere Reserve.

The village is served by a combined sewer system which accepts foul water from properties but also rainwater from highway gulleys and roofs. When it rains, the pumping station at the bottom of the village becomes overwhelmed by the flows and the storm overflow discharges into the Blackbridge Brook, a SSSI (Site of Special Scientific Interest).

In 2020, there were 17 spills lasting a total of 50.38 hours. In 2021 there were 28 spills lasting a total of 58.34 hours, averaging out to over 2 days of continuous discharge per year. The watercourse is classified as 'failing' under the Water Framework Directive so a solution had to be found to reduce the discharges.

Traditional solutions would rely on storing excess flows in tanks but construction of these has a significant carbon footprint and ongoing pumping and maintenance costs. More importantly, as we experience more frequent and severe storms, tanks do not provide a long-term solution. We wanted to find a better way that reduced our environmental footprint, provided community benefits and a responsible investment opportunity by focusing on catchment-based solutions.

We collaborated with the Parish Council to:

- offer every property a free, slow-draining water butt to capture rainwater from roofs whilst still allowing water use in gardens. More than 72% of homeowners took up this offer and it removed more than 30,000 litres of rainwater from the sewer system.
- Identify areas with impermeable surfaces and sent a brochure to home and landowners setting out a variety of interventions to slow the flow including soakaways and planters. This had a 100% uptake.
- Divert flow from the Council's highway gulleys to soakaways and permeable land. This had an additional benefit of reducing some internal property flooding
- Removing the connection from a rainwater drain from the foul system after conducting a risk assessment with the Environment Agency to ensure the water did not need treating in the foul system.

There have been no discharges since the interventions were implemented despite a few significant rainfall events of up to 30.23 mm in 12 hours.

In total, the interventions cost £16,937 compared to an estimated £120,000 cost of a traditional storage solution, less than 15%. The interventions have been shown to be completely effective when used in a small, controlled area. We now have a detailed programme of work to roll this out on a large scale and want to deliver it at pace.

4.3 Budds Farm Wastewater System

Budds Farm is our largest wastewater system and the risk from storm overflows is a Band 2, very significant risk (ref: draft DWMP). The investment needs here are significantly larger than other wastewater systems in our region. It is important to tackle storm discharges in this system due to the spotlight on this in the national media but, much more importantly, it is discharging into an internationally designated natural harbour.

Our plan for Budds Farm is to deliver the required spill reduction using a staged approach over 2 - 3 AMPs. This approach will prioritise reducing spills into the harbour from Budds Farm WTW and will also prioritise green nature-based solutions that offer a more sustainable future with much wider and longer-term benefits. To achieve this, the first stage is to reconfigure the outfalls at Budds Farm WTW and Eastney (see Figure 4-2, numbers in square brackets below refer to blue boxes in this figure) such that storm overflow spills from Budds Farm WTW no longer discharge into the harbour via the short sea outfall (SSO) [4]. Our plan means that storm overflows will instead discharge via the long sea outfall (LSO) [1] via the existing tunnel to Eastney Pumping Station. To facilitate this, the following changes will be made to the system in order to free-up capacity within the LSO [1] during storm conditions:

- Spills from Henderson Road (Eastney) CSO will be redirected from the LSO [1] to Fort Cumberland Storm Tanks [2]. This will utilise these large storm tanks.

- Final effluent from Budds Farm WTW, which usually discharges via the LSO [1], will discharge into the harbour via the SSO [4] – only during conditions when the storm overflow would otherwise be spilling into the harbour. During dry weather, the final effluent will continue to be discharged via the LSO [1].

We expect these changes to result in a significant improvement to water quality within the harbour and, as a result, protect the habitats site. Furthermore, the changes will also provide shellfish water improvements; the LSO [1] discharges outside of a shellfish designated water. Assessments are ongoing to fully understand the overall impacts on water quality in the harbours and shellfish waters.

We plan to also make the following further improvements to the system during AMP8 in addition to the outfall reconfiguration described above and as part of the first stage of tackling the storm discharges at Budds Farm:

- Green nature-based 'slow the flow' catchment measures in Portsmouth. The purpose is to enable us to achieve the required spill target at Fort Cumberland Storm Tanks [2] by 2030. We expect the impact of these measures to combine with similar measures already included in the plan to reduce spills from other storm overflows in the Portsmouth area of the Budds Farm catchment. These measures will be supplemented by additional buried storage if required to achieve the overall spill reduction target (EnvAct_IMP2) at the Fort Cumberland outfall [2] by 2030. The timing of these measures will need to coincide with the outfall reconfigurations to reduce any short-term increase in the number of spills from Fort Cumberland Storm Tanks.

- A combination of green nature-based 'slow the flow' catchment measures and sewer lining in Havant and Hayling Island to start to reduce the spill count and volume from Budds Farm

WTW. We will monitor the impact of these measures during the course of the AMP as part of an adaptive and incremental approach in order to inform further measures in AMP9 and beyond.

In summary, our plan for Budds Farm in AMP8 will eliminate spills into the harbour from Budds Farm WTW [4] (not counting emergency overflows) and will limit spills from Fort Cumberland [2] to 10 spills per annum, in line with the EnvAct_IMP2 requirement for shellfish waters. Spills from Budds Farm WTW via the LSO [1] will be reduced during AMP8, with further reductions planned for future AMPs as part of a staged multi-AMP approach.

Figure 4-2: Budds Farm outfall configuration

4.4 Storm Overflows from AMP7 Investigations

We are completing several investigations during the current AMP that are identifying the need to reduce the spills from storm overflows. The two relevant investigations are:

(a) Storm Overflow Assessment Framework investigations, and
(b) WFD Investigations.

Storm Overflow Assessment Framework (SOAF) investigations

The investigations followed the Environment Agency's Storm Overflow Assessment Framework. We have aligned the outputs of these investigations to the storm overflows WINEP driver requirements for AMP8.

These AMP7 investigations are still ongoing. The first batch of investigations for 36 sites were completed in March 2023. The investigations for a further 25 sites will be completed by 2025. We have the evidence of the need for investment and will have developed models to identify solutions and impacts for these sites. The information included in the WINEP submission for AMP8 is therefore flagging the need for this investment, but it is draft and subject to change upon completion of the investigations.

WFD Investigations in AMP7

The WFD investigations in AMP7 are identifying improvements to reduce discharges from storm overflows. These sites have been included under the storm overflow driver EnvAct_IMP4 to provide solutions for a less than 10 spills solution.

4.5 Risks and Issues

Our approach to tackling storm overflows at source through SuDS and other measures is a fundamental shift from the traditional engineering of 'end of pipe' storage solutions. It comes with a number of risks and issues.

Separation of rainfall will require modifications to the existing drainage systems. Retrofitting new drainage systems within urban areas can be difficult, disruptive and expensive. Careful consideration needs to be given to how this could be done, where it can be implemented, the volume of rainwater that needs to be removed from the sewers and the discharge points to which it can be channelled. It is vital that the current challenges are not simply displaced elsewhere. It is a longer-term solution, and not a quick fix. This means there will be challenges when it comes to delivering outcomes by a fixed date.

Our partner organisations tend to agree that separation is likely to be a real challenge in existing urban environments, particularly those of a historic nature. Removing existing surface water connections from the combined sewer network to achieve a year-on-year reduction needs a coordinated approach to ensure the problem is not merely moved elsewhere. However, retrofitting solutions to reduce the impacts of flooding, remove pollutants whilst providing recreational, amenity and wildlife benefits should be pursued.

However, traditional engineering options should not be discounted. A balance between local quick win hard engineering solutions versus soft and/or wider scale solutions must be considered, especially to meet regulatory timetables. There are areas that are likely to require hard engineering approaches, such as in towns and villages in vulnerable coastal landslide complexes. There, all water should enter piped disposal systems and kept entirely out of the ground as any water in the ground will reduce ground stability and trigger ground movement, damaging infrastructure and properties.

It is clear that we cannot deliver rainwater separation on our own. Collaborations with the EA, Councils, Planning Authorities, Highways Agencies and local communities are needed to co-create the solutions. By working together, the issue of rainwater can be tackled, step by step. Every separation scheme is progress towards this long-term goal.

Appendix A: Details of AMP8 programme

This appendix sets out the details for our storm overflows programme for AMP8 under the specific storm overflow driver guidance from the Environment Agency (EA). Six further storm overflows are being addressed under the shellfish water guidance, where this has more stringent requirements or an earlier delivery date – these are not included in the figure below.

The storm overflows are prioritised for AMP8 investment primarily according to whether they impact shellfish waters, as per the guidance from the EA.

Table A1: AMP8 storm overflow programme breakdown: Primary drivers

Primary Driver	Capex – Preferred Option (£m)	Capex – Least Cost Option (£m)	Number of Overflows
EnvAct_IMP2	550	382	102
EnvAct_IMP3	9	9	1
EnvAct_IMP4	182	158	45
EnvAct_INV4	13	13	210
Total	754	562	149 Improvements 210 Investigations (150 OARs, 500 overflows affected)

Table A2: AMP8 storm overflow programme breakdown: Solution type

Solution Type	Capex - Preferred Option (£m)	Capex - Least Cost Option (£m)	Number of Overflows (note: contains overlaps)
Infrastructure	314	374	122
SuDS	261	9	P – 101; LC - 21
Wetlands + Lining	151	151	26
Screen Upgrades	14	14	109
INV4 Investigations	13	13	210
Total	754	562	-

Table A3: AMP8 storm overflow programme breakdown: Activities

Activity	Preferred Option	Least Cost Option
Volume of buried storage provided (m3)	117,000	170,000
Length of sewer lined (km)	309	309
Area of wetland (ha)	53	53
Total hectares managed by SuDS	572	20
Length of road managed by SuDS (km)	348	13
Number of downpipes managed by SuDS	72,000	2400
Number of permeable driveways	2000	68
Total car park area managed by SuDS (ha)	7	0.2

Table A4: AMP8 storm overflow programme breakdown: Whole Life Cost

Option	Capex (£m)	Opex (£m)	Embodied Carbon (£m)	Operational Carbon (£m)	Whole Life Cost (£m)
Preferred Option	754	63.0	60.7	32.5	910
Least Cost Option	562	32.6	49.0	50.0	694

Table A5: AMP8 storm overflow programme breakdown: Whole Life Benefit

Option	Natural Environment Benefits (£m)	Catchment Resilience Benefits (£m)	Access, Amenity & Engagement Benefits (£m)	Whole Life Benefit (£m)
Preferred Option	26	157	113	295
Least Cost Option	20	6	4	30

Table A6: AMP8 storm overflow programme breakdown: Net Cost-Benefit

Option	Whole Life Cost (£m)	Whole Life Benefit (£m)	Net Cost-Benefit (£m)
Preferred Option	910	295	615
Least Cost Option	694	30	664