Drainage and Wastewater Management Plan

Level 1 Regional DWMP

from Southern Water

Contents

Foreword

It's time to change the way we think about water – our most precious natural resource. We rely on it for everything we eat and drink, for washing ourselves and our clothes, and to help create the energy we need for heat and light. It's also essential for the products we enjoy, and the rivers, fields, forests and beaches that we all love.

Our region faces real challenges in the future. Our population is growing fast, and climate change is bringing greater risk of both drought and flooding. Together with our customers we need to deliver sustainable, high-quality services, and that means thinking differently today to make sure they are there for decades to come.

This means rethinking about what happens to our used wastewater. At the moment, we just expect it to be taken away, recycled and safely released back into our rivers and seas.

I've been open that our environmental performance has not been good enough. We hear our customers concerns about pollution of the environment, especially rivers and bathing waters, from our discharges from storm overflows. We are committed to reducing discharges from storm overflows. We'll need to challenge and adapt the way our networks have been designed to operate and work with partners organisations and communities to make better use of rainwater. I'm committed to achieving real change so that we deliver a service our communities deserve.

Every day our 39,900 kilometres of sewers and 3,476 pumping stations transport on average 1,371 million litres of wastewater and rainwater from our 4.7 million customers' homes and businesses, and from the drains outside. This water is carefully recycled by screening, filtering and treating at our 367 treatment works, meeting strict environmental standards before being returned to the environment.

Our customers rightly expect these essential services from us as a water company. However, we face real challenges to maintain them both now and in the future:

a) The climate emergency, particularly in the South East, means there are more droughts and heavy storms. These weather extremes have become the norm.

(b) There are significant pressures from growth across our region to provide homes for a rapidly expanding population.

(c) The need to protect and improve the environment, and the ecosystems that depend on it, is now greater than ever.

Our role in providing water for life is to plan for and manage these impacts while at the same time enhancing health and wellbeing, protecting and improving the environment and sustaining the economy.

A large part of this means helping to make sure we keep our rivers, lakes and coasts clean. Of course, we can't do this alone. The pressures on the quality of water in the environment come from many sectors and industries, including highways, agriculture, land use planning, developers, industry, and pleasure and commercial waterway users. Likewise, our operations, and the effluent we discharge into the environment, affect the health and sustainability of the natural environment and we must continue to improve the efficiency and quality of our service.

Over the last 30 years we have made huge improvements in the water quality at the 84 bathing waters across the region. 79 are classified by the Environment Agency as excellent or good, and we are working hard to get all 84 into the excellent classification. Our inland waters are a significant concern, with only 14% judged to be in good ecological status by the Environment Agency.

To deliver rapid change, we must continue to share data and information on the health of our waters and biodiversity to understand what is causing the biggest impact. The interrelationship between our sewers and surface water is complex. We need to know how and where we can separate or slow the flow of rainwater entering our systems to prevent the use of storm overflows. We need to find a way to reduce pollution of our rivers and seas, while also reducing the possibility of flooding from sewers that devastates homes and businesses.

We know we can do this by working together across river basin catchments and multiple sectors, we can create cleaner, greener urban environments that are better for the health and wellbeing of our customers and communities. We can most definitely create a more sustainable and hospitable environment in which our wildlife can flourish.

In essence, this is what our first Drainage and Wastewater Management Plan is. It is the culmination of over 80 engagement events with 75 organisations. It is a collaborative view of where we should focus our attention in delivering against these ambitions; delivering solutions that meet the challenges ahead, working across wider water and environmental systems.

Lawrence Gosden
Chief Executive Officer,
Southern Water

Executive summary

This is our regional (level 1) Drainage and Wastewater Management Plan (DWMP). It is supported by plans for each of the 11 River Basin Catchments (Level 2 DWMP) and our wastewater systems (Level 3 DWMP). These can be read in detail on our website and we'll continue to keep these webpages updated.

It sets the direction for a long-term approach to ensure drainage and wastewater services are resilient, sustainable and affordable into the future. It takes an integrated and cross-sector water management approach that drives long-term investment and makes greater use of nature-based solutions and sustainable drainage systems. It's also a plan that will help us better manage the significant environmental and economic impacts from population growth, creeping urbanisation and climate change.

Our plan is the result of a collaboration between our own experts in drainage and wastewater management and 75 other organisations across the South East who also have responsibilities for drainage, flooding, land use planning and protection of the environment. This has allowed us to take a wider view and align investment needs with these local partners. Co-operation and partnerships will make the cross-sector funding for water and the environment go further and enable us all to do more to protect the environment and the customers and communities we serve. Our DWMP sets out the investment needs for the next five-year planning period 2025–30, known as our Asset Management Plan 8 (AMP8), and starts to build a picture of future needs out to 2050.

We have identified the need for £13.4 billion of investment over the next 25 years. This allows us to manage the impacts of climate change and population growth but doesn't take account of potential changes to legislation, customer expectations or the cost of replacing our current assets.

The investments identified will provide the best long-term value to our customers and communities by reducing risk through more sustainable approaches which provide wider benefits. These are our 'preferred' investment options to be funded from customer bills through our standard regulatory processes.

Introduction to the regulatory process

Our Drainage and Wastewater Management Plan explains how we can protect and enhance the environment while providing resilient drainage and wastewater services for customers now and in the future.

Drainage and Wastewater Management Plans (DWMPs) are long-term strategic plans (looking 25 years ahead) produced by all water companies providing wastewater services in England and Wales. These plans will soon become a statutory requirement under the Environment Act 2021, and will need to be published every five years, in the same way that the Water Resources Management Plan is updated.

DWMPs must set out how a water company will manage and develop its wastewater systems to make sure they're resilient and have the ability to manage the impacts of climate change and population growth, while also protecting and improving the natural environment. The plan must also show the associated costs and timescales for implementing the measures needed to deliver the level of performance expected by our customers and regulators.

A national DWMP framework has been developed by Water UK in collaboration with Defra, the Welsh Government, Ofwat, the Environment Agency (EA), Natural Resources Wales, the Consumer Council for Water, ADEPT and the Blueprint for Water. The framework sets out an approach to planning that uses data, evidence and modelling to understand the risks to customers and the environment from the performance of drainage and wastewater systems. Options are then identified to manage and reduce those risks, including estimated costs and timescales, to inform future investment needs.

The options and investment needs set out in our DWMP are just that, options. No funding has been committed. We'll need to make the case to our regulators in order to invest the money we receive from customers.

We repeat this process every five years as part of Ofwat's periodic review (PR), and the Environment Agency's development of the Water Industry National Environment Programme (WINEP). The PR process regulates water company charges for water and wastewater services and determines the investments that we can make. The next review, PR24 (Price Review 2024), will determine how much funding we will have available during 2025–30.

Our Level 2 DWMPs are also provided on our website for each of our 11 river basin catchments. Level 3 DWMPs, meanwhile, are produced for each wastewater system – there are 381 of these across our region that we own and operate. We developed a level 3 DWMP for 61 of our 381 wastewater systems during the first round of DWMPs.

These 61 cover the largest, most complex and highest risk systems as well as some smaller ones that our partner organisations asked us to include. Together, the 61 systems cover 78% of the population we serve. We'll develop Level 3 plans for the other 320 wastewater systems in our region during cycle two of the DWMP.

We also published technical summaries which provide information on the process that we followed in developing our plan and the methodologies we developed for each stage of the planning process. The data, evidence and results from our DWMP are shown in tables and maps, including regional risk maps for each of the planning objectives.

Our plan at a glance

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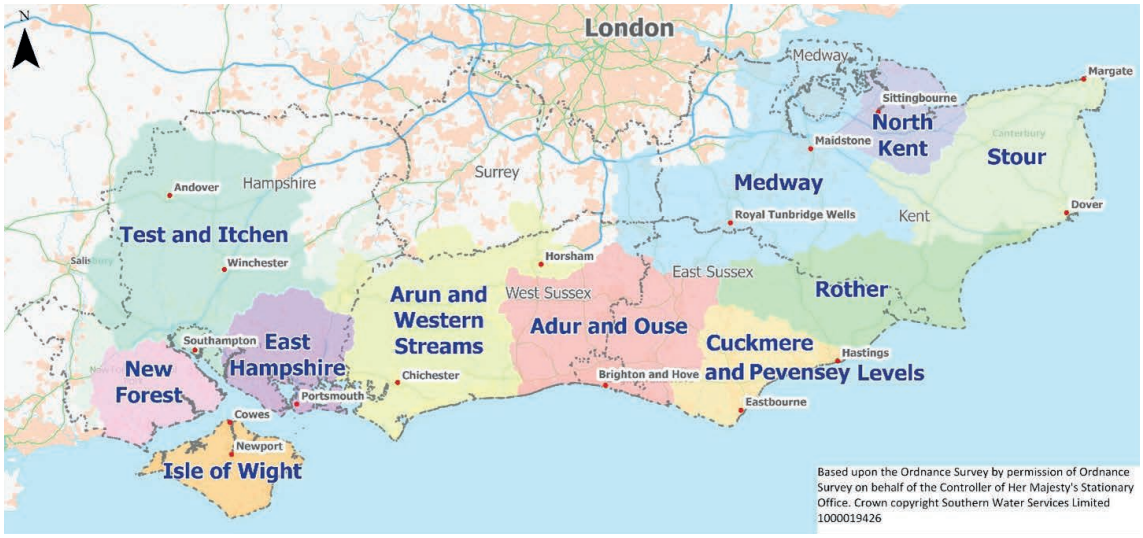
Our drainage and wastewater services

We operate our wastewater systems to protect natural habitats across our region, including:

- More than 700 miles of coastline
- 84 designated bathing waters
- 3,400km of rivers
- Four Areas of Outstanding Natural Beauty (AONB)
- South Downs and New Forest National Parks
- More than 350 Sites of Specific Scientific Interest (SSSI)
- 38 Special Areas of Conservation (SAC)
- 17 Special Protection Areas (SPA); and
- 13 Ramsar sites.

Figure 1 shows our operating area and highlights the 11 river basin catchments (RBCs) within it. Across the region, our 381 wastewater systems provide services to customers in urban centres including cities, towns and many villages. We cover approximately 17% of the geographical area and provide wastewater services to around 99% of the population. Smaller villages and remote properties use alternative arrangements for wastewater disposal, such as septic tanks and local private systems.

Figure 1: Map of our operating area



Working with others

The DWMP has provided an opportunity for more collaborative and integrated planning. Ofwat, Defra and the Environment Agency (EA) expect water companies to lead the development of the DWMP, although not all drainage systems are owned and operated by water companies. There are many other organisations that have responsibilities and interests in drainage, flooding and protection of the environment.

We adopted the EA's 'Working with Others' approach to co-create our plan with experts from across our business and with partner organisations. This approach to "engage, deliberate and decide (EDD)" enabled us to transparently share data and to benefit from the knowledge and expertise of our partners.

We collaborated with over 180 individuals from 75 organisations and experts from across our business to develop our plan. At a regional scale, we engaged groups such as our Strategic Environment Panel and the Southern Region Flood and Coastal Committee (RFCC). In the 11 RBCs across our area, we worked with:

- The Flood Risk Management Authorities (RMAs) such as the EA, Internal Drainage Boards and Lead Local Flood Authorities (County Councils and Unitary Authorities)
- The Local Planning Authorities required to meet government housing targets
- Neighbouring water companies and those providing water supply services within our region
- Organisations that protect and improve the environment such as Natural England (NE), the National Park Authorities, Catchment Partnerships and the Rivers and Wildlife Trusts.

We ran three sets of workshops for each RBC, six region-wide webinars as well as hosting 41 meetings to agree the risks and identify the unconstrained options for 61 wastewater systems. For full details of our partnership approach, visit Who we're working with.

Working with these partners means our DWMP considers and incorporates a much wider range of socio-economic and environmental outcomes than were set out in the national guidance. We incorporated planning objectives on achieving good ecological status under the Water Framework Directive (WFD), securing nutrient neutrality , preventing groundwater pollution and protecting drinking water sources, improving surface water drainage and improving and protecting bathing and shellfish waters (see Box 1).

These objectives supplement the regulatory approach of counting and reporting asset failures while providing public health, environmental, community, wildlife and economic benefits. Read our planning objectives and the methodologies we used to assess the risks of not achieving them.

Feedback from our public consultation

"The company has clearly given much consideration in the development of its plan and carried out extensive engagement with stakeholders and other groups including customers. It is also clear how these groups have influenced the plan and importantly how the company has responded to the comments made."

CC Water, DWMP consultation, 2022

Planning objectives

Box 1

Our DWMP has 14 planning objectives developed with partner organisations and our colleagues to build in the things they care about and know are important in relation to the performance of our drainage and wastewater systems. These objectives are:

- **PO1:** Internal sewer flooding risk
- **PO2:** Pollution risk
- **PO3:** Sewer collapse risk
- **PO4:** Risk of sewer flooding in a one in 50 year storm
- **PO5:** Storm overflow performance
- **PO6:** Risk of WTW compliance failure
- **PO7:** Risk of flooding due to hydraulic overload
- **PO8:** Dry weather flow compliance
- **PO9:** Achieve good ecological status/potential
- **PO10:** Improve surface water management
- **PO11:** Secure nutrient neutrality
- **PO12:** Reduce groundwater pollution
- **PO13:** Improve bathing waters
- **PO14:** Improve shellfish waters

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Our approach has enabled us to identify and consider links and relationships with other plans, including Local Plans, our Water Resources Management Plan, Flood Risk Management Plans and the River Basin Management Plans. As a result, our customers, communities and local businesses will see greater collaboration between ourselves, other water management organisations and environmental groups.

Customer engagement

We kept our customers informed as we developed our first DWMP by sharing regular online updates. We also engaged customers in developing our DWMP through our customer insight programme, which hosts a range of customer panels:

- Water Futures 2030 (household customers)
- Water Futures 2050 (future customers)
- Water Futures and vulnerability (vulnerable customers)
- Water Futures Business (non-household audiences)
- Water Futures and diverse cultures (customers from harder to reach audiences and diverse cultures)

The panels have been asked to consider a range of issues since 2021, and the insight gained has informed and steered the development of our DWMP.

Board engagement

Our Board and directors have been engaged and involved in the development of our DWMP, ensuring alignment to Defra's Guiding Principles for Drainage and Wastewater Management Plans. This document sets out the expectations of Defra, the EA, Ofwat and six guiding principles:

- Be comprehensive, evidence based and transparent in assessing, as far as possible, current capacity and actions needed in five, 10 and minimum 25-year periods considering risks and issues such as climate change. Plans should also align, as far as possible, with other strategic and policy planning tools.
- Strive to deliver resilient systems – that will meet operational and other pressures and minimise system failures.
- Consider the impact of drainage systems on immediate and wider environmental outcomes including habitats and in developing options for mitigation to include consideration of environmental net gain and enhancement.
- Be collaborative – recognising the importance of sectors working together to consider current and future risks and needs and to deliver effective solutions, setting out how they will do this, how they have engaged with and responded to stakeholders.
- Show leadership – in considering the big picture for an organisation's operational capacity to develop and deliver the plan, and mindful of linkages with other strategic planning frameworks.
- Improve customer outcomes and awareness and that solutions and actions provide both value for money and consider societal benefits.

Our Board has considered the final DWMP and confirms that it is satisfied that:

- The guiding principles and the DWMP technical framework are being followed and applied
- The planning objectives are being met (both common and bespoke)
- There are clear links and processes in place to ensure the appropriate DWMP interventions, including partnership and co-funded schemes, will be put forward for investment in PR24 business plans
- Measures are in place to achieve objectives set in the Government's Storm Overflows Discharge Reduction Plan
- It is a best value plan for customers and the environment for managing and developing drainage and wastewater services and is based on robust evidence and costing processes.

Planning for the future

The UK Parliament declared a national climate emergency in 2019 to drive adaptation to climate change and reduce carbon emissions by 80% by 2050.

Our DWMP is a long-term plan that sets out the investment needs for the short, medium and long term to meet our customers' expectations, provide the necessary capacity and create resilient wastewater systems. We need to start investing now for the future to avoid unaffordable water and wastewater services bills in the future.

Our DWMP provides an important step towards integrated water cycle planning and management – where planning across drainage, agriculture, land use, highways and the environment is co-ordinated to ensure the availability of high-quality water for people, industry and the environment.

The changing climate will significantly increase pressures on our drainage and wastewater systems. We realise the scale of these challenges and recognise that a radical step change is needed to ensure we have the right level of investment now and into the future to provide resilient wastewater systems.

We've identified 12 significant challenges ahead:

1. Climate change. This is already affecting our weather patterns. The past seven years have been the warmest on record. Predictions are for less overall annual rainfall in our region, but we can also expect periods of exceptionally heavy summer storms and warmer wetter winters. These may overwhelm our sewers or present longer periods of drought, which will create operational challenges to make sure our customers and the environment are not affected by flooding, pollution or drought.
2. Population growth. This results in additional homes connecting into existing systems and the development of new towns that require new drainage and wastewater infrastructure. The rate of growth is increasing and a further 800,000 people are forecast to need homes in our region by 2040. Urban development of roads and infrastructure is resulting in fewer green spaces and trees to absorb rainfall and reduce run-off which is likely to lead to more frequent flooding.
3. Tightening environmental permits. These will be needed to make sure important habitats are protected and remain resilient. Over 24% of our wastewater treatment works (WTW) have permits which will deliver high quality, low nutrient effluent. We are using the best available technology, however, we expect the EA to tighten permits further.
4. Nutrient enrichment. There are urgent concerns regarding nutrients enriching our coastal and inland waters and affecting the ecology of the natural environment. We're already using the best available technologies and expect further investment to be needed in the future.
5. Keeping rivers, lakes, reservoirs and coasts healthy and clean. High quality open waterbodies are fundamental for local tourism, shell fisheries and recreation. The Water Environment (Water Framework Directive) Regulations, 2017, is the primary legislation that protects our rivers and lakes, estuaries, coastal waters and groundwater, and drives the need to ensure all aquatic ecosystems meet 'good status' by 2027. Only 14% of rivers in England are currently classed with 'good ecological status ' by the EA.
6. Persistent and biologically active chemicals/ pharmaceuticals. These have the potential to disrupt hormones systems in both humans and wildlife. They are entering the drainage network from homes and businesses, but also in rainwater draining from farmland and roads.
7. Public health. The rise in popularity of wild open water swimming and watersports means there is a concern for public health due to the bacteria in rivers and coastal waters. It is also becoming apparent that the quality of our groundwater drinking water supplies are being degraded by poorly maintained sewers and septic tanks, and from discharges direct to ground in areas that are not connected to our mains sewerage networks.
8. Plastics and microplastics. There are a growing number of products that could have a significant but, as yet, not fully understood impact on people and the environment. They are entering the drainage network from homes and businesses, but also in rainwater draining from open land and roads.
9. Carbon. Our industry has a large carbon footprint due to the energy required to treat drinking water, process wastewater and pump sewage around our networks. As an industry we have committed to reach net zero carbon operational emissions, and we have published our Net Zero Plan.

10. Ageing assets and infrastructure. Much of our sewer network is in excess of 50 years old and is not built to cope with current levels of storm water. Sewers also deteriorate over time leading to collapses, blockages, leakage or infiltration of groundwater. Groundwater infiltration can cause overloading which can lead to restricted toilet use or localised flooding. Escape of sewage from sewers can affect the quality of water underground in aquifers, which are a source of drinking water.
11. Water recycling and repurposing. We expect droughts to happen more often as our climate changes. To make sure we have enough water to meet demand, we need to change how we look at and use wastewater. Treated wastewater that is currently released out to rivers and the sea is a valuable resource which could instead be recycled and used again to augment drinking water supplies.
12. Affordability. The current cost of living crisis is placing greater financial pressure on our customers. We need to carefully consider the costs of how we manage the future challenges and achieve our environmental ambitions. The rate of investment will need to increase to keep pace with these challenges and prevent us passing costs onto future generations, but we want our water bills to be affordable for all, especially the vulnerable.

Water recycling pilot

Our draft Water Resources Management Plan has proposed four schemes that will recycle high-quality treated wastewater. In some areas, this will be put into rivers where we can abstract it again, and in others it will be into a storage facility such as a reservoir where it will mix with other sources of water. Doing this means we can store the water until we need it, and it helps to protect the environment as we are not impacting on the flow or quality of the river.

What our public consultation told us

62% of the total responders agreed that we had captured the main challenges for drainage and wastewater management across our region. Of those that did not agree, some thought the main challenges are political. Regulations should be changed so that we're able to refuse connections to new development where there is not enough capacity. Some want to see the water industry made a statutory consultee when it comes to development planning. Items labelled as flushable should be banned. Others think biodiversity depletion is the most critical challenge

Our DWMP builds on the significant investment already made during the current five-year investment period (see Box 2).

Box 2

Building on the present

Our Plan builds upon the business plan for 2020-25 and the investments made during this period including:

- Our **£83 million** Pollution Reduction Programme to reduce the number of pollution incidents by **80%** by 2025
- Our **£517 million** environment programme to improve the standard of 7 bathing waters and 537kms of rivers
- Our investment of **£207 million** to create the capacity and infrastructure necessary to support the 156,849 new houses forecast to be connected to our network by 2025
- Our commitment to reduce the number of spills from storm overflows by **80%** by 2030

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Feedback from our public consultation

"The most important future challenge for all authorities within the water management sector is changing mindsets to ensure that water is more widely regarded as a precious resource in its whole lifecycle and not solely as a risk (in the case of flooding) or a right (in the case of drought)."

County Council, DWMP consultation 2022

Feedback from our public consultation

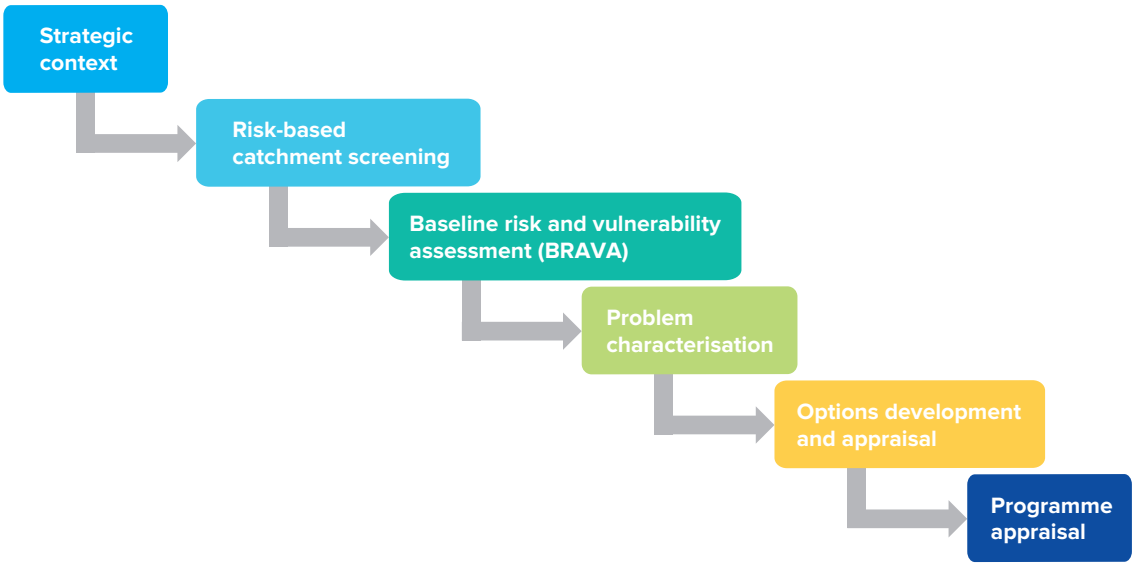
"I like the fact that you now have a plan – but a 20 to 30-year timeframe is too long and I won't see any benefit. It should have a shorter time frame."

Customer, DWMP consultation, Autumn 2022

Developing our DWMP

Our plan has been developed in accordance with the national DWMP framework guidance. The main steps in the process are shown in Figure 2.

Figure 2: Steps in the development of our DWMP



Strategic context

The Strategic context defines the objectives of the DWMP and the key drivers behind the need for a long-term plan. It includes the planning objectives against which current and future performance is to be measured, at a company and local planning level. Read our strategic context.

Risk-based catchment screening (RBCS)

This approach allowed us to focus our investment where there is evidence of system vulnerability. The RBCS uses existing, readily available data to identify risks, which can then be explored further in the next stages of the DWMP.

The RBCS involves the assessment of each sewer system against 17 indicators set out in guidance published by Water UK. We included an additional metric on customer complaints.

Read our technical summary on the RBCS.

Baseline risk and vulnerability assessment (BRAVA)

The DWMP uses risk assessments to understand the probability and impact of the current and future performance of our wastewater systems on our customers and the environment. The national guidance requires all water companies to set the base year as 2020, and to use incident data, for the period 2017 to 2019 inclusive, for the risk assessments.

We developed a risk assessment methodology for all 14 of our planning objectives. Some of these were developed with partner organisations such as the EA and Natural England. Read our BRAVA risk assessments and methodologies. The results of the risk assessment are presented in three risk bands defined in the national DWMP guidance (see Box 3).

DWMPs – A risk based approach

Box 3

Risk assessments were developed for all 14 planning objectives to identify the current (2020) and future (2050) risks. The results are presented in three risk bands set out in the national guidance:

- **Band 0:** Not significant
- **Band 1:** Moderately significant
- **Band 2:** Very significant

Regional maps of the risk assessment results can be found on our website here: **https://www.southernwater.co.uk/dwmp/regional-brava-risk-maps**

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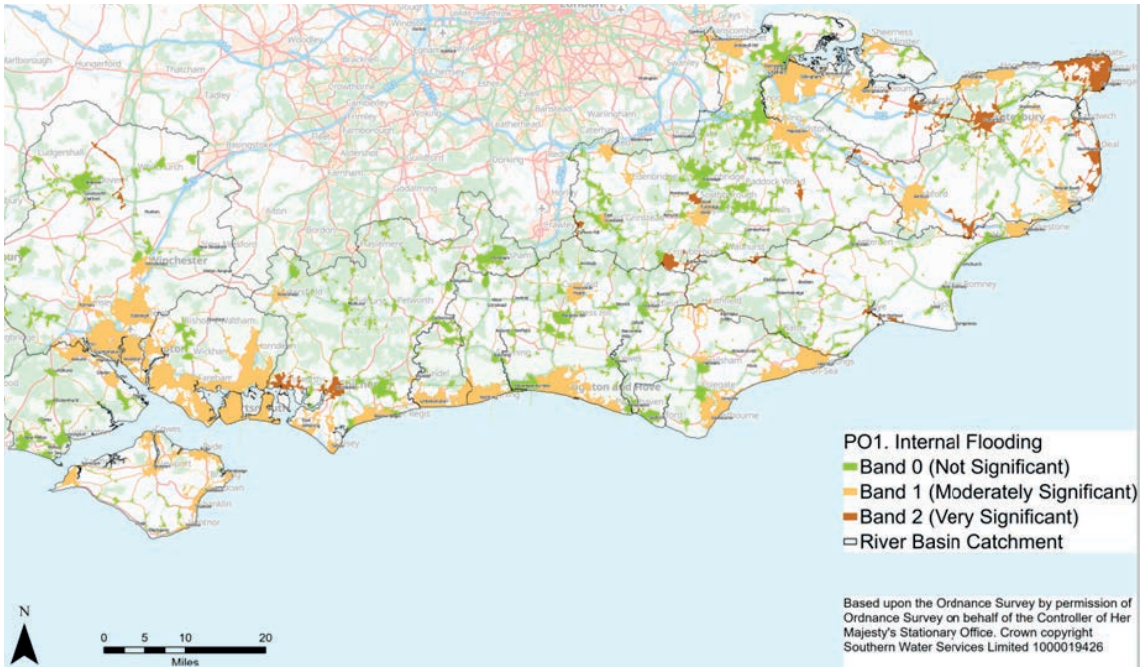
A regional map showing the 2020 results of our risk assessment for the planning objective on internal flooding risks is shown in Figure 3. Our maps showing the risk assessment results for all 14 planning objectives are on our website.

We also completed a resilience assessment to consider the risks to our systems from natural hazards, such as flooding, as well as disruption to power supplies and telecommunications, as set out in the national guidance. The shocks and stresses that our wastewater systems could face now and into the future are just some of the issues we considered as a business to test and improve our resilience. Actions to improve the resilience of our assets and systems have been taken forward as part of our Resilience Action Plan, and we are specifically taking action on power resilience in this current five-year investment period under our Pollution Incident Reduction Programme.

Figure 3: Risk assessment results for internal flooding in 2020



Further information can be found in our technical summary on the risk assessment stage of our plan.

Problem characterisation

The problem characterisation stage within the DWMP enabled us to explore the causes of risks and identify the wastewater systems with the highest level of concern. Sandown, Swalecliffe and Weatherlees Hill have the most planning objectives in risk Band 2 – each with seven of the 14 Planning Objectives in Band 2. The risks are likely to be the most complex and difficult to resolve, and they are the three wastewater systems with the highest level of concern across our region.

Our technical summary on problem characterisation provides further information on this stage of the DWMP.

Options development and appraisal

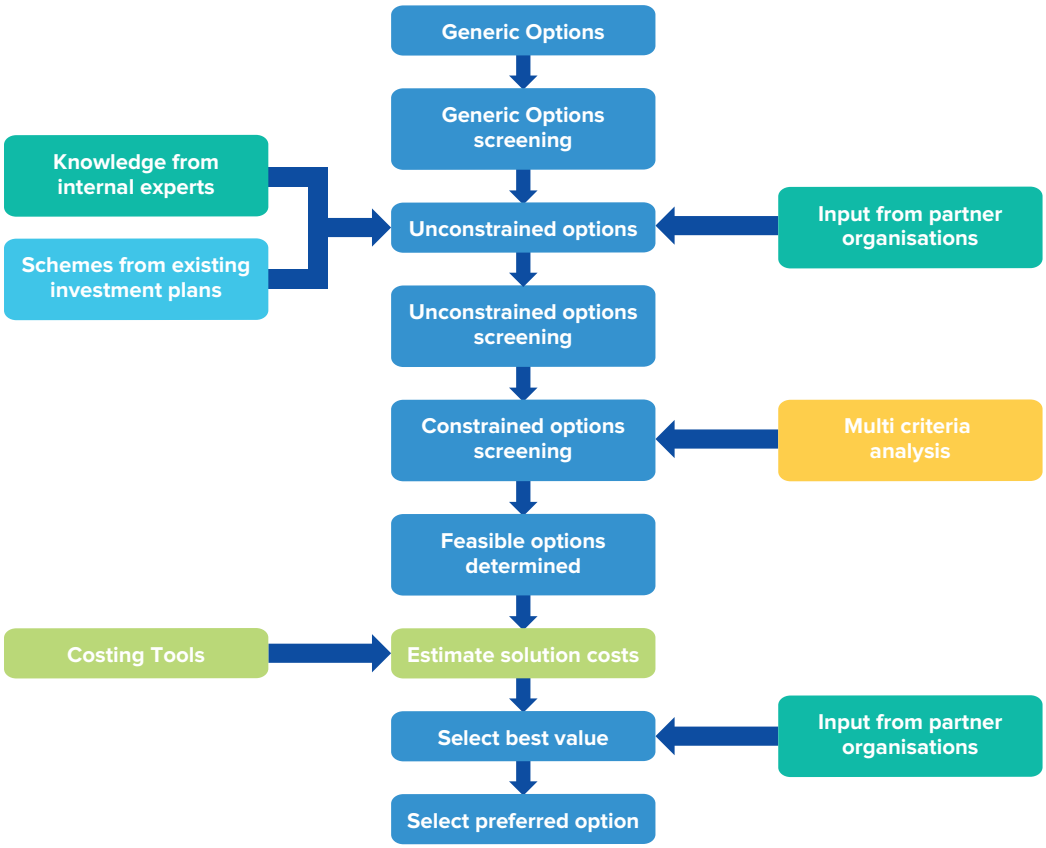
We adopted the source-pathway-receptor (S-P-R) model, widely used for environmental risk management, for our DWMP. It helps us to consider and identify opportunities to tackle and reduce the risks 'at source' as well as by investing in our infrastructure assets 'the pathway'. It also identifies whether we need to mitigate the impacts on customers and the environment in the 'receptor', the receiving waterbody for any discharges or at customer homes.

We progressed all the systems with a high and medium level of concern, and a selection of systems with a low level of concern, through the options development and appraisal (ODA) stage. In total, we took 61 systems, serving 78% of our customers, through the ODA process to develop their investment needs.

Figure 4 sets out a flow chart of the ODA process. An initial list of generic options set out the types of intervention that could be used to address identified risks – this included over 2,000 unconstrained options for the 61 wastewater systems.

Inspecting the Swalecliffe system

Figure 4: ODA – from generic to preferred options



The unconstrained options were screened using a multi criteria analysis (MCA) to appraise the wider social, economic and/ or environmental benefits, as set out in our Strategic Environmental Assessment (SEA) Scoping Report. We estimated the cost for these options using a costing tool which assigned values to each option, based on previous known examples of the unit. The MCA resulted in over 1,500 feasible options for our plan.

The outputs of the ODA and draft investment needs were shared and discussed with business experts and external partners at a series of workshops in March 2022. Best value options were then selected as 'preferred'.

Our technical summary on Options Development and Appraisal provides further information on this stage of the DWMP.

Programme appraisal

The programme appraisal stage collates the preferred 'best value' investment needs identified during the ODA into a regional 'needs based' investment programme.

We defined "best value" as the option that will provide the most net benefits relative to the estimated cost it will incur, and the population served.

The Programme Appraisal meant we were able to assess the wider risk reduction that could be achieved by each of the options across all 14 planning objectives. Each option was given a risk reduction score to enable the options to be prioritised and scheduled in our investment programme.

The investment programme provides the information on the costs, benefits and the expected level of BRAVA risk Band Reduction (BR) for each option. This is explained in the Investment Needs section below.

Further details can be found in our technical summary on programme appraisal.

Creating resilient wastewater systems

Our vision is to create a resilient water future for our customers in the South East.

This means making sure our drainage and wastewater systems are (a) not causing unacceptable risks to customers and the environment, and (b) are resilient to threats and hazards both now and in the future to avoid loss or disruption to services.

We assessed the current and future risks in preparing our DWMP for each of our planning objectives. We discuss the risks for each of the planning objectives in this part of our DWMP with the planning objectives grouped under:

1. Wastewater recycling and nutrient removal
2. Asset health and resilience
3. Sewer flooding and
4. Storm overflows.

Stokes Bay Beach

Wastewater recycling and nutrient removal

The Environment Agency (EA) sets limits on the quality and quantity of recycled water (called effluent) that is discharged back into the environment from wastewater treatment works (WTWs) through the setting of permits.

These permits are based on the nature and sensitivity of the water body and local environment to make sure any releases don't cause harm or an unacceptable risk of harm.

Legal compliance with our permits is central to our DWMP, which focuses on managing and mitigating the risks from our systems and planning the right combination of investments to benefit our customers and the environment.

The permit conditions set by the EA usually include details of the composition of our treated effluent and stipulate the quality standards for the effluent discharged back to the environment. Parameters include biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), pH, ammonia (NH3), Nitrate (NO3) and Phosphorus (P).

We're required to monitor metals at some of our sites and we also have ultraviolet (UV) treatment installed to disinfect effluent before it is discharged to the environment. This is particularly important when the effluent is hydrologically connected to Shellfish Waters and Bathing Waters where it could impact human health.

We considered the issue of wastewater recycling and nutrient reduction in our DWMP under four planning objectives:

- PO6 – Wastewater Treatment Works Compliance: Quality
- PO8 – Wastewater Treatment Works Compliance: Dry Weather Flow
- PO9 – Achieving Good Ecological Status or Potential, and
- PO11 – Nutrient Neutrality.

Permits to release wastewater

A consent or permit can be a prescriptive or a descriptive licence:

1. 295 of our WTWs have a prescriptive licence.
2. 72 of our WTWs, mainly our very small WTWs, have a descriptive licence.

A prescriptive permit sets limits on the pollutants that can be released to the environment so that they do not cause any harm. In the case of a descriptive permit, specific numerical conditions are not set.

Risk of wastewater treatment compliance: quality (PO6) and dry weather flow (PO8)

The performance of our WTWs, wastewater pumping stations (WPS) and storm overflows is a significant factor in preventing pollution of the environment. It's our core responsibility to operate our systems to make sure we're compliant with the permits issued by the EA, at all times. However, problems do occasionally occur that lead to a pollution incident. These can include factors under our control, such as equipment failures, and things that we cannot control. Examples of external factors that can cause pollutions include:

- A sudden drop in temperature which adversely affects our biological treatment processes
- Network or operational issues such as groundwater infiltration during heavy rainfall
- Power outages in extreme weather events
- Sustained increases in sewage flows due to changes in customer behaviour – for example, the shift in home working during the pandemic
- An inadvertent spillage of toxic chemicals into the sewer from, say, a road accident.

Our focus is to proactively manage our assets and systems no matter what challenges arise, and to comply with our permits to ensure our services and infrastructure do not lead to environmental harm.

What our public consultation showed us:

Our public consultation on the draft DWMP asked customers and stakeholders to prioritise which of the following four areas of investment would be the most important to them:

- Sewer flooding
- Sewer condition and groundwater pollution
- Wastewater compliance and pollution
- Improving the environment.

41% of the total responses stated that permit compliance was the most important. The table below shows the importance in order of preference:

Investment area	Aggregated responses to options (%)			
	1st	2nd	3rd	4th
Sewer flooding	27%	17%	27%	27%
Sewer condition	14%	45%	32%	9%
Compliance	41%	30%	23%	12%
Environment	18%	9%	18%	53%

It was recognised that investing in compliance would have positive impacts on many other areas such as reducing pollution and nutrients and improving the environment. However, many commented that all options are of the highest priority. Asking for them to be ranked did not make sense and all need addressing with equal urgency. It is essential that all options are achieved. A holistic approach to all the issues is needed.

Complying with permits for PO6 and PO8

Our DWMP included the national planning objective 6 (PO6) on the risk of WTW compliance with permits for the quality of discharges to the environment. We used this objective to assess our current and future risk of breaching the permitted treated effluent quality standards for each of our 295 WTW with prescribed quality standards.

We added a planning objective 8 (PO8) in our DWMP to assess the current and future risk of compliance with the dry weather flow (DWF) permit conditions.

We have 308 WTW sites with DWF permits and, for each of these, we looked at our current (2020) DWF compliance risk by assessing the capacity in the treatment works to take additional flow. Our BRAVA methodology for PO8 assessed our current and future risk of breaching these flow rates.

The risks associated with DWF compliance (PO8) and WTW treatment quality (PO6) are linked as an increase in DWF may require improvements in the treatment processes to maintain the effluent standards of discharges.

Dry Weather Flow (DWF)

DWF is the average daily flow that we expect to reach our WTW during a period without rain. DWF has four main components: domestic wastewater, trade effluent, cess imports and infiltration.

The future risks for both planning objectives have been forecasted by estimating the growth in population to 2050 using long-term population growth forecasts and best estimates provided by Local Planning Authorities. Although we routinely build sufficient capacity into our WTW to enable us to remain compliant with our permits, we'll continue to work closely with

local planning authorities to build a greater understanding of the risks from growth over the medium to long term. Details of the growth projections are in our technical summary on growth.

The DWMP does not currently assess the need for tighter permit conditions at WTWs. We think this is a pivotal planning tool to be able to deliver more resilient catchment-based solutions to these challenges. For example, we expect regulations regarding nutrients to become more stringent with continued pressure to further improve water quality standards.

Technologies to enable us to reach lower permit levels will be developed. Knowing future environmental limits, targets or permit levels will enable us to plan for the right investment at the right time, and using catchment and nature-based solutions could help avoid returning to the same sites every investment period to make incremental improvements. This forward planning will facilitate adaptive planning and enable us to identify major investment needed to protect the environment from wastewater operations.

We will continue to work with the EA to ensure our treatment works are treating wastewater to appropriate standards set out in their permits.

Infiltration from groundwater and coastal salt water

Flow in our wastewater systems is affected by infiltration of groundwater and intrusion of coastal salt water. Infiltration occurs when the water in the ground rises to a level where our sewers are surrounded by water. More infiltration occurs when the sewer is in poor condition.

Infiltration is a significant issue across our region due to the chalk geology of the North and South Downs, especially across East Kent, Sussex and North Hampshire. The areas in Hampshire most affected by groundwater infiltration into the sewer network are the villages in the Pillhill Valley, to the west and east of Andover. In coastal areas, the groundwater can be salty in nature, which causes specific problems with biological processes at our wastewater treatment works.

Infiltration entering the sewers can overwhelm them and prevent sewage from customers' properties reaching our treatment works. As a result, some customers can suffer from restrictions to their use of bathrooms, toilets and kitchens.

Internal flooding and releases from storm overflows can also happen when too much rainwater gets into the sewer system. In these cases, we might need to use tankers and over-pump to remove this excess water from the sewer system.

The EA requires wastewater companies to submit their plans for managing groundwater infiltration of the sewers. These are known as infiltration reduction plans (IRPs). These are published on our website and we continually review them to take account of, for example, our extensive continuing programme of surveying and sealing the sewers to improve their performance.

We identified where infiltration is a concern through the risk assessment on dry weather flow (DWF) compliance. This means we can proactively target infiltration where we have flow issues into our sites.

Protecting and improving the environment

Our region has a wealth of beautiful inland, coastal and natural environments that are not only fundamental to supporting the economic and social vitality of our region, but also to the wildlife, biodiversity and ecosystems that thrive here.

Many of the rivers, streams, ponds, wetlands and coastal waters have national and international nature conservation designations. These include SSSIs (Sites of Special Scientific Interest), SACs (Special Areas of Conservation), SPAs (Special Protection Areas) or Ramsar, MPAs (Marine Protected Areas), MCZs (Marine Conservation Zones) or are part of a National Park, LNR (Local Nature Reserve) or an AONB (Area of Outstanding Natural Beauty). Our region is home to globally rare chalk rivers, streams and marshland habitats. The quality and quantity of the water in the environment is fundamental to supporting all of this.

Customer insight:

"I think it's really important for Southern Water to prioritise benefitting the environment – supporting ecosystems, preventing wastewater polluting the environment and investing in combatting climate change."

Youth Panel Future Customer: Future Priorities, December 2021

We recognise the important role we play in protecting the environment and enhancing these nationally and internationally important sites for nature across our region. We have duties to conserve and enhance biodiversity under the Environment Act 2021 amendments to the Natural Environment and Rural Communities Act 2006.

In our first DWMP we evaluated the benefits to the environment through a multi-criteria options appraisal. Further detail can be found in our Technical Summary on Options Development and Appraisal.

We included two additional planning objectives to understand the risks from our releases on the quality of surface waters in rivers and the sea, and on internationally designated habitat sites. These are:

(a) PO9: Achieving good ecological status/good ecological potential (GES/GEP)

(b) PO11: Securing nutrient neutrality (NN).

Both are about reducing the levels of nutrients, mainly phosphate and nitrate, in the effluent from our wastewater treatment works.

The water quality in rivers and the sea is affected by many industries and sectors. We therefore need to work with other organisations and sectors to achieve the Government's objectives for the health of rivers and the sea. The Environmental Targets (Water) (England) Regulations 2023 have set ambitious targets for nutrient reduction:

- the agriculture water target – 40% reduction (from 2018 baseline) of total nitrogen, total phosphorus and sediment entering the water through agricultural diffuse pollution by 2038
- the wastewater target – 80% reduction (from 2020 baseline) by 2038 in total phosphorus released into freshwaters from wastewater releases
- the water demand target – 20% reduction by 2038 (from 2020) in volume of potable water supplied per day per head of population (in the relevant sections that look at demand, PCC and Target 100).

To develop our DWMP, we've been working with our regulators, the EA and Natural England, Local Authorities and member organisations of the catchment partnerships that have nature conservation, enhancement and enjoyment as core goals.

Water quality – good ecological status/ good ecological potential (PO9)

The quality of the effluent that is released from our WTWs and from our sewer overflows affects the quality of the waters that receive them. In turn, this affects the habitats that ecosystems depend on, and impacts our customers, communities and the visitors to our region. Good ecological status or good ecological potential is the measure through which the quality of the water environment is assessed (see box).

There are many potential sources of pollution that affect our rivers and seas. These are listed by the EA as reasons for not achieving good (RNAG) ecological status. They include our drainage and wastewater systems as well as other sources such as private releases and road and agricultural run-off.

We'll focus investment on those wastewater systems identified by the EA and make sure that priority actions are included within the statutory Water Industry National Environment Programme (WINEP) so funding can be secured from our customers and shareholders to deliver them.

The investment needs identified under this planning objective are mainly for studies, such as Urban Pollution Management (UPM) studies, to understand the sources of pollution or other water company activities. The options for improving the water quality in our rivers, streams and coastal waters can be categorised into three types:

- Studies/investigations – required to understand the impact of wastewater releases and identify measures required to achieve good ecological status.
- Improvement schemes derived to tackle storm overflows where the 'Reason for not achieving Good' (RNAG) status has been attributed to the performance of intermittent releases (see the section on storm overflows); and
- Improvement schemes identified for the WINEP in the next five-year investment period to 2030.

The majority of options identified have been assigned as short term as we must carry out further studies and investigations to confirm whether the performance of our assets is part of the reason for failure to achieve GES/GEP. The outcomes of these studies will determine the extent and period of investment required to deliver and achieve GES/GEP.

Good ecological status

Good ecological status (GES) is a key term in the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. This legislation requires "necessary measures to prevent deterioration of the status of all water bodies" and improves the quality of waterbodies. The water quality or ecological status of a stream, river, lake, estuary, lagoon or coastal water is an index of the quality of the water itself and the variety and quantity of plant and animal species it supports. By comparing the observed ecological status against the theoretical status, it would have in a completely natural state unaffected by human activity, one of five status classifications can be assigned to a waterbody: high, good, moderate, poor and bad. "Good" ecological status is the target condition for all waterbodies by 2027.

Good ecological potential (GEP) applies to all "artificial" or "Heavily Modified" waterbodies (HMWBs). These will include waterbodies that have been modified for flood protection, navigation, recreation or water storage. It's accepted that, through the physical modifications made, GES can never be achieved for the HMWBs so the target is to achieve GEP – the best ecological condition possible under these alternative uses and conditions.

Ecological status is assessed by measuring the impact of activities (e.g. pollution and habitat degradation) on biological, physico-chemical and hydromorphological quality indicators. Failure of any one individual indicator means that the whole water body fails to achieve good or better ecological status or potential (the 'one out all out' rule). There are five classifications from bad to high.

The FreshWater Blog provides a short video to explain more.

The UK Government reports that only 14% of assessed rivers and 19% of estuaries are currently at good ecological status. In terms of water quality in rivers and the indicators affected by water companies, the figures are:

- Dissolved oxygen: 82% at good status.
- Ammonia: 92% at good status.
- Phosphorus: 45% at good status.
- Hazardous substances: Chemical status: 0% at good status. Chemical status excluding ubiquitous, persistent, bioaccumulative, toxic substances (uPBTs): 93% at good status.

This data comes from the 2019 set of probable and confirmed reasons for not achieving good status (RNAGs), linked to 2016 WFD classifications. This data show that for our operating region, there are 1,798 waterbodies, of which 331 (18%) are suspected, probably or confirmed as one indicator for not achieving GES due to our continuous permitted releases, and 51 (3%) from storm overflows.

Case Study:

An integrated Plan for Chichester, Langstone and Pagham Harbours

The chalk stream catchments of the South Downs and shoreline of the South Coast provide one of the most ecologically valuable and beautiful coastlines in Europe. Integral to this are the Harbours of Chichester, Langstone and Pagham.

In recognition of their significance for wildlife and habitats, the harbours are protected by some of the highest international, European and national designations. They also have an important role in supporting tourism, fishing, recreation and the local economy. Despite the protection designation affords, the harbours and the wildlife habitats they support are in slow decline. The pressures of growth, climate change and recreational pressures combined with water quality impacts are, over time, threatening the immense natural capital value of the harbours.

In May 2021, we convened a summit of senior leaders under the independent chairpersonship of Professor Sir Dieter Helm, CBE. The summit partners are working together to develop an integrated plan which will set out a shared vision to accelerate water quality improvements and restore nature in the three harbours and their catchments by 2030 and beyond.

Restoring our harbours.

Customer feedback:

"One of the major issues that we have to our whole quality of life down here is the pollution of Chichester Harbour. To be fair, lots of the proposed remedies you've put forward, if they're carried through, will help, but we need it done as quickly as possible. We've got an AONB, SSSI, a Ramsar site, the list is endless, a very popular holiday destination, and yet our harbour is deteriorating. The shellfish, crabs and lobsters which the local fisherman rely on for their livelihood, their populations are decreasing substantially. This is something that can't wait until 2050, it has to be remedied now. People think it's because of the housing and sewage, but a lot of it is due to farming. Generally, all round, we do have discharges into the harbour. I know to a certain extent you have to get involved with Natural England and the Environment Agency, because I know at the moment you have to do it within permits, so it's a question of strengthening the permits. That's our big issue."

Local Authority, Long Term Priorities Workshop, July 2022

Nutrient neutrality (PO11)

Evidence from studies over the last few decades are showing that many water dependent habitats and ecosystems are in significant decline. There are many issues causing this, one of which is the impact of nutrients and other pollutants which come from a variety of sources including recycled wastewater, agricultural and urban run-off and other point sources, for example, from industry.

Increased levels of nutrients, especially nitrogen and phosphorus, can speed up the growth of certain plants, disrupting natural processes and impacting wildlife. Algal blooms and excessive vegetation growth uses up the dissolved oxygen in the water and can kill fish and prevent birds from feeding.

Nutrient neutrality

Nutrient neutrality is a means of making sure that a development plan or project does not add to existing nutrient burdens within catchments, so there is no net increase in nutrients as a result of the plan or project.

The River Itchen from Five Bridges Lane.

Habitats sites

The Conservation of Habitats and Species Regulations, 2017, as amended (Habitats Regulations) is the legislative basis for protecting Habitats sites. Natural England (NE) is the statutory conservation body in England providing advice on the conservation of Habitats sites. The internationally designated Habitat sites covered by the regulations are:

- Special Areas of Conservation (SACs) including marine and offshore sites
- Special Protection Areas (SPAs) including marine and offshore sites
- Ramsar Sites – these are wetlands of international importance designated under the Ramsar Convention.

The Habitats Regulations expect all designated sites to meet or be restored to 'Favourable Conservation Status' (FCS). FCS is assessed on the condition of the site itself and the flora and fauna it supports, rather than the water quality. However, some habitats have supporting water quality attributes that, if failed, are considered to undermine favourable conservation status.

Where sites are already failing their conservation objectives, the ability to provide additional permissions such as for new housing is "necessarily limited" by case law. This means that wastewater from new developments needs to be certain to not add to the existing nutrient burden to further undermine the conservation status. The Government and NE have provided advice and support to help 42 local planning authorities on this issue. The approach is known as nutrient neutrality.

Feedback from our public consultation

"Nutrient neutrality is having a significant impact on the delivery of housing which has been sustainably planned through the Local Plan. As a significant portion of our borough is covered by the nutrient neutrality requirement, it is causing impacts on the distribution of housing."

Borough Council, DWMP consultation, Autumn 2022

One way that developments can help is to demonstrate that all surface water run-off and wastewater nutrients (nitrogen and/or phosphorus) generated will be less than or equal to the load that the existing land generates.

Local planning authorities (LPAs) have responded quickly, especially for the Solent in Hampshire and Stodmarsh in Kent. In the Solent, a government sponsored nutrient trading platform and partnership working between LPAs, government, NE and the EA with the engagement of landowners, has already delivered over 3,000 nutrient neutral homes.

NE has also developed tools such as bespoke catchment calculators to help assess the likely impact of any new development. We plan to use these tools to identify ways to cancel out the additional nutrient pollution through our investment plans.

This will involve the creation of new wetlands, woodland or grasslands – providing new spaces for nature and recreation in the process – or installing more sustainable drainage systems (SuDS). These would also help to prevent sewer flooding, the use of storm overflows and improve the quality of bathing waters, shellfish waters and other waterbodies.

We welcome the House of Commons Environmental Audit Committee recommendation that Defra direct the EA and NE to calculate nutrient budgets for each river catchment in England. We'll work with NE and other partners to do this.

We have explored the risks of nutrients from our wastewater systems impacting on the 38 internationally designated Habitats sites across our operating region in our risk assessment on nutrient neutrality (PO11).

Algal bloom from over-nutrification,

Reducing nutrients from our assets

Our WTWs remove nutrients from wastewater as part of the recycling process before it is released back into the environment. The two main nutrients of concern are nitrate and phosphate – both are contained in domestic and industrial sewage.

The EA permits set the concentrations of nitrate and phosphate in our releases to a level where they will not harm the environment. The permits are regularly reviewed, particularly where new development is increasing the demands on our wastewater systems. Permit changes are an important way for us to negotiate investment through the Water Industry National Environment Programme (WINEP) which would enable the technology and supporting infrastructure, including constructed wetlands, to be financed and installed.

In July, during the consultation on our draft DWMP, the UK Government announced the actions it would be taking to improve water quality and tackle nutrient pollution. The Levelling Up and Regeneration Bill will place a new statutory duty on water and sewerage companies in England to upgrade WTWs by 2030 in nutrient neutrality areas.

For phosphate, we can normally achieve 80% of the permit level and we're able to achieve even more by dosing with it ferric and adding tertiary solids removal. As an example, in recent years we have invested over £25 million at our two WTWs in Hailsham to remove phosphate. However, the costs are high, and the process is carbon intensive and requires the use of chemicals. We're keen to find sustainable solutions while keeping customers' bills low.

For nitrate, removal is dependent on the process and the concentration of the sewage. We're able to remove more nitrate from more concentrated sewage and this tends to be site specific, depending on the equipment available. Separation of rainwater from the sewage system helps to increase the concentration of sewage. A greater percentage of solids in the sewage also increases the success of removing the residual nitrate at the works. Conversely, where the works do not have a nutrient removal process, a reduction in the nutrient load arriving at the works is more beneficial.

Where we cannot strip further nutrients from releases at our WTWs, we are actively looking at new technological solutions, which we'll install if the necessary funding is secured.

The EA has issued guidance on nutrient neutrality for Habitats sites for the next Water Industry National Environment Programme (WINEP) to 2030. We have developed and submitted a programme of investment to upgrade our WTWs in Stodmarsh (near Canterbury), the River Itchen in Hampshire, and the Solent.

We have included these investment needs to meet the 2030 government target in our DWMP. We have also extrapolated these costs to all wastewater systems with a Band 1 or 2 risk for nutrient neutrality. This identifies the potential investment needs to take action to protect other Habitats sites over the next 25 years.

We're already working with planning authorities to tackle the challenges of nutrient neutrality in Stodmarsh in Kent and Chichester Harbour (see case studies).

Case Study:

Stodmarsh – working with Kent Councils to address nutrients in a National Nature Reserve

We're working with the Kent Councils joint Nutrient Neutrality Working Group to address the issue of nutrients in Stodmarsh, one of the most important National Nature Reserves in our region. Nitrate and phosphate from our WTWs and from agriculture and other land uses is causing over-enrichment of its waters and is damaging its ecological value.

Natural England have put a Position Statement in place to protect the habitats in the area requiring developers to demonstrate 'nutrient neutrality' meaning all future growth or development must eliminate or offset the impacts of proposals to ensure no further detriment to the sites.

We completed a study on the sources of nutrients and the impact of these on the site in 2022. We're working together with the Kent Councils Working Group to develop a catchment-wide approach to tackle the issues. As part of this, we're developing an action plan to address the nutrient contributions from our WTWs.

The group is developing a strategic, catchment-scale approach to begin to restore the Nature Reserve to its former condition and to unblock development in the region. This includes joint working to address our contribution to the nutrient overload through wetland schemes for 'effluent polishing'.

Wetland cells with reedbeds and high-rate sand filtering will be used to remove nutrients, microorganisms and fine particles that haven't settled out during the previous filtering processes at the Canterbury and Dambridge Wingham treatment works. More detail on the proposals will be developed as the work progresses. The initial feasibility is being carried out by Natural England's appointed consultants.

We're increasingly applying effluent polishing techniques to our discharges to ensure compliance with ever tighter permits and consents. These types of schemes to protect, restore and enhance the environment are being submitted for funding to the EA's (EA) WINEP.

Case Study:

Reducing nutrients in Chichester Harbour

We're working on nutrient neutrality issues in Chichester Harbour where we're:

- Planning to resolve existing infrastructure issues to accommodate future growth projections
- Investigating the potential for nature-based solutions to capture surface water run-off and prevent it from entering the sewers and causing storm overflows
- Working with farmers to reduce nitrate application and run-off from farmland around the harbours
- Working with partners to build beneficial habitats such as hedgerows, reedbeds and wetlands that can capture overland run-off from roads and farmland and remove any excess nutrients prior to entering the harbours. They will also provide beneficial habitats, improving the landscape, helping to manage flooding and capture carbon
- Collaborating to develop a long-term strategy to protect water quality and the important habitats of the harbours through the Harbours Summit.

Chichester Harbour.

To reduce the risks to PO9 and PO11 we'll continue to:

- Work with the planning authorities in Kent to achieve nutrient neutrality in Stodmarsh and unlock new development
- Work with other authorities to develop a long-term strategy to protect and improve water quality and the important habitats of Chichester, Langstone and Pagham Harbours
- Provide advice and support to LPAs and developers to find sustainable, best-value solutions that enable Habitats sites to be restored to favourable condition while supporting the necessary growth and economic development in the South-East
- Work with NE, the EA and other partners across river basin catchments to deliver the Environment Act 2021 targets of reducing phosphorus loading from treated wastewater by 80% by 2038
- Deliver the improvements in wastewater treatment to achieve the new EA 'technically achievable limit' permits at our sites in NE's nutrient neutrality areas by 2030
- Actively support the Government's target to reduce nitrogen, phosphorous and sediment from agriculture to the water environment by 40% by 2037
- Work with Water UK and government to explore mechanisms to reduce sources of phosphate in consumer products.

Case Study:

Working with farmers to protect the rural environments

Our Catchment Risk team is working with local landowners and farmers to find ways to protect our countryside and the wildlife it supports. Some examples include:

Upper Beult Farm Cluster (UBFC)

Since 2019, we've been working with Kent Wildlife Trust (KWT) to establish a farm cluster in the Upper Beult. We provided funding for a full-time Farm Cluster Facilitator to organise group events, 1:1 farm visits and biodiversity surveys. The Cluster has built local good will towards farm trials to help develop pesticide measures to reduce the high concentrations of agricultural pesticides being detected in the River Beult.

Arun to Adur Farmers Group (AAFG)

For the past four years, we've been working in close partnership with the Arun to Adur Farmers Group in the Worthing Chalk block. Building strong relationships with over 40 members has engendered significant farmer interest in participating in our groundwater nitrate programme to reduce nitrate leaching. Uptake has been so strong that the programme has now exceeded capacity.

Winchester Downs Farmer Cluster (WDFC)

Run by the South Downs National Park Authority, the farms in this cluster are directly aligned with some of our groundwater catchments. We've recently developed a new soil health project to support soil conservation, carbon sequestration and regenerative agriculture. This involves comparing different soil health mapping systems to help understand which system provides the most accurate and effective means of recording improvements in soil health on their farms.

Soil Analysis at Burntwood Farm.

Links with the Water Resources Management Plan

Our Water Resources Management Plan (WRMP) makes sure that there is sufficient good quality water in the environment for the natural systems and wildlife that need it, as well as meeting the needs for public water supply. There are synergies between the WRMP and the DWMP in two key areas: (a) the consumption of drinking water and the volume put back into our wastewater systems, and (b) water recycling for re-use.

Future flows from our customers' homes in our sewers are dependent on the amount of water people use. Currently, it's estimated that each person uses an average 133 litres of water per day, with 92.5% of this ending up in the sewer. We estimate that this will reduce to 125 litres by 2050. However, our ambitious Target 100 programme works with our customers to reduce this further to 100 litres per day by 2040, or even less in some areas due to water neutrality issues.

Water neutrality

Water neutrality is defined as no net increase in water abstraction for drinking water use from new development.

Target 100 is a good example of integrated water management, however, reaching the goal could also be achieved through the capture and re-use of water in the home.

Reducing the volume of water used by customers may also reduce the flow in our sewers and the wastewater requiring treatment at our WTWs. We'll monitor this carefully to ensure that reducing flow in sewers does not cause an increase in the risk of sewer blockages (see PO1 and PO2). A sufficient base flow is needed to flush solids through the system and ensure the sewers remain self-cleansing, as originally designed.

The South East is a water stressed region facing a climate emergency. This means we should be thinking about the release of treated wastewater out to sea as a lost resource. We're considering water re-use options, as well as desalination to abstract water from the sea, to meet future demand. Our customer insight has told us that water recycling is the preferred option.

Our draft Water Resources Management Plan is proposing four recycling schemes across our region to 2035: Sandown, Isle of Wight, (to be delivered in 2027–28), Ford, Sussex, (2027–28), Aylesford, Kent (2030–31) and Budds Farm, Hampshire (2030–31).

Peel Common Wastewater Recycling pilot.

Asset health and resilience

The Planning Objectives PO2, PO3 and PO12 highlight operational activities and investments needed to maintain and improve our existing systems.

Peel Common Wastewater Treatment Works

Risk of pollution (PO2)

We have a duty to protect and improve the environment in which we operate, and we recognise that causing it no harm through pollution incidents is the minimum our customers expect from us. We know we need to improve our pollutions performance to demonstrate our commitment to our customers and the environment.

The performance of our WTWs, pumping stations and storm overflows is a significant factor in preventing pollution.

Sewage can be released from our network when there's a blockage or other problem. If untreated wastewater is diverted to waterbodies via storm overflows, the storm tanks at our WTWs or emergency overflows, it can cause a pollution. Wastewater can also rise out of the sewer network through manholes because of groundwater flooding.

Pollutions are categorised by the severity of their impact using the EA's Common Incident Classification Scheme (CICS). We report pollution incidents to the EA. We have ambitious targets to achieve zero pollution incidents by 2040, with less than 80 incidents by 2025.

Our Pollution Incident Reduction Plan

We have a dedicated Pollution Incident Reduction Plan (PIRP) to deliver this commitment. The PIRP is supported by an £83 million investment programme to reduce risks and significantly increase monitoring of our networks. This includes £60 million on strategic projects to deliver improvements in network digitisation, logistics and asset maintenance. This is a detailed programme of activities, which so far has halved serious pollution incidents in 2020, compared to 2019, with those at WTWs reduced by approximately 40%.

Customer insight:

"It would be great to feel as though you can really trust a company and that they are one of the 'good guys'. I no longer feel this way about Southern Water after they chose to dispose of their wastewater in such a way."

Future Customer Youth Panel: Future Priorities, December 2021

Figure 5: Our route to zero pollution incidents

We've set an ambitious target to reduce pollution incidents to zero by 2040.
To work towards this, we've developed a detailed Pollution Incident Reduction Plan.

2019-20 **434** POLLUTION INCIDENTS

2025 **<80** POLLUTION INCIDENTS

2040 **ZERO** POLLUTION INCIDENTS

People

- **Complete restructure of the Executive Team** and additions to our Board with strengthened governance.
- Appointment of a **Director of Risk and Compliance** to challenge front-line teams.
- New **Wastewater Network Management Controller** to better coordinate out-of-hours emergency support.
- **'Think Pollution'** training given to all first responders to empower them to reduce pollutions.

Culture

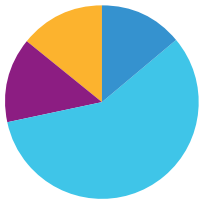
- **Refreshed company vision, values and purpose** which support and align to a modern compliance framework.
- **Enhanced compliance** across all wastewater treatment works including compulsory compliance and Code of Ethics training for all relevant colleagues.
- A cultural shift driving the **self reporting of incidents** so it is one of the best in the industry.
- **Customer campaigns** to raise awareness of the causes of sewer blockages and how they can help reduce them.

Assets and process

- **Invested £26m** in wastewater sites over the past year.
- Five year plan overspend funded by shareholders of **£150m** to transform the business.
- Auto restart technology **installed at 350 sites** to improve resilience to power outages.
- **State of the art machine learning** used to predict potential blockage hotspots.
- **Emergency continuity plans** being developed for all sites
- More than **£100m invested** in IT systems and processes.

Figure 6: Root causes of pollution incidents at Margate, Sandown and Peel Common

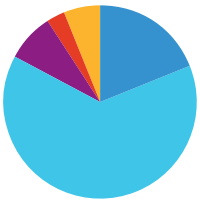
Margate and Broadstairs



- Blockage **14%**
- Pumping Station/Treatment Work Issue **57%**
- Sewer / Rising Maing Issue **14%**
- Hydraulic Overload **0%**
- Cause could not be Identified **14%**

2017	2018	2019
0	1	6

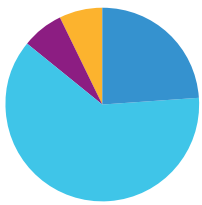
Sandown



- Blockage **19%**
- Pumping Station/Treatment Work Issue **64%**
- Sewer / Rising Maing Issue **8%**
- Hydraulic Overload **3%**
- Cause could not be Identified **6%**

2017	2018	2019
5	2	29

Peel Common



- Blockage **24%**
- Pumping Station/Treatment Work Issue **62%**
- Sewer / Rising Maing Issue **7%**
- Hydraulic Overload **0%**
- Cause could not be Identified **7%**

2017	2018	2019
11	6	28

Our analysis confirmed that the root causes of pollution incidents tend to be due to four main reasons:

- Blockage in our network
- Rising mains (sewers where water is pumped to a higher elevation)
- Electrical and mechanical breakdowns
- Other operational breakdowns.

This understanding enables us to focus and target our management of these assets and to define the future investment needs to reduce risk. The proactive nature of our PIRP means that many of the baseline 2020 risks identified in our DWMP have been or are being tackled in the current investment period to 2025. This has involved investing in our assets to improve resilience to, for example, power failures in the electricity network, as well as our operational activities.

We will achieve our pollution reduction targets by enhancing the resilience of our assets though our ongoing PIRP and implementing our DWMP. We will:

- Fully comply with the EA permits for our sites, including WTW, WPS and storm overflows
- Review operational procedures to improve reliability of plant and equipment
- Replace assets at risk of impacting performance, to reduce risks of asset breakdowns
- Enhance our customer education programmes to reduce blockages
- Extend our programme of proactive jetting to clear debris before blockages occur
- Increase the coverage of sewer level monitors in the system to provide early detection of sewer blockages and enable active clearance prior to customer and environment impacts
- Invest in smart technology to monitor, in real time, the performance of the sewer network and identify blockages before pollution or flooding occurs
- Deliver an effective and timely emergency response to clear blockages and rectify equipment breakdowns.

We also have strategic projects, focused on upgrading our asset maintenance, digitalisation of our networks and logistics, to improve resilience of our assets and systems to reduce pollution risk.

Case Study:

Reaching out to our future customers

It's important that our future customers understand the challenges we face in water and wastewater management so that they can help us to mitigate them. Our community team has a school outreach programme to raise awareness about issues such as water efficiency and blockage prevention. Recent engagement has focused on why CSOs (Combined Sewer Systems) discharge and the natural solutions our Clean Rivers and Seas Task Force is using to prevent this.

Almost 950 schools across the blockage hot spots of Canterbury, Herne Bay, Whitstable, Faversham and Sittingbourne in Kent, are soon to take part in a GreaseTech project. This will provide each school with the "Lifecycle of Oil" service grease management system.

We'll offer advice and help show young people the impact of fat, oil and grease on our systems, and how they can help be a part of the solution.

Risk of sewer collapse (PO3)

The planning objective relating to the condition of sewers is PO3 on sewer collapse. A sewer collapse is defined by Ofwat as "where a collapse has not been identified proactively and it causes an impact on service to customers or the environment".

The definition of a sewer includes rising mains, which are sewers where wastewater is pumped under pressure to a high point in the sewer network. The planning objective on sewer collapse includes both sewer collapses and rising mains bursts.

We report annually to Ofwat on the number of sewer collapses per thousand kilometres of all public sewers. This includes rising mains, pipe bridges and failures on the infrastructure network including inputs into the inlet of treatment works and terminal pumping station rising mains. We are not required to report collapses in private sewers. This national reporting on the number of collapses only provides an indication of the general asset health of the sewer network. It does not measure the level of service disruption, damage to customer's homes or businesses, the cost of a repair or any impact on the environment.

The impact on our customers and the environment from most sewer collapses is low but there are two important exceptions to this:

1. The impacts of flooding and pollution can be significant when it comes to the collapse of any of our critical sewers
2. The long-term impact of sewers that leak sewage into the surrounding ground in areas where there is a risk of groundwater pollution.

The DWMP risk assessment is based on historic data and provides an indication of the overall condition of the sewer network.

Customer insight:

Our December 2021 insight programme told us that our customers were 'horrified' that we might only be reactive in repairing sewer flooding damage. They also said that lower bills offered no compensation for continued incidents of sewer flooding. We should future proof our systems against the increased chance of blockages or flooding and, in return, customers would be willing to have their bills increase. They said we need to communicate what we are doing with their money and the benefits it provides.

Sewers that are in poor condition can cause blockages, collapse, infiltration and exfiltration. Blockages and collapses can lead to flooding of homes and business and pollution of the environment, while leaking sewers can impact groundwater quality. Too much groundwater in the sewer also increases the use of emergency storm overflows as our treatment sites become overwhelmed.

Critical sewers are those which are either costly or difficult to repair, and/or are vital to the performance of the network. They are large, very deep, pass under major roads or railways, and include rising mains.

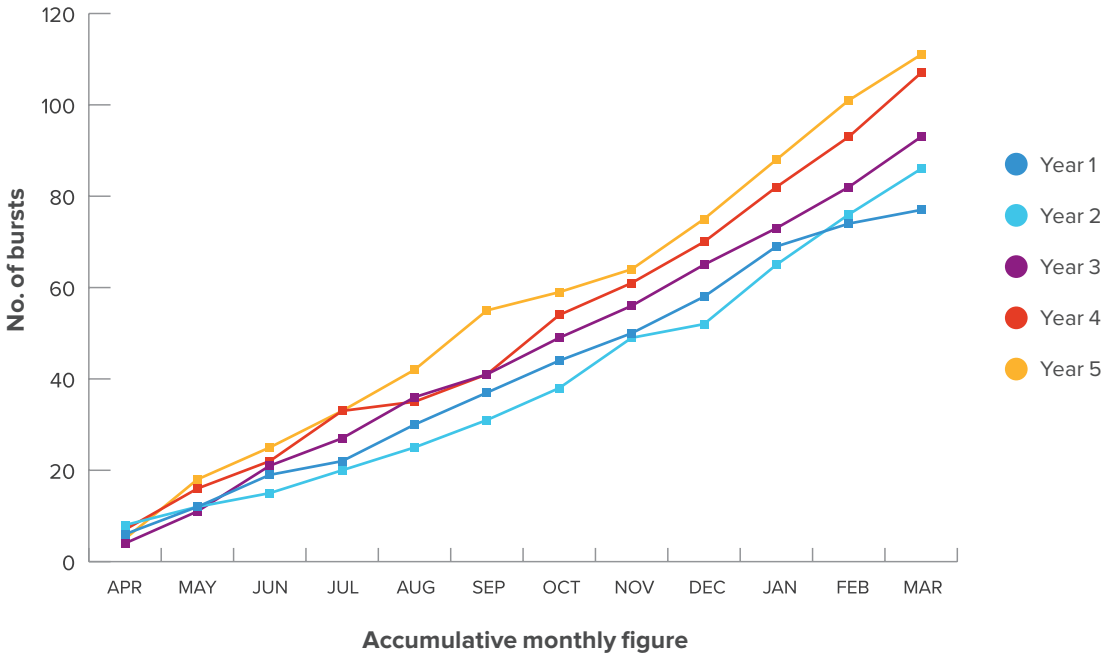
There are many risks associated with critical sewers and we plan to develop our assessments in future DWMPs to consider their criticality. We'll need to use other datasets, such as the proximity of our sewers and assets to environmentally sensitive or designated sites. We believe the definition of critical sewers should be expanded to those that would most significantly impact a protected area, for example, a Drinking Water Protected Area, a shellfish or bathing water, or a Habitats directive site.

Our analysis of bursts by diameter and material consistently shows that cast iron, spun iron and PVC are the materials responsible for 50% or more of our bursts. Rising mains made of these materials are at the highest risk of bursts. They also represent a higher proportion of our rising main assets. Rising mains up to 150 millimetres in diameter account for more than 50% of all bursts. The main reason behind this is age. As assets age their failure rate can increase. We're seeing a greater increase in bursts from these assets for a variety of reasons, including deterioration of materials, ground movements and more extreme temperature changes. Increasing populations and heavy rainfall are also increasing pressure on these ageing assets.

Our findings indicate that a small number of rising mains can significantly influence the total number of bursts. As an example, in 2016–17, 44 rising main bursts out of the total of 117 for the year occurred as repeat events on just 16 rising mains – this is 37% of the total. This information enables us to target our investments.

We invested £8.4 million during 2015–20 on planned maintenance to replace 15km of rising mains. Figure 7 shows that this level of investment has not prevented an increase in bursts. We've seen a 100% increase on the burst rate during 2005–10. To 2025 we expect to deliver roughly 8km of rising main replacement, alongside a major investment covering 3.5km at Military Road in Thanet. At the same time, we've invested in our incident response capabilities, including improvements in our operational control centre, to mitigate the risk of impact from sewer collapses and bursts.

Figure 7: Annual cumulative number of rising mains burst (2015–20)



We are focused on proactive maintenance of our critical sewers, with condition surveys carried out at regular intervals, as defined by the Sewer Rehabilitation Manual. This includes proactive targeted rehabilitation and repairs prior to collapse. We're also increasing inspections of high-risk sewers and investment to prevent failures before they impact customers or the environment. Proactive repairs, ultimately, help to reduce the cost and disruption to our customers of bursts. For non-critical sewers, we'll aim to react quickly and efficiently to repair and replace any sewer collapses.

Our investment to 2025 into smart networks has now started to enable real-time detection of sewer blockages and collapses. We have also identified 165km of critical sewers and 29.5km of critical rising mains which will need to be replaced in the next 5 years. The two categories of sewers are considered separately: gravity sewers and rising mains.

1. For gravity sewers, CCTV or Electroscan survey costs have been calculated on the assumption that we survey 1km of sewer for each incident identified between 2017 and 2019. The associated sewer rehabilitation costs are derived from past experience which suggests that 15% of the length of sewer surveyed will need rehabilitation to repair defects in the sewers. The costs for pipework have been calculated assuming a pipework rehabilitation cost for a typical 300mm diameter gravity sewer.
2. For rising mains, the rehabilitation costs have also been calculated on the assumption that we repair 1km of sewer length for each incident identified between 2017 and 2019. The costs for addressing rising mains have been calculated assuming a rising main replacement for a typical 300mm diameter rising main.

We estimate the cost to repair these critical assets to be around £80 million, so we need to drive new lower cost replacement and repair approaches to reduce costs. We'll work with our partners to deliver this, however, we'll need a sustained level of funding, over several investment periods, to make sure we keep pace with the deterioration of our networks.

We'll further develop the risk assessment for sewer collapse by using the designation of critical sewers and other important data in cycle 2 of the DWMP, subject to any revisions to the national DWMP guidance.

For sewer collapse, we'll continue to:

- Develop our management plans to give greater weighting to the risk of groundwater pollution, including the potential risks and impacts to sources relied on for water supply
- Carry out a programme of surveys, monitoring and rehabilitation of critical sewers to reduce collapses and bursts.
- Use technology to create smarter networks and enable faults to be notified and rectified before customers become aware of an issue
- Respond to collapses of non-critical sewers on a reactive basis to reduce the risks of pollution and internal flooding
- Take action to remove rainwater from our foul and combined systems to reduce the likelihood of flooding homes or causing pollution in the event of a collapsed sewer
- Report to Ofwat on sewer collapses (a measure of the overall condition of our sewers)
- Inspect, repair and replace private sewers to prevent infiltration of groundwater, and to prevent exfiltration that could lead to groundwater pollution
- Develop the risk assessment for sewer collapse for cycle 2 of the DWMP.

Case Study:

Thanet sewers: Being safe rather than sorry

In the 1920s and 30s, deep sewers were laid into the chalk bedrock under Thanet, Kent, without infilling or sealing of the tunnels. This means that whenever the flow increased, for example during storms, wastewater flooded into the tunnels and seeped through the bedrock. There were concerns that this was contaminating the underlying water supply. Over the years, measures were taken to seal some of the tunnels, but not all of them.

Working with the EA to meet the requirements of the Groundwater Protection Directive, we agreed a 15-year programme to seal off the remaining tunnels and address the pathways through which storm water entered the chalk aquifer.

Phase 1 of the project started in 2010, with phase 2 beginning in 2015, which also included a Community Grant Scheme. We lined and sealed around 200 deep chalk tunnels and repaired some 240 small bore sewers. To date, 155 manholes have been replaced, 84 have been refurbished and 72 new manholes have been installed. Around 1,070m of existing sewers have been upsized and a large tank sewer has been constructed, while 4,600 tonnes of material have been removed from the tunnels, with the EA monitoring and classifying the waste disposal. We still have four tunnels left to seal and the target date for completion of the scheme is 31 March 2025, at a cost of around £38 million over two years.

The extensive scheme was developed with Kent County Council Highways and the EA. We used it as an opportunity for a STEM (Science, Technology, Engineering and Mathematics) initiative with a local school as well as to provide open days for local Councillors and the general public. Because this project has been so successful, we are extending it to cover Deal, also in Kent.

Continuous monitoring of the aquifer has been ongoing since 2010. The results to date show no evidence of contamination from wastewater and that it is more likely that other industries may introduce contaminants into the aquifer. There will not be a definitive conclusion for a number of decades yet. We decided it was more important to protect the aquifer than risk our precious drinking water supplies.

Upgrading the sewer adits at Thanet.

Groundwater pollution (PO12)

We included an additional planning objective 12 (PO12) on groundwater pollution in our DWMP as a result of working with partners, including the EA and neighbouring water companies. This will help us to target investment in terms of the repair and replacement of sewers, so we can safeguard the quality of groundwater and protect the environment and drinking water supplies in the future. This risk assessment also helps us understand how groundwater feeds rivers and wetlands and, in turn, our coastal areas. The condition of sewers is an important factor to determine the risk of groundwater pollution.

Pollution from nitrate is the single biggest groundwater quality issue. Within England there is a widespread rise in nitrate concentrations in groundwater. This is a particular concern in the South East as our water supply is reliant on underground sources, with some 70% of our water coming from the chalk aquifers across parts of Kent, Sussex, Hampshire and the Isle of Wight.

The majority of nitrate in groundwater in the UK comes from agriculture (livestock and fertilisers), atmospheric deposition, and point sources (such as releases from WTWs). Nitrate also comes from leaking sewers, poorly maintained septic tanks,

privately-owned 'package' treatment works in the countryside as well as from releases direct to ground from storm overflows.

The post-1945 agricultural boom and slow rates of filtration into the underlying aquifers means that much of the nitrate we see in our water today is a result of this intensive use of nitrate fertilisers during the post-war era. However, present day sources of nitrate are also a risk to water quality both now and into the future.

Groundwater nitrate concentrations in some locations are now approaching, or have exceeded, statutory limits for drinking water. We protect the quality of water supplied to customers by treating it to remove the nitrate, meeting strict standards set out by the Drinking Water Inspectorate. However, this treatment comes at a cost to our customers so we need to make sure that our underground sources do not continue to deteriorate.

The condition of sewers is a key risk factor for groundwater pollution so investing in good asset management for the sewer network is important to reduce risk. We evaluated the overlap of our sewer network with Groundwater Safeguard Zones (SGZs) and Source Protection Zones (SPZs) and determined the risk, using additional data on sewer condition and discharges to ground. This approach is the first consideration in terms of targeting sewer integrity surveys. Further targeting of these surveys will be carried out so we can continue to target our investment.

Case Study:

Protecting groundwater quality through collaboration

We've been working in collaboration with Brighton & Hove City Council (BHCC), the South Downs National Park Authority (SDNPA) and the EA since 2015 to protect groundwater sources. Through the Aquifer Partnership (TAP) we are taking action.

Examples of the work include:

- Installing a rainscape in the Wild Park Local Nature Reserve in Brighton to catch pollution and hold back floodwaters
- Initiating a raingarden campaign calling for communities, residents and businesses to create as many rain gardens as possible in the Brighton, Hove and Lewes area.
- Providing guidance, training and tips to encourage people to look at different ways of managing the rainwater that lands on their homes and gardens.
- Working with farmers to understand the soil and crop nutrient requirements prior to fertiliser application to reduce the risks of over application of nitrate fertilisers and reduce leaching and pollution of the aquifer whilst saving the farmer money.
- Offering grants to targeted farms to help pay for items such as roofed wash-down areas with bio-filters to treat dilute pesticide and reduce the risk of broader pollution reaching our groundwater.

TAP also champions the aquifer, promoting knowledge and understanding whenever and wherever we can. Importantly, schools are joining us to manage water better for the future, bringing students on a journey of discovery along the way.

We have found elevated nitrate levels in the chalk aquifers in parts of our operating area, which may be coming from wastewater. The groundwater source zones we're most concerned about are provided in our methodology for the groundwater risk assessment.

We're already taking action to address these risks. In Thanet, we've invested over £60 million to repair and line the old underground tunnels containing sewers. This will prevent the escape of sewage into the chalk aquifer.

We're also working extensively with farmers to protect groundwater from nitrate pollution with key schemes through our strategic water resources planning process in our Water Resources Management Plan (WRMP), and through the Water Industry National Environment Programme (WINEP). The risk from leaking sewers is included in our DWMP so that we can identify the long-term investment needs to address the risks from our drainage and wastewater systems.

The inclusion of PO12 on groundwater pollution in our DWMP helps us assess the risks to the environment, our own water sources and those of neighbouring water companies. We've worked with the EA to develop the risk assessment for groundwater pollution for our first DWMP. Together we've identified other factors and data to include in the future DWMP groundwater pollution risk assessment, such as the need to use:

1. Groundwater Capture Zones: these are modelled areas using hydrogeological models and can include additional areas where groundwater can be impacted outside of the Groundwater Safeguard Zones (SGZ)
2. Hydrogeology data: using the flow apportionment from our groundwater models to identify output areas of the groundwater source catchment that contribute more to abstracted water. This "flow apportionment" modelling can help target risk identification and prioritisation of investment in sewer rehabilitation
3. Wastewater asset risk: age and material, pipe diameters and flows, structural issues, infiltration risk data and other information from our asset risk registers
4. Releases of effluent directly to groundwater from private effluent treatment systems. Although not our responsibility or under our control, these can impact on groundwater sources so need to be considered in the DWMP
5. Inadequate or poorly maintained private effluent treatment plants. We'll need to work with the EA to explore what data is available to include in the risk assessment
6. Release of wastewater to ground via septic tanks. We know the condition or capacity of septic tanks may not be adequate but there is no incentive for owners to replace them.

Our plan is to take action to reduce the risks of groundwater pollution. We will:

- Prioritise and manage the integrity and rehabilitation of our sewer networks where they overlie SPZs and Groundwater Capture Zones (GCZs)
- Provide advice to developers on appropriate arrangements for wastewater management where no wastewater system currently exists. This may mean the developer bearing the cost of building the connection to the nearest wastewater system or developing, in association with us, a new discrete system and local wastewater treatment works
- Work with the EA, Water UK and Government to enhance the arrangements, mechanisms, legislation and funding for the provision of first-time sewerage schemes
- Work with local councils, the EA and other water companies to actively look for and pursue first time sewerage schemes in areas where groundwater sources are being polluted due to the lack of a mains drainage sewerage system.

First time sewerage schemes

Our powers and responsibilities do not extend to private sewers, such as the pipes connecting individual homes to the public sewer, so leakage from these sewers will not be addressed though our current investment plans. We're pleased that the government is considering giving water companies the right and legal powers to repair defective drains on private property.

The total length of privately owned drains is greater than that owned by water companies. Many of these private drains are old or poorly maintained and probably constructed and laid to lower standards than public sewers.

There are many small communities that are not connected to our wastewater systems, and there are concerns about the suitability of arrangements for wastewater disposal, especially for new developments.

Our wastewater systems serve approximately two million homes and businesses across our region, mainly located in urbanised areas. The majority of the geographic area, more than 70%, is rural with many villages, settlements and farms without a mains wastewater drainage system. An emerging concern is the risk of pollution of groundwater in Source Protection Zones (SPZs) due to routine releases from non-networked settlements and/or private leaking sewers and poorly maintained septic tanks.

The First Time Sewerage scheme is the existing mechanism for customers to apply to us to extend our wastewater systems to cover more villages. Our findings in the DWMP suggested that the process for first time sewerage schemes is too difficult and complex. This means that wastewater systems are not being extended with the pace necessary to keep up with growth in these villages and the increasing risk of groundwater pollution.

Where recent schemes have been provided by us, some customers are choosing not to connect as they would then be liable for wastewater service charges. A change in government policy and legislation is required for the provision of first-time sewerage schemes. The costs and benefit assessment should take account of the downstream costs of these releases on drinking water treatment, as well as the environmental impacts which can be quantified as part of the assessment.

Sewer flooding

Being affected by sewer flooding is one of the most devastating things that can happen to our customers and their businesses. We're committed to reducing the number of customers' homes and businesses at risk from flooding from our networks.

This is an increasing threat due to pressures on our systems so we're using data and evidence to assess the risks in both 2020 (the base year) and, where possible, for future risks up to 2050.

The risk of flooding from sewers has been considered within our DWMP under four planning objectives. These are:

- PO1: Internal sewer flooding
- PO4: Risk of sewer flooding in a 1 in 50 year storm
- PO7: Annualised flood risk (hydraulic overload)
- PO10: Surface water management.

The risk assessment for PO1 on internal sewer flooding is based on the historic records of the number of incidents within a three-year period (2017 to 2019). It's the main driver for future investment.

The other three planning objectives for flooding use hydraulic modelling and asset data to predict where sewer flooding could occur during storms. They enable a forward look to assess how the sewer flooding risks will change in the future under different climate scenarios, changes in urban development and asset deterioration, as well as the reductions in risk through our investment decisions.

Risk of internal sewer flooding (PO1)

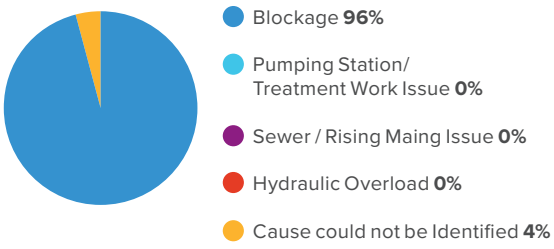
PO1 is one of the six national planning objectives which all water companies need to include in their DWMP. Internal flooding is defined as the flooding of customer's homes and business from sewers where flood water has entered the home. This is potentially damaging, disrupting and a health hazard, and can be deeply upsetting and distressing.

Blockages of sewers account for approximately 70% of internal flooding incidents. In total, we recorded 1,547 internal flooding incidents over the three-year period from 2017 to 2019, which is an average of 515 per year. Our action and investments have already reduced this to 394 incidents in the 2020–21 reporting year. Figure 8 shows the typical causes of internal flooding for three of our wastewater systems.

Our data shows that the main cause of blockages is through the misuse of toilets and sinks for the disposal of fats, oils and grease (FOG), as well as 'unflushable' items such as wet wipes, plastics, sanitary products and nappies. This is an industry-wide issue and all water companies run customer education campaigns to inform and change customer behaviour.

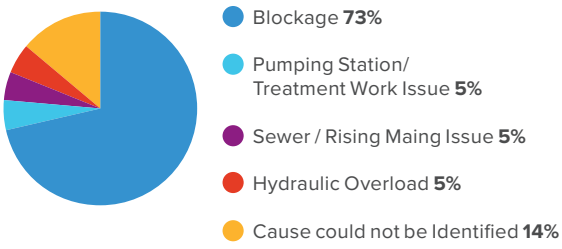
Figure 8: Examples of the causes of internal flooding

Margate and Broadstairs



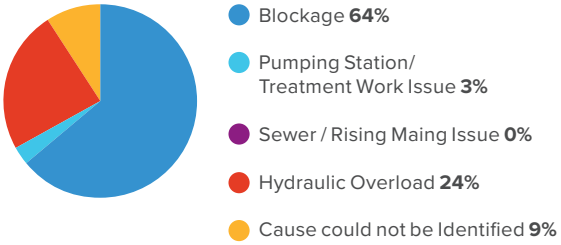
2017	2018	2019
23	28	29

Chichester



2017	2018	2019
8	1	13

Portswood (Southampton)



2017	2018	2019
9	15	9

The Environmental Audit Committee's report into Water Quality in Rivers (January 2022), which concluded:

"Fats, oils and greases and cleaning and hygiene products containing plastic are causing huge problems for drainage systems when they are poured away in sinks or flushed down the toilet. The disposal of FOG by takeaways and other food service establishments is currently unregulated. Grease management solutions exist, but awareness appears to be low. The food service industry needs clear guidance and standards to be established, failing which firmer regulation is likely to be required, to ensure it begins to take responsibility for addressing an issue which is costly for water company customers and detrimental to sewerage systems and the environment. There could be potential circular economy benefits for businesses that can utilise these harmful waste products as biofuels. (Paragraph 262)

"The water and grease management industry must develop standards for the sectors which use FOG routinely to collect and dispose of such responsibly without it entering the drainage network. The Committee further recommend that Ministers work with the water industry to consider whether fats, oils and greases should be classed as a trade effluent and all takeaways and food outlets required to install grease management systems. (Paragraph 263)

"Wet wipes and other 'unflushables' are a major constituent of sewer blockages. Many householders are unaware that flushing anything other than the '3Ps' ('pee, poo and paper') risks blocking sewers and could lead to a pollution incident. Better product labelling, introducing producer responsibility schemes and the use of behavioural science by water companies all have the potential to reduce blockages and the costs of clearing them. (Paragraph 264)

"Single use plastic sanitary products, often coated with chemicals that can harm aquatic life, are clogging up drains and sewage works and creating 'wet wipe reefs' in rivers. Revolting 'fatbergs' as big as blue whales are being removed from sewers, costing companies and their customers in the region of £100 million a year.

"The use of plastic in single use sanitary products should be prohibited, with exemptions only provided for medical requirements. The Committee urge the Government to adopt the measures outlined in the Plastics (Wet Wipes) Bill to prohibit the manufacture and sale of single use cleaning and hygiene products containing plastic. The Government should further incentivise the reduction of waste and recoup costs by using new powers in the Environment Act to extend Extended Producer Responsibility schemes to cover single use cleaning and hygiene products that cause blockages. (Paragraph 265)".

The House of Commons Environmental Audit Committee made recommendations on FOG and unflushables in their report on water quality in rivers published in January 2022, including better product labelling, tighter producer responsibilities, and legislation on grease management systems. We welcome these recommendations.

Customer education

Our award-winning and pioneering FOG and Unflushables team have a region-wide programme of customer education. This includes media campaigns targeted in blockage hot spot areas, working with food service establishments on grease management, and proactive customer surveys. We have a community door-knocking programme to talk directly with customers, and we provide talks at schools, community group events and roadshows. The team works closely with our operational field service teams to make sure our sewer cleaning programme is targeted on FOG hotspots. They also work with Environmental Health teams at local councils. Specific campaigns include targeting food establishments to reduce FOG.

Our DWMP has identified specific locations where there are clusters of properties flooded internally due to FOG and unflushable-related blockages, many of which are repeat incidents. Customer education campaigns have been identified in our DWMP as an enhanced activity over and above the region-wide customer education programme. This approach enables the FOG and Unflushables team to design and implement a very specific and targeted campaign based upon the customer demographic by adopting a range of tools and techniques to influence and change behaviour. This may be a one-off campaign or a sustained programme lasting several months or years to bring about and maintain the necessary behaviour change.

Feedback from partner organisations on our customer education programme has been positive and several have suggested working with them to expand the messages to engage customers on other aspects of water. We intend to follow up with these partners and propose that campaigns could cover issues such as the need for rainwater separation to reduce flooding and releases from storm overflows, rainwater capture and re-use to reduce water use, and to reduce chemicals entering the wastewater system.

Case Study:

Tackling blockages through education and engagement in Horsham

Throughout December 2022, we targeted customers in the Horsham area with a campaign to help prevent blockages. There have been 1,930 blockages in Horsham over the last five years, 60% of which have been caused by people putting the wrong thing down their sink or toilet. The campaign includes:

- Whole and half page adverts in the Mid Sussex and Horsham County Times promoting the ‘Keep it clear’ message and directing people to visit our FOG and Unflushables pages on the website
- Digital display and social display advertising across Horsham on how to avoid blockages
- Visiting local businesses and door-knocking to offer advice on blockage prevention
- A town centre drop-in stand on 15 December 2022
- Direct emails to 43,000 customers setting out the local statistics and promoting the FOG and Unflushables messages.

The campaign is part of a £28 million investment to upgrade the Horsham Wastewater Treatment Works. The programme will improve the efficiency and capacity of the works and help to meet our environmental commitments in the area for years to come. Some of the community aligned benefits include landscaping and habitat enhancements to bring an overall 9% gain in biodiversity within the site.

Flood risk reduction and response

We have a long history of recording, investigating and rectifying incidents of sewer flooding in customers' homes. These incidents are recorded on a register of properties that have flooded as a result of rainfall overwhelming the sewer. The national reporting method counts all properties flooded regardless of the severity of flooding, whether it's seepage from a manhole in a basement, backup into a bath or shower tray or the complete internal flooding of the ground floor of a property.

Our register currently holds details of about 350 property addresses that are at risk of internal flooding and another 8,350 properties at risk from external flooding. Our focus is to make flooding of homes an exception by 2040, but we recognise that preventing flooding can be technically challenging and cost more than our customers are willing to pay for us to resolve them.

Our approach to reducing flood risk is three-fold:

- **Operational solutions:** For example, improving the resilience of pumping stations, increased sewer cleaning targeted in hotspot areas to reduce the number and impact of blockages.
- **Sustainable solutions:** Work with local councils and other organisations such as developers, catchment partnerships and community groups to separate rainwater from the foul and combined sewer systems, using nature-based and sustainable drainage systems (SuDS).
- **Traditional solutions:**
    - Deliver property level resilience measures to reduce the risk of a repeat flooding for specific properties
    - Increase the capacity of storm tanks at WTWs, increase network storage through underground concrete tanks or increase the size of the network. This will be delivered using an adaptive approach, on a no regrets basis, so that future storage needs may be met through more sustainable solutions.

Our Flooding Reduction Programme has been running over a number of investment periods. The programme will achieve significant reductions in the number of flooding incidents through:

1. Improving the resilience of our assets, especially reliability
2. Fast and effective alarm handling in our Regional Control Centre
3. Improving our emergency response to incidents
4. Implementing a flood data dashboard showing leading indicators to track causes
5. Identification of clearly defined hot spot or high consequence areas for targeted interventions
6. Up-skilling site teams and contractors.

We're currently investing £35 million to 2025 to improve our systems by creating smarter sewer networks through a digitalisation programme and installing around 23,000 sewer level monitors. This will provide information to help us take pre-emptive actions and carry out maintenance that will reduce the number of flooding incidents, by approximately 60 per year.

Our smart network will be a major step forward for a UK water company in monitoring across its drainage network. Technology like this can also help us to reduce the risk of sewer flooding and releases from storm overflows. We have linked these sewer monitors into our regional control centre so we can react quickly to any signs of emerging problems.

Other ways to reduce the risk of internal flooding include tree root ingress surveys and clearance, and condition surveys – both should reduce the number of floods by 30 incidents per year.

We predict a reduction in the average number of internal flood incidents per year of 40% by 2025, although this is dependent upon the amount of rainfall during the year.

Our capital investment programme has delivered more traditional engineering solutions to reduce flood risk by enlarging storm tanks and constructing additional storage within the sewer network, as well as newer methods such as individual property flood resilience measures. Our solutions hierarchy and priorities are to:

1. Ensure the existing wastewater systems are working as effectively as possible
2. Ensure we have the capability and capacity to respond quickly and effectively when things go wrong
3. Tackle problems at source using sustainable and nature-based solutions where we can, and finally
4. Expand our existing drainage and wastewater infrastructure and assets.

Feedback from our public consultation:

"Customer education is required on all fronts not just in areas of high incidents of blockages. Education is required on most aspects of wastewater management."

Customer, DWMP public consultation, Autumn 2022

Risk of flooding in a storm (PO4 and PO7)

Planning objective 4 (PO4) on the risk of sewer flooding in a 1 in 50 year storm is one of the six set out in the national DWMP guidance. It was included as a resilience metric to help water companies to demonstrate the scale of the risks from sewer flooding now and into the future, with the goal of reducing the number of properties at risk over time.

Our DWMP includes an additional planning objective (PO7) on annualised flood risk. This looks at the risk of flooding from storms of other severities, from a storm that we would expect to see every year through to storm with a severity that would be expected only once in a 30-year period. It expresses this risk as an 'annualised flood risk' or the risk of flooding in any year from a range of storms. It helps us, and our partners, to assess the consequences of more frequent storms than a 1 in 50 year event, and how sewer flooding may combine with surface water flooding to cause disruption to customers.

PO4 and PO7 both measure the risk of internal and external flooding to properties as a result of excessive rainwater on sewer capacity during storms.

Most modern wastewater systems, built since the 1960s, were designed as separate systems with one system for wastewater and one for rainwater. Older systems can be 'combined' and have some capacity to carry rainwater, often for a 1 in 30 year storm based on the historic rainfall records available at the time.

Combined sewer systems were built to drain both wastewater from homes and businesses and rainwater from roofs, paved areas such as roads and car parks. These systems coped well for many years but, with our changing climate, they are now put under increasing pressure from the rainfall patterns of today. This means that sewer flooding and releases from storm overflows can be expected more often, especially during heavy and extreme storms, such as a 1 in 50 year storm.

Flooding can occur in low lying areas and in customer's homes and businesses during periods of significant rainfall when the capacity of the sewer networks is exceeded. This is known as hydraulic overload. The likelihood of hydraulic overload is increasing due to climate change and also as a result of urban creep. More paved areas, hard standings and the roofs of home extensions, connected into the foul or combined drainage system, increases the demand on the sewer system during storms.

Definition: Urban creep

This is where fields, gardens and green spaces are paved over with impermeable surfaces and the additions of extensions to buildings and roads resulting in greater rainwater run-off into drainage systems, rather than the rainwater infiltrating into the ground.

The risk assessment for these planning objectives used hydraulic models to predict where water would escape from the sewer system and the area of land at risk from flooding. The assessment counted the number of properties that are in the area at risk from flooding.

This method of modelling to estimate the number of properties in areas at risk from flooding is very basic. It does not take into account the local topography, surface features or infrastructure that affects where water flows in a storm. It has led to large numbers of properties being identified as currently at risk, but the number obtained from this assessment does not match our last 30 years' of flood records. For example, this method has led to 1,484 properties identified as at risk in Portswood in Southampton, and yet we only have five records of internal flooding of properties in this area over the past 30 years.

The difference in the number of properties identified in areas at risk by the modelling means there is significant uncertainty in the options and investment needs proposed in our DWMP to address the risk of flooding in a 1 in 50 year storm (PO4).

Our strategy is to focus investment on tackling the real risk and impacts to customers where flooding has occurred and remains a high risk, not just where there is a theoretical risk. We also need to further develop our hydraulic models to take into account the flow of water on the ground and better define the properties that are at risk from flooding. This will significantly reduce the level of uncertainty and enable us to refine the investment needs in future cycles of the DWMP. In the meantime, we won't include the investment needs for planning objective 4 in our preferred plan, and instead keep them within an alternative investment pathway.

Drainage area plans (DAPs)

We invested over £6 million during 2015–20 to reduce the risk of flooding. We developed Drainage Action Plans (DAPs) for 103 of our wastewater systems. The DAPs identified options to reduce flood risks to properties on our register. This has put us in a good position in terms of knowing the location and preferred options for many internal flooding problems across our operating region.

We have imported these options, where they are yet to be funded and delivered, into our DWMP. Some of the DAP options are for wastewater systems in Band 0. This is because DAP options are based on our records of internal sewer flooding over the last 30 years, not just the records for 2017–19 as specified in the national DWMP Framework. We have used a longer record of incidents to support the validation of predicted flood risks and targeting of investment.

The DAP options were developed for specific properties, or clusters of properties, that have been flooded once or several times. The solutions are for traditional storage and pipe upsizing because they provide greater certainty in terms of costs and outcomes. However, these options tend to only benefit the properties previously flooded and the localised area. Benefits across the whole of the wastewater system are limited by the capacity and flow in the pipes away from the location and diminish the further away from the improvements made.

Alternative solutions such as rainwater separation can provide wider, multiple and more sustainable benefits. Removing or preventing a significant volume of rainwater from entering the sewer system at source will reduce the risks from storm overflows and flooding elsewhere within the wastewater system. It could also significantly reduce electricity and carbon pumping costs, asset deterioration, and treatment costs. We will investigate the causes of all flooding incidents to identify what action can be taken.

These solutions can be used in combination depending on the situation, the severity of the issue and the expected levels of growth and urban creep.

Impact of growth on sewer flooding

Some local councils informed us during the development of the DWMP that communities have concerns about the impact of new development on the capacity of the existing drainage and wastewater infrastructure. Examples were provided of communities where sewer flooding was a problem, restricting the use of toilets and water within their homes.

We look at the impact of proposed new development when we're consulted on planning applications. We're not a statutory consultee for planning applications.

We calculate the additional wastewater flow from the new development and whether the existing network will accommodate it. We then request the local planning authority (LPA) to apply planning conditions where there is insufficient capacity, and we register the site for a 'growth scheme', also termed 'network reinforcement' – see box.

Definition: Network reinforcement

This is a growth scheme to upsize sewer pipes and/or wastewater pumping stations to cater for additional flow into the existing wastewater system from planned new development in communities.

Limited capacity in the sewer network is not a constraint to development if planning conditions ask for it to be phased to align with the development of upgraded wastewater infrastructure.

We have limited powers to prevent connections to our network, even when capacity is limited. Planning policies and planning conditions play an important role in making sure that development is coordinated with the need for additional infrastructure and does not contribute to pollution of the environment or flooding.

Ultimately, better management of rainwater will reduce the risk of flooding as well as helping to limit storm overflow releases and reduce demand on water resources. We're working with LPAs to make sure surface water management and sustainable drainage systems (SuDS) are top of mind when designing new developments. By making sure that the surface water drain is not connected to the foul or combined sewer network, we can reduce the risk of flooding and pollution.

At the moment we can't refuse applications to connect surface water drains to the combined network. This means that if flooding occurs because of a heavy storm, we have no way of separating surface water from wastewater. We would welcome a policy that gave us more powers to refuse these connections.

The DWMP risk assessment explores the impact of growth on our systems, and how the risks change with expected levels of new development. Our technical summary on growth provides further information.

Planning objectives 1, 4 and 7 on sewer flooding are included in the DWMP to understand where sewage escapes from the system and causes flooding during a storm. Our work with our partners, including the Lead Local Flood Authorities (LLFAs) and the EA flood teams, led to the inclusion of an additional planning objective on surface water management (PO10).

Surface water management (PO10)

We included PO10 on surface water management in our DWMP to consider two issues:

- Where rainfall can't drain away because of the lack of capacity of the sewer and drainage network during a storm; and
- Where flooding occurs due to the interaction between our surface water drains and other systems, for example, where they release into culverts, rivers and the coast.

PO10 enables us to gain a better understanding of where there is a risk of flooding from both our systems and those owned and managed by other organisations. The risk assessment identifies the locations where we need to work with the LLFAs, other councils, internal drainage boards (IDBs) and the EA to improve the management of surface water and to reduce the impact of localised flooding on our customers.

The risk from surface water flooding was identified through discussions with our partners, reviews of the EA's Risk of Flooding from Surface Water maps, historical flood incident data attributed to hydraulic overload and also through the properties predicted to flood in PO4 and PO7. The analysis found that the catchments that are likely to be impacted are those with insufficient capacity in combined sewer systems, as well as those with separate surface water drainage systems. Our risk assessment for PO10 identified 36 wastewater catchments (out of 381) as Band 1 or 2 that require further investigation to understand the risks and investment needs.

Combined flooding from roofs, roads, rivers, drainage systems and sewers can be complex and difficult to resolve. A good understanding of the causes and flood mechanisms is needed. Further hydraulic modelling of surface water sewers and their interactions with other drainage systems will be necessary. This will help us to develop options to tackle the flooding issues in areas affected by multiple sources of flooding.

It became clear during discussions with the LLFAs and the EA that our existing models need to be developed further to be able to model both sewer flooding and surface water flooding. The models will need to:

- Map and replicate the topography of the natural and built environment in the hydraulic model to understand how rainwater flows across the catchment
- Include analysis of the interaction of rainwater run-off with combined and surface water sewer networks in areas where flooding is reported and predicted
- Collect further data such as manhole and flow surveys to make sure that the models are of sufficient accuracy to replicate the performance of surface water system at key locations. This may require the representation of non-Southern Water assets such as culverted watercourses
- Review the potential surface water management options that could include increasing capacity, flow management measures or flood management.

We need to tackle the problem together with our partners in the community and deliver projects that reduce flood risks from several sources. These solutions will also provide wider multiple benefits for those communities.

Storm overflows

Storm overflows have been attracting a lot of public and media attention due to the concern about releases of untreated sewage.

This is partly due to the increasing popularity of open water swimming but also growing public concern about the environment more generally. The government has responded by committing to a step change in action to protect public health and the environment from storm overflow releases.

The National Infrastructure Commission report on surface water flooding

In November 2022, the National Infrastructure Commission (NIC) published its report on surface flooding: Reducing the risk of surface water flooding. It estimates that nationally, without action, climate change and urbanisation could put an additional 230,000 properties at a high risk of surface water flooding by 2055. It calls for a more focused and coordinated approach between local organisations to reduce the number of properties that will be at risk by increasing the capacity of drainage systems and capturing more rainwater.

The NIC report recognises that, under the 2010 Flood and Water Management Act, developers still have a legal right to connect surface water from new development into existing drainage infrastructure. It proposes that the government makes sustainable drainage systems a legal requirement for most new development, and that the right to connect to public sewers in Schedule 3 of the Act is amended. It also proposes that the government should consider whether and how to control unplanned increases in hard surfaces through controls, incentives, and public education.

The report acknowledges that water companies play a key role in reducing surface water flood risk by improving drainage, but that this should not be interpreted as an entitlement for property owners and developers to connect surface water to public sewers. The government and Ofwat should change the investment focus from drainage pipes and underground storage to enable and encourage future investment in more sustainable solutions to manage surface water flooding. We welcome the NIC report and its recommendations.

Key recommendations from the NIC report:

- Government acts to mitigate the impact of urban development on surface water flooding
- The EA should improve identification of the highest risk areas, drawing on local maps and models
- Government should set a long-term target for a reduction in the number of properties at high and medium risk of surface water flooding
- Government should clarify in its strategic priorities that Ofwat should enable water and sewerage companies to invest in solutions to manage surface water flooding, including nature-based solutions where appropriate
- In high-risk areas, local authorities, water and sewerage companies and, where relevant, internal drainage boards, should be required to develop costed, long term, joint plans to manage surface water flooding, including local targets for risk reduction, assured by the Environment Agency with input from Ofwat
- Government should devolve public funding to upper tier local authorities in the new flood risk areas based on their level of risk
- For properties remaining at high risk of flooding, government should explore options for funding property level measures.

What are storm overflows?

"Storm overflows are safety valves built into the combined sewer system to discharge excess sewage to rivers, lakes, or the sea when rainfall exceeds capacity. This protects properties from flooding and prevents sewage backing up into streets and homes during heavy rain. A growing population, an increase in hard surfaces and more frequent and heavier storms because of climate change have increased pressure on the system, bringing the frequency of discharges to an unacceptable level."

Government statement on Storm Overflows, Defra, March 2022

Releases from storm overflows are permitted by law when they are in line with the permit issued by the EA. These permits are based on limiting the concentration of pollutants to "that which would not cause harm to the receiving waterbody". This means that a typical overflow is designed to spill approximately 40 times a year. The exception to this is for releases that affect bathing and shellfish waters.

Storm overflows constructed or upgraded since the EU Directives on Bathing and Shellfish waters have been designed so that the frequency of releases will not exceed 10 per year for shellfish waters and three releases during the bathing water season for bathing waters (as an average over 10 years). We used these criteria in our risk assessments for bathing water quality and shellfish water quality.

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 the result of heavy rainfall. Our DWMP highlighted the significant amount of rainwater that can enter the combined sewer during a storm. Figure 9 shows the sources and percentages for two of our larger wastewater systems. In both examples, the "other" water in the sewers is rainwater – up to 97% of the total flow in our sewer in a 1 in 20 year storm.

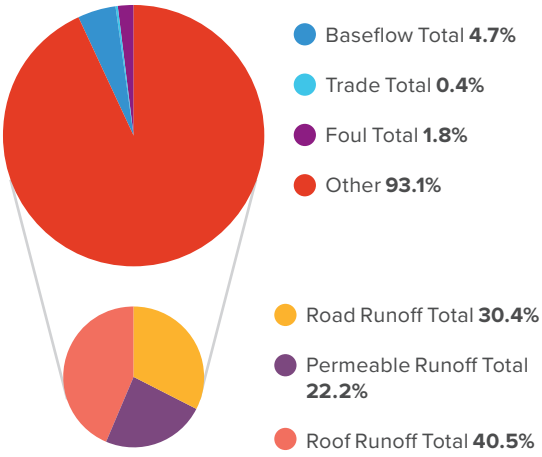
Feedback from our public consultation:

"Storm discharges should be designed out of the system. Discharging wastewater into the environment should not be part of the process, let alone be a legal part of the process."

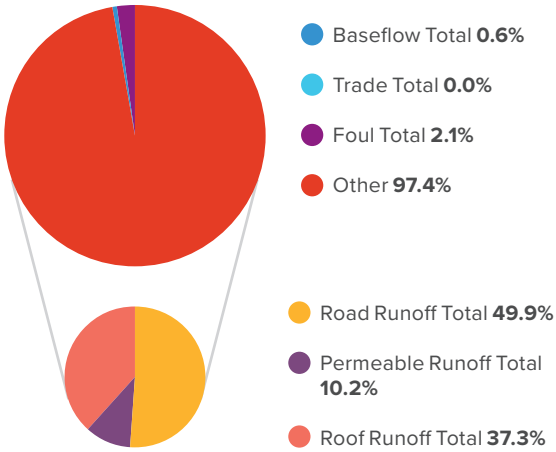
Customer, DWMP Consultation, Autumn, 2022

Figure 9: Sources of flow in sewers in a 1 in 20 year storm

Sandown – Source of Inflow of a 1 in 20 year Storm Event (2020)



Swalecliffe (Whitstable) – Source of Inflow of a 1 in 20 year Storm Event (2020)



The majority of this rainwater is run-off from roofs, roads and paved areas, including pavements and car parks. Some comes from permeable areas such as parks and green spaces, which become saturated in a storm and which, once waterlogged, means that any additional rainfall will run off rather than infiltrate into the ground.

Definition: Baseflow

Baseflow is the flow in a sewer without any wastewater or rainwater. It is created by water entering from the ground through infiltration. Infiltration takes place when water in the soil surrounding the pipes enters through the joints or cracks where present.

This means most releases are heavily diluted, up to 95% is rainwater. The greater the dilution the less harm caused. The benchmark for storm overflow releases is a dilution ratio of eight, meaning that the flow in the river in dry weather must be eight times greater than any flow of water from the wastewater system. Where this is achieved, the water automatically released from storm overflows is of a similar dilution as treated effluent. The water, although often screened, is otherwise untreated so contaminants and pathogens could be introduced into the water environment and pose a risk to water users and the ecology of plant and animal life.

Storm overflows operate automatically. Water companies do not operate these storm overflows to “dump” sewage into rivers to reduce costs or maximise profits. Overflows are usually a concrete weir within the sewer system that allows water to automatically spill over and flow out via a storm overflow pipe to the local river or the sea. The number of spills over the weir is counted by electronic equipment called, Event and Duration Monitors (EDMs), and other instruments local to the site.

Our wastewater treatment works often also have storm tanks on site to prevent spills. These are large concrete storage tanks to capture and hold excess flows arriving at the works during a storm. However, the storm tanks can also overspill and release diluted sewage into rivers or the sea when the capacity of the tank is exceeded during storm conditions.

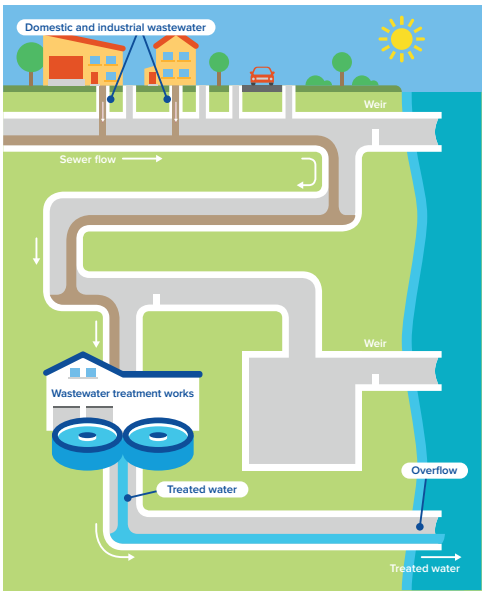
Storm overflows at a WTW tend to have the highest frequency of releases. Often the storm overflow has a screen to prevent debris, for example, wet wipes and sanitary products, from being released to the environment.

Figure 10 illustrates how combined sewers and storm tanks at wastewater treatment works operate to reduce releases of untreated sewage during storms to the environment.

Figure 10: How do combined sewers and overflows work?

Using storm tanks and combined sewer overflows in different weather conditions to reduce the risk of our customers' properties from flooding

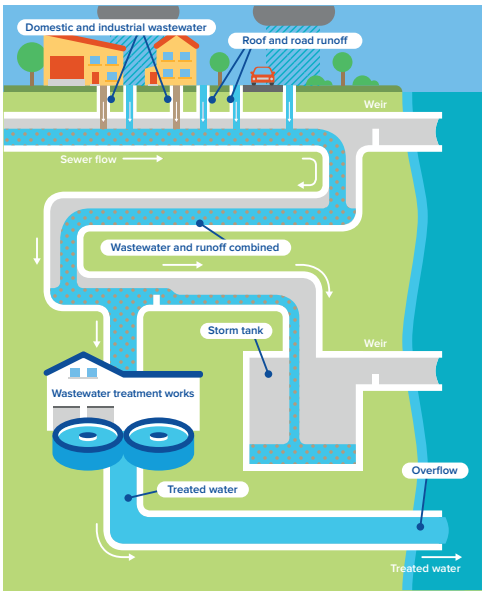
No rainfall or small showers



During dry weather the flow of wastewater from domestic and industrial properties is treated at the wastewater treatment works and then released into rivers or the sea.

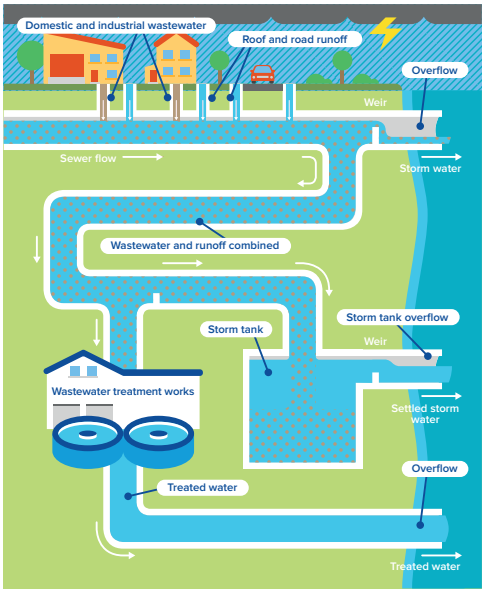
Overflows also referred to as outfalls in other documents.

Heavy showers



In wet weather, when rain runoff is combined with wastewater in the sewer, our storm tanks can be used to hold any excess ready to be treated after the high flows.

Severe storm



For sustained storm conditions, and once the storm tanks are full, overflows are used to prevent the flooding of homes, businesses, hospitals and schools.

The storm overflows are an automatic response to the capacity of the sewers or storm tanks being exceeded. Water companies do not operate these storm overflows to “dump” sewage into rivers to reduce costs or maximise profits.

Risks from storm overflows (PO5)

There are 979 storm overflows across our wastewater network of 39,900 kilometres of sewers, 3,476 wastewater pumping stations and 367 wastewater treatment works. In 2020, these released on 20,313 occasions, totalling over 201,003 hours.

Customer insight:

"What possible justification can there be for a private, for-profit company pouring sewage into our seas and rivers just because it has rained heavily. Isn't it time that SW started to think about alternative means to get rid of surplus waste?"

Water Futures 2030, October 2021

We used three years of data on storm releases from 2017–19 to identify high spilling storm overflows and find out which wastewater systems were in each risk band. The map showing the risk of storm overflow performance for each wastewater system is available on our website. Table 1 shows the 10 worst performing wastewater systems by number of spills during this three-year period. (Note: Our DWMP risk assessment set the Band 0 threshold for storm overflows on inland waters at less than 20 releases in a year in line with the EA's Storm Overflows Assessment Framework (SOAF). This threshold will need amending for cycle 2 of the DWMP although our storm overflow programme aligns with the government's storm overflows plan based on 10 spills or less).

Table 1: Recorded spills from storm overflows between 2017–19 (10 highest spilling wastewater systems shown)

Wastewater system	Population served	No. of storm overflows	Spills using 12-24hr counting method			No. of medium and high spilling storm overflows
			2017	2018	2019	
Sandown	124,937	94	898	1312	1350	26
Motney Hill	254,144	68	576	1072	624	15
Peel Common	257,249	76	206	662	448	13
Tonbridge	49,838	19	177	362	402	7
Budds Farm Havant	366,725	32	136	424	223	7
Bexhill And Hastings	141,227	27	164	209	350	5
Gravesend	59,928	11	175	177	249	4
Hailsham South	28,533	15	130	119	330	7
Newhaven East	58,692	9	115	206	254	2
Ford	130,053	22	62	151	292	6

Note: There are 231 other wastewater systems with storm overflows, of which 110 have zero high spilling overflows, 92 have one, 24 have two, and 4 have three high spilling overflows.

We know that any release of untreated sewage from the wastewater system is not acceptable to our customers. Some of these releases, which have been categorised as pollution incidents, are caused by equipment breakdowns or operational issues. We're already taking action to reduce the releases that do not comply with the EA permits through our Pollution Incident Reduction Plan.

We have the lowest average number of spills of any water company, based on the data published by the EA.

Our aim is to make significant reductions in the number of releases from storm overflows as quickly as possible. In 2020–21, the average number of spills was 20 per overflow, and we're working to reduce this further by the end of AMP7. The actions we're already taking are reducing the number of spills, see Figure 11.

Figure 11: Summary of storm overflow releases

Year	No. of spills	Duration (hours)
2020	20,313	201,003
2021	19,077	160,984
2022	16,688	146,819

The EA data which shows why rivers and the sea are not in good ecological condition lists storm overflows as one of the causes. Of the 1,798 waterbodies in our operating area, 508 (28%) are either suspected, probable or confirmed as partly being as a result of water company operations (15% are confirmed). The number of waterbodies in our region where storm overflows are thought to be a reason for not achieving good ecological status is 51 (or 3%). The greatest impact on water quality in England, according to the EA, is from the agriculture sector.

The government's Storm Overflow Discharge Reduction Plan

The government responded to public concerns regarding the risks of releases from storm overflows by committing to a step change in action to protect public health and the environment. It formed the Storm Overflows Task Force in August 2020 to tackle the issue. This led to a series of actions to reduce releases from storm overflows being included within the Environment Act, published in November 2021. These include five new duties on water companies to:

1. Secure a progressive reduction in the adverse impact of discharges from storm overflows
2. Publish data on storm overflow operation on an annual basis
3. Publish near real-time information on the operation of storm overflows
4. Monitor the water quality upstream and downstream of storm overflows and sewage disposal works
5. Produce comprehensive statutory Drainage and Sewerage Management Plans (also known as Drainage and Wastewater Management Plans) setting out how they will manage and develop their drainage and sewer system over a minimum 25-year planning horizon, including how storm overflows will be addressed through these plans.

There are also three new duties/powers for government to:

1. Produce a statutory plan to reduce releases from storm overflows and their adverse impact, and report to Parliament on progress
2. Produce a report setting out the actions that would be needed to eliminate discharges from storm overflows in England, and the costs and benefits of those actions (both publications are required by 1 September 2022)
3. Direct water companies in relation to the actions in Drainage and Sewerage Management Plans.

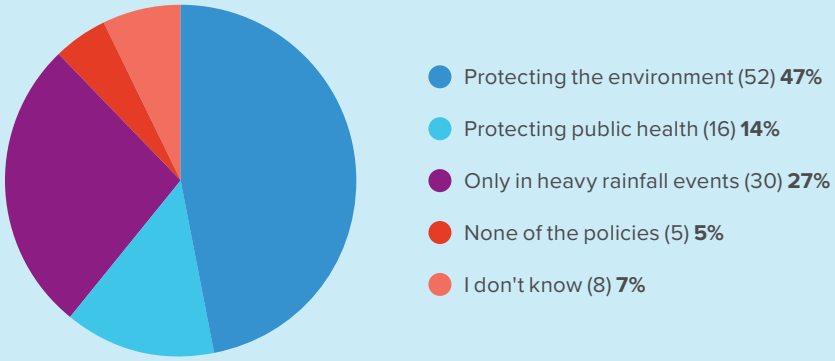
The government's plan commits the EA and Ofwat to actively encourage water companies to consider green infrastructure to achieve the targets set out in the plan, and work to ensure assessment processes promote and incentivise the use of nature-based solution rather than more carbon intensive alternatives. It expects water companies to:

- prioritise a natural capital approach, considering carbon reduction and biodiversity net gain, as well as catchment level and nature-based solutions in their planning.
- operate in partnerships across catchments maximising co-funding and green finance opportunities, wherever appropriate, including through market mechanisms.
- value rainwater as a resource which benefits people and the environment, and to protect the natural water cycles that maintain biodiversity and full flowing rivers.
- prevent additional rainwater from entering the combined sewer network and remove existing rainwater connections where it is the best value solution.

Defra's Storm Overflows Evidence Project concluded that SuDS alone would not be able to redirect enough rainwater to achieve zero releases in an average year. Therefore, SuDS must be combined with storage tanks to achieve elimination.

We asked our customers during our 2022 public consultation to provide their views on the policy scenarios in the government's draft storm overflow discharge reduction plan, and the potential investment needs. The most support was for the policy to reduce the harm to the environment with 47% of responders preferring this option.

What our public consultation told us



The greatest level of concern is to protect the environment from the impact of spills with 47% of responders choosing this option. This is followed by 27% that think the policy should be for spills only to be allowed in heavy rain, then by 14% expressing concerns over public health. Only 5% did not support any of Defra's policy scenarios and 7% had no opinion.

Feedback from our public consultation:

"The aim must be to invest to reduce sewage pollution, improve monitoring, reduce storm overflows, improve the environment and tackle underinvestment in Southern Water assets in sewage plants, pumping stations and sewage pipe infrastructure."

Customer, DWMP consultation, Autumn 2022

Stakeholder feedback:

"I don't think that reducing serious pollution from storm overflows to zero is ambitious enough. Ofwat said that this was severely lacking in ambition. It's such a shame, as we are so far away from what we need to overcome the challenges set out, as Southern Water is the worst performing in the country in this area."

Environmental group, Long Term Delivery Strategy stakeholder consultation, July 2022

The priority for investment is to protect high priority sites, including designated bathing waters and shellfish waters. We assessed the risks to bathing water and shellfish waters as separate planning objectives in our DWMP.

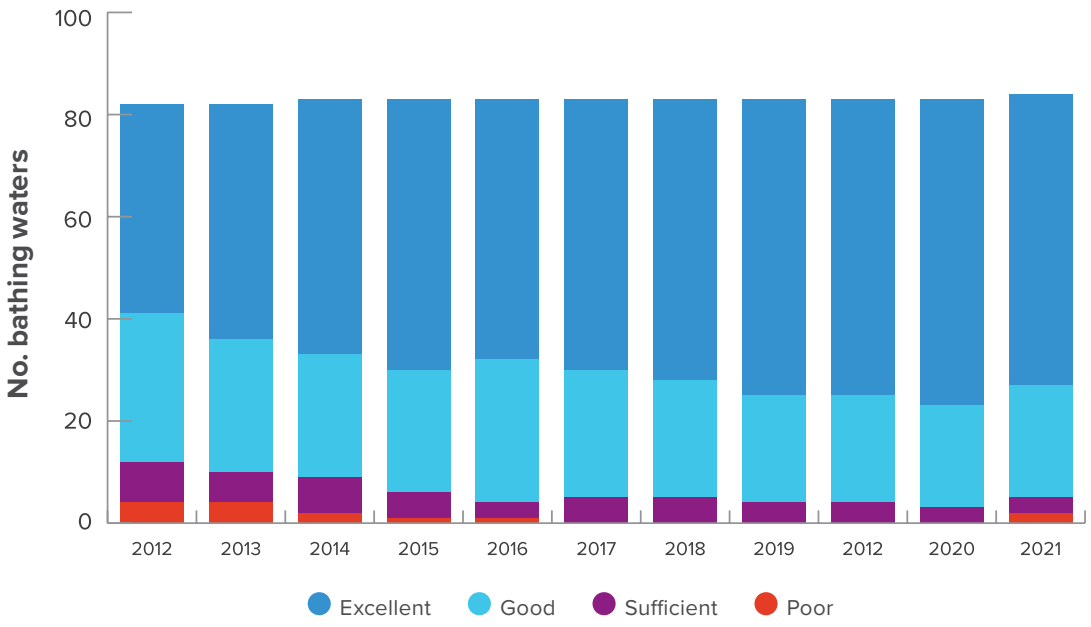
Risks to bathing waters (PO13) and shellfish waters (PO14)

There are 700 miles of varied and beautiful coastlines in our operating area, with 84 designated coastal bathing water beaches attracting many thousands of visitors a year. We also have numerous shellfish waters located around the Solent and Southampton Harbours such as Chichester, Emsworth, Thornham, Portsmouth, Langstone, Spithead and Stokes Bay, as well as the Swale and Isles of Wight and Sheppey. The quality of the bathing and shellfish waters is vital to local economies.

Shellfish harvested from these waters must be suitable for human consumption, free from harmful bacteria and protected from any deterioration. The Shellfish Waters Directive is designed to protect the designated aquatic habitats of bivalve and gastropod molluscs, which include oysters, mussels, cockles, scallops and clams in order to support shellfish life and growth. It sets physical, chemical and microbiological requirements that designated shellfish waters must either comply with or, where this is not the case, improve so that it is compliant.

Shellfish waters are monitored for various parameters based on water quality standards, including suspended solids, salinity, dissolved oxygen (DO), organo-halogenated substances such as polychlorinated biphenyls (PCBs) and organochlorine pesticides, metals and guideline values for coliforms in shellfish flesh. For each of these substances, the directive specifies the minimum number of samples to be taken, the water quality standards to be met and the percentage of samples that must meet these standards. The standards are either a numeric limit or a descriptive standard. We're fully committed to ensuring our wastewater releases don't negatively impact the designated shellfish waters in our region.

Figure 12: Bathing water quality results from 2012–21



We've invested millions in our wastewater systems to reduce our impact on water quality. Our current commitment to 2025 is to maintain 57 bathing waters at "excellent" and to improve two more to achieve excellent status, and to improve at least five from "sufficient" to "good". We aim to improve all 84 bathing waters to excellent classification by 2040.

Figure 12 illustrates improvements in bathing water quality over recent years.

Our improvement programme has included the creation of an in-house Misconnections Team to trace and find where foul wastewater from homes is getting into surface water sewers. These misconnections can result in sewage from homes and businesses being directly released into rivers and the sea without any treatment. We work with local authorities to make sure that property owners are aware of these risks and properly manage their private drainage systems.

Bathing and shellfish waters are also affected by a range of other sources of pollution such as contaminated rainwater running off roads and agricultural land, wastewater from privately-owned treatment works, boats and animals on the beach such as dogs and seabirds. We're working closely with our Local Authority partners to continue to improve the quality of the coastal waters so our customers, communities and visitors to our region can enjoy them safely.

We included two additional planning objectives in our DWMP to assess the risks to bathing waters (PO13) and shellfish waters (PO14) from the performance of our wastewater systems. The risk assessment methodologies for each of these identify those that are hydrologically connected to, or which could influence the quality of, these waters. For example, there are 15 wastewater systems that are hydrologically connected to shellfish waters where our operations could potentially have an impact.

The investment needs identified for both bathing and shellfish waters focuses on reducing spills from storm overflows and customer behaviour change in terms of misconnections and blockages. The options can be categorised into two types:

- Studies and investigations linked to appropriate ongoing studies. Findings will determine future investment needs to achieve excellent and good status for bathing and shellfish waters respectively. Future investment needs will be included in our next DWMP.
- Options to reduce storm overflows in accordance with the requirements of the government's Storm Overflow Discharge Reduction Plan.

We will:

- Reduce releases from storm overflows and minimise pollution incidents from our systems
- Continue with our bathing water enhancement programme, investing in sewer misconnections and other activities with partner local authorities, to deliver excellent classification of all 84 bathing waters across our operating area
- Ensure that shellfish waters are protected from contamination from human pathogens through disinfecting sewage releases to comply with, or exceed, the requirements.

Beachbuoy spill monitoring service

In May 2021 we launched an updated version of our Beachbuoy service; an online map that shows when and where storm releases have happened so people can make an informed decision before entering the water. Unlike anything in our industry, the map shows all our region's designated bathing waters and two non-designated recreation harbours, along with more detail about each release of untreated sewage.

We've linked Beachbuoy directly to our new reporting system, Aspire, so updates on releases to the environment show on the map in near real-time. The Beachbuoy service is available on our website and it is now widely used.

Launching a water quality buoy at Tankerton.

Case study:

Improving bathing waters through our misconnections team – spotlight on Worthing and Pelham Beaches

We're working closely with local councils environmental health and the EA on our Bathing Water Enhancement Programme (BWEP), investing £31.5 million to 2025 to maintain and improve our 84 designated bathing waters.

A vital part of the investment programme is to trace and correct misconnections, a core activity for our BWEP. Two examples of the work of the misconnections team are at:

Pelham Beach, Hastings

At a cost of £23,000, the team walked over the catchment area, recording observations, taking photos and samples. They lifted surface water manholes to check for signs and odours that suggested the presence of household wastewater and found 52 misconnected properties and 120 misconnected facilities. Working with Hastings Borough Council, the issues were resolved and Pelham Beach now has a stable 'good' classification, and water quality in the Ore Valley Stream has improved.

Worthing

The team found eight misconnected properties, 31 misconnected facilities and identified incidents of sewer misuse. One of the misconnections was significant. It found that a recent refurbishment of a charity premises had connected four toilets, two kitchens and eight hand basins to the surface water sewer which had an outfall onto the beach. Working with Adur and Worthing Councils, all the issues have been successfully resolved and Worthing Beach has now also received a 'good' classification.

Across our region

We investigated more than 40 bathing waters and four shellfish waters (the Hermitage Stream, Paulsgrove Harbour, Chichester Harbour and the North Kent Coast) as well as seven urban rivers since the start of the bathing waters season in 2022. The team identified 228 misconnected properties and resolved 215 of these, and a total of 689 misconnected facilities have also been identified and resolved.

It costs around £213,000 per annum to keep the team up and running, but with a £70,000 penalty for each pollution caused, it easily pays for itself as well as protecting our beautiful coastal waters and supporting local economies.

Inland bathing waters

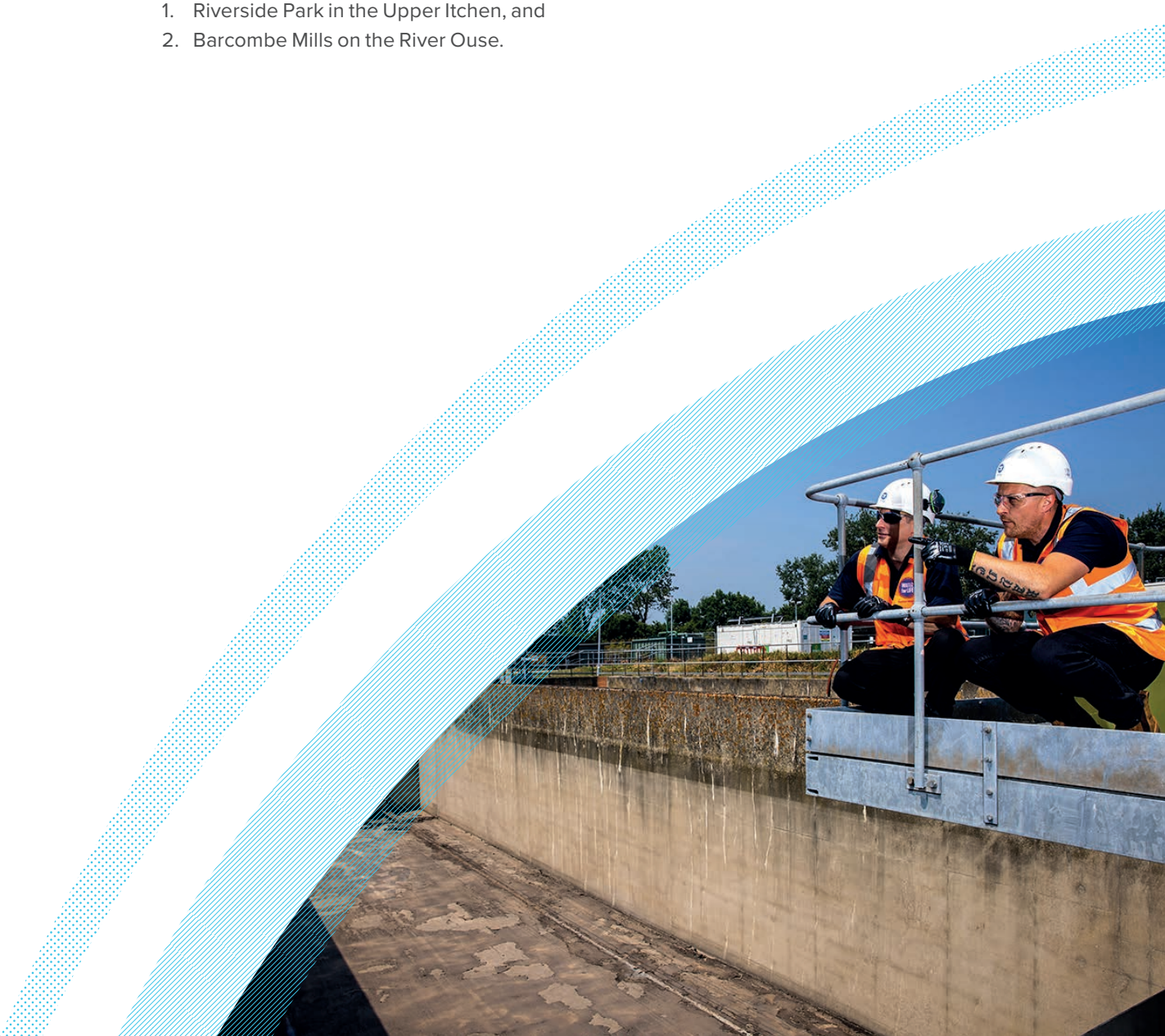
Our customers and visitors are increasingly using inland waterbodies and rivers for recreational activities and as bathing waters. There are known locations across our area where customers use local parks and rivers for bathing. None of these are designated bathing waters as the water quality does not meet the quality standards that are required for public bathing.

The government is actively encouraging water companies to designate at least one widely used stretch of river for bathing by 2025 and so we have proposed to the EA that two inland locations are considered for investigations under the WINEP to 2030. The two locations proposed are:

1. Riverside Park in the Upper Itchen, and
2. Barcombe Mills on the River Ouse.

There are many complex issues to consider before bringing forward a designation as a waterbody suitable for public bathing. The Outdoor Swimming Society has published a useful guide on setting up bathing waters so they are safe for recreational uses. Defra is going to revise its existing guidance on the application criteria for a new bathing water designation to make it easier for communities to apply.

Meanwhile, we plan to develop information on our website to help local authorities and community groups discuss their ambitions with us to begin the process. It's expected that these inland waters will need to be formally designated as bathing waters by the EA to facilitate any investment to improve water quality in these locations.



Our plan for reducing flooding and spills

This part of our DWMP looks at our plan for managing and reducing the risks from sewer flooding and storm overflows, and the risks to shellfish waters and bathing waters as discussed above.

The publication of the Storm Overflows Discharge Reduction Plan in August 2022 led to further work on the assessment of risks and causes of discharges from storm overflows for our DWMP. We used the latest full year of data from 2021 and artificial intelligence techniques to analyse the spill data from our overflows to determine the root cause of spills:

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

Climate change will mean less rainfall in the future and more intense summer storms which we know will overwhelm many existing drainage systems and cause localised flooding. On average, 93% of all flow in our sewers during a storm is rainwater, based on our modelled data for our wastewater systems. Typically, 45% comes from paved areas, for example, from roads, 34% from roofs and 14% from permeable areas. The actual foul wastewater component in a storm event can be as little as 1% of the flow in the system, and the rainwater up to 97%.

We have a choice. We either invest significantly in upgrading the capacity of thousands of kilometres of sewers to cope and build more and more storm tanks or we work on managing the rainwater.

Rivers, streams and ditches are natural drainage systems for rainwater. As areas have been urbanised, these watercourses have sometimes been culverted and squeezed into pipes underground, and new sewers constructed to take the rainwater and wastewater from the buildings and roads.

New, nature-based solutions could focus on restoring these hidden watercourses and allowing rainwater to flow back into local ditches, rivers and streams and drain down to the sea.

Our hierarchy for managing rainwater is:

1. Capture and re-use of rainwater, for example, for watering the garden, washing cars or for flushing toilets. This approach could reduce customers' water use as well.
2. Separation of rainwater from wastewater. Diverting rainwater back to the ground by allowing it to flow naturally through permeable surfaces such as fields, parks and playing fields, or to local rivers and streams through separate surface water drainage systems.

   Separation means keeping rainwater out of combined sewers and keeping more wastewater in the sewers. Less rainwater and groundwater in sewers will create more capacity for future growth.
3. Slowing the flow. This is about safely holding back and temporarily storing water on the surface in areas where no harm is caused, using sustainable drainage systems, such as swales, raingardens, ponds and planters. By reducing the peak flow, existing drainage systems will simply drain the water away over a longer period time. This reduces flooding and the use of storm overflows.

These solutions also create more accessible green spaces, wetlands and natural environments such as urban woodlands, as well as supporting the long-term climate adaptation of communities.

Too much rainwater in our sewers leads to:

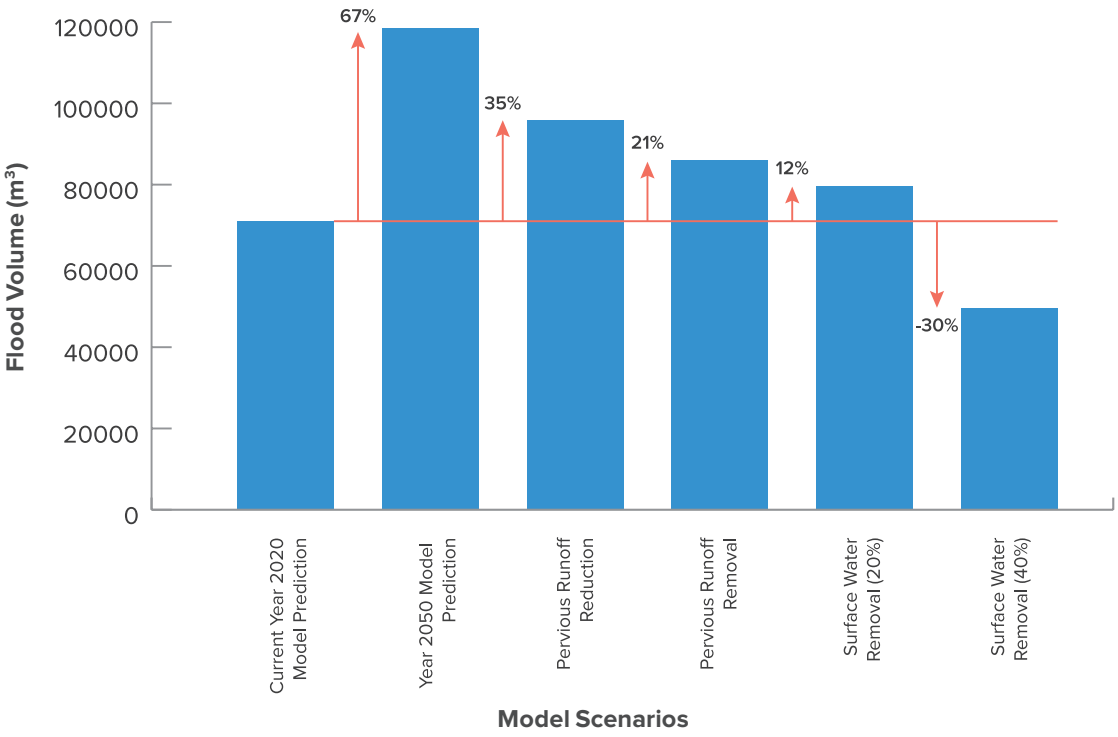
- flooding in customer's homes and businesses
- localised flooding in gardens and streets when water escapes from the sewer network
- wider flooding when rainwater is unable to get into the combined system
- storm overflows discharging diluted sewage into the environment
- pressure on the sewer network creating capacity issues and potentially leading to rising main failure, sewer collapse and asset deterioration
- increased energy and carbon costs of pumping the water significant distances to our wastewater treatment works and then treating it
- a reduction in the effectiveness of wastewater treatment processes at our wastewater treatment works due to the dilution of the sewage arriving at the works.

Our modelling suggests that climate change, growth and urban creep could increase sewer flood volumes by up to 67% by 2050 (see Figure 13). This data is for our largest wastewater system, Budds Farm, in East Hampshire.

Overall, climate change could lead to a doubling of the number of homes at risk from sewer flooding by 2050 compared to 2020. It also shows that reducing the run-off of rainwater from pervious areas (green spaces) could reduce the volume of flood water expected in 2050 from 67% down to a 35% increase from 2020. Removing this run-off completely reduces the increase in flood volume to 21%. It's only by separating 40% of rainwater (surface water) that we see a 30% reduction in the volume of flood water in 2050 compared to 2020. Our modelling indicates that overall, we will need to separate at least 25% of paved areas such as roads and roofs in an area to offset the impacts of climate change, creep and growth.

Budds Farm Wastewater Treatment Works.

Figure 13: Impact of climate change and options for our Budds Farm system

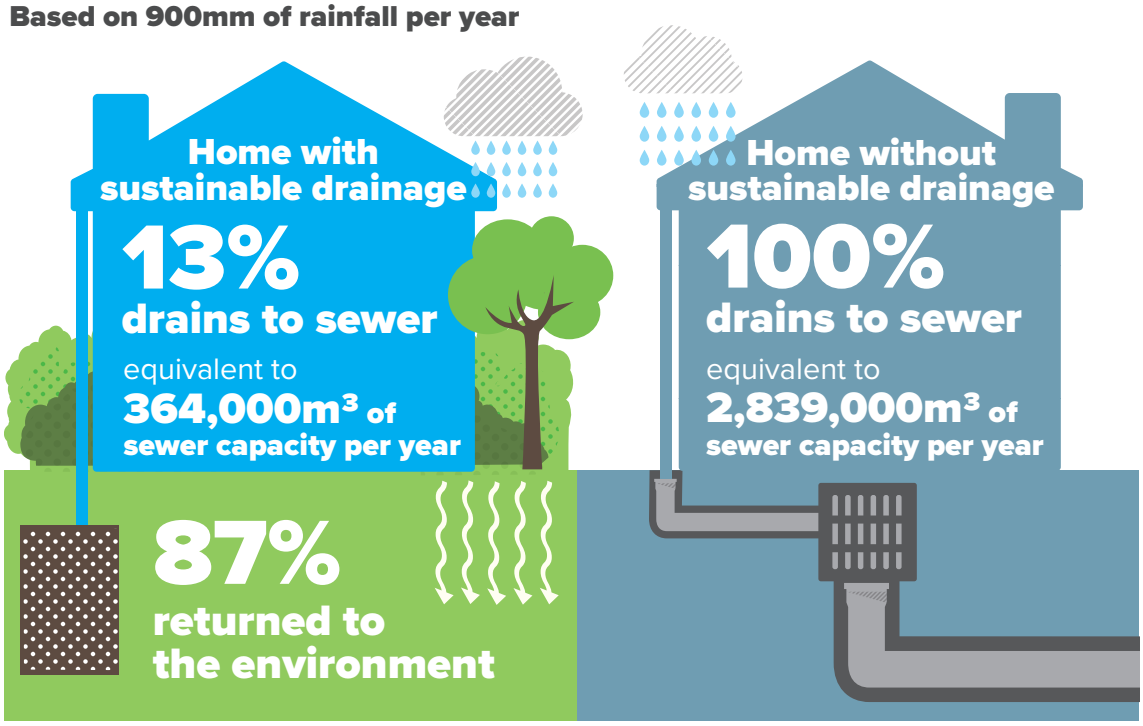


We believe that rainwater separation is the most sustainable long-term option for tackling the issues of storm overflows and flooding. Using the natural environment to help keep surface water out of our sewer systems by constructing swales and wetlands will also benefit wildlife, provide access to nature for local communities, and help improve air quality and lower carbon costs. Benefits of this approach are likely to include:

- Significant reductions in sewer flooding from water escaping from the sewer network
- Reductions from wider flooding when rainwater cannot get into the sewer network as it is already full
- Fewer storm overflows discharging heavily diluted sewage into the environment
- Greater focus on catchment management and nature-based solutions
- Reduced energy and carbon costs as a result of pumping less water significant distances to our wastewater treatment works
- Creating capacity at our wastewater treatment works so that part of the system can be shut down for maintenance, for example, taking a filtration tank offline without disrupting our service
- More effective and efficient removal of nitrate at our wastewater treatment works due to reduced dilation of the influent sewage arriving at the works
- Improved water quality in the environment, including in rivers, bathing waters and shellfish waters
- Greater opportunities to work with local councils to adapt communities for future climates and greener cities to create healthier and happier places to live
- Reducing future investment needs and customer bills.

Separating rainwater, however, is not an easy option, especially where there is a need to retrofit Sustainable Drainage Systems (SuDS) or provide new surface water drainage systems within existing developments. Figure 14 shows that the rainwater run-off from a home with sustainable drainage could be as little as 13% compared to a home without SuDS.

Figure 14: Water run-off for a development of 10,000 homes

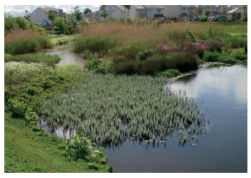


Feedback from our public consultation

In our public consultation, 94% of responders either 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.

Figure 15: Example of sustainable drainage systems (SuDS) that we can adopt

Swales
Shallow, broad and vegetated channels



Ponds and wetlands
Provide both stormwater attenuation and treatment

Rills
Small, shallow, lined channel through which surface water can flow

Tanks
Used to control and manage surface water runoff either as a soakaway, storage tank or a combination of both

Bio-retention systems
Includes tree pits, ponds and wetland (permanently wet) and rain gardens

Basins
Provide flow control through attenuation of storm water runoff

Image courtesy of Susdrain.org.

All images courtesy of Water UK unless indicated.

Many external partners working with us to develop the DWMP expressed a keen interest to find suitable locations to construct SuDS in recognition of the multiple social and environmental benefits they provide.

Figure 16: Storm water run-off comparison (based on a 200m^2 area)

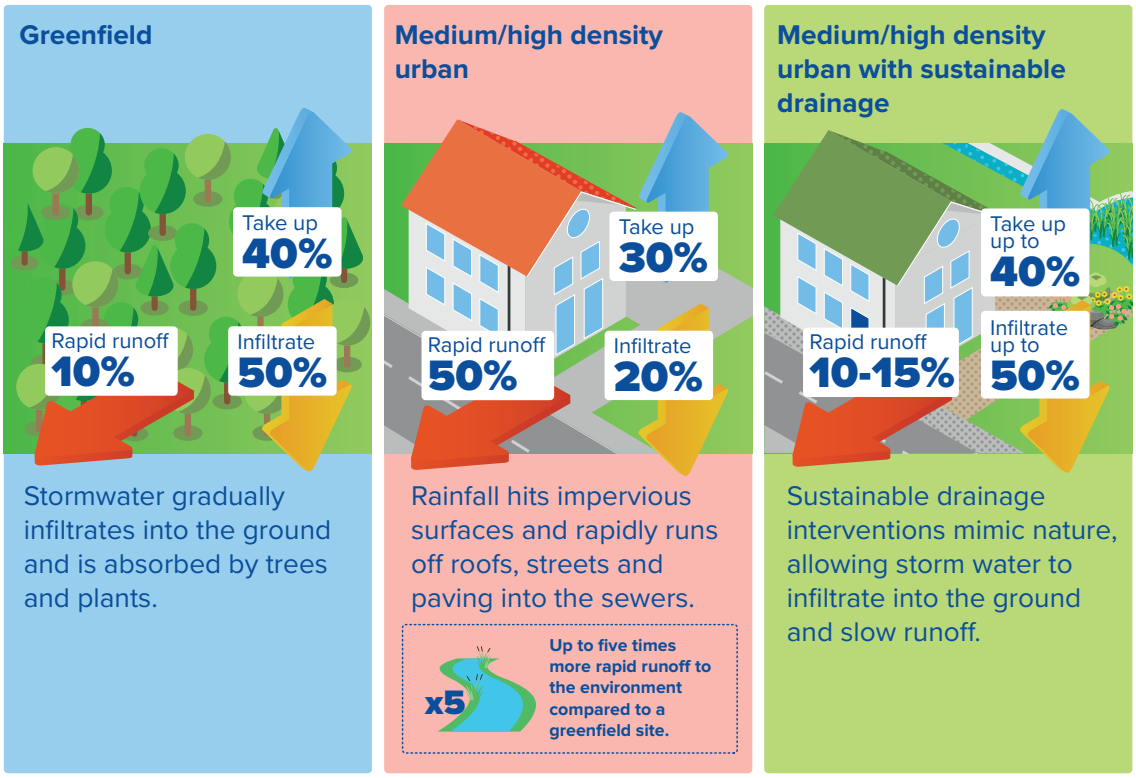


Figure 16 illustrates the differences in storm water run-off from greenfield and urban areas, without and with sustainable drainage. It illustrates that by using sustainable drainage it's possible to reduce rainwater run-off to the level of greenfield sites.

We can't deliver rainwater separation on our own. Collaborations with the EA, Councils, Planning Authorities, highways authorities and local communities are needed to co-create the solutions. Our DWMP is a long-term plan and, by working together, the issue can be tackled, step by step. Every separation scheme is progress towards this long-term goal.

We know that the existing housing stock and infrastructure is the problem. Future development should not be. Local Planning Authorities are already working with developers on new developments to better manage rainwater. We have recently updated our sustainable development policy, which includes the following for developers:

- Sewer connections – connections from new developments to foul or combined sewers for surface water run-off will not be accepted unless all options to separate surface water have been applied
- Sustainable drainage – designs must include features to slow the flow of surface water run-off as close to the source as possible, for example, green roofs, permeable paving, rain gardens and water butts
- Water recycling – incorporate rainwater capture and grey water recycling systems into designs, linking it to blue-green infrastructure and joining or establishing partnerships to eliminate rainwater from drains
- Nutrient neutrality – to mitigate the expected increase in nitrogen and phosphorus from a new development so that they can become nutrient neutral. Specific developments in the Stodmarsh area in Kent and parts of South Hampshire and Chichester are required to demonstrate this.
- Water neutrality – developments in Sussex North must demonstrate water neutrality for any new development with designs meeting 85 litres per person per day. Achieving this will require water capture, water re-use and off-setting by reducing water use in existing developments nearby.

Feedback from our public consultation

Our partners tend to agree that separation is likely to be a real challenge in existing urban environments. Removing existing surface water connections from the combined sewer network to achieve a year-on-year reduction needs a coordinated approach. However, retrofitting solutions 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. 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 be kept entirely out of the ground, as any water in the ground will reduce ground stability and trigger ground movement, damaging infrastructure and properties.

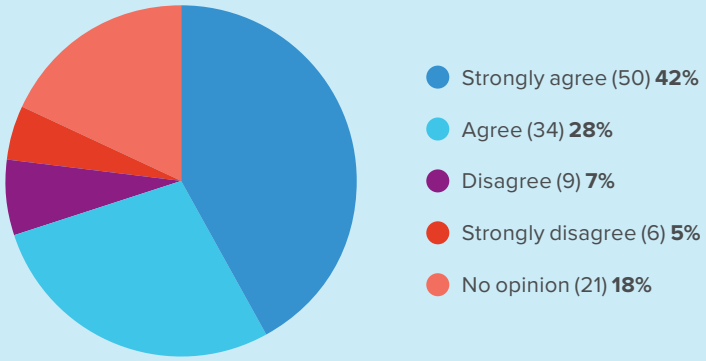
Our DWMP preferred plan takes a bold, innovative and sustainable approach to reducing the risks of sewer flooding and storm overflows through multiple activities:

1. Asset optimisation: Make sure our wastewater systems, assets and networks are mapped and working as intended. Invest in technology to create smart networks to maximise the use and capacity of existing drainage systems
2. Rainwater separation: Prioritise the removal of existing surface water connections from the combined sewer network above building additional storage, and achieve year-on-year reductions in the amount of rainwater that is connected to the combined sewer
3. Sustainable solutions: Develop effective long-term solutions that deliver a natural capital approach, consider carbon reduction and biodiversity net gain, as well as catchment-level and nature-based solutions
4. Deliver wider benefits: Maximise co-benefits to address multiple issues and deliver wider environmental or societal value
5. Work in partnership: Actively seek opportunities to work in partnership with others to provide ‘green’ infrastructure such as trees, hedgerows, parks, fields and forests and ‘blue’ infrastructure including rivers, canals, ponds, wetlands, reservoirs and floodplains within existing communities
6. Separate existing systems: Use the opportunity to separate combined sewers and lay new separate surface water systems when replacing and upgrading sewers
7. Advise new developments: Strengthen our advice to planning authorities to ensure new build properties and developments only connect foul drainage to our sewers
8. Adopt SuDS: Adopt SuDS constructed by developers as part of new developments where they meet the industry standards and the criteria for adoption
9. Retrofit SuDS: Retrofitting is challenging, but essential in urban areas. Work with local councils and industry to identify opportunities to encourage property owners to install SuDS to existing buildings
10. Tackle road run-off: Work with the highway authorities to support and encourage them to improve surface water management and reduce pollution from the road network
11. Target customers with education campaigns: Extend our FOG and unflushables awareness campaigns to reduce blockages to include messages on sustainable drainage.

We believe this approach offers best value for our customers, shareholders, the environment and the local economy.

What our public consultation told us

The responses to our consultation showed huge support for a more sustainable approach to tackling the issue of storm overflow releases. 94% of all responders agreed or strongly agreed that rainwater should be separated from foul wherever possible to reduce flooding and overflow spills. We also 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.
- 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 is at a premium and there are multiple pressures on it. It's unclear whether the amount of land required for nature-based solutions 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 – 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 releases into the Blackbridge Brook 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 two days of continuous releases 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 provide 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 gullies to soakaways and permeable land. This had an additional benefit of reducing some internal property flooding
- Remove 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 less than five discharges since the interventions were implemented despite 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.

Our Cleaner Rivers and Seas Task Force

We established our Cleaner Rivers and Seas Task Force in 2021 to deliver six pathfinder projects with the purpose of working with partners to test, explore and deliver solutions to reduce storm overflow releases. The six pilot locations are Deal, Margate, Swalecliffe (Whitstable), Sandown on the Isle of Wight, Fairlight and the pan-parishes around Andover. However, these pathfinder areas are rapidly expanding to cover further areas as the DWMP is being developed.

The focus is to drive changes and more sustainable approaches that will continue to perform into the future as our climate changes. There are three main types of intervention to reduce the risk of flooding and storm overflow use:

- Upstream source control (removing and slowing the flow of rainwater into the system)
  - Rainwater harvesting
  - Permeable paving
  - Green roofs
  - Soakaways (includes tree pits)
  - Rain garden (swales)
  - Planters
- System optimisation (making better use of the existing infrastructure)
  - Optimisation of our drainage and wastewater system and interfaces between assets
  - Different mechanical and electrical equipment (for example, new pumps)
  - Improvements in pumping station and storm tank use and control
  - Smart network control with increased digitalisation.
- Infrastructure enhancements (building larger infrastructure)
  - Larger sewers, storm tanks and/or treatment works.

All six pilots are exploring different solutions to do this including using nature-based solutions such as wetlands, swales and tree pits. Learning from these pilots is being used to evaluate the natural and social capital benefits provided through this approach. This will inform the wider roll out of our new surface water management approach.

Case study:

£1.6 million SuDS in schools project

Nearly 50 schools across our region are participating in a new project to help to slow the flow of rainwater into our sewer systems. The schools are using rain harvesting and nature-based solutions like rain gardens and tree pits to remove or slow the flow of excess surface water run-off from hard surfaces such as playgrounds, car parks and roofs.

Developing these Sustainable Drainage Systems in schools will help to reduce excess rainwater entering our overloaded combined sewer systems, one of the main causes of floods, poor water quality and spills in our waterways.

Meanwhile, more greenspaces in the schools will be good for wildlife as well as the health and wellbeing of the schoolchildren. The children will learn about water and wastewater issues that affect their local environments, including misuse of the sewers and water saving measures. Findings from our public consultation have told us this is what our customers want:

The scheme, which took place between October 2022 and April 2023 is jointly funded with the Department for Education. This is the first time we have run a large-scale programme of this kind in schools, and we hope to repeat it in future years.

Our Storm Overflow Discharge Reduction Plan

We have put forward an ambitious programme to reduce releases from storm overflows to the Environment Agency for inclusion within the Water Industry National Environment Programme (WINEP) for 2025–30. This programme, if supported by the regulators, will enable us to use customers' bills to reduce releases at 149 storm overflows to meet the government requirements at these sites by 2030.

The programme includes 17 of the 20 highest spilling storm overflows in our region (at a cost of £59 million) in the proposed programme. The overall programme targets the 30 highest spilling overflows in our region. These tackle some of the storm overflows that are of significant local concern to our customers.

Our storm overflow release reduction plan is based on the following themes:

1. For groundwater driven releases:
   - lining of private and public sewers to reduce infiltration and
   - creation of wetlands to treat the spills through natural processes before the water is released to the environment. These are sized for each overflow based on the population in the area and flow in the system.
2. For rainwater driven releases:
   - Combination of SuDS solutions and some traditional storage. This is based on the non-permeable area calculated for each catchment and the modelled calculated volume of storm releases.

Our proposed programme for 2025–30 is summarised in Table 2.

Table 2: Summary of our proposed storm overflows discharge reduction programme for 2025–30

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 m^3 of storage	£775m	15.5 (Circa 4600 spills avoided)

Our regional programme for storm overflows will deliver the statutory milestones set by the government, including:

- Delivery of recommendations from our 2020–25 studies and investigations
- Shellfish waters <10 spills by 2030. This is the main focus for our 2025–30 programme
- No more than three spills per bathing water by 2035 (2 spills to achieve Excellent bathing water classification). Mostly delivered during 2030–35
- No environmental harm to waters by 2045, delivered through an investigation programme to assess harm or spill frequency, and identify the actions required
- <10 spills per year across all overflows by 2050.

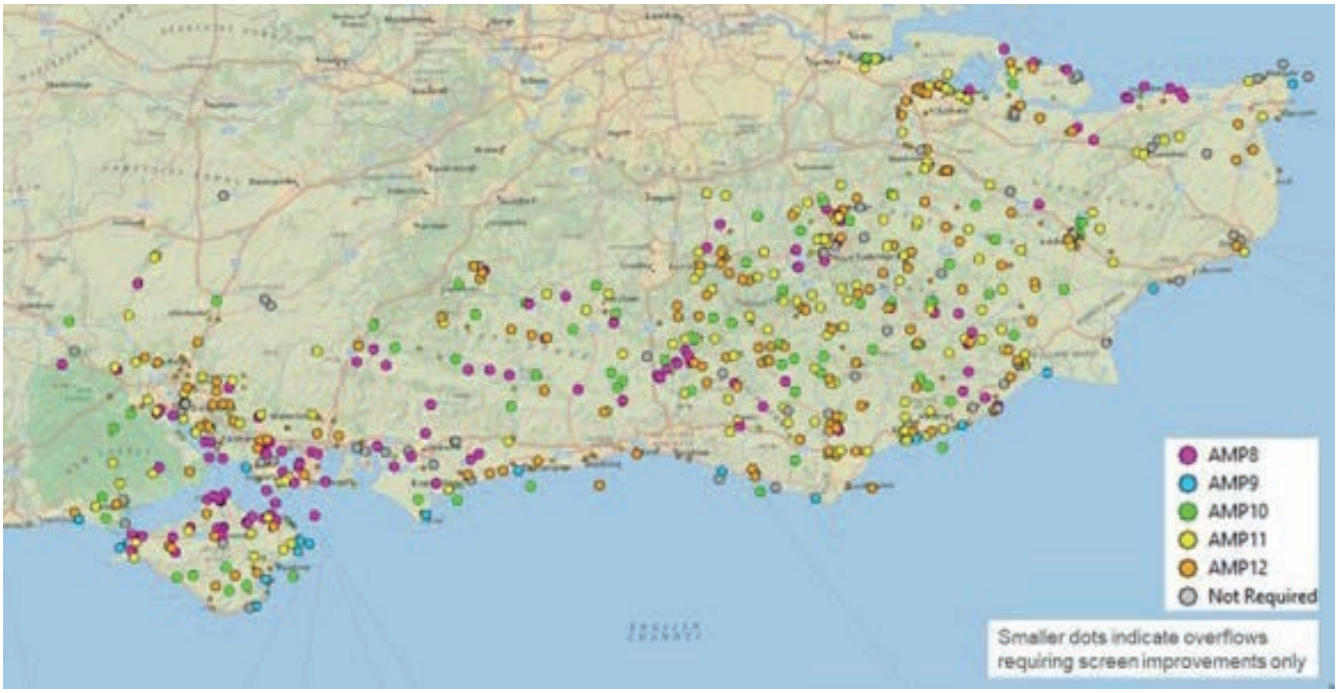
The Water Industry National Environment Programme

The Environment Agency (EA) issues the guidance on the Water Industry National Environment Programme (WINEP) to help water companies identify the investments needed to protect and enhance the environment. The primary role of the WINEP is to steer water companies on the actions they need to take to meet the environmental legislative requirements and to agree a list of work and investigations to be carried out by with the individual water companies in England. The WINEP has been an important mechanism for delivering substantial benefits to the natural environment, providing some £25 billion since 1989. Between 2020 to 2025 it will account for approximately £5.2 billion of asset improvements, investigations, monitoring, and catchment interventions across England.

The investment needs identified in our DWMP to enhance our existing systems to protect and improve the environment need to be included within the WINEP in order that we are able to use funding from customer's bill and stakeholder's investment to deliver the actions. The development of the WINEP runs alongside, and is complimentary to, the Price Review business planning process.

Figure 17 shows the full extent of the storm overflows identified as requiring investment by 2050 and the investment period in which we are planning to make the reductions.

Figure 17: Storm overflow investment needs by investment period



We've prioritised our proposed investment needs using the guidance from the EA, issued in August 2022 and November 2022 for WINEP. This guidance leaves room for water company discretion on certain deliverables (for example, the EnvAct_IMP4 target requires a target % of the total stock of overflows to be improved in each AMP). In these cases, we have prioritised overflows with the highest recorded spill count average in 2020–21. The prioritisation for the storm overflows by investment period is shown in Table 3

Table 3: Priorities for investment over the next five investment periods to 2050

Investment period	Prioritisation rationale
AMP8	• All shellfish waters overflows. • Overflows with improvements quantified via AMP7 investigations. • 17 of the 20 highest spilling overflows across our region.
AMP9	• All remaining bathing waters overflows
AMP10	• All remaining storm overflow spilling more than 40 times a year
AMP11	• All remaining high priority storm overflows once investigations are completed to meet the 2045 target
AMP12	• All remaining overflows that require improvement

The types and mix of solutions that we're proposing to adopt and deliver with our programme is shown in Table 4. In line with the government's plan, we'll prioritise removing existing surface water connections from the combined sewer network over building additional storage, wherever this achieves the best outcome for customers and the environment. This supports the governments requirement for better management of rainwater which "should be discharged back to the environment as close as possible to where it lands or channelled to a close watercourse without first mixing it with sewage" (Defra, August 2022).

Table 4: Solution type and number of overflows

Solution type	No. of overflows
SuDS supplemented by buried storage	411
Storage only	105
Wetland creation and sewer lining	70
Total number of overflows with spill reduction improvements	586
Screen improvements only (IMP5)	318
No action required	75

Our proposed investment needs for storm overflows to meet the government's Storm Overflows Discharge Reduction Plan is shown in Table 5.

The needs are subject to the government delivering other aspects of their plan (such as enabling rainwater to be discharged to the nearest watercourse), the EA enabling the investment needed to be included within the Water Industry National Environment Programme, and Ofwat accepting our proposals in terms of efficiency and impact on customer bills. In addition to these improvements, we'll be carrying out further investigations into more than 200 of our storm overflows. These investigations, which will be completed by April 2027, will further inform the investment needs shown below in AMP8 and 9.

Table 5: Our Storm Overflows Discharge Reduction investment needs and outputs

Our proposed investment needs for storm overflows	AMP8	AMP9	AMP10	AMP11	AMP12	Total
	2025–30	2030–35	2035–40	2040–45	2045–50	
Preferred option Capex cost (£ million)	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	n/a

For further information on our regional programme and the methods and assumptions used in developing it, see our technical summary.

We'll make the case for significant investment in storm overflows in our business plan for 2025–30, for submission to Ofwat as part of the 2024 Price Review. This will be supported by the evidence provided by the DWMP and our Clean Rivers and Seas Task Force.

Our calculations indicate that between 15% and 80% of rainwater will need to be removed to reduce sewer flooding to a not-significant Band 0 level by 2050. We know that this will not be easy.

Customer feedback:

"With the combined sewer overflows, it would be good if you could give us more information on the amount of waste discharged. You talk about it in terms of hours, but you don't give us any information on the content of the overflow. While you do give information on nitrates and phosphates, there's no information on when you're tipping almost raw waste into our harbours. It seems nonsensical to be transparent about one thing but not another. I live close to the harbour and having this information is really important for the quality of the harbour environment."

Parish/community council, Long Term Delivery Strategy stakeholder consultation, July 2022

Report from the national Storm Overflow Evidence Project

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.

An independent report from the Storm Overflows Evidence Project published by Defra in November 2021 suggested that the cost of reducing the number of releases from storm overflows could be much higher. The findings were (Defra, 2021):

- A policy limit of 40 spills on average per year, reduced to 10 spills for sensitive catchments would cost between £18 billion and £110 billion. The impact on annual household bills could be between £30 and £208 per year
- A policy focused on achieving 10 spills per year on average in sensitive rivers such as chalk streams would cost between £16 billion and £82 billion. The impact on annual household bills could be between £26 and £150 respectively
- A policy focused on achieving 10 spills per year on average in rivers where storm overflows are observed to be the reason for not achieving good ecological status would cost between £13 billion and £59 billion. The impact on annual household bills could be between £22 and £108 respectively
- A policy focused on improving rivers known to be used for bathing to achieve an average spill frequency of five per year would cost between £8 billion and £26 billion. The impact on annual household bills could be between £13 and £48 respectively.

These costs were based on an analysis of 15,000 storm overflows in England, and the range shows the level of uncertainty in the cost to deliver the targets. The difference between our indicative costs and the costs within the Defra report shows the current level of uncertainty of how much such a significant change to existing wastewater systems would cost and the ability to achieve this through catchment and nature-based solutions.

Investment needs

Our DWMP highlights the risks to our customers and the environment from the performance of our wastewater systems.

We have identified 228 wastewater systems (60%) where there is at least one very significant risk in 2020.

Climate change, urban creep, growth and asset deterioration means these risks will increase unless we continue to invest in our wastewater systems. For example, our modelling indicated that unless we reduce the risks, the number of properties at risk from sewer flooding could double by 2050 when compared to 2020 level, due to forecast climate changes.

The rate of investment will need to increase to keep pace with these challenges and prevent us passing the costs onto future generations. We need to adopt a new approach as well as new technology to reduce future investment needs to ensure they remain affordable for future customers.

The purpose of the investment needs is to reduce the risks in each wastewater system to an acceptable level for our partners and customers. The relative priority and timescale for achieving Band 0 for each issue must reflect its regulatory requirement and its importance to our customers, balanced against the costs. We explored customer and stakeholder views on achieving Band 0 (not significant) risks even if this means a rise in bills as part of our public consultation.

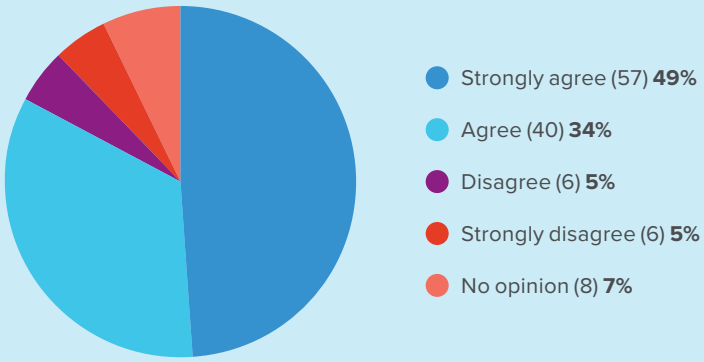
The investment needs for each of the 61 wastewater systems progressed in the first cycle of the DWMP are provided on our website. These plans show the preferred, best value options to reduce the risks within each system. The indicative timescales for each investment need are based on when the risk occurs and when the investment is needed to reduce the risk. Some options may take several investment periods to achieve the desired outcomes. We also identified potential partners in the investment needs tables.

We assessed the effectiveness of each investment need in reducing the risk to band 0. Where further action is needed to get to Band 0, we estimated the additional cost by extrapolating the average cost per band reduction for each planning objective. This process is explained in the technical summary on programme appraisal .

Many of these investment options deliver benefits under more than one planning objective. The reduction that each option has against each of the 14 planning objectives was assessed to provide an overall risk score for each option.

The prioritisation and optimisation processes are iterative, and the importance and timing of actions will be explored further with partners and customers in the development of the business plan for 2025–30. The phasing and integration of our drainage and wastewater objectives will need to be considered alongside other areas of water company expenditure as part of our long-term plan.

What our public consultation told us about best value



Around 83% of the responses agreed or strongly agreed that we should prioritise best value options to reduce the risks across the planning objectives rather than least cost. A total of 7% offered no opinion whilst the opinion of the remaining 10% was equally split between disagreeing or strongly disagreeing.

In general, our customers and communities think that least cost is likely to prove least satisfactory. Cost should not come into decision-making and, when it comes to the protection of the environment, no expense should be spared. Cost alone should not be the greatest consideration. Cheaper options often fail to meet their objectives, introduce additional problems further along the line, cause more environmental degradation and loss of biodiversity as well as impacts on human health and well-being.

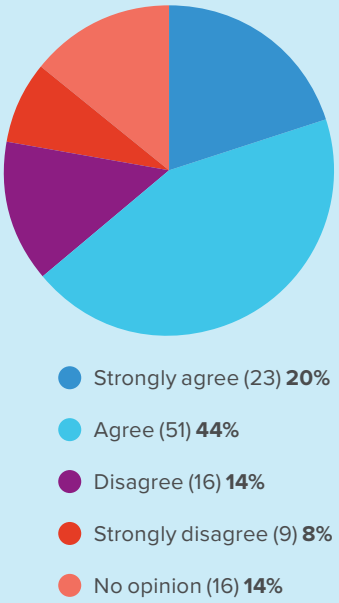
Partners and councillors tend to think that least cost is continually chosen as the water industry regulatory environment is contradictory with Ofwat looking to decrease customer bills in real terms whereas the EA increasingly expects higher standards.

What our public consultation told us about band reduction

We asked if the drainage and wastewater risks should be reduced to Band 0 (not significant) even if this means that customer bills would increase.

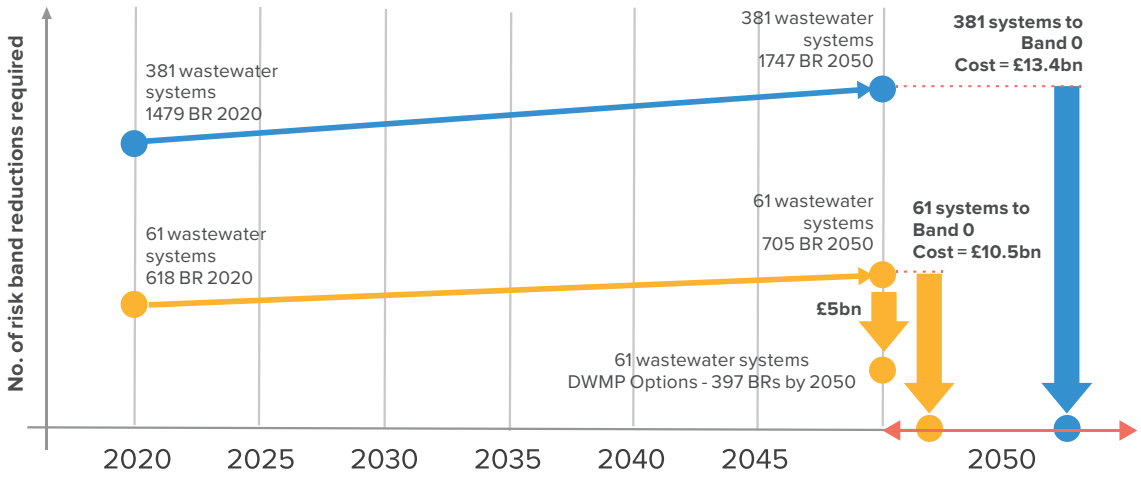
A total of 64% of the 115 responses either agreed or strongly agreed with reducing the risks to Band 0 even if it resulted in an increase in customers' bills. This includes 61% of the 54 customers responding to this question.

Although the majority agree that the risks should be reduced to Band 0, and many recognise that customers should contribute towards the costs, we were told that a rise in bills must be proportionate to customers' ability to pay and a reasonable proportion should first be met through reducing company profits, shareholder dividends and executive salaries.



We used the information and costs from the investment needs for the 61 wastewater systems to extrapolate and determine the investment needs for all 381 of our wastewater systems, see Figure 18. This extrapolation process is covered in detail in the programme appraisal technical summary. Not all the planning objectives have a 2050 risk assessment, so we know that the figures below are an under-estimation of the future investment that will be needed. The advantage of extrapolating the investment needs for all 381 wastewater systems across our operating area is that the total scale of investment for the future can be understood, the priorities for investment identified and the financing considered. The figures will be refined and improved as the DWMP planning process matures and more information becomes available for the next cycle.

Figure 18: Extrapolation to determine total investment needs to reduce risks to band 0



61 Wastewater Systems = 3.7M Population 377 Wastewater Systems = 4.7M Population

The total investment needs are shown in Table 6. Our DWMP indicates that to reduce the risks for all 14 planning objectives across 381 wastewater systems to band 0 by 2050, a total investment in the order of £13.4 billion will be needed.

Table 6: Total Investment needs identified in our DWMP

Investment needs for next 25 years to 2050	Total cost for all planning objectives (£ billion)
Options for 61 wastewater systems	£5 billion
61 wastewater systems to band 0	£10.5 billion
381 wastewater systems to band 0	£13.4 billion

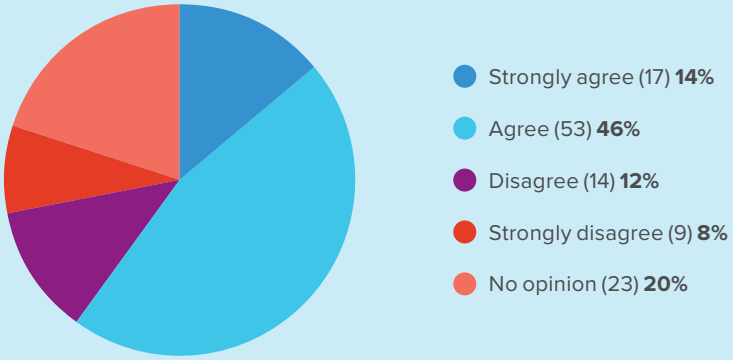
Table 7 shows the total projected costs per type of option.

Table 7: Total investment needs by type

Option type	Total cost (£ million)
Additional network storage/conveyance (Grey)	£2,461
Surface water separation/removal (Blue/Green)	£6,945
Additional WTW treatment capacity	£2,233
Wetlands	£407
Customer education programme	£18
Jetting	£20
Pipe rehabilitation	£870
Maintenance WPS	£49
Maintenance WTW	£289
Modelling studies	£41
Studies other	£27
TOTAL	£13,358

What our public consultation told us about the range of proposed investments

We asked our customers, communities and stakeholders if, overall, they supported the range and type of Investment Needs identified in our DWMP.



A total of 60% of responders said that they supported or strongly supported the range and type of Investment Needs identified. 20% had no opinion, 12% disagreed and 8% strongly disagreed.

Our customers and communities are very concerned about pollution and contamination and have expressed mistrust in both our ability to address the issues as well as our intention to do so. They feel that the investment plans will not address the issues within an acceptable timeframe. However, if we implement the solutions outlined in the investment plans, which are wide ranging and comprehensive, a resolution to current problems could be achieved.

Customer feedback:

"Why should we pay less now only for future generations to pick up the tab? Likewise, a big increase now is likely to render it unaffordable for some. A small gradual increase seems the only reasonable approach"

Selecting our preferred plan

The DWMP is a risk-based plan that supports planning for the uncertainties of the future by identifying the most likely future investment needs.

But there are significant uncertainties about growth and climate change. This means we need to forecast and monitor change and plan the right interventions at the right time to keep risks to customers and the environment at an acceptable level. The use of adaptive planning approaches helps us to identify and select our preferred plan in the face of all these uncertainties.

Adaptive planning means taking decisions now based on the known risks and needs that do not restrict options to address future challenges or unknowns. As a result, we're then able to adapt or change our approach to respond accordingly to the future needs as the uncertainties become more certain.

We know that growth and climate change will place greater pressures on our critical infrastructure and the essential services that we provide to our customers. The risk assessments for 2050 start to define what the future may hold. We used the risk assessments to assign investment strategies, see our technical summary on problem characterisation. These strategies underpin our approach to adaptive planning so we know when and where future investment may be needed.

The DWMP has included a range of future risk assessments to forecast when risks will occur. Examples include:

- Where environmental or technical constraints are forecast to restrict new development from being connected to an existing wastewater system, then plans can be made to transfer wastewater to an alternative site for treatment
- If sea levels rise and place too great a risk to a coastal treatment works in, say, 20 years' time, then a decision may be needed within the next 10 years on whether to plan to relocate the treatment works away from the risk
- If flooding in a community is forecast to be a very significant risk in 2040, then do we incrementally build additional network storage to keep pace with growth and climate change or invest in providing a new separate surface water system.

We explore and test what the future may look like through scenario planning and developing adaptative pathways for our investment. This is completed at two spatial scales: firstly, at the wastewater system to understand how our systems may need to change in the future, and secondly for our whole operational region as part of the business planning process to consider the financing and affordability of investment.

The national DWMP Framework sets out the need to forecast the future using scenarios for growth and climate change. The requirement is to use a central estimate of growth and the climate scenarios in Water UK's Capacity Assessment Framework (CAF). The CAF states "an uplift of 20% should be applied to all design storms for assessing the 25-year time horizon. This is based on the High Emissions P50 projection for 2100, scaled down to 2050. Sensitivity testing should be carried out by applying +30% and -30% to the 20% climate change uplift for future design storms. This equates to a lower estimate of 14% uplift and an upper estimate of 26%". We used these scenarios in our BRAVA risk assessment modelling to predict the future risks up to 2050 and determine the total investment needs that meet the performance standards expected by our customers in the long term.

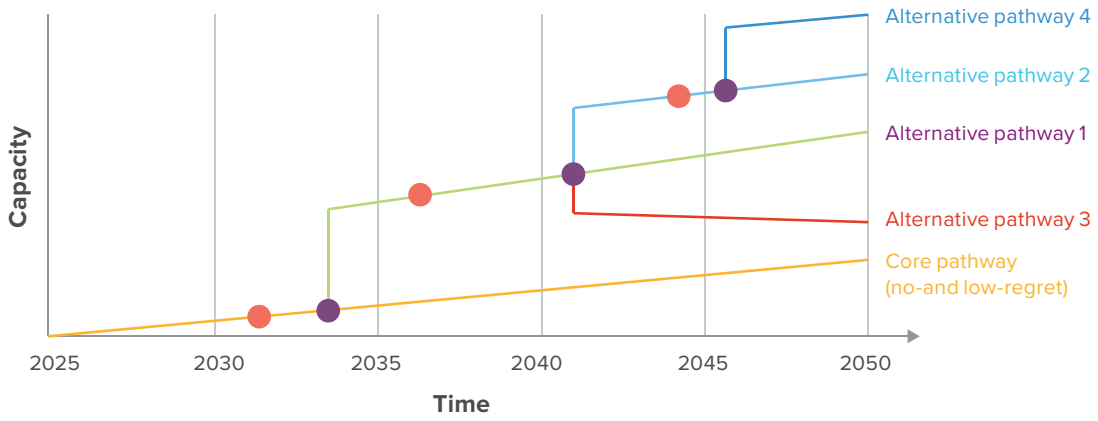
The most significant uncertainty in our future risk forecasts is for planning objectives PO4 and PO7 on sewer flooding risk in a storm. This is due to the national approach to flood modelling for PO4, which specifies a method for predicting the number of properties at risk from sewer flooding.

The modelling method is considered to over-predict the number of properties at risk, and so the level of investment identified in our DWMP to protect these properties from flooding is an over-estimate. But the risk of sewer flooding could double by 2050 so we need to continue to invest in protecting customer's homes and businesses, while improving our hydraulic models to reduce the levels of uncertainty.

We have included the investment needs for sewer flooding in our DWMP but are moving the majority of these investment needs out of our preferred plan into an alternative pathway. This allows us to improve the modelling and data to reduce the uncertainties and see the effects of climate change before committing this scale of investment.

Ofwat published the final PR24 guidance on long-term delivery strategies in April 2022, explaining how the DWMP will inform water companies Long Term Delivery Strategies (LTDS). Figure 19 illustrates the concept of core and alternative pathways (Ofwat, April 2022). Further details of how we have applied the Ofwat guidance in our DWMP are explained in the technical summary on our approaches to uncertainty.

Figure 19: Example of core and alternative pathways, Ofwat 2022



- Decision point: the latest point at which a decision on moving to an alternative pathway should be taken
- Trigger point: the point at which an alternative pathway will be followed

A core pathway represents costs to meet low, but likely, scenarios and low regret investment choices. Alternative pathways define the other plausible paths for investment needs depending upon the future uncertainties such as growth and climate change, and the timing for when a change in risk is expected to occur.

Our core pathway is to 'maintain' the existing systems and assets to maximise their performance, and only factoring lower changes in climate and growth. This means investing on a 'no regrets' basis, in our 381 wastewater systems to ensure they work and perform as designed to keep risks to customers and the environment in Band 0.

We will optimise our systems first to get the best performance from our existing infrastructure, before investing in providing new assets. Our core pathway also includes investment to keep pace with and enable new development across the region.

Our core pathway with low climate change and growth includes the investment needs for all planning objectives except:

- PO4 (1 in 50 year flooding) as this investment will only be needed in adverse climate scenarios;
- PO2 (Pollution Risk) as the investments already made in resilience and smarter networks will enable us to reduce pollution risks;
- PO6 (WTW compliance quality) as this is a measure of resilience and we manage and operate our assets to achieve full compliance under the current climate and population; and
- Only 22% of the investment needs under PO7 (the annualised risk of sewer flooding). This is the percentage of the number of properties on our register of flooded properties compared to the number of properties identified by the modelling in areas at risk from sewer flooding.

Our preferred plan consists of the best value, preferred options identified in our DWMP and allows for medium levels of climate change and central estimate of growth. These options will reduce the risks towards band 0 and, typically, will be focused on tackling the issues at source, working with nature and delivering wider multiple benefits.

We have included the investment needs for all planning objectives in the preferred plan with the exception of some investment relating to sewer flooding and pollution:

- For sewer flooding, we have not included investment to tackle the properties identified at risk through the modelled buffer zones due to the uncertainties in this data. It means that, for flooding, we will focus investment on those areas where properties are impacted by flooding now and in the future. We have included the investment to reduce flooding identified under PO4 (1 in 50 year storm) in an alternative pathway. We will move to the alternative pathway when we reach a trigger point in the rate of change of our climate where wider scale property flooding is expected.
- Some pollution investment needs are excluded as we have already invested significantly in these during AMP7 to reduce the risks from that identified using the 2017–2019 data in BRAVA.

We have created three alternative pathways based on different levels of climate change and growth to enable us to test the sensitivity of our investment plan. These identify where we may need to change our investment needs as future uncertainties become more certain – such as the location for future development, the rate of climate change in the South-East and the impact on government policies on surface water management and environmental standards. We aligned our alternative pathways to the growth and climate change scenarios set out in the national DWMP Framework.

A lower climate scenario for the DWMP is a 20% increase in rainfall intensity but at the lower end of the sensitivity testing specified in the DWMP Framework i.e. +20% with a -30% sensitivity = 14% increase by 2050 above 2020 levels. We've also tested the sensitivity of our plan using a high emissions climate scenario, which is the +20% increase in rainfall intensity. Alternative pathway three includes all the investment needs identified in our DWMP to get all planning objectives to band 0 by 2050.

Our core and preferred plan, and alternative pathways for our DWMP are explained in Figure 20.

Figure 20: Cost of our preferred plan in our DWMP, and the cost of alternative pathways

Pathways	Comments	Cost (£ billion)
Core pathway	No/Low regrets DWMP framework: Lower climate change sensitivity band and lower estimate of growth. Excludes 1 in 50 (PO4), Annualised Flood Risk (PO7), WTW Compliance (PO6) and Pollution Risk (PO2)	£5.5 billion
AP1 – alternative pathway 1	Low climate change DWMP framework: Lower climate change sensitivity band and central estimate of growth. Excludes 1 in 50 (PO4) and pollution risk (PO2), includes 22%* of annualised flood risk (PO7), and includes WTW compliance (PO6)	£7.5 billion
Preferred Plan	Preferred plan: medium climate and growth DWMP Framework: Medium climate change and central estimate of growth. Excludes 1 in 50 (PO4) and pollution risk (PO2), includes 22%* of annualised flood risk (PO7) and includes WTW compliance (PO6)	£7.7 billion
AP2 – alternative pathway 2	High growth DWMP framework: medium climate change and high estimate of growth. Excludes 1 in 50 (PO4) and pollution risk (PO2), includes 22%* of annualised flood risk (PO7) and includes WTW compliance (PO6)	£7.8 billion
AP3 – alternative pathway 3	Full DWMP: All planning objectives to band 0 by 2050 DWMP framework: Adverse climate change and central estimate of growth. Investment needed to get all planning objectives to band 0 by 2050.	£13.4 billion

* 22% Ratio of DG5 at risk (555 internal and 8950 external) with total annualised properties at risk in 2050 (42361)

The DWMP will be reviewed and updated every five years, enabling us to determine the investment levels needed to avoid increasing risks, and ideally to reduce risks to band 0 over the longer-term. Specific trigger points and decision points will be identified for each wastewater system to understand when a change in approach or investment strategy is required.

We have considered the impact of customer bills of our core plan, our preferred plan and the worse-case alternative pathway three. The indicative figures are provided in Table 8.

Table 8: Potential impact on customer bills

(£ per year)	2025–26	2026–27	2027–28	2028–29	2029–30	2035	2050
Our core plan	£10.30	£19.87	£29.32	£38.65	£47.86	£70.65	£166.92
Our preferred plan	£13.43	£25.82	£38.05	£50.12	£62.05	£98.27	£233.40
Our full DWMP	£18.36	£35.47	£52.37	£69.06	£85.55	£159.19	£405.17

The investment needs from our first DWMP will inform our business planning for 2025–30 and our Long-Term Delivery Strategy (LTDS). The LTDS establishes the enhancement investment needed to deliver our core pathway, and various adaptive pathways to reduce risks balancing the risk appetite of our customers, the rate of risk reduction they expect, and its affordability. The triggers and monitoring that will be needed to identify when to adopt a different pathway will be set out in our LTDS. These adaptive pathway triggers will be established as core business metrics and will be routinely monitored to ensure our current pathway produces a resilient wastewater service that represents best value for our customers.

Customer and stakeholder engagement

Register of stakeholder comments

We collated and entered any concerns, comments, challenges and expectations raised by internal colleagues, customers and partners into a Register of Stakeholder Comments as we developed our plan.

The register dates back to June 2020, when we started engaging others in the development of our DWMP and includes the feedback we received during workshops with partner organisations and from our preliminary consultation in September and October 2021. It sets out the material issues raised during the development of the DWMP and should be viewed alongside the plan as it shows how we have addressed, or intend to address, the issues raised.

Customer insight panels

Since 2021, our DWMP has been introduced to our insight panels who were asked to consider a range of issues in 'waves' of insight gathering. The insight gained has told us that our customers think that the DWMP:

- Feels like a considered, comprehensive and robust plan that has been produced to tackle some massive challenges over the long term and provides a real sense of the scale of the challenges
- Has welcome and reassuring references to keeping costs down for customers showing that we have considered and have empathy with the economic environment they are dealing with
- Sets out our commitment to supporting tourism and economic growth in the region
- Takes the challenges of drainage and wastewater seriously and recognises the extent of the challenges with planning that goes into the very long term.
- Has some unanswered questions around funding implications and how specifically it will all be delivered, but they are pleased that it plans to tackle the issue of CSOs at source.

More recently, early PR24 insight on wastewater management has also told us our customers:

- Welcome the consideration of macro factors like urban creep, people behaviours and climate change when planning for wastewater management
- Find it reassuring that multiple organisations are talking to each other about the DWMP to ensure there is a cohesive strategy to manage wastewater and limit environmental damage
- Think a 25-year view reviewed every five years feels forward looking, comprehensive and with the capacity to evolve over time
- Are pleased to have a wider picture of the issues for the whole of the South East
- Are reassured to know about the DWMP, but find the granular detail is too much information for them to engage with
- Feel that it isn't always particularly customer facing and is jargon heavy, word heavy and lacking explanation for example, on the risk assessment results
- Think it is sufficient to know that there is a DWMP and to leave the detail to Southern Water and relevant agencies.

"I like that the DWMP covers 25 years, as that feels that long enough forecasting is being done by SW rather than focusing on the initial short term and running into problems later."

June 2022, Water Futures 2030 group

"Some of the figures being used – £20 billion in investment needed – are staggering and adds a rich context for the scope of the plan(s) and the challenges going forward."

June 2022, Water Futures 2030 group

"Ageing assets and infrastructure. This is where investment has been so sadly lacking for decades, and the resultant leaks, pollution and sewerage overflows are the result, which makes it the top priority, surely."

June 2022, Water Futures 2030 group

We will continue to gain insight form our customers in order to ensure our investment plans align with their needs and priorities.

Our preliminary consultation: September 2021

The feedback from the customer insight programme means we used a light touch on involving customers in the detail of the DWMP. We held an open consultation on our developing DWMP in September and October 2021. The purpose of this preliminary consultation was to gain feedback on:

1. Our Strategic Environmental Assessment Scoping Report, which set out how we planned to consider the environment in our decision making
2. Our selection of wastewater systems to take forward into the Options Development and Appraisal stage of the DWMP in the first cycle, and
3. Our developing plans on each of the 11 river basin catchments.

The Report on the 2021 DWMP Stakeholder Consultation is on our website. Only 10 customers responded to the preliminary consultation. The major concerns expressed at that time were:

- the impact of storm overflow discharges on our inland waters and especially on rare chalk streams
- whether we have the capacity in our systems to cope with projected levels of growth in our region
- the condition of our assets and its resilience to climate change impacts
- a need to consult with local communities and groups in developing the DWMP. This was also an issue raised during the public consultation, see below for further information.

The public consultation: June to September 2022

Our public consultation on the draft DWMP, which ran between June and September 2022, meant our customers were able to engage with us concerning the plans and proposals we had developed through working with partner organisations. We received a total of 153 responses from our customers, community groups, Councillors and partner organisations.

Many customers, community groups and parish councils told us that they felt this engagement was too little and too late and this was a disappointment as they had local knowledge to contribute to the process. Some thought the consultation was a pointless exercise.

Many responders used the opportunity to let us know that our shareholders should not receive or deserve dividends until pollutions are ended and our infrastructure is fit for the 21st century. Others responded that we should be re-nationalised.

We accept this feedback as a true representation of their views. We'll continue to engage customers and communities in the plans that directly affect them and their local area as we progress with the implementation of our DWMP. It's important that we have certainty regarding our funding for 2025–30 before we raise expectations locally that we can implement schemes and reduce the risks.

Once Ofwat has made its final PR24 determination, we will have that degree of certainty over the funding available to us and will begin detailed local planning. We'll fully engage with local councils, communities, Risk Management and Planning Authorities and Environmental Groups using Defra's recognised Catchment Based Approach (CaBA) guidance to co-create, co-design and hopefully, co-deliver locally-based plans.

In the meantime, feedback from our customers, community groups, local parish councils and partner organisations has been used to finalise our DWMP.

The feedback we received showed there was a general consensus that:

- the DWMP captures the main challenges for drainage and wastewater management across our operating area
- for the first time there is transparency of the scale of problems and environmental risks associated with our drainage and wastewater systems
- we need to take a holistic approach to all the issues raised, with equal weighting given to all the solutions proposed
- there should be more commitment to partnership working at both a strategic and local level and more alignment with, and emphasis on, local nature recovery strategies
- there is substantial support for separating rainwater and foul water systems as the best value way to reduce the risks of flooding, storm overflow discharges and pollution
- there is acceptance that investing now to reduce the risks will mean customer bills may have to rise, but this needs to be fair and a proportion should first be met through reducing the company's profits, executive bonuses and shareholder dividends
- we should be more ambitious in reducing the risks sooner rather than later.

We have published a full report on the consultation on the website at: https://www.southernwater.co.uk/dwmp/have-your-say

We have also published a Statement of Response that summarises the responses to our consultation and how we have addressed the feedback in our final DWMP.

Feedback on our Strategic Environmental Assessment

At the same time as the public consultation, we consulted on our draft Strategic Environmental Assessment (SEA). The findings from this are also published on the website at: https://www.southernwater.co.uk/dwmp/strategic-environmental-assessment.

Developing partnership projects

We see the DWMP as a shared plan but recognise that, in this first cycle, we have only represented the investment needs specific to Southern Water. We're using the DWMP as we prepare our business plan for 2025–30, and to support the development of the Water Industry National Environment Programme (WINEP).

The partnership process means that our plan has emerging links with the plans of the other Risk Management Authorities. Examples of these include the Defra sponsored "Blue Heart" project focusing on Eastbourne and South Wealden, where we are working as part of the East Sussex County Council led partnership to deliver an integrated approach to mitigating flood risk and improving the resilience of local communities to flooding, and working with Rother District Council on cliff stability issues in the Fairlight area.

Feedback from our public consultation:

"What the DWMP seeks to achieve over its twenty-five-year lifespan can only be considered to be transformative and as such it will require the assistance of others to help identify and deliver demand side, catchment scale and the innovative projects that are needed."

County Council, DWMP consultation 2022

It is our ambition that, as the DWMP and the collaborations evolve through time, these plans are further integrated into an overall strategic plan for drainage and wastewater management across our region in a similar way to how water resources planning has evolved through Water Resources South East.

Feedback from our public consultation:

"To provide sustainable solutions for drainage and wastewater management, that effectively protects the environment and provides best value for customers a diverse range of stakeholders should be engaged with, particularly farmers, large landowners, developers, house builders, industry and local planning authorities."

DWMP consultation 2022

We'll continue to strengthen relationships with partner organisations as we progress and implement the DWMP and explore opportunities for co-creation and co-funding of schemes with wider multiple benefits. Our investment needs tables identify potential partners for each of the future projects. Examples of the types of partnerships that will be developed include working with:

- Local councils (for example, Environmental Health teams) and communities to engage customers in issues around the misuse of the sewers and drainage misconnections
- Lead Local Flood Authorities and the Environment Agency to reduce surface water, river, coastal and sewer flooding and implement sustainable and nature-based solutions including separating rainwater from draining into our sewer systems
- Local Planning Authorities to develop and strengthen the advice and guidance to developers to enable housing targets to be met sustainably and meet Nutrient and Water Neutrality requirements
- Catchment Partnerships and local environmental groups and communities to green our urban environment
- Highway authorities – specifically to reduce the rainwater running off roads into combined sewers and seize opportunities for wetland creation, rain gardens and tree planting
- Environment Agency and local communities to create wetlands as a natural and low carbon means to treat releases from storm overflows caused by significant groundwater infiltration into the sewer network.

Case Study:

Co-creation and co-delivery with the Deal Water Action Partnership at Albert Road, Deal, Kent, 2021: tackling sewer flooding

The Deal Water Action Partnership (Deal-WAT) comprises the county and district councils, Kent County Council highways, the MP's office and Southern Water's Storm Overflow Task Force. It was established to understand why Albert Road in Deal has long suffered from sewer flooding incidents. Albert Road is the hydraulic low point in the catchment and excess rainwater entering the drainage system overwhelms the sewer network and collects in the road.

The approach taken included:

- A technical report produced by Southern Water
- Assets in Albert Road and surrounding area surveyed by Kent County Council
- Deal-WAT discussions of the interventions required in the area
- A "no regret intervention" works by Kent County Council to increase the number of road drains, upsize surface water drains and an upgrade to the gullies pipes into the surface water pipe in Albert Road

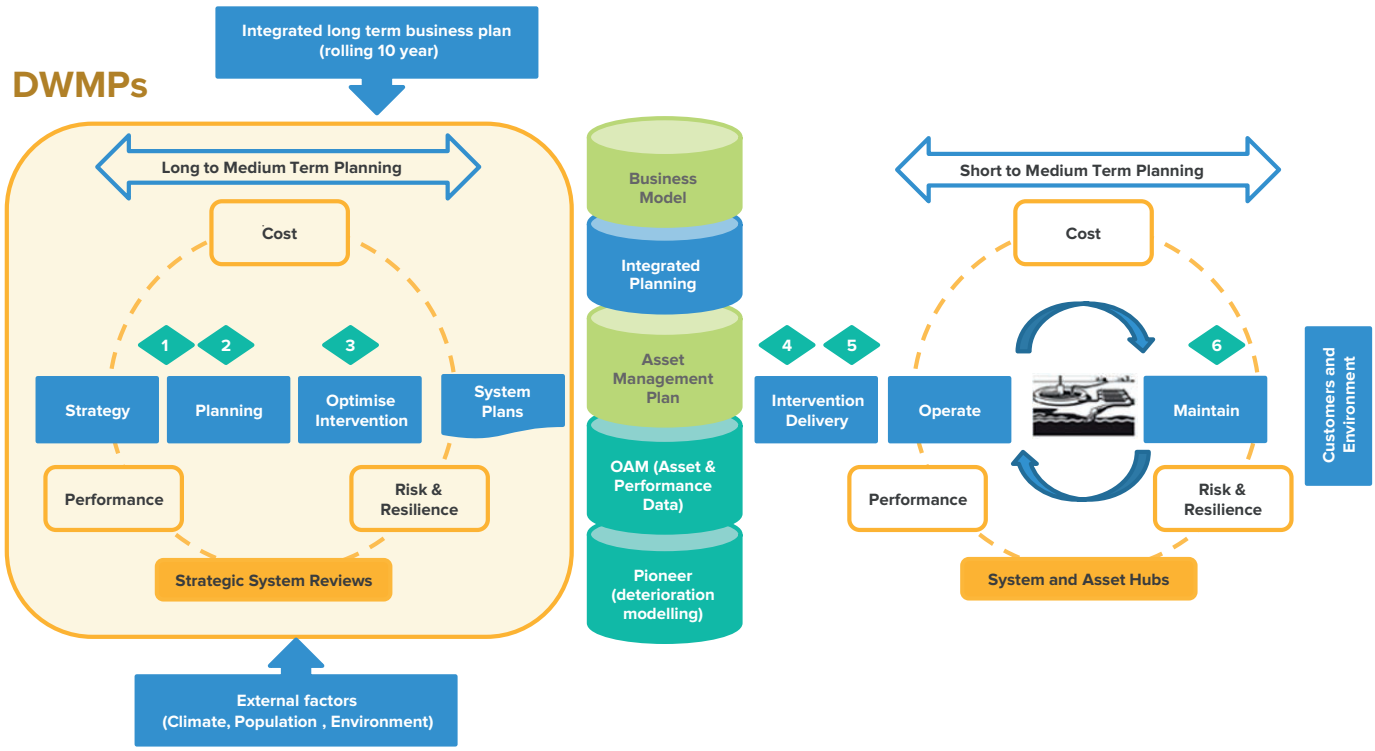
Our next steps

Our DWMP will inform our business plan submission for the Ofwat 2024 Price Review process (2025–30).

The Price Review is the mechanism for Ofwat, the economic regulator, to review and agree water company investment plans to ensure they provide cost efficient solutions that are affordable for customers.

It sets the prices and investment levels for the five-year period 2025–30. The investment needs identified in the DWMP, and the prioritisation of these needs, will feed directly into our business plan and future business plans. The business planning process is illustrated in Figure 21.

Figure 21: Our asset management and business planning process



The affordability of the investment needs will be discussed with our customers and Ofwat as part of the business planning process. Customer 'Willingness to Pay' (WtP) research is a mechanism used to assess how much customers are prepared to pay for our services. Ofwat are conducting research on customer's willingness to pay as part of its Price Review process.

Many of the investment needs in our DWMP relate to enhancement activities to improve the performance of our wastewater systems and reduce the risks to the environment. These activities are generally funded through the Environment Agency's Water Industry National Environment Programme (WINEP).

We're working with the EA to develop the WINEP for AMP8, and drawing upon the DWMP to ensure that our preferred options are included under the appropriate drivers specified by the EA. There is no mechanism for including options to tackling sewer flooding in the WINEP, so we are developing a specific enhancement case to ensure we're able to fund actions to reduce sewer flooding and the resilience of our wastewater systems from, for example, coastal flooding.

Once Ofwat has made its final determination for PR24, we will have a degree of certainty over the funding available to us during 2025 – 2030, and can begin detailed planning and progress the potential partnership opportunities which were identified in our DWMP. We will continue our engagement with local councils, other flood risk management authorities, planning authorities and environmental groups to develop plans for co-funding and co-delivery of actions.

We use a Risk and Value (R&V) approach to delivering our capital investments to seize opportunities for greater efficiencies and securing wider multiple benefits as we plan the delivery of projects. During this stage as specific designs and locations of work become clearer, we're able to complete the Habitats Regulation Assessments and Water Framework Directive Assessments on our proposed investments.

Our first DWMP has enabled us to create a strong foundation for the future. We have captured our lessons to be learned from the first cycle and we look forward to working with Ofwat, Defra, EA, Water UK and other water companies on the national DWMP Implementation Group to review and enhance the guidance for future DWMPs.

We're embedding our DWMP planning processes into our business, so it becomes the way we plan for the future. We have already started to test new ways of delivering against the challenges that our plan sets out with our Pathfinder projects. Our risk assessments will be formally integrated into our risk management, catchment risk management assessments and business planning processes and systems. By doing so, the DWMP will enhance our data, GIS capabilities and systems so that it is improved for future reporting requirements. As a result, we will see our DWMP mature and improve quickly into the next cycle of development and reporting.

Our DWMP and our Water Resources Management Plan (WRMP) together form the foundation stones of robust long-term planning for both water supply and drainage and wastewater.

Customer feedback

"Finally, there is a document that collates all elements of the drainage and wastewater investment needs and provides clarity on the underlying approach and methods used in preparing the company plans for the networks and treatment works."

County Council feedback

"This consultation should not be a completed event but a continuing process leading to PR24 and the submission to Ofwat in which stakeholders remain involved."

Community Group feedback

"Clearly the Regional DWMP is the result of a lot of work and background research which is very welcome. The risks are clearly set out and the ambition is also welcome. However, it is also clear that the challenges are great and the paths to success are not necessarily clear and certainly not easy."

DWMP consultation, Autumn 2022

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