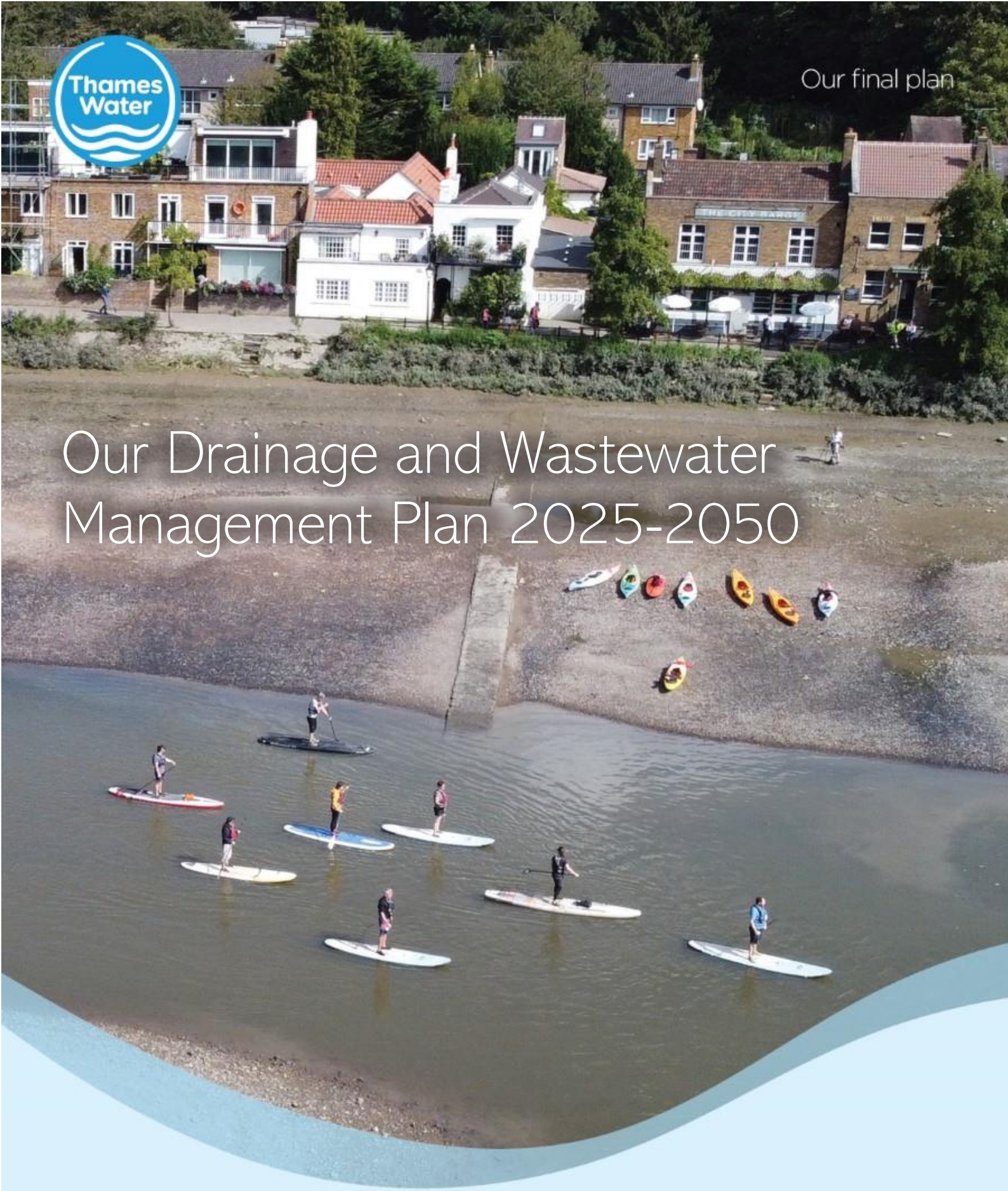
Our final plan

# Our Drainage and Wastewater Management Plan 2025-2050



## Technical Appendices
## Appendix P - Our response to London Flooding 2021

May 2023

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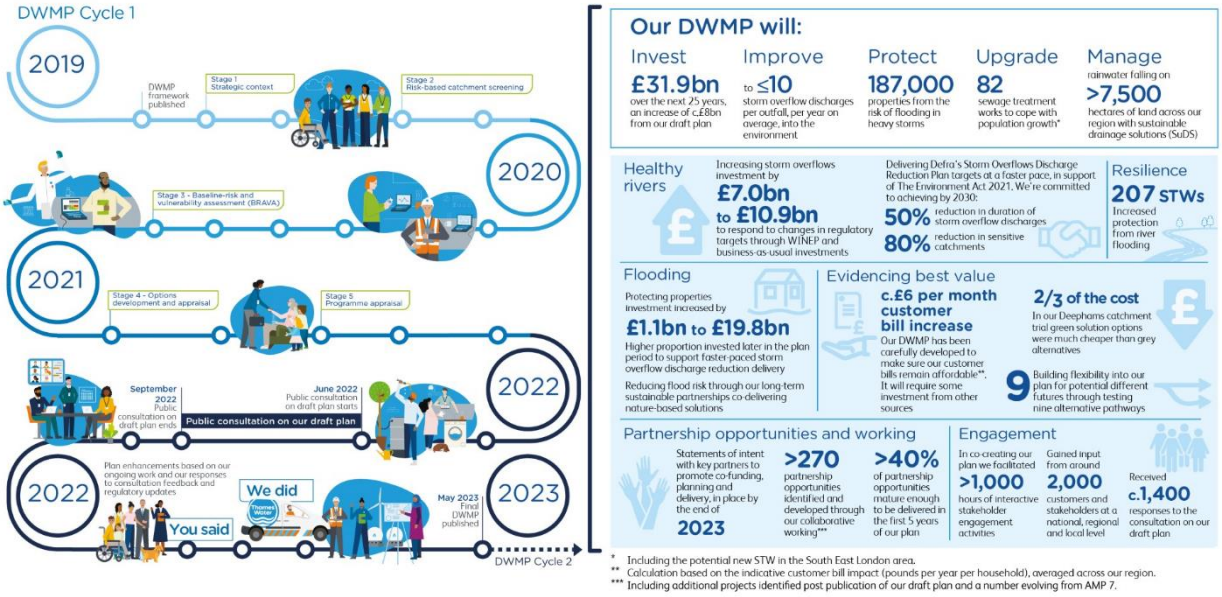
# Preface

We're proud to present our first Drainage and Wastewater Management Plan (DWMP) and encouraged by the level of positive feedback we've received. Over the last four years, we've engaged and worked collaboratively with around 2,000 of our customers and stakeholders, to deepen our shared understanding and develop new ways to manage drainage and wastewater across our region. We illustrate our DWMP Cycle 1 and its headlines below.




We've progressed and enhanced our DWMP since we published it for public consultation in June 2022. We were pleased to receive lots of positive comments and support on the quality and ambition of our draft plan as well as useful ideas for making our final DWMP even stronger.

We've updated our draft plan based on our ongoing DWMP work, regulatory updates and our responses to the consultation feedback wherever possible*. Our updates include providing more detail where you felt it was needed and creating new appendices to answer technical queries. For more details on how we've progressed our final plan and responded to the consultation feedback, please see our Non-technical summary and You said, We did Technical appendix.

* Some public consultation feedback didn't require further action or wasn't relevant to the DWMP process. Other feedback was relevant to future DWMP planning cycles and will be used to inform this work.

## Progress signposts

We want to make it easy for you to see what's changed. You can spot all the places we've updated our draft plan with our 'progress signposts' which we've used across our final DWMP documents.

For documents newly created for the fDWMP, we've provided a progress summary table upfront, to demonstrate what type of information the document provides.

## Progress summary table

The progress signposts summary table for the chapters in this document is outlined below. We've used orange cells to indicate where our draft plan has been updated with progress.

| Progress signposts summary: Appendix P – Our response to London Flooding 2021 | Progress updated | More detail or new content | Number(s) updated | Delivery timeframe updated | Informing DWMP cycle 2 |
|---|---|---|---|---|---|
| 1 Flood risk in London | | | | | |
| 2 Reviews into the London 2021 floods | | | | | |
| 3 Action after the 2021 flooding | | | | | |
| 4 Our strategy to reduce flood risk in London | | | | | |
| 5 Conclusion and next steps | | | | | |

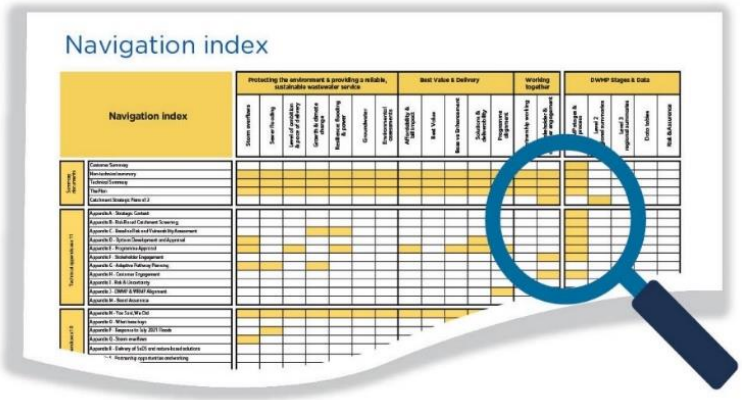
## Key DWMP content

This document specifically includes the following key DWMP content:

- Protecting the environment and providing a reliable, sustainable wastewater service:
  - Sewer flooding
  - Level of ambition & pace of delivery
  - Growth & climate change
  - Resilience: flooding & power
- Best Value and Delivery:
  - Affordability & bill impact
  - Solutions & deliverability
  - Programme alignment
- Working together:
  - Partnership working
  - Stakeholder & customer engagement

## Navigating our documents

To help you navigate around our final DWMP document suite and find where key DWMP content features, we've placed a Navigation index at the back of this document.



# Executive Summary

Our DWMP is a 25-year plan for drainage and wastewater to implement changes to benefit our customers, communities, and the environment. It's designed to look after the health of our rivers and ensure that we are resilient to the risks of flooding. Our DWMP gives us a roadmap to make sure future generations have a wastewater service that serves their needs and is kind to the environment.

London has suffered flooding on many occasions over the years. Flooding sources in London include river (tidal and fluvial), sea, groundwater, surface water, reservoirs, canals, and sewers. However, rainfall leading to surface water flooding is the most likely source of flood risk, and it's ranked in the London Risk Register[1] within the highest risk category.

This report summarises the causes and impacts of the London 2021 floods and explains the complexity in managing surface water flood risk in London. It covers the different reviews undertaken in response to the floods, including our own internal review and the London Flood Review, their findings and recommendations. The impacts of the floods and the findings of the review collectively crystallised the recognition of the increasing risk that surface water flooding presents and the need to work collaboratively to manage it. This recognition spurred the creation of the London Surface Water Strategic Group (LSWSG) and the commissioning of a London-wide surface water strategy. This is an unprecedented and coordinated approach to tackle surface water flood risk. We are part of the LSWSG and committed to support the strategy and any supporting action plan.

Our DWMP articulates the scale of the investment required to address flood risk at catchment and local levels. Our strategy to reduce surface water flood risk in London takes a holistic approach where we'll optimise and tactically increase the capacity of the sewers, reduce the demands on the network through absorbing and delaying rainwater through Sustainable Drainage Systems (SuDS), designing for exceedance, and improving flood resilience in high-risk areas.

This document explains several initiatives including community action plans, sewer flooding resilience programme, London Tideway Tunnel opportunities and London water and waste strategy. We also explain how we're applying our strategy to two trial areas, the Fillebrook and the Counters Creek.

We're on the right path and want to build upon the immense work already undertaken by all our partners who, like us, are passionate about reducing flood risk in London.

[1] LFB Letter (london.gov.uk):
https://www.london.gov.uk/sites/default/files/london_risk_register_version_11.pdf

# 1 Flood risk in London

## Sources of flood risk

1.1 London is at risk of flooding from a number of sources: 'Tidal' flooding when storm surges raise the height of high tides (the Thames Barrier and associated defences protect London against this to a very high standard); 'fluvial' flooding from its rivers; surface water flooding; 'sewer' flooding when our sewers are blocked or overcome by heavy rainfall; groundwater flooding from rising groundwaters; and finally, flooding from reservoirs and canals, but this risk is generally low.

1.2 The most likely risk of flooding in London is surface water flooding which happens when intense rain overwhelms the drainage systems (drains and sewers) and can lead to internal sewer flooding as the combined sewer system reaches its capacity and backs up into lower properties or surcharges (overflows) onto streets. It's worth noting that during very heavy rain, multiple types of flooding can occur simultaneously, which makes it difficult to differentiate between surface water and sewer flooding as the systems are integrated.

1.3 Managing surface water flooding is increasingly difficult because of many factors:

- The Victorian drainage sewer was not designed to cope with current and future population
- Increasing levels of impermeable surfaces. As explained in Appendix R[2] (section 3) research we commissioned in 2008 showed a 17 percent increase in impermeable surfaces since 1971 in the London boroughs of Camden, Brent, Ealing, Hammersmith and Fulham, and Kensington and Chelsea[3]
- Lack of accurate data, including the location, state of maintenance and ownership of flood risk and drainage assets and the complexity of modelling the interaction between above and below ground systems and overland flows
- Storms' exact location, time, duration, and intensity are very difficult to predict accurately. This is linked and exacerbated by the lack of accurate warning or alerts system. Although flood risk mapping is available the unpredictable nature of storms makes it difficult to foresee the impacts on the ground
- The public's general lack of awareness of the risk, how to protect themselves and their properties, how to respond to a flooding event, mitigate its effects and the insurance required
- Lack of sufficient funding, lack of knowledge of funding opportunities and how to develop and submit proposals to secure funding
- Climate change which is increasing the storms' intensities and frequency

[2] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-r-delivery-of-suds-and-nature-based-solutions.pdf
[3] Thames Water Permeability Project, Ambiental Technical Solutions Ltd, 2008

## Surface water management responsibilities

1.4 The responsibility for surface water management in London is shared by many organisations. London's 33 boroughs are defined as the Lead Local Flood Authorities (LLFAs) in the Flood and Water Management Act 2010[4]. They are responsible for the day-to-day activities to try to prevent and mitigate the effects of surface water flooding through actions set out in their Local Flood Risk Management Strategies. They also have statutory duties regarding the review of drainage strategies of development proposals. Other Risk Management Authorities (RMAs), including us, have a responsibility to oversee flood risk infrastructure and operational responses to flooding events from different sources of flooding. The Environment Agency (EA) provides a strategic overview of surface water.

1.5 The Thames Regional Flood and Coastal Committee (TRFCC)[5] is responsible for ensuring that there are coherent plans for identifying, communicating, and managing flood and coastal erosion risks across catchments and shorelines. They encourage efficient, targeted and risk-based investment and provide a link between the EA, LLFAs, RMAs, and other relevant bodies. They are responsible to the Department for Environment, Food, and Rural Affairs (Defra).

1.6 The importance of addressing surface water flooding and its complexity has led to a recent review by the National Infrastructure Commission in their report 'Reducing the risk of surface water flooding'[6]. In addition, the government announced in January 2023 their decision to implement Schedule 3 of the Flood and Water Management Act 2010[7] which would require developments to have SuDS. Separate to this, but also related, DEFRA's local plan reform[8] aims to improve local flood and coastal erosion risk planning to provide a more strategic and comprehensive plan by 2026. This will support long-term local action and investment. Defra consider that future strategic local flood risk management plans should:

- Support a catchment-based approach
- Provide a framework to support long-term action and investment
- Follow an adaptive, long-term approach which accounts for climate change
- Identify opportunities to achieve multiple benefits
- Inform local decisions on growth, spatial planning, and land-use
- Foster collaboration and community engagement
- Demonstrate clear accountability and transparency.

## London flooding

1.7 London has suffered many flooding events from sources of flooding and varying intensity over the years. Flooding occurred in 1906 (storm and sewer), 1917 (storm and sewer), 1921 (storm and sewer), 1927 (storm and sewer), 1928 (river-tidal), 1941 (storm and sewer), 1953 (storm surge, high tide), 1975 (storm), 2004 (storm and sewer), 2005 (storm and sewer), 2006 (storm and sewer), 2007 (storm and sewer), 2014 (river), 2016 (storm

[4] Flood and Water Management Act 2010 (legislation.gov.uk)
[5] Thames Regional Flood and Coastal Committee (RFCC) - GOV.UK (www.gov.uk)
[6] https://nic.org.uk/studies-reports/reducing-the-risks-of-surface-water-flooding/surface-water-flooding-final-report/#tab-summary
[7] Sustainable drainage systems review - GOV.UK (www.gov.uk)
[8] Local flood risk management planning reform advisory group - GOV.UK (www.gov.uk)

on Referendum Day), 2017 (storm, sewer), 2018 (storm and sewer) 2021 (storm and sewer) and 2022 (storm).

## London 2021 events

1.8 On 12 July 2021, very intense rainfall fell over a swathe of west London from a convective storm. On 25 July 2021, a similar event occurred, but this time the rain fell over a larger part of London and Essex. The events resulted in the flooding of many homes and businesses and London's transport, education, and health infrastructure. Over 1,500 properties have reported some internal flooding, either from sewers backing up inside the properties, or overland flows reaching sufficient depth to penetrate properties through air bricks, door, and window frames.

1.9 On the 11 July, the Met Office issued a 'yellow' weather warning for the following day covering the entire South East region[9] . They predicted a 'low likelihood of medium impacts' with a 'most likely' forecast of 20-30mm of rain. In fact, more than a month's worth of rain fell in under an hour and some areas received nearly 80mm of rain (170% of July's average rainfall) over the course of the storm, with Kensington, Westminster, and Hammersmith the most affected. The Met Office later confirmed return periods[10] of up to 179 years for the rain that fell in one hour.

[9] July-flooding-internal-review: https://www.thameswater.co.uk/media-library/home/about-us/investing-in-our-region/flooding-review/july-flooding-internal-review.pdf

[10] A return period is associated to the probability of events such as floods occurring. A return period is usually described in terms of a '1-in-10 year' or '1-in-100 year' event. Despite how it sounds, this does not mean that such an event will only occur once in 10 or 100 years, or that once it has happened it won't happen again for another 10 or 100 years. A return period gives the estimated time interval between events of a similar size or intensity. For example, if the return period of a flood is 1-in-10 years, this means it has a 10/100, or 10%, probability (or chance) of occurring in any given year, regardless of when the last similar event occurred. While, on average, there will be one 1-in-10-year event in ten years, in any given ten-year period there may or may not be an event of this magnitude. It is also possible for there to be more than one such event, or for there to be events of a higher magnitude in the same period. Source: Independent Review Stage 3: London Flood Review Stage 3 Non-Technical Report: https://www.thameswater.co.uk/media-library/home/about-us/investing-in-our-region/flooding-review/london-flood-review-stage-3.pdf

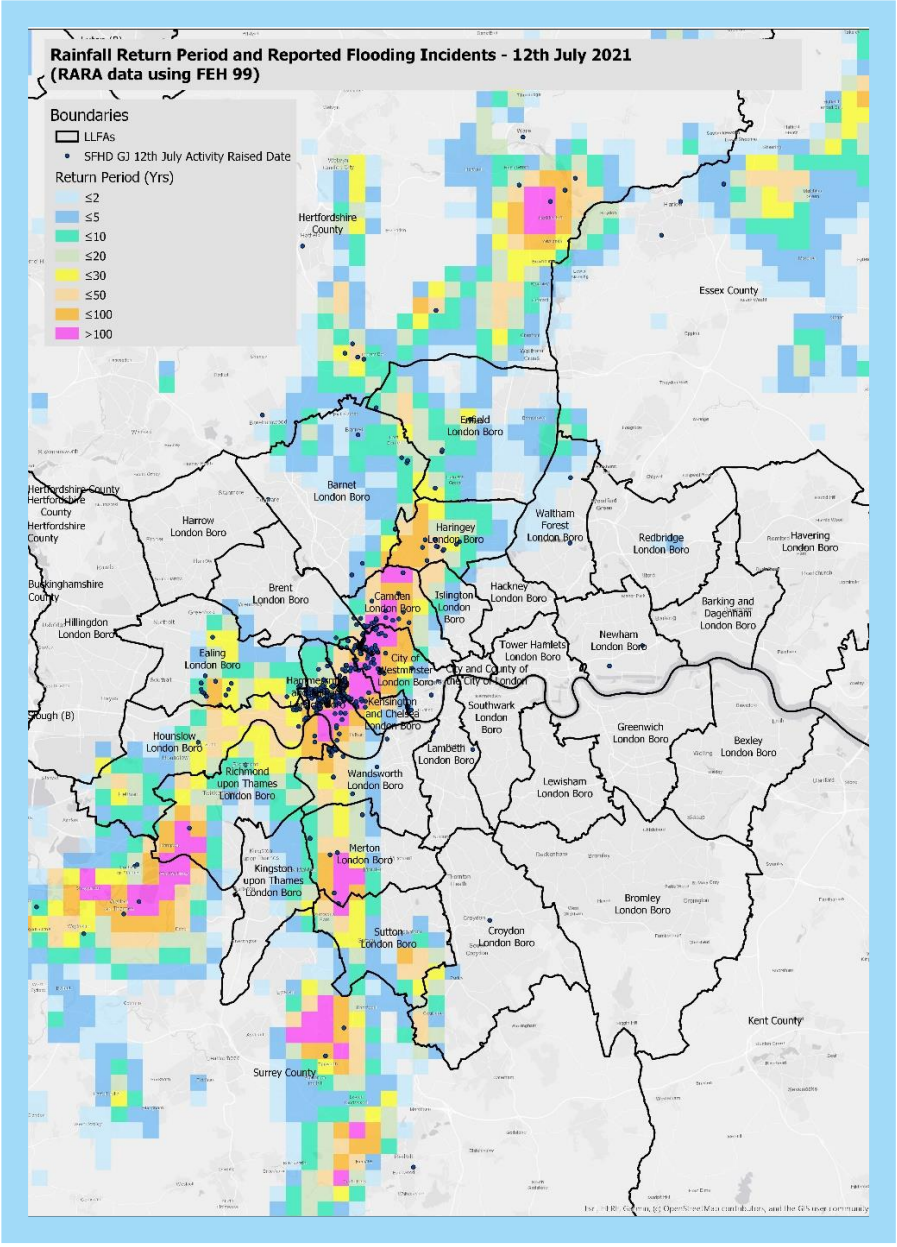



Figure 1-1: Map of rainfall intensity across London on 12 July 2021

1.10 London has two types of sewer systems, a 'combined' sewer, which serves mainly central London, where foul water and rainwater are collected in the same pipe and go to a sewage treatment works for treatment, before being released to a river; and a 'separate' system, which serves the rest of London. In the separate sewer system, foul water is collected in a 'foul' sewer and goes to a sewage treatment works, and surface water (rain) is collected in a separate surface water and taken to a river. In combined sewer areas, during very heavy rainfall, the mixed rain and foul water in the combined sewers in central London can overflow into the tidal Thames through a number of emergency outlets called combined sewer overflows (CSOs). However, the high tides that coincided with both storms closed the flaps on these overflows that prevents the tide from entering the sewer system. This meant that the sewers could not overflow into the Thames, to their maximum capacity, and so the flow backed up, potentially increasing the extent of the sewer flooding. The joint probability of the 12 July 2021 storm occurring at the same time as peak high tide is 1 in 716 years. Although this represents a very small probability it did happen in 2021.

1.11 On the morning of 21 July, the Met Office issued a 'yellow' warning for the following Sunday. Again, this warning covered all the South East region. In the days leading up to the storm, the Met Office issued further warnings about the severity of the storm, forecasting a low likelihood of extreme rainfall levels – again, around 25mm was still considered the most likely with a 'low likelihood of significant impacts. On the afternoon of 25 July (during the storm), the Met Office upgraded its weather warning to 'amber' due to heavy showers and thunderstorms stretching from northeast Surrey to western Essex. More than a month's worth of rain fell in a few hours, with Walthamstow receiving nearly double the average July rainfall. The Met Office confirmed a return period[11] of 118 years for the amount of rain that fell in one hour.

[11] A return period is associated to the probability of events such as floods occurring. A return period is usually described in terms of a '1-in-10 year' or '1-in-100 year' event. Despite how it sounds, this does not mean that such an event will only occur once in 10 or 100 years, or that once it has happened it won't happen again for another 10 or 100 years. A return period gives the estimated time interval between events of a similar size or intensity. For example, if the return period of a flood is 1-in-10 years, this means it has a 10/100, or 10%, probability (or chance) of occurring in any given year, regardless of when the last similar event occurred. While, on average, there will be one 1-in-10-year event in ten years, in any given ten-year period there may or may not be an event of this magnitude. It is also possible for there to be more than one such event, or for there to be events of a higher magnitude in the same period. Source: Independent Review Stage 3: London Flood Review Stage 3 Non-Technical Report: https://www.thameswater.co.uk/media-library/home/about-us/investing-in-our-region/flooding-review/london-flood-review-stage-3.pdf

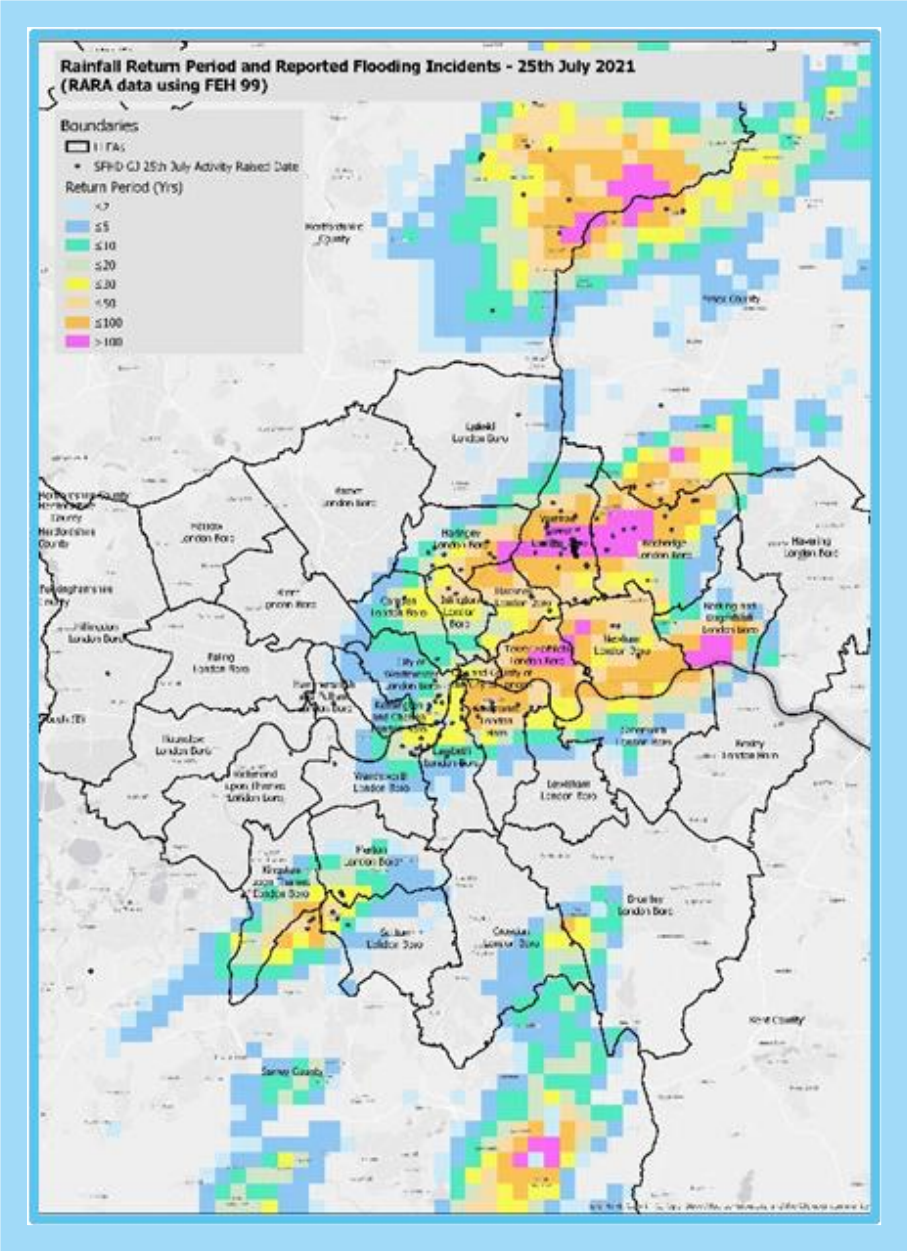



Figure 1-2: Map of rainfall intensity across London on 25 July 2021

# 2 Reviews into the London 2021 floods

2.1 London Councils[12] reported that twenty-four boroughs were impacted by the July storms, with the worst impacts felt particularly in parts of north and east London. To date, more than 2,000 properties have reported flooding, although significant under-reporting is suspected.

2.2 The extent of the flooding initiated a number of reviews into the causes and lessons learned from the floods. This included the London Resilience Partnership (LRP) which published a 'debrief' with 30 recommendations. The Mayor of London organised a 'Roundtable' of senior representatives from the key risk management organisations in London which looked at the incident response to the floods and the longer-term management of surface water flood risk. The Roundtable produced a series of recommendations[13] which were then passed to an officer-level 'Task and Finish Group' to develop the actions to enable these recommendations.

2.3 The Roundtable's recommendations followed five key themes which became the remit of the Task and Finish Group: governance, funding, communications, long term strategy and evidence. One of the key findings of the Task and Finish Group[14] is that there is a lack of understanding of the risks of surface water flooding and the responsibilities of the various stakeholders. The absence of an overall strategic plan and vision, as well as a body tasked with its development and implementation, underly this issue. We support the production and implementation of this plan as it will lead to the implementation of measures to achieve a better management of surface water. We're part of the Task and Finish Group and contributed to the LRP strategic flood response framework, working with Multi-Agency Coordination Group and on Multi-Agency flood plans in Haringey and Barking & Dagenham, and participating in borough flooding exercises.

2.4 Apart from these reviews, there were several investigations into the flooding including debriefs by the London Assembly's Fire, Resilience, and Emergency Planning (FREP) Committee and its Environment Committee and over 25 Section 19 (S19) investigations[15] by LLFAs. We supported the production of the S19 investigations by holding a workshop on 28 Sep 2021. During the workshop we provided background information we'd already collected and explained to LLFAs how we could support them with information to include in their S19 reports. We also introduced our two reviews of the 2021 flooding[16], an internal review and the commissioning of the independent London Flood Review.

[12] https://www.londoncouncils.gov.uk/members-area/member-briefings/environment/surface-water-flood-risk-management-london
[13] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/environment-publications/surface-water-flooding-london
[14] https://www.londoncouncils.gov.uk/node/39403
[15] https://www.legislation.gov.uk/ukpga/2010/29/section/19#:~:text=19%20Local%20authorities%3A%20investigations%20%281%29%20On%20becoming%20aware,authorities%20have%20relevant%20flood%20risk%20management%20functions%2C%20and
[16] https://www.thameswater.co.uk/about-us/investing-in-our-region/london-flooding-response

## London flooding: Thames Water internal review

2.5 We recognised that the service we provided to our customers in response to the London 2021 floods was not good enough, as many people were unable to contact us, our teams were slow to get to some of the worst hit areas and we did not work as effectively with the boroughs as we should have. The severity of the storms was more than expected and our customer service fell short of what people should rightfully expect.

2.6 We commissioned an internal review[17] to examine our performance during and after the storms, to identify what we could have done better and develop actions to ensure we do so in the future. Our internal review covered the following issues: background to the July storms, our response through our customer contact centre, communication with stakeholders and operational response, who was affected, lessons learnt and key actions including actions underway.

2.7 We identified six key areas for improvement, supported by the lessons learnt and 14 actions to address these, which we followed up. The areas for improvement are our response to adverse weather warnings, approach to customer service and ability to respond to enquiries, our ability to use data to gauge the impact of adverse weather, communications with stakeholders, incident response processes and onsite response. Since then, we improved our website information and accessibility and published a sewer customer questionnaire online to gather information about properties at risk and the impacts of flooding.

## The London Flood Review

### Setting up the London Flood Review

2.8 We commissioned the London Flood Review (LFR) to understand why the flooding on 12 and 25 July 2021 was so severe, to determine whether our assets may have exacerbated the flooding, and to make strategic-level recommendations on how to manage the growing risk of flooding from intense storms.

2.9 To ensure a fully impartial assessment, a team of independent, internationally recognised, experts, known as the Independent Expert Group, was commissioned. They led the LFR and we provided them with resources to appoint and manage their own supporting consultants. They were fully independent from us, setting the objectives of the Review and the parameters of the investigation. The four core objectives for the LFR were to:

- Research, understand and report on the "what, when, why and how" of the two July storms
- Examine the flooding mechanisms and consider the performance of drainage systems against drainage standards, with specific focus on Counters Creek and Maida Vale flood alleviation schemes
- Consider how change to existing and planned drainage system works, operations or policies might have alleviated the flooding and make London more resilient to future storms

[17] july-flooding-internal-review.pdf (thameswater.co.uk)

- Be as evidence-based as possible

2.10 To support the LFR, the Independent Expert Group convened a 'Strategic Stakeholder Panel', consisting of the key strategic organisations with a flood risk interest / responsibility in London. These organisations were, the Greater London Authority (GLA), Transport for London, EA, London Councils, London Drainage Engineers' Group, Consumer Council for Water, TRFCC and Thames Water). Our regulator, Ofwat, was an observer. The Panel was consulted on the LFR's draft reports ahead of their publication.

2.11 The LFR reported in four stages: Stage 1: What? Stage 2: Why? Stage 3: How? Stage 4: What next? We've summarised the focus of each stage in the table below.

| Published reports | Focus |
|---|---|
| Stage 1 report | An objective review of the available data relating to the flooding on 12 and 25 July 2021 |
| Stage 2 report | An investigation into the catchment response and root causes that led to flooding on 12 and 25 July 2021 |
| Stage 3 report | An assessment of the performance of Thames Water Assets including flood alleviation schemes critical pumping stations and operational performance of the network during the flooding events on 12 and 25 July 2021 |
| Stage 4 report | A summary of the lessons learned and recommendations to improve resilience to future flooding events |

Table 2-1 - Summary of the London Flood Review

### The LFR's findings

2.12 The LFR published its final report on 12 July 2022, consolidating the findings from the previous Stage reports and presenting 28 recommendations. The LFR's key findings are:

- The main cause of the flooding was the intensity of the rainfall, which overwhelmed private, local authority's and our drainage systems. In some areas the flooding was exacerbated by tide-locking of the combined sewer overflows into the Thames, which caused a number of connecting sewers to back up.
- There were no significant operational failures on the Thames Water network. The three flood alleviation schemes and the two strategic pumping stations that the LFR investigated performed to design standards.
- The varied types of flooding – sewer flooding, surface flooding and combined surface and sewer flooding – and the extreme nature of the storms mean that it is not possible to identify a single solution that could have prevented the flooding
- There is no overarching body with a responsibility for providing the strategic lead or perspective on surface water flooding. Thames Water and local authorities have a role to play, and these roles are interconnected and interdependent.

## Scheme performance review findings

2.13 The LFR reviewed the performance of three recently implemented flood alleviation schemes using a 1D hydraulic model. They also assessed what benefit the Thames Tideway Tunnel may have had, had it been operational during the storms. The information below is included in pages 26-27 of the LFR stage 4 technical report[18].

2.14 **Westbourne Grove Flood Alleviation Scheme (FAS) (City of Westminster):** the scheme was designed to reduce flood risk for 120 properties which had previously reported flooding. The scheme operated as designed, by diverting excess flows into a storage tank. The tank nearly reached full capacity. Levels in the main sewer were reduced by 400mm, compared with a scenario which represented the network layout before the scheme was built, reducing flood risk in the area. Four properties which had been designed to be protected by the scheme reported flooding. Evidence suggests at least two of these properties had a Flooding Local Improvement Project (FLIP) installed. Therefore, there is a risk the FLIP failed, or was inundated through other sources, such as surface water not being able to enter the sewer system. We're carrying out further investigations. It may be that other properties were also flooded but had not reported.

2.15 **Maida Vale FAS (City of Westminster):** the scheme covers three distinct areas:

- The Tamplin Mews scheme was designed to protect 120 properties up to a 1 in 30 year storm, by reducing the water levels in the sewer locally. Six of the 120 properties protected by the scheme reported flooding, along with new properties which reported flooding for the first time. This is likely to be because these newly reporting properties are still connected to the trunk sewer. Properties which had provided evidence of flooding previously were disconnected from the trunk sewer and flows were diverted into the new sewer draining to the tank in Tamplin Mews. The trunk sewer was overwhelmed by the intensity of the event.
- The Formosa Street/Westbourne Green scheme was designed to protect 73 properties which have previously reported flooding by reducing the water levels locally up to a 1 in 30 year storm. The principle of the scheme is to divert flows away from locations which previously reported flooding. As a result, water levels are increased in other areas due to changes to flow routes. Some properties which newly reported flooding in July are likely to drain to sewers where the top water level has increased as a result of the scheme. However, we were unable to confirm if flooding would be experienced anyway as a result of high levels in the network as there was uncertainty over existence and level of connection. The LFR recommended that we investigate these areas of potential detriment further to determine if solutions are required.
- Cambridge Gardens consists of FLIPs installed at five properties. None of the properties reported flooding, suggesting the FLIPs performed as designed. No nearby properties reported flooding.

2.16 **London Tideway Tunnels (LTT) (across London):** not yet operational. The purpose of the tunnels is to reduce combined sewer overflows into the river Thames to improve water quality, rather than being operated to act as a flood mitigation asset. However, the analysis

[18] https://www.thameswater.co.uk/media-library/home/about-us/investing-in-our-region/flooding-review/london-flood-review-stage-4-technical.pdf

was carried out to assess any benefits that the tunnel system and associated improvements may provide in similar events in the future. The tunnel was predicted to fill to a maximum during the 25 July 2021 event. During the 12 July 2021 event, the rainfall was more localised so the impact across the whole drainage network was reduced. In both events, there would have been only a minor improvement in reducing levels near to interceptions, demonstrating that the tunnel will not make a major difference for similar storms once connected, under current operating protocols which prioritise spill prevention.

2.17 **Counters Creek Flood Alleviation Scheme (CCFAS) (as constructed) (Royal Borough of Kensington and Chelsea, London Borough of Hammersmith and Fulham):** The scheme consists of approximately 1300 FLIPs. In addition, local schemes such as rider sewers and street FLIPs were constructed, which provide street level isolation from the surcharged sewer network to 44 properties. It also includes permeable paving schemes to offset potential detriment caused by installing several FLIPs in a localised area. As the schemes affect very localised areas, there is little impact catchment-wide on reducing top water levels. None of the 44 properties protected by local schemes reported flooding in the July events. 21 properties of the 1300 properties with FLIPs did report flooding: it is not known if this is related to a failure of the FLIP or caused by inundation from surface water. There were an additional 444 properties which reported flooding for the first time which were neither the focus of the scheme, nor were they addressed through the scheme.

2.18 The previously proposed Counters Creek sewer relief tunnel was also reviewed to determine any benefit it may have provided during such an event. In 2018, we wrote to the Royal Borough of Kensington and Chelsea and the London Borough of Hammersmith and Fulham to inform them that the tunnel scheme was not going ahead as it was no longer cost-effective, particularly since many FLIPs had already been installed across the catchment to protect the most at-risk properties Therefore, the tunnel scheme was not taken forward. Had the scheme remained in the Business Plan, it would not have been operational during the London 2021 floods, so the analysis is purely hypothetical.

2.19 The analysis identified that approximately 64 properties, which were part of the original focus of the CCFAS, reported flooding during July 2021. Some properties had FLIPs installed, although it is not known whether the FLIP failed or if there was surface water which affected the performance of the FLIP. This shows how effective the FLIP programme was. Out of the over 1300 FLIPs installed, only 21 properties reported flooding. The LFR analysis also showed that 31 of the 64 properties which reported flooding may have benefited from the tunnel. It is worth noting that a cost-benefit analysis of the tunnel scheme was not done in the LFR.

2.20 The LFR also looked into the performance of the local pumping stations at Lots Road and Hammersmith. It concluded that they experienced some reductions in capacity as a result of operational issues, due to the pumping stations not having all pumps available and a delay to manual switch-on of pumps. While these operational issues increased water levels locally, they did not play a significant role in flooding during the July events. This is because the systems were overwhelmed by the high intensity rainfall, which far exceeded the capacity they were designed for.

2.21 The map below provides a picture of the flooding that happened on the 21 July. It was produced in March 2022 and, although we received further reports of flooding it still represents an accurate picture of what happened on the ground. The map outlines the Counters Creek sewer (in red), and the North West Storm Relief sewer (in green). It shows borough boundaries (black) with the small dots representing the locations of FLIPS. The heatmap is the number of properties flooded. The map aims to demonstrate that the flooding observed in 2006 and 2007 that affected the Counters Creek is spatially different to the flooding observed in 2021. There is a point where the two sewers cross and where customers suffered flooding in both events.

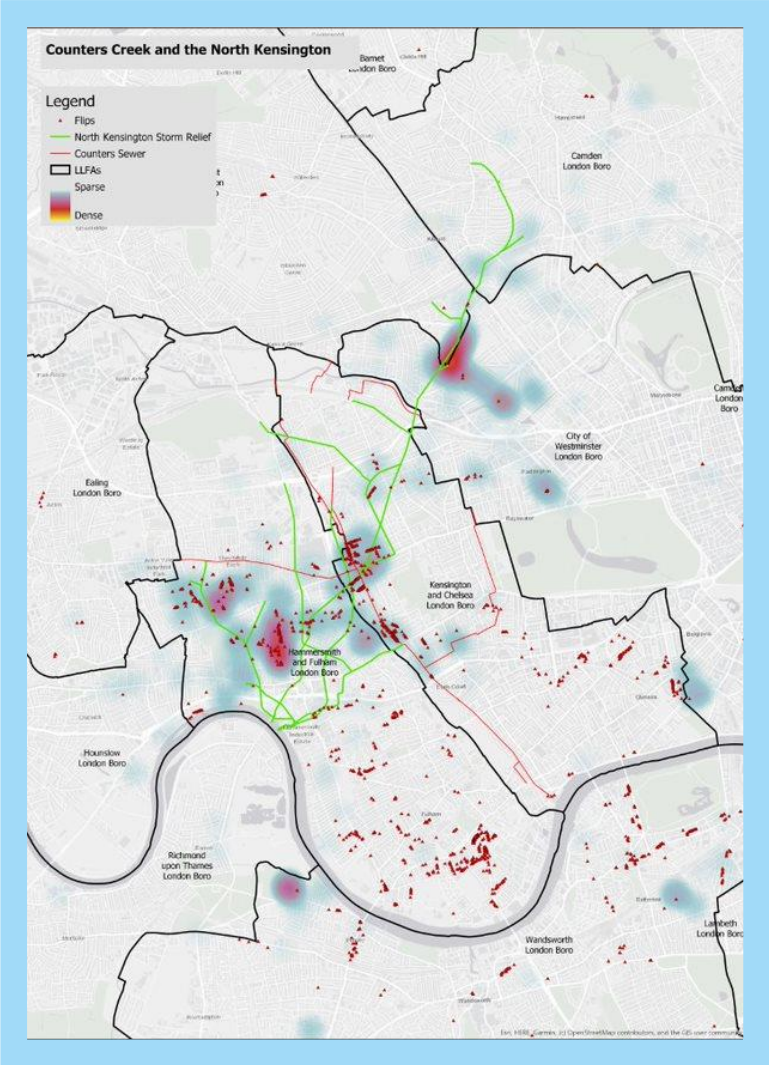



Figure 2-1 Map of the Counters Creek sewer (red), the North West Storm Relief Sewer (green), property level protection devices (small triangles) and a heatmap of the reported flooded properties during July 2022

## The LFR's recommendations

2.22 The LFR final report includes 28 recommendations. The full wording of the recommendations is included in Appendix 1 of this document. They are grouped into 5 key themes:

- **Governance:** No single organisation is in overall charge of managing surface and sub-surface water flood risk in London. Furthermore, there is a lack of understanding of the

overlaps and interactions between the differing responsibilities among a wide range of organisations.

- **Funding:** There is insufficient funding mobilised to manage the risk. There is a lack of knowledge about potential funding opportunities and a lack of understanding of what is needed to develop and submit proposals to secure the needed funds.
- **Evidence:** There is a lack of understanding of what flood assets are currently available, who owns and maintains them, and what condition they are in. In addition, there is also a lack of modelling that can help organisations understand where floods are likely to occur and what efforts should be undertaken to reduce the risk.
- **Communications:** There is a lack of understanding of the risks of surface water flooding and the responsibilities of the various stakeholders to lower such risks.
- **Strategic Plan**: The absence of an overall strategic plan and vision, as well as a body tasked with its development and implementation, underpins all of these issues.

2.23 We've reviewed the 28 recommendations and believe that the following three recommendations are clearly the responsibility of Thames Water to lead on and fit with our sewer flooding management strategy:

- Recommendation 14. Set trigger points, likely to be aligned with the multi-agency flood plan and London Resilience Group's triggers, to mobilise operational and TW Customer Contact Centre staff and engage with key stakeholders to prewarn of a potential event.
- Recommendation 21. Thames Water to share policy on procedure for assessing FLIP installation with stakeholders for clarity and openness.
- Recommendation 22. Understand where customers implement their own measures. This data will help RMAs to understand the cumulative impact of these measures on flood risk. Create digital form for consultation process so that Thames Water is informed.

2.24 We are in the process of delivering these actions. The remaining 25 recommendations require the close collaboration of several organisations to achieve them. We've proposed that these should be reviewed by the London Surface Water Strategic Group (see section 4 below) for consideration as to whether and how they should be discharged, including whether they should be integrated into the London surface water strategy.

2.25 To ensure that the findings of the LFR were well disseminated, three versions of the final report were published (a non-technical summary, a more technical 'summary for policy-makers' and the full technical report). The Chair of the LFR also presented to a range of stakeholders, including the National Infrastructure Commission (to inform the government's commission, TRFCC, the Mayor's Surface Water Roundtable, London Councils' Chief Executives' Environment Committee, London Council's London Environmental Directors' Network, Royal Borough of Kensington and Chelsea's Environment flooding working group, Thames Water's Customer Challenge Group, and Thames Water Utility Limited Board.

2.26 Following the completion of the LFR, the LFR's website was maintained for 6 months (until 12 December 2021) and then the reports were transferred to Thames Water's website.

# 3 Action after the 2021 flooding

## London Surface Water Strategic Group (LSWSG)

3.1 The July 2021 floods highlighted that London's drainage systems are an integrated system-of-systems and that managing flooding from intense storms requires the close collaboration of all responsible agencies. Both the LFR and the Mayor's Surface Water Roundtable identified the need for a high-level, multi-agency, 'Strategic Group' to drive the necessary collaboration, and produce and deliver a London-level surface water management strategy and action plan.

3.2 The LSWSG is made up of organisations with a strategic interest and/or responsibility for managing surface water flooding. It comprises representatives from six boroughs (on behalf of all the 33 boroughs) and the Director/Mayoral adviser level representatives from the GLA, Transport for London, EA, London Fire Brigade, Thames RFCC and Thames Water. Funding has been secured from the Thames RFCC for up to five years to fund an independent chair, a part-time secretariat, a project officer and towards developing the strategy.

3.3 The first meeting of the LSWSG was held on 08 December 2021 to approve the draft Terms of Reference for the Group and the scope for the London-wide surface water management strategy. In setting up the LSWSG, the LFR's first recommendations was initiated.

3.4 The LSWSG met on the 20 April 2022 to review their forward work programme. The actions from the various flood reviews, including the LFR, were consolidated and the quick wins / no regrets actions identified. The LSWSG committed to deliver a number of these actions the following year, to track the delivery of the remaining actions and to publish a monitoring report on all the actions identified in the key reviews.

### London surface water strategy

3.5 The aim of developing a London-level strategy and any supportive action plans is to:

- Serve as a holistic, non-statutory strategy (in at least its first cycle), setting out a unifying vision for London
- Enable and support improved co-ordination between risk management agencies
- Define a risk-based approach to managing surface water and sewer flood risk management, cognizant of the impacts on other flood risks
- Improve co-ordination on the planning and delivery of projects across London
- Facilitate access to resources or systems on a London-wide basis, including the ability to secure and leverage more funding
- Provide enhanced guidance and evidence to reinforce improved surface water and sewer flood risk management
- Enable better engagement with Londoners and improve their capacity to act
- Support a holistic and sustainable approach to resilience, taking account of other climate risks

3.6 The consultants appointed to develop the London surface water management strategy will use our DWMP, the LFR's reports, section 19 investigations done by LLFAs, and updated surface water management plans to inform the development of the strategy.

3.7 The LFR's recommendations supports the 'SuDS first' approach proposed in our DWMP (recommendation 25 - see appendix R[19]). It encourages the strategy to look at surface water flow paths along the routes of London's lost rivers (recommendation 26) and to identify opportunities to temporarily and safely detain stormwater to protect other, more vulnerable areas.

3.8 The invitation to tender for the strategy was published in early April 2022 and it is anticipated that the final strategy should be published within a year. We have contributed towards the costs of the strategy and will make our sewer models and other resources available to support the production of the strategy. As members of the LSWSG we will have a critical role in endeavouring that the strategy is delivered and monitored.

[19] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-r-delivery-of-suds-and-nature-based-solutions.pdf

# 4 Our strategy to reduce flood risk in London

4.1 The London 2021 floods, the subsequent reviews and our DWMP collectively provided the necessary triggers for a step change in both the urgency and approach to managing surface water flood risk. Our strategy to reduce this risk in London provides a holistic, multi-layered approach involving optimising and tactically increasing the capacity of the sewers, reducing the demands on our networks, designing for exceedance and improving flood resilience in high-risk areas. Our DWMP articulates the scale of the investment required and, by drilling down into catchment and local levels, it sets out a range of required interventions.

## New ways of working

4.2 These new ways of working underpin the delivery of our strategy to reduce flood risk in London. They include:

- **Rethinking rivers:** River health is a growing concern. We can benefit from the 'Smarter Water Catchment' pilots that are already running in the river Crane as well as the river Evenlode (Oxfordshire) and River Chess (Buckinghamshire). As part of our future price control (PR24), we have submitted an ambitious programme, called 'Rethinking Rivers' to the EA which puts this into practice at a large scale and would build on the successes of our three Smarter Water Catchments trials currently underway.
- **Rethinking rainwater:** Our approach for rainwater will be defined in this document and specifically in our approach to working in partnership to absorb and retain surface water in SuDS to take the strain off our sewers as explained in the DWMP SuDS technical appendix[20].
- **Rethinking relationships:** We have started and want to extend our engagement with both LLFAs and River Catchment Partnerships. The DWMP Partnership working technical appendix[21] gives further information on our commitments.

4.3 We plan to publish our Vision 2050 and the associated 'Rethinking' ways of working later this year.

[20] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-r-delivery-of-suds-and-nature-based-solutions.pdf
[21] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-s-partnership-working-and-opportunities.pdf

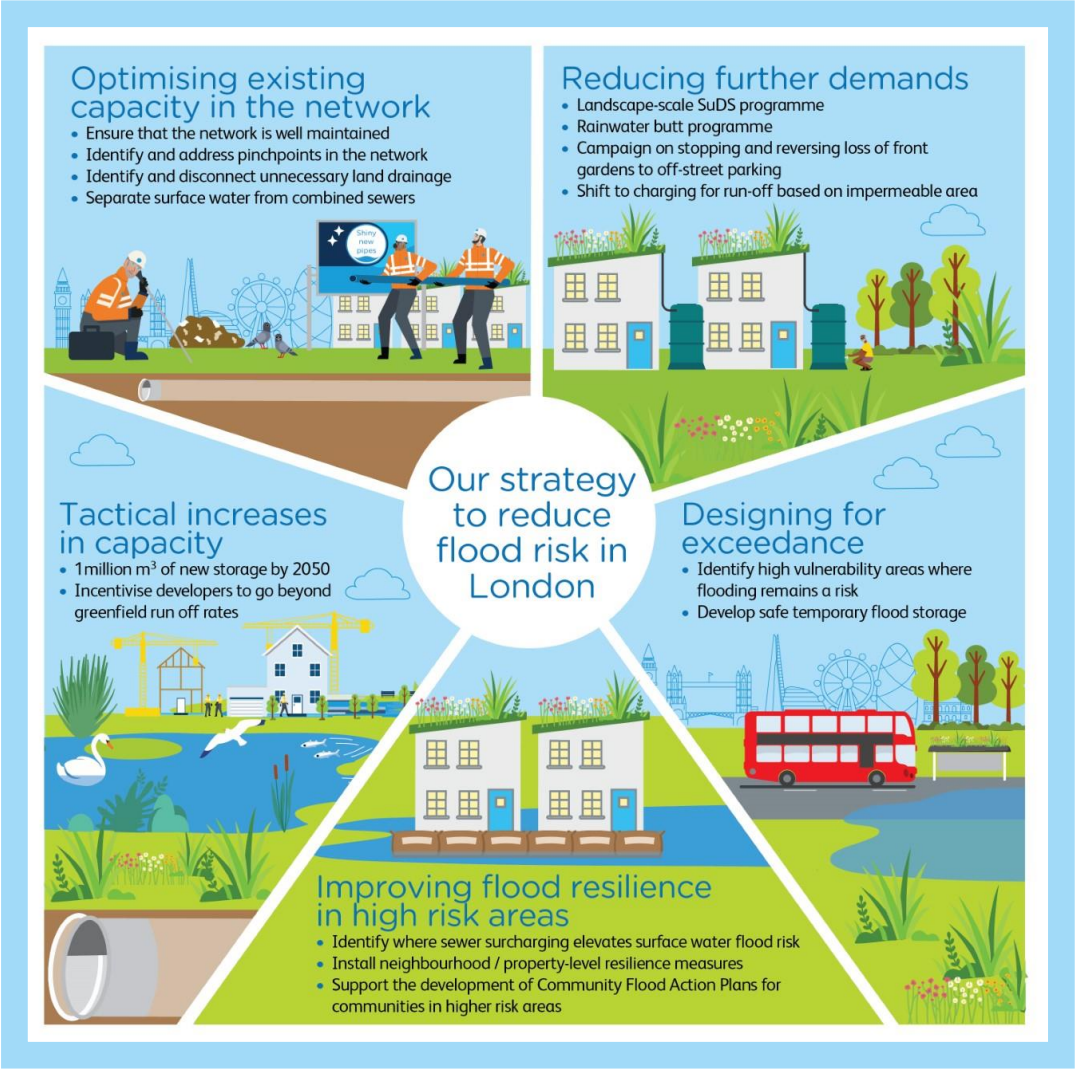



Figure 4-1: Schematic of our strategy to reduce flood risk in London

## Catchment Strategic Plans (CSPs)

4.4 Catchment Strategic Plans (part of the DWMP) explain how the DWMP is expected to address future challenges such as population growth uncertainties; incomplete mapping and the extent of our hydraulic surface water sewerage network model coverage; location of property level misconnections; and ownership and maintenance of SuDS. In the CSPs we highlight the importance of working together to improve and enhance our wastewater and surface water services in these areas and achieve our goals.

4.5 There are 7 CSPs for London: Beddington & Hogsmill, Beckton, Crossness, Deephams, Long Reach, Mogden and Riverside. They all share the same ambitious targets of:

- 95% of properties not at risk of flooding in a 1 in 50-year storm by 2050
- Improve water quality by addressing storm overflows - no more than an average of 10 discharges per annum by 2045 at overflow locations
- Enhancing resilience at our sewage treatment works to achieve 100% permit compliance and protect river water quality.

4.6 The CSPs summarise our long-term plan for the catchments and provide links to allow readers to investigate further into various risk zones. They cover the following points:

- How we've worked in partnership to develop our strategic plan
- Our predictions of the future challenges we face in this region
- How the plans are expected to address these challenges and who else needs to be involved
- Our shared strategy for maintaining the safe and reliable delivery of wastewater and surface water services in the long-term.

4.7 We, and our stakeholders want this DWMP to work in balance with the natural environment and make the best use of available land. Our hierarchy of options considered in the optioneering stage reflects this principle, maximising the efficient use of existing assets and prioritising natural surface water management solutions over network improvements. Each plan has different options which could include:

- Surface water management: surface water separation and the installation of features to collect, store and/ or infiltrate surface water from buildings and impermeable areas, such as driveways and car parks as part of enhancing our surface water sewerage system. This option also looks to reinforce the fundamental basis of our sewerage systems being separate by addressing property misconnections of surface water into the foul sewer system or foul to surface water.
- Large-scale surface water management strategies: the delivery of surface water management strategies across the risk zones to significantly reduce or remove the rainfall runoff entering the foul sewer system at these locations.
- Inter-catchment transfers: to utilise and optimise existing inter-catchment connections between the catchments and also between some of the STWs. These connections could be used to transfer flows between catchments without capacity to those with short term capacity.
- Intelligent sewer network: active system management at key points in the network to optimise available network capacity by balancing network flows. e.g., automation of weir chambers on trunk sewers or the active system management of pumping stations, using sewer monitors for live/predictive modelling.
- Sewer lining and manhole sealing: undertaking a programme of sewer and manhole lining, we will target as a priority the areas of high infiltration and with a high potential to reduce unwanted flows into our sewer system that currently take up much of its capacity.
- Combined sewer separation: converting existing combined sewers to dedicated surface water and foul water sewers. The partitioning of the systems will provide capacity relief at times of high rainfall. Surface water can be conveyed on the surface using SuDS measures.
- Network improvements: managing the impact of surface water on the sewerage system through the identification of network improvements to address deficiencies in the sewerage network capacity, specifically in areas with deliverability constraints and a high risk of sewer flooding now or in the future. This includes the construction of large attenuation sewers, new surface water and foul water sewers.

- Individual property protection: providing vulnerable homes with active and passive flood protection measures such as flood proof doors, self-sealing bath/shower systems (non-return valves) and installation of household pumping stations.
- Treatment process technologies and protection from high river levels: implementation of a range of different technologies identified to enhance the performance of the STW, through either retrofitting or new-build options. This will include the use of more intensive wastewater treatment processes which have the capacity to meet future demands and the construction of flood bunds to protect our assets from high river levels.

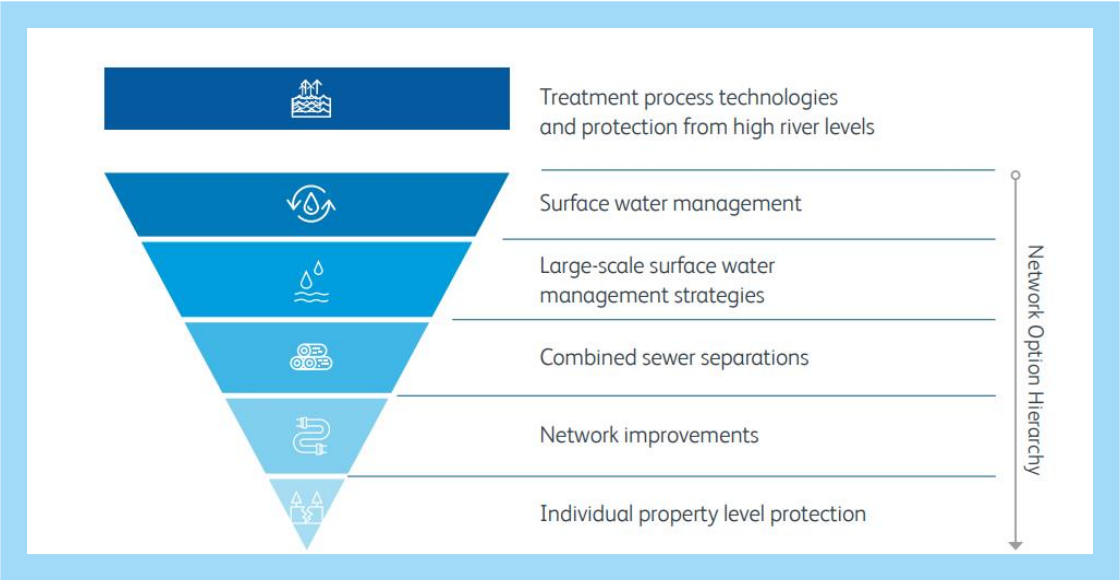



Figure 4-2: example of network option hierarchy from the Beckton CSP

4.8 Each of the CSPs include information on the phasing of the plans outlines the sequencing of our proposed interventions for each region. The CSPs can be found on the DWMP webpage[22] and from our DWMP portal[23] in which you can find the catchments per postcode.

## Community Action Plans

4.9 We recognise that there are a number of communities in London that have experienced multiple surface water flooding incidents recently, including in 2021, and where there is no quick or easy solution to their flood risk. We believe that our customers should not be helpless victims of extreme weather and with the right support they can not only become more resilient but can work with us and other partners to co-create better plans.

4.10 In 2021 we appointed the National Flood Forum[24] (NFF), a national charity that works with flooded communities, to support six communities in setting up their own community flood action groups (CFAG) and develop their own community flood actions plans (CFAP). A CFAP sets out the actions that the community will take to improve its own resilience and how it will work with the RMAs to inform their plans regarding the community.

4.11 This pilot has proven so successful that on the 26 April 2023 we secured TRFCC funding to support a further eight communities over the next four years. The proposal for Year 4 is

[22] https://www.thameswater.co.uk/about-us/regulation/drainage-and-wastewater-management
[23] https://storymaps.arcgis.com/stories/201050209c7a4658a1c2265aa4411375
[24] https://nationalfloodforum.org.uk/

to create a London-level community flood forum. The CFAPs also help the communities secure funding for the priority actions identified in their plans, such as installing property-level flood resilience measures and local SuDS projects.

## Sewer Flooding Resilience Programme

4.12 Following the London 2021 floods, we committed £10 million to survey properties in the worst affected sewer-flooded areas to understand why they flooded and to help protect those at highest risk of flooding again in the future.

4.13 We contacted customers in 3,402 properties in the Counters Creek area which we knew, or thought may have flooded from the 12 July storm. 1,552 of these properties confirmed flooding and were asked to contact us to arrange a survey. To date over 900 properties (60%) that reported flooding have been surveyed.

4.14 Each survey looked at the how the property connects to the sewer, the size and depth of the sewer, and the layout and depth of the property's internal drainage. It also collated information on the impermeable area of the property and the number of properties sharing a sewer connection (to assess the volume of flows to the sewer), the type of property (self-contained basement flat (SCBF) vs a multi-storey property with a basement) and the vulnerability of the customers (elderly, disabled or infirm).

4.15 To assess the property's future flood risk, we combined information from the survey with the property's flood history and the modelled sewer flood risk from a 1 in 30-year storm. We used this information to develop a risk-based approach to prioritising properties for the installation of sewer flooding resilience measures, based on four risk groups:

- Higher risk of internal flooding - these are properties that may experience significant depth of internal flooding from 1 in 30-year storm. These were sub-prioritised into properties where we know that there are a) highly vulnerable customers in SCBF, then b) all SCBF, then c) multi-storey properties with basements.
- Lower risk of internal flooding - these are properties where the risk of internal flooding is less than "higher risk" properties. They may experience some internal flooding from a major storm, but not as severely as the higher risk properties
- Low risk of flooding - these are properties not identified at risk of internal and/or external flooding from a 'major' storm. Properties at 1 in 30 to 1 in 50-year risk will be part of our AMP8 business plan
- Overland flood risk – these are properties that are not at risk of flooding through their sewer connection (usually because they don't have a basement) but may be at risk of flooding from overland flow from a surcharging sewer

4.16 The default sewer flooding resilience measure we are installing is a non-return valve (NRV). Where we believe that a property may be at high risk of self-flooding (from rain and wastewater flows from the property backing up behind a closed NRV), we may install a FLIP, but the modelled self-flooding demonstrated that this risk ranges from minimal to non-existent in most properties.

4.17 To date we have installed measures protecting over 300 properties and expect to protect a further 200 in this AMP. Information gained through this programme will inform our PR24 submission.

## London Tideway Tunnel opportunities

4.18 The Lee Tunnel (LT), already in operation, will be fed by the Thames Tideway Tunnel (TTT), with the entire system being called the London Tideway Tunnels (LTT). The operation and use of the LTT is subject to environmental permitting at the storm overflow points, as well as an agreed London Tideway Tunnels Operating Techniques (LTTOT) between us and the EA.

4.19 We'd like to explore further opportunities that the LTT may bring while retaining compliance with the LTTOT. Initial work already completed indicates that there may be an opportunity to reconfigure the trunk network upstream of the LTT interception points that could further reduce flood risk. Some of the locations under consideration have a current flood risk that could be reduced, including parts of Hammersmith and Chelsea.

## London water and wastewater strategy

4.20 We're finalising a holistic water and wastewater strategy for London. The strategy for the wastewater network is to integrate drainage systems with green infrastructure for a cleaner River Thames. We'll achieve this by:

- Updating our asset base so that it is reliable, resilient to climate change and able to support London's growth
- Managing our wastewater treatment plans so that they remain reliable and meet 100% permit compliance
- Eliminating pollution discharges to our rivers and work with our partners to further improve river water quality
- Bringing the TTT into full service by 2025, digitising the tunnel as well as our existing trunk sewer system to use real-time data (rainfall, sewer levels, flow, storm discharges etc.) alongside predictive models (rainfall, hydraulic, operational resources etc.) to reduce discharges to the tidal River Thames by up to 95%
- Reducing the risk of sewer flooding in homes by building resilience in the network, working in partnerships with public, private, non-governmental and community partners, and using the new Thames Tideway Tunnel to its full potential to support the reduction of risk
- Encouraging more SuDS with over 7,000 hectares of impermeable area drained into SuDS, including rainwater harvesting, rain gardens, green roofs and rewilding projects
- Using smart controls and sensors to track how our system performs under pressure, enabling improvements and enhancing our response to and recovery from significant weather events
- Updating our systems and processes so customers can engage with us at any time through the channel of their choice, access data on their local environment, be resilient against flooding and influence the service they receive

## Applying our strategy to trial areas: Fillebrook and Counters Creek in the Beckton catchment

4.21 We're applying our new 'rethinking' ways of working to flood risk management projects. We've already established relationships with stakeholders, other RMAs, LLFAs and flooded customers in many flood risk areas.

4.22 In order to identify trial areas, we reviewed all the locations where significant flooding occurred. We investigated historic investigations and models to understand the flooding location and root cause. For some areas, like the Counters Creek, there are detailed studies, and our understanding of the flooding mechanism is sound, while in other few areas a comprehensive understanding of the flooding is very limited. The area across London where there have been multiple significant flooding events affecting hundreds of properties in recent years is the lost river Fillebrook in the London Borough of Waltham Forest. This impact, together with the fact that it is served by a separate sewer network, contrasts our work in Counters Creek, which led to us identifying it as our second trial area. We also have four active Community Flood Action Groups in this area, supported by an engaged and motivated local authority.

4.23 We'll predominantly use the 'rainwater' and 'relationships' ways of working in these trial areas, the Fillebrook and the Counters Creek Resilience projects as the prime focus on both areas is flood risk.

### Fillebrook pilot study

4.24 As part of our 2025-2030 business plan, we're proposing an ambitious study and funding to boost good understanding as well as early actions for the Fillebrook critical drainage area. This area suffered extensive flooding on a number of occasions, most recently on the 25 July 2021 and 8 August 2021.

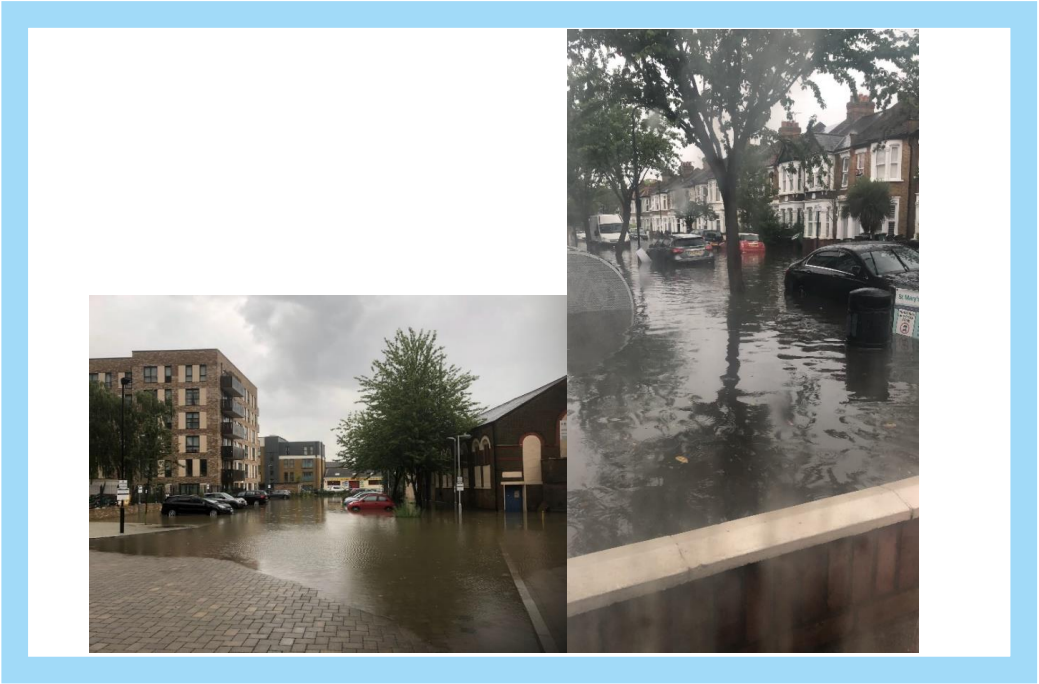


Figure 4-3: Photographs of flooding in Valentine road (LHS) and Brooke road (RHS) in July and August 2021 (source: London Borough of Waltham Forest)

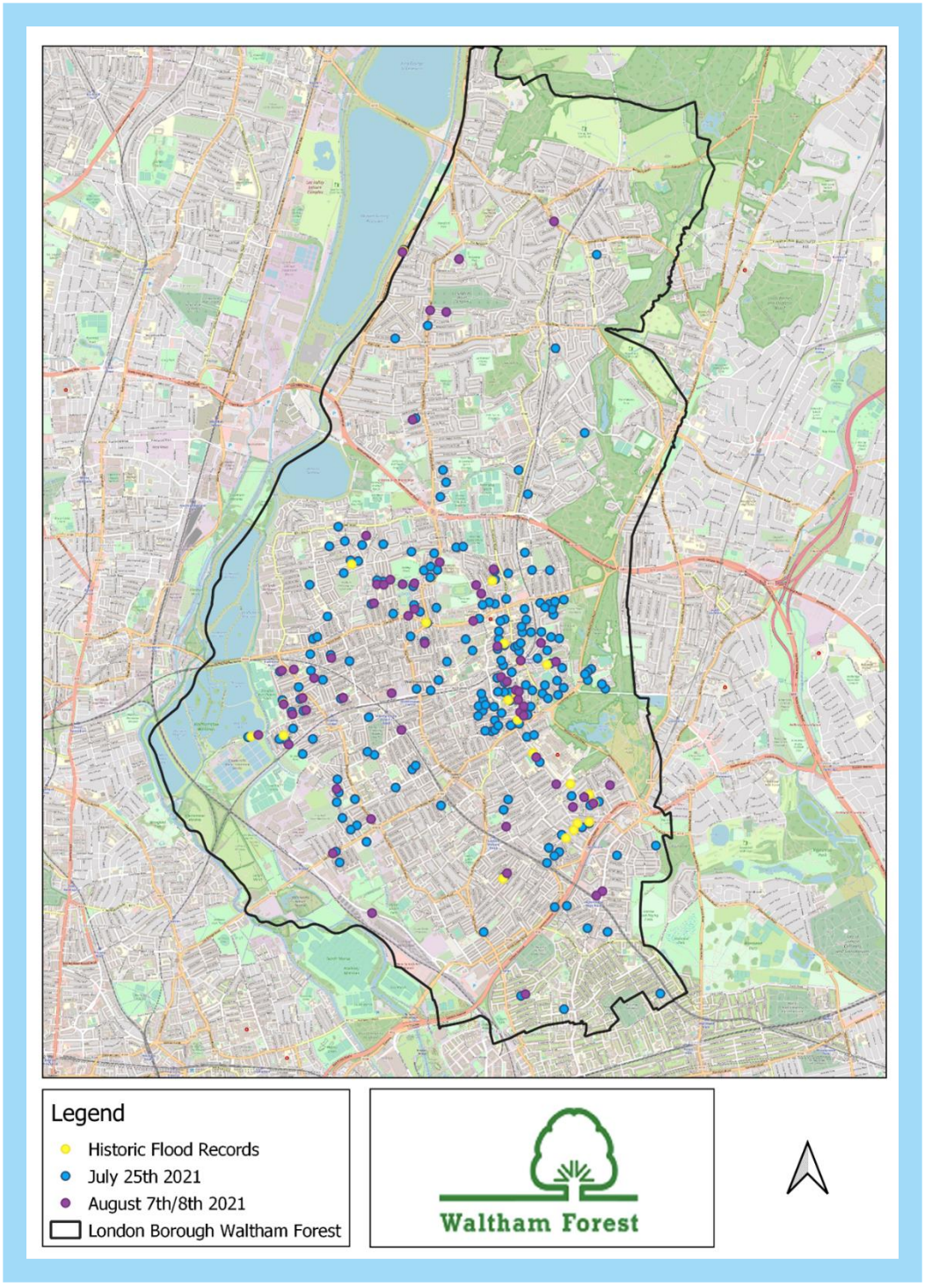



Figure 4-4: Map of flooding locations for July and August in the London Borough of Waltham Forest (Source: London Borough of Waltham Forest S19 report[25])

4.25 Our aim is to produce a bespoke, catchment-specific strategy, for the Fillebrook that outlines the locations and interventions needed to improve flood risk management now and into the future. We want a strategy that:

- Defines activities for protection to greater than 1:50 from sewers and surface water flood risk for the area

[25] https://www.walthamforest.gov.uk/sites/default/files/2022-04/Borough-wide%20Section%2019%20Report%20July_August%202021_Final.pdf

- Complies with the National Infrastructure Commission requirement for multiple RMA integrated plans to address flood risk
- Outputs that are easily be incorporated in DWMP Cycle 2
- Uses the London Strategic SuDS Pilot[26] style of modelling to identify delivery opportunities for SuDS and Nature-Based Solutions
- It tests and applies the London surface water strategy that is proposed for development over 2023
- Delivers solutions to reduce flood risk, including safe exceedance routes, and property level mitigation to some clusters in the Fillebrook to levels of protection greater than 1:50
- Enhances existing drainage infrastructure, including identifying and resolving sewer misconnections
- Undertakes hydraulic monitoring pre- and post-construction of mitigation measures to help develop an evidence base for distributed SuDS implementation across a catchment

4.26 We will engage with stakeholders throughout the trial and implementation to identify additional partnership working opportunities and improve the community's understanding of flood risk within the area. Through the four Community Flood Action Groups, we have begun applying our 'rethinking relationships' approach in the Fillebrook, but there is still a long way to go. We believe that through the collaboration we've initiated through the Fillebrook trial we'll substantially enhance the co-creation and co-delivery of solutions. This will fuse strong and long-standing relationships. We want this model to be sufficiently established to be replicated in other flood risk areas / catchments.

### Counters Creek Resilience Project

4.27 Applying the 'rethinking rainwater' approach in Counters Creek has a significant advantage due to our extensive understanding of the flood risk in the area. As part of our 2025-2030 business plan, we want to extend the work currently underway in Counters Creek to protect more homes from sewer flooding. This will include the protection to properties at risk of flooding in greater than 1 in 50-year storm and will predominantly be localised on property level intervention.

4.28 Following from that, we propose to implement the solutions identified within the DWMP to further manage flood risk. Lastly, there may be some trunk sewer reconfiguration opportunities that we need to develop and understand better before we include them in a delivery plan.

4.29 We've more established relationships with stakeholders and some customers in Counters Creek as we've investigated the flood risk in the area for a number of years. Due to the combined nature of the sewer system and lack of public realm space, options available in Counters Creek differ to those in the Fillebrook. With different options comes a different relationship with stakeholders and communities.

[26] https://www.susdrain.org/resources/evidence.html

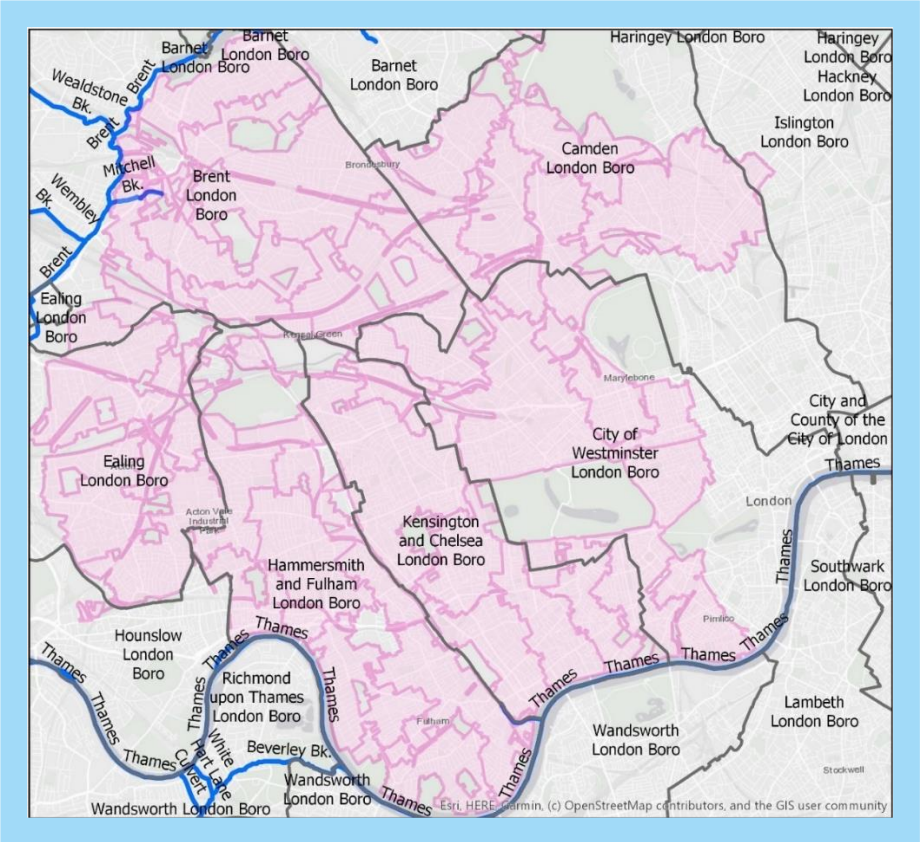



Figure 4-5: Map of the Counters Creek catchment with Thames Water sub-catchments (in pink)

4.30 Some stakeholders and customers have expressed their concerns regarding our decision not to deliver the storm relief sewer element of the Counters Creek programme, whilst others have celebrated the outcome. We'll work with stakeholders and customers to earn back their trust and ensure that their collaboration and valuable input helps to reduce flood risk in the Counters Creek.

## Counters Creek Performance Commitments

4.31 In 2019, Ofwat's final determination on our business plan included a new performance commitment: 'Understanding the risk of flooding and level of resilience within the Counters Creek catchment'. The commitment has two elements to it:

- by no later than the end of July 2023, we must deliver a fully assured report, for the Counters Creek catchment, which sets out our understanding of the risk in the catchment and outlines its long-term strategy for alleviating flooding in the area; and
- we must report annually, via our annual performance report, on how we are managing our network to ensure long-term resilience and reduce flood risk for customers, and how we're progressively developing our understanding of flood risk in the catchment.

4.32 The first report is near completion and will be released by the regulatory deadline. This report is integrated with the DWMP results and will refer to supporting evidence to which is already published in our DWMP for the Beckton Catchment[27].

[27] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/beckton-catchment-strategic-plan.pdf

# 5 Conclusion and next steps

5.1 In this report, we have explained how the London 2021 floods led to the realisation of the need for an urgent and strategically co-ordinated approach to tackle surface water flood risk in London. We also set out how the findings of the various flood reviews support the multi-layered approach set out in our surface water management strategy and the investment proposed in our DWMP. With the formation of the LSWSG, the commitment and drive to collaborate on managing the risk has been made, and the forthcoming London-level strategy will provide a framework to enable more targeted and co-ordinated action. Through the activities set out in this document, we'll continue to support this invaluable work and pilot new approaches that can be mainstreamed to enable the scale of change needed.

5.2 Our DWMP will inform our PR24 submission to Ofwat. As the PR24 plan is influenced by Water Industry National Environment Programme demands, not all the activities proposed in our DWMP may be included in the funding settlement. Lessons learned from translating DWMP strategic investment plans into Price Reviews will also inform the second cycle of DWMPs.

# Appendix 1: LFR recommendations

| London Flood Review recommendations | |
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| **Governance**<br><br>Roles and responsibilities<br><br>Planning and development | 1. Thames Water (TW) to work with other agencies to develop a multi-agency strategy to develop response to flooding. Engage with other organisations to identify clear roles and responsibilities during the event.<br><br>2. Set up an organisational body to develop strategic plans for management of surface water over Greater London. Report annually on progress against these plans.<br><br>3. Review the planning to consider adding water companies as statutory consultees in the planning process, to provide comments related to sewer flooding risk and network availability. |
| **Funding**<br><br>Flood risk schemes and Sustainable Drainage Systems (SuDS)<br><br>Incident response<br><br>Insurance | 4. Review the process of applying for and securing funding for flood risk schemes.<br><br>5. Seek opportunities for partnership working in areas of known flood risk to spread the cost of potential schemes, including consideration of source control as well as schemes which protect receptors. Identify blockers which prevent effective schemes being taken forward and lobby for additional resources to be made available to achieve funding.<br><br>6. Ring-fence funding to LLFAs for flood risk duties. Lobby for additional funds to be made available so that the full remit of duties can be met.<br><br>7. Enable the Strategic Surface Water Management Group to manage and coordinate response to flooding, including deployment of clean-up crews to areas of greatest need.<br><br>8. Work with those who flooded to support their access to the FloodRe reinsurance scheme, the Build Back Better fund, and feedback any necessary improvements to the scheme. Consider lobbying for further investment into FloodRe scheme to include cover for houses of multiple occupancy and commercial properties to ensure they have access to insurance. |
| **Evidence**<br><br>Monitoring and forecasting | 9. Investigate timescales and suitable application for multi-agency response to improve forecasting. Use forecasting to identify event risk zones and consider use of ICMLive models to develop computer learning models as a predictive tool to identify impact and operational response during an event. |

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| Modelling<br><br>Asset performance<br><br>Report and forming evidence base for future investment | 10. Develop existing modelling specifications, or create new ones, which provide clear guidance on the use of rainfall, boundary conditions and complex flow mechanisms. Ensure that a common model environment is used so that shared risks between LLFAs and TW are well understood.<br><br>11. Review critical assets and identify ways of monitoring data and information, such as data sharing platforms, during an event to inform decision-making and prioritisation. This may draw on data from all organisations as well as freely available data. Consider whether a digital twin is of benefit to replicate the system and understand the impact of various operations on system performance.<br><br>12. Assess impact of gully cleaning to determine the gullies which should be cleaned most frequently. This may not be the gullies where flows pond but may be further upstream to allow for flows to get into the system and be conveyed away from risk zones. The impact on other infrastructure should be considered.<br><br>13. Review current data collection processes across all stakeholders and identify improvements. Establish a suitable data platform to host flooding history data and manage appropriately. Appoint a data manager to be responsible for data and how it is shared. |
| Communication<br><br>Preparing for events<br><br>Responding to events<br><br>Post-event response and clean up<br><br>Coordinating and sharing information across organisational bodies | 14. Set trigger points, likely to be aligned with the multi-agency flood plan and London Resilience Group's triggers, to mobilise operational and TW Customer Contact Centre staff and engage with key stakeholders to prewarn of a potential event.<br><br>15. Ensure that the current response plan includes alerting customers who have either signed up to be notified of risks in their area, previously experienced flooding, or are on the priority services register, that there is a potential risk of extreme weather in advance of the event so that they may prepare.<br><br>16. Carry out exercises to practice new flood response and communications plans to improve preparedness and cooperation across multiple organisations.<br><br>17. Implement process for updates to website messaging and key lines of communication to be shared across all key stakeholders as an event unfolds.<br><br>18. Create and disseminate an 'emergency communications group messaging' briefing document to staff and stakeholders. Update regularly during and after flooding events to enable clear and consistent messaging across the various stakeholders.<br><br>19. Establish a data sharing agreement between TW and other relevant stakeholders which sets out what and how data is shared. Enable LLFAs quick access to data. |

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| Coordinating and sharing information for customers | 20. Create cross-organisation educational campaign regarding flood risk to help residents and businesses to understand their risk and steps that they can take to reduce that risk and gain insurance.<br><br>21. TW to share policy on procedure for assessing FLIP installation with stakeholders for clarity and openness.<br><br>22. Understand where customers implement their own measures. This data will help RMAs to understand the cumulative impact of these measures on flood risk. Create digital form for consultation process so that TW is informed. |
| Strategic Plan<br><br>Asset resilience<br><br>Re-greening London<br><br>Planning Policy | 23. Set out clear terms of reference of what flood risk resilience schemes are aiming to achieve, in terms of acceptable levels of risk, desired standard of protection and design requirements, in conjunction with Recommendation 11. Agree across the RMAs. Understanding the flood risk mechanisms in play will result in a scheme which delivers the maximum benefit potential to all stakeholders.<br><br>24. Strategic Surface Water Management Group to assess criticality of strategic assets and assign required standard of protection. Review measures in place to ensure continuity of performance during flooding events. Review current Flood Asset Register compiled by LoDEG and make recommendations to improve consistency and understanding of assets. Assess assets which are critical for flood risk management and the implications for other assets where they may fail. Communicate findings to all stakeholders.<br><br>25. Consider incentivisation of Nature-Based Solutions to form part of the flood risk management infrastructure to improve the 'grey to green' water and reduce runoff into the drainage network to encourage widespread promotion and uptake of installation.<br><br>26. Identify the significant flow paths in the city, which often follow the path of the lost rivers. These should be formally designated as protected overland flow routes. Formalisation of these routes may involve minor but wholesale amendments to kerb lines, low point attenuation areas (i.e. blue corridors and informal detention basins) to make these routes safe for conveying flood waters. Additional policy should be written preventing changes within these designated routes without a full assessment and understanding of how these changes may affect their function.<br><br>27. Local authorities to consider implementing more stringent development policies so that greenfield runoff rates must be achieved. This should also be followed up to encourage developers to implement realistic and functional solutions.<br><br>28. Local planning authorities to amend their planning policies where there is a known risk of sewer flooding to incorporate any basement development or construction work. This will increase the workload of the planning authorities, so we recommend that funding is increased to meet this change in demand. |

# Glossary

| Term | Description |
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| 1 in 30-year storm | A storm that has a 1 in 30 chance (3.33% probability) of being equalled or exceeded in any given year. This does not mean that a 30-year flood will happen regularly every 30 years, or only once in 30 years. |
| 1 in 50-year storm | A storm that has a 1 in 50 chance (2% probability) of being equalled or exceeded in any given year. This does not mean that a 50-year flood will happen regularly every 50 years, or only once in 50 years. |
| Asset Management Plan (AMP) | A five-year planning cycle used by English and Welsh water industry regulators to set allowable price increases for privately owned water companies and for the assessment of performance indicators such as water quality and customer service. |
| Baseline Risk And Vulnerability Assessment (BRAVA) | Following Risk Based Catchment Screening (RBCS), more detailed risk assessments on those catchments where we believed there was an adverse risk to performance over time. We modelled their performance to 2020 (baseline), 2030, 2035 and 2050. |
| Business Plan | Business Plans are produced by water companies every 5 years. They set out their investment programme to ensure delivery of water and wastewater services to customers. These plans are drawn up through consultation with the regulators, stakeholders and customers and submitted to Ofwat for detailed scrutiny and review. |
| Catchment Strategic Plans (CSPs) | Summary reports to promote system thinking across large wastewater catchments. These provide early sight of our final plans enabling co-authoring opportunities for our stakeholders. Each document outlines the challenges that the catchment will face in the future and the long-term plans to address these issues. |
| Combined sewer | A sewer designed to receive both wastewater and surface water from domestic and industrial sources to a treatment works in a single pipe. |
| Customer Challenge Group (CCG) | An independent body that challenges both our current performance and our engagement with customers on building our future plans. |
| Cycle 1 and Cycle 2 DWMP | Our current DWMP is referred to as Cycle 1, it covers a planning period of 2025-2050. Our next plan will be published in five years' time and is referred to as our Cycle 2 DWMP, it will cover a planning period of 2030-2055. |
| Department for Environment, Food and Rural Affairs (Defra) | UK government department responsible for safeguarding the natural environment, food and farming industry, and the rural economy. |
| Drainage and Wastewater Management Plan (DWMP) | A Drainage and Wastewater Management Plan (DWMP) is '*a long-term strategic plan that sets out how wastewater systems, and the drainage networks that impact them, are to be extended, improved and maintained to ensure they are robust and resilient to future pressures*'. The planning period is 25 years, from 2025 to 2050. DWMP is iterated every five years; the first known as 'Cycle 1', published as a final plan in May 2023. |
| dDWMP | The draft version of the Drainage and Wastewater Management Plan, published in June 2022[28]. |
| fDWMP | The final version of the Drainage and Wastewater Management Plan, to be published in May 2023. |

[28] https://www.thameswater.co.uk/about-us/regulation/drainage-and-wastewater-management

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| Dry Weather Flow (DWF) | Dry Weather Flow is the average daily flow to a Sewage Treatment Works (STW) during a period without rain. |
| Environment Agency (EA) | UK government agency whose principal aim is to protect and enhance the environment in England and Wales. |
| EA Pollution Categories 1 to 3 | Category 1 incidents have a serious, extensive or persistent impact on the environment, people or property.<br>Category 2 incidents have a lesser, yet significant, impact.<br>Category 3 incidents have a minor or minimal impact on the environment, people or property with only a limited or localised effect on water quality.<br>Further Ofwat guidance available here: WatCoPerfEPAmethodology v3-Nov-2017-Final.pdf (ofwat.gov.uk) |
| Event Duration Monitoring (EDM) | Event duration monitoring (EDM) measures the frequency and duration of storm discharges to the environment from storm overflows. |
| External hydraulic sewer flooding | External flooding occurs within the curtilage of a property due to hydraulic sewer overload.<br>Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk) |
| Flooding Local Improvement Project (FLIP) | FLIP' is a non-return valve with a pump that can push flows from a customer's property into a full sewer when the non-return valve is closed. |
| Foul sewer | A foul sewer is designed to carry domestic or commercial wastewater to a sewage works for treatment. Typically, it takes wastewater from sources including toilets, baths, showers, kitchen sinks, washing machines and dishwashers from residential and commercial premises. |
| Grey infrastructure | New sewers, sewer upsizing and attenuation storage to provide additional capacity in the wastewater networks. Also covers new pumping stations, rising mains and/or civil structures at STWs. |
| Green infrastructure | Sustainable surface water management solutions, including sustainable drainage systems (SuDS), that are designed to mimic naturally draining surfaces. Typically applied to surface water or combined sewerage systems, but can also be applied to land, highway or other forms of surface drainage. |
| Historic England (HE) | A non-departmental public body of the government whose aim is to protect the historical environment of England by preserving and listing historic buildings, ancient monuments. |
| Hydraulic overload | Hydraulic overload occurs when a sewer or sewerage system is unable to cope with the receiving flow. |
| Internal hydraulic sewer flooding | Flooding which enters a building or passes below a suspended floor caused by flow from a sewer.<br>Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk) |
| L2 Area (Strategic Planning Area) | An aggregation of level 3 catchments (tactical planning units) into larger level 2 strategic planning areas. The level 2 strategic planning areas allow us to describe strategic drivers for change (relevant at the level 2 strategic planning area scale) as well as facilitating a more strategic level of planning above the detailed catchment assessments. |
| L3 Catchment (Tactical Planning Unit) | Geographical area in which a wastewater network drains to a single STW. Stakeholders may be specifically associated with this area. Includes for surface water sewerage that may exist which serves the wastewater geographical area but drains to a water course. |

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| Lead Local Flood Authorities (LLFAs) | LLFAs are Risk Management Authorities as defined by the Flood and Water Management Act 2010. They have statutory duties with respect to flood risk management, investigating flooding and the compilation of surface water management plans. |
| Long-Term Delivery Strategy (LTDS) | A requirement by Ofwat on water companies, to ensure that short term expenditure meets long term objectives for customers, communities, and the environment. These will be submitted as part of the Price Review. |
| Misconnections | Misconnections are where either surface water drainage or foul water is connected to the wrong system e.g., surface water to foul only or foul to surface water systems. |
| Natural capital accounting | The process of calculating the total stocks and flows of natural resources in a given system, either in terms of monetary value or in physical terms. |
| Natural England (NE) | A non-departmental public body sponsored by the Department for Environment, Food and Rural Affairs to protect the natural environment in England, helping to protect England's nature and landscapes. |
| Non-governmental organisation (NGO) | An organisation that operates independently of any government, typically one whose purpose is to address a social or political issue. |
| Options Development and Appraisal (ODA) | A method to focus the level of planning effort, i.e., proportionate to the risks identified, with a view to providing a measure of consistency across the industry. |
| Ofwat | The regulatory body responsible for economic regulation of the privatised water and wastewater industry in England and Wales. |
| PR24 | Every five years, water companies set out their plans for what they'll deliver and how much they'll charge customers[29]. Their plans over the next five years should include how they will:<br>• Provide a safe and clean water supply<br>• Provide efficient sewerage pumping and treatment services<br>• Control leaks<br>• Install meters<br>• Maintain pipes and sewers<br>• Maintain and improve environmental standards<br>This process is known as the price review, and the next one will be in 2024, when Ofwat will make its final decisions. We call this PR24. |
| Risk-Based Catchments Screening (RBCS) | A first-pass screening exercise of catchment vulnerability against 17 different risk indicators. To understand which catchments are low risk catchments and those that are likely to be at risk in the future if not supported by our long-term plan. |
| Risk Management Authorities (RMAs) | Authorities responsible for Flood Risk as defined in the Flood and Water Management At 2010. These include, Lead Local Flood Authorities, Highway Authorities, Local Planning Authorities, Natural England and the Environment Agency. |
| Sewage Treatment Works (STW) | A sewage treatment works receives and treats wastewater to a standard legally agreed with the Environment Agency, before it is released back into the environment. |

[29] https://www.ccwater.org.uk/priorities/price-review/

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| Specific, Measurable, Achievable, Relevant, and Time-Bound (SMART) | A framework for setting effective targets. |
| Storm overflow discharges | Storm overflows are used to manage excess flows, which typically occur as a result of heavy rainfall. Excess flow that may otherwise have caused flooding is released through a designated outfall to a water course, land area or alternative drainage system. |
| Strategic Environmental Assessment (SEA) | A systematic decision support process to ensure that environmental and other sustainability aspects are considered effectively in policy, plan and programme making. |
| Surface water sewer | A surface water sewer collects rainwater from domestic and commercial roofs, driveways, patios etc to a local watercourse or suitable surface water drainage system. |
| Sustainable Drainage systems (SuDS) | Drainage solutions that provide an alternative to the direct channelling of surface water through networks of pipes and sewers to nearby watercourses. SuDS aim to reduce surface water flooding, improve water quality, and enhance the amenity and biodiversity value of the environment. SuDS achieve this by lowering flow rates, increasing water storage capacity and reducing the transport of pollution to the water environment. |
| Thames Regional Flood and Coastal Committee (TRFCC) area | The TRFCC area was established by the Environment Agency under the Flood and Water Management Act 2010 that brings together members representing the Constituent Authority. Featured TRFCCs are listed here on our DWMP portal: Drainage and Wastewater Management Plan (arcgis.com) |
| Water Industry National Environmental Programme (WINEP) | The framework under which Defra and the EA require environmental improvements to be delivered by water companies. Guidance is released by regulators, which water companies interpret for their geographical area, and resubmit the outputs back to regulators for endorsement. |

# Navigating our DWMP

We've developed a comprehensive document suite to share our final DWMP. This includes five summary documents that contain increasing levels of detail. To help you to navigate around our document suite and to find key DWMP content, we provide a Navigation index below and on our DWMP webpage. The orange cells refer to where key DWMP content can be found across our final document suite.

| Navigation index | | Protecting the environment and providing a reliable, sustainable wastewater service | | | | | | | Best value and delivery | | | | | Working together | | DWMP stages and data | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Storm overflows | Sewer flooding | Level of ambition & pace of delivery | Growth & climate change | Resilience: flooding & power | Groundwater | Environmental assessments | Affordability & bill impact | Best Value | Base vs Enhancement | Solutions & deliverability | Programme alignment | Partnership working | Stakeholder & customer engagement | DWMP stages & process | Level 2 regional summaries | Level 3 regional summaries | Data tables | Risk & Assurance |
| Summary documents | Customer summary | | | | | | | | | | | | | | | | | | | |
| | Non-technical summary | | | | | | | | | | | | | | | | | | | |
| | Technical summary | | | | | | | | | | | | | | | | | | | |
| | The Plan | | | | | | | | | | | | | | | | | | | |
| | Catchment Strategic Plans x13 | | | | | | | | | | | | | | | | | | | |
| Technical appendices x11 | Appendix A - Strategic context | | | | | | | | | | | | | | | | | | | |
| | Appendix B - Risk-Based catchment screening | | | | | | | | | | | | | | | | | | | |
| | Appendix C - Baseline risk and Vulnerability assessment | | | | | | | | | | | | | | | | | | | |
| | Appendix D - Options development and appraisal | | | | | | | | | | | | | | | | | | | |
| | Appendix E - Programme appraisal | | | | | | | | | | | | | | | | | | | |
| | Appendix F - Stakeholder engagement | | | | | | | | | | | | | | | | | | | |
| | Appendix G - Adaptive pathway planning | | | | | | | | | | | | | | | | | | | |
| | Appendix H – Customer engagement Part A – Draft DWMP | | | | | | | | | | | | | | | | | | | |
| | Appendix I - Risk and uncertainty | | | | | | | | | | | | | | | | | | | |
| | Appendix J - DWMP and WRMP alignment | | | | | | | | | | | | | | | | | | | |
| | Appendix M - Assurance | | | | | | | | | | | | | | | | | | | |
| New technical appendices x9 | Appendix N - You Said, We Did (YSWD) | | | | | | | | | | | | | | | | | | | |
| | Appendix O - What base buys | | | | | | | | | | | | | | | | | | | |
| | Appendix P - Response to July 2021 Floods | | | | | | | | | | | | | | | | | | | |
| | Appendix Q - Storm overflows | | | | | | | | | | | | | | | | | | | |
| | Appendix R - Delivery of SuDS and nature-based solutions | | | | | | | | | | | | | | | | | | | |
| | Appendix S - Partnership opportunities and working | | | | | | | | | | | | | | | | | | | |
| | Appendix T - Groundwater quality | | | | | | | | | | | | | | | | | | | |
| | Appendix U - Resilience | | | | | | | | | | | | | | | | | | | |
| | Appendix V – Customer engagement Part B – Consultation Survey Report | | | | | | | | | | | | | | | | | | | |
| Environmental assessments | Appendix K - Strategic environmental assessment (SEA) | | | | | | | | | | | | | | | | | | | |
| | Appendix L - Habitats regulations assessment (HRA) | | | | | | | | | | | | | | | | | | | |
| Portals and data | Customer portal | | | | | | | | | | | | | | | | | | | |
| | Practitioner portal | | | | | | | | | | | | | | | | | | | |
| | Data tables | | | | | | | | | | | | | | | | | | | |
| | Data tables commentary | | | | | | | | | | | | | | | | | | | |

We welcome your views on our DWMP. Please share them with us by emailing: DWMP@thameswater.co.uk.

*This document reflects our DWMP 2025-2050 as published in May 2023.*