



Surface tensions

WORKING TOGETHER AGAINST FLASH FLOODING

By Professor Samer Bagaen

About Localis

Who we are

We are a leading, independent think tank that was established in 2001. Our work promotes neo-localist ideas through research, events and commentary, covering a range of local and national domestic policy issues.

Neo-localism

Our research and policy programme is guided by the concept of neo-localism. Neo-localism is about giving places and people more control over the effects of globalisation. It is positive about promoting economic prosperity, but also enhancing other aspects of people's lives such as family and culture. It is not anti-globalisation, but wants to bend the mainstream of social and economic policy so that place is put at the centre of political thinking.

In particular our work is focused on four areas:

- **Decentralising political economy.** Developing and differentiating regional economies and an accompanying devolution of democratic leadership.
- **Empowering local leadership.** Elevating the role and responsibilities of local leaders in shaping and directing their place.
- **Extending local civil capacity.** The mission of the strategic authority as a convener of civil society; from private to charity sector, household to community.
- **Reforming public services.** Ideas to help save the public services and institutions upon which many in society depend.

What we do

We publish research throughout the year, from extensive reports to shorter pamphlets, on a diverse range of policy areas. We run a broad events programme, including roundtable discussions, panel events and an extensive party conference programme. We also run a membership network of local authorities and corporate fellows.

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Professor Samer Bagaen



Advisory Panel

This research project was supported by an advisory panel, whose members are listed below. Panel members provided comments on an agenda based off the interim findings of this research project. They may not necessarily agree with every analysis and recommendation made in the report:

- Chris Rumsey, Senior Public Affairs Adviser, Association of British Insurers
- David Simmonds MP, Chair, All Party Parliamentary Group on Housing and Planning
- William Harrington, Waterway and Flood Water Management Policy Team, Defra
- Jonathan Hunter, Surface Water and Water Industry Manager, Environment Agency
- Jonathan Kassian, Head of Research, FloodRe
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- Tracey Garrett, Chief Executive, National Flood Forum
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Foreword

As a nation, we have become used to seeing pictures in the news of riverbanks that have burst, fields resembling lakes, trapped cars and buses which have become deluged in flash floods, and of course, the heart-breaking scenes of homeowners looking on at the devastation caused to their homes. However, what we often don't see is the aftermath of flooding – what happens once the blue lights of the emergency services fade away and the news agenda moves on.

It is estimated that floods cause £1.1bn of damages per year in England, and we at LV= General Insurance pay around £32,000 for a flooding claim. However, while the costs are extremely high, for the homeowner themselves, flooding is an extremely traumatic event which has a devastating impact on a person's life, both physically and mentally. Unless you have personally been impacted by flooding, very few people can really comprehend the upheaval and stress which occurs in the weeks, months and even sometimes years afterwards – from being out of your home and in alternative accommodation which can be for a considerable amount of time (sometimes up to a year), to having your much loved and treasured possessions disposed of as they are simply unrecoverable having been subjected to unsanitary flood water. As an insurer, we see first-hand the very real impact it has on our customers, and whilst we always endeavour to make things as stress-free as possible, unfortunately we are seeing the number of flood claims increase, particularly when it comes to surface water flooding. Not only this, but the size and scale of flooding events is worryingly increasing.

The UK is seeing the consequences of climate change. The nation is heating up too fast: winters are up to 30 percent wetter and summers are between 1°C and 6°C warmer and up to 60 percent drier, depending on the region. Consequently, the UK is becoming less resilient to more extreme weather in the form of storms, floods, and heatwaves. At the same time, there is an ever-increasing need for more houses to be built. As highlighted in the 2021 'Plain Dealings' report, last year alone over 5,000 new homes in areas at the highest risk of flooding were approved – putting every single one of these homeowners at risk of the traumatic impact of flooding.

However, whilst these figures are startling, development in flood risk areas does not just impact properties in that particular location but can put other areas at greater risk too. When previously undeveloped areas are concreted over, it removes more opportunity for rainfall to soak away into the ground. Instead, the water remains on the surface, which in turn increases water run-off, further increasing the risk of flooding. Indeed, this is even exacerbated by driveways and gardens being paved over with impermeable surfaces.

Given the increasing prevalence of flooding coupled with the growing need for housing, it is absolutely essential that different sectors and government (both national and local) work together to find solutions so that we can help 'future-proof' the UK's housing stock. Whilst on a sector-by-sector basis action is being taken - including in the insurance industry with the vital work of Flood Re and the exploration of the use of Property Flood Resilience (PFR) measures when repairing properties which have been previously damaged by floods - we must now work more closely to share learnings and help protect homeowners.

LV= General Insurance is therefore pleased to be able to sponsor this report which looks at some of the policy areas that will need to be considered when trying to tackle flooding, and in particular surface water flooding, whilst also attempting to meet the government's objective to build more homes. The report highlights the important need for all new homes - regardless of development size - to have drainage strategies in place in order to help protect homeowners who already live in urban areas or where they already have some form of flood risk. It also highlights the need for flood mapping to capture future flood risks, as currently the impact of increasing rainfall, drier summers and rising sea levels is not factored into planning decisions for new homes.

The recommendations which have been made present an opportunity to meet some of the key challenges head-on and help future-proof housing stock. In addition, a long-term holistic approach to flooding should be developed, with property developers, insurers and local authorities working together to tackle this important issue. By tackling this together, we can go some way to ensuring people can afford to own their own homes while at the same time preventing them from going through the physical and mental trauma of being flooded.

Steve Treloar, Chief Executive Officer, LV= General Insurance.

Executive Summary

The effects of climate change are already being felt across the UK, with major flooding events arriving almost year-on-year, particularly in the most unpredictable form – surface water flooding. Yet, even in this dramatic context, our resilience against disaster could be threatened by any major capital investment programme cutbacks and infrastructure retrenchment may occur in any case in the short-term, through the impact of inflation and a shortage of skills and material.

The ongoing housing supply crisis in England requires more houses to be built, all of which have potential to increase the risk of surface water flooding. The challenge is in constructing modern infrastructure which does not increase the risk of surface water flooding and is more resilient to it when it occurs. With the risk of flash floods elevating, the need to shore up institutional alignment and capacity whilst investing in sustainable infrastructure is more pressing now than ever before. Investment must be sustained and strategic in order to ensure homeowners and communities are protected and informed.

The risks of surface water

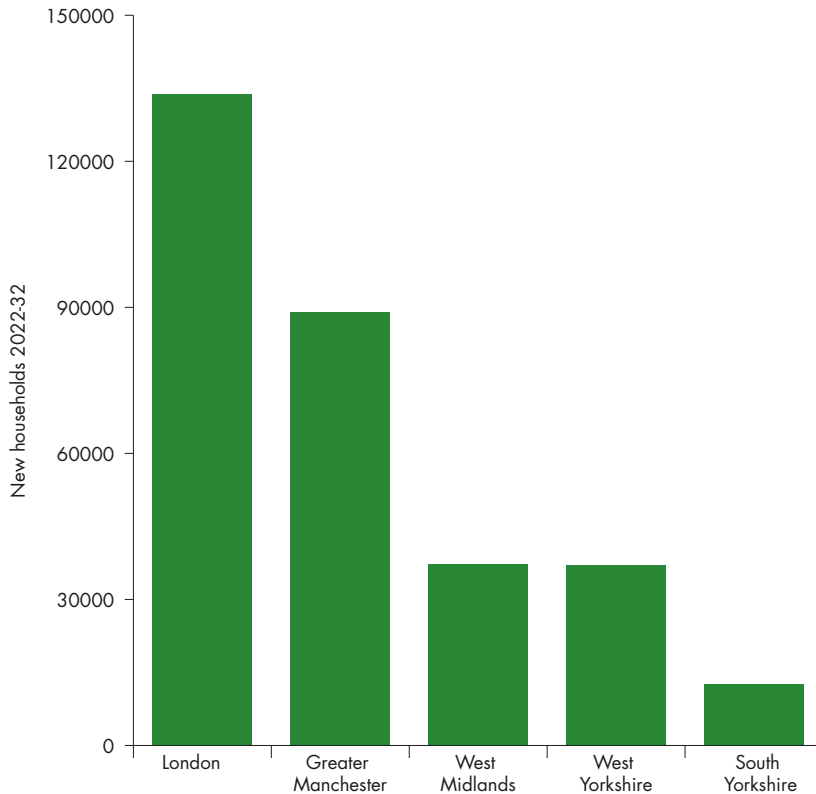
The amount of rain from extremely wet days increased by 17 percent from the period of 1961-1990 to 2008-2017. Under a high emission scenario, by 2070 rainfall in the UK could be as much as 47 percent lower in the summer and 35 percent higher in the winter than at present. There will be increases in the intensity of heavy summer rainfall events where large volumes of water fall on dry, impermeable ground, upping the frequency and severity of surface water flooding. There will also be a significant future increase in the number of heavy winter rainfall events, and an intensification of hourly rainfall in summer. The accumulation threshold of rainfall in these predicated scenarios indicates that flash flooding will become much more frequent.

Urbanisation and surface water are intimately linked together. The impact of the former on the latter owes to an increase in built and manipulated surfaces, roads, and other physical infrastructure. This changes the spatial distribution of processes such as infiltration and recharge, evapotranspiration, and run-off production. This is exacerbated by driveways and gardens being paved over with impermeable surfaces, further increasing water run-off. All of these factors are further detrimental to proper drainage in the increasing number of very hot dry spells when the ground becomes less able to soak up rainwater. Sustainable drainage systems (SuDS) are increasingly seen as a solution to this challenge. They provide an alternative to the direct channelling of water through networks of

pipes to nearby watercourses. According to the British Geological Survey, 'SuDS aim to reduce surface water flooding, improve water quality and enhance the amenity and biodiversity value of the environment'¹.

Household projections in at-risk areas

Demand in at-risk borough by city region



Source: NAO/DLUHC

Implementing SuDS, as well as upgrading existing infrastructure to cope with increased rainfall, requires coordination across the broad governance of the built environment – from the planning of new homes to the redevelopment of existing housing stock, across the management of connective infrastructure and

1 British Geological Survey – Sustainable drainage systems (SuDS)

nearby land, to the engagement of the wider local public sector and civil society. Understanding where the current gaps and overlaps are in the institutional layout of flood management is therefore crucial in forging a path to better cooperation on this increasingly pressing issue.

Institutional roles and responsibilities

In the UK, there is no single body responsible for managing flood risk altogether or specifically surface water flood risk. Responsibility is joint among a number of bodies:

- Highways England is responsible for motorways and major trunk roads.
- Local authorities or national park authorities are responsible for other roads.
- Water and sewerage companies are responsible for managing the risks of flooding from piped water and foul or combined sewer systems providing drainage from buildings, driveways and courtyards.

In England, the Department for Environment, Food and Rural Affairs (DEFRA) is the policy lead for flood and coastal erosion risk management. Lead local flood authorities (LLFAs), which are either county councils or unitary authorities, lead in managing local flood risks. There are other authorities (risk management authorities) with responsibility for flooding, including the Environment Agency (EA), water and sewerage companies, and internal drainage boards.

Local Resilience Forums are the foundation of England's emergency planning and response arrangements for a wide range of resilience issues, including flooding. They bring together a number of organisations, including the emergency services and local authorities, and the Multi Agency Flood Plans (MAFPs), they produce aim to coordinate all of those involved in responding to flooding. On the central government side of emergency action, the Environment Agency (EA) works with the Met Office on flood guidance statements to improve capability for short-term forecasts, to aid local authorities' response to surface water flooding. In terms of long-term forecasting, however, the EA only maps current risks for planning permission purposes; it does not map future risks. This means that the impact of increasing rainfall, dryer summers and rising sea levels are not factored into planning decisions for buildings, which will need to withstand these accelerating effects of climate change during their lifespan.

The separation of responsibilities between some of these authorities is problematic on the ground when flooding occurs, given the uncertainty over the geography of specific instances of flooding and our ability to predict where, for example, a thunder storm may form. Furthermore, given that only current risks are mapped,

new development is being allowed to be delivered in places where future risks are not known. This is consistently identified by stakeholders as the biggest concern for flood risk: that flood plains are being built on, and consistently losing space for water. Civil society can only do so much with planning and mitigation under existing legislation and regulations. What is needed is sustained investment in and by local government to build capacity – particularly in the planning system.

The planning system

The planning system, codified in the National Planning Policy Framework (NPPF), is the primary legislative underpinning of flood management in new and old developments. The NPPF sets out measures for avoiding and managing risks from flooding, based on the central role of local planning authorities in preparing local plans and in deciding applications for planning permission. The NPPF was strengthened in April 2015, with a new expectation that sustainable drainage systems would be provided in all new major developments (nine houses or more), regardless of location, unless demonstrated to be inappropriate.

What is still missing is that minor developments (nine houses or less, infill or permitted development) do not get seen by LLFAs and there are concerns that even in unitary authorities, these developments do not come under sufficient scrutiny from resource-stretched planning teams. Yet these developments can have, by virtue of their location and design, big impacts on surface water run-off. Although they may individually be small developments, in aggregate they can increase the risk of surface water flooding across an area. In the year to June 2022, DLUHC planning statistics show that decisions were made on 35,282 dwellings, as part of minor developments, in areas where more than one percent of homes are already at significant flood risk, with 6,777 of these in London or Metropolitan Boroughs. 6,575 of these permissions were in planning districts where more than five percent of homes are already at risk of some form of flooding. Given a national approval rate of 73 percent for minor developments, this could mean as many as 25,550 homes adding pressure to drainage infrastructure²³.

While many of these dwellings will have been subject to flood impact assessments for the minor development itself, there is no obligation for their applications to be considered as part of the LLFA flooding strategy. The same is true of permitted development, which requires a flood impact assessment for anything in flood zone two or three, but again may avoid serious scrutiny for aggregate impact in the

2 DLUHC Live Planning Tables

3 National Audit Office (2021) – Managing Flood Risk (raw datafiles)

case of pre-approved applications, which made up 20 percent of all residential permitted development in districts with more than one percent of homes already at risk in the year to June 2022⁴. There are currently plans in place in government to address this gap in the governance of development oversight through changing categorisation, with an updated policy originally scheduled for Autumn 2022.

Additionally, at present, there are no requirements in building regulations themselves for flood resistant and resilient construction, a fact particularly pertinent to planning decisions such as basement conversions. Part H of the building regulations specifically covers drainage. It requires that surface water is infiltrated into the ground if practicable. If infiltration is not practicable, it should be disposed into a watercourse or, less preferably, to a surface water sewer. Disposal into a combined sewer is the last resort in policy, compounding challenges by the water companies in how they manage combined sewage overflows and discharges into rivers and seas.

To overcome these obstacles, what is needed is a strong strategic planning authority. LLFAs, the EA, and all other risk management authorities need to work closely together and ensure that the plans they are making, both locally and nationally, link up. An essential part of managing local flood risk is taking account of new development in land use plans and strategies. The ongoing housing supply crisis in England requires more houses to be built, all of which have potential to increase the risk of surface water flooding. The challenge is in constructing modern infrastructure which does not increase the risk of surface water flooding and is more resilient to it when it occurs.

Moving forward

Funding is one of the major issues in delivering resilience against surface water flooding. Notwithstanding the general need for capital investment in infrastructure, government grant criteria can be overly restrictive, especially for smaller projects. This tends to disproportionately impact deprived places that are left off the agenda and left behind. There is a need to help people understand what they can do themselves through flood action groups to recognise flood risk. Partnerships should start at grassroots with planning and talking to those who have experience of past flooding, aggregating up to a full programme of investments in both infrastructure and institutional capacity.

The engagement and consultation with stakeholders carried out as part of this research not only revealed that people should be at the heart of any surface

4 Ibid.

water flooding response, it highlighted the case for the stronger partnerships than are currently in place. The rationale for stronger partnerships revolves around a desire to not put more pressure on communities to make themselves resilient. With communities and residents already enduring the cost-of-living crisis, there is a reluctance or perceived unimportance amongst some to the thought of investing to make their homes flood resilient. In 2022, Flood Re launched the 'Build Back Better' scheme through five of its insurance members, which offers some homeowners the chance to install Property Flood Resilience measures (up to £10,000) when repairing their property after a flood. It is hoped that through this scheme there will be better understanding around the types of methods available and their durability and help encourage greater uptake.

Recommendations

The most prominent finding of the engagement carried out with stakeholders as part of this research was the need for greater partnership working:

- There should be **more joined-up working and stronger communication** between lead local flood authorities and risk management authorities, particularly on matters of land use. This also involves the Environment Agency.
- Collaboration between developers, landowners, lead local flood authorities (LLFAs) and central government agencies to understand and manage flood risk and resilience must be **encouraged and incentivised across all new developments**.

Beyond that, there are actions to be taken by both central and local government to ensure greater resilience to flooding in general and surface water flooding in particular:

Central government:

- Produce **a comprehensive flood infrastructure funding programme** that is less restrictive and targeted toward places most at risk.
- Encourage 'bottom-up' practice by streamlining the funding process for smaller, district or community-based projects.
- Produce a **legal framework for local resilience forums** that is informed by local experiences.
- Strengthen **accountability and support mechanisms for communities** affected by flooding – ensuring that they are relative to the

scale of the flooding and subsequent damage.

- Introduce provisions for **all, including minor, developments to be monitored** by lead local flood authorities regarding their flood risk management.
- **Training should be provided to planning departments** of lead local flood authorities as part of a more strategic push to ensure that infrastructure projects and their contracts have strong, actionable flood provisions.
- The next revision of the National Planning Policy Framework must require local plans to **demonstrate how lead local flood authorities have assessed aggregate risk across the whole area**, as well as how flood impacts will avoided, controlled, mitigated, and managed.

Local government:

- For infrastructure and procurements concerning flooding, lead local flood authorities should **move away from human-engineered barriers and toward natural drainage systems** that work to slow the flow of surface water and relieve pressure on sewers.
- Lead local flood authorities should identify land that is required for current and future flood management and safeguard it from other developments.
- In absence of flood resilience provisions in building regulations, lead local flood authorities should look to **build such provisions into infrastructure projects** and their constituent contracts.
- Lead local flood authorities should **ramp up public engagement in surface water flood risk localities** to produce a contextualised support package and contribute to a mapping of relative flood risk from neighbourhood to neighbourhood.

Introduction

Climate change and the various and manifold impacts of extreme weather events, including floods, are a fact of life we need to be better prepared for as a nation. In England alone, some 5.4 million homes – one-in-six – are at risk of flooding, with the majority of them susceptible to surface water flooding⁵. As it stands, the National Infrastructure Commission assert that more than a million homes have a more than one percent chance of flooding in any given year⁶. Likewise, a growing population is placing ever greater demand stress on our water and waste systems, especially in growth hot spots.

Flood resilience is a public infrastructure challenge that has to be gripped tightly at every level of place – from our major cities and towns through to villages. If there is any sense that the overarching and central levelling up mission is to reduce geographic economic inequality, we need to provide greater certainty to families, communities and businesses on flood risk and mitigation.

In this sense, there is a need to connect levelling up with improved surface drainage. As a policy agenda, this means securing long-term capital funding to mitigate the risk of flooding when urban drainage systems become overwhelmed and water flows onto streets and nearby buildings. The experience of February 2020 when storms Ciara and Dennis wrought extreme rainfall leading to surface water flooding resulted in estimated £214m flood claims – of which 3,350 were for domestic property totalling an estimated £107m and 1,500 commercial property flood claims, totalling some £85m. In 2022, heavy rain falling on dry ground led to surface water flooding incidents across London and the South East, causing disruption to homes and businesses⁷.

The risks of retrenchment

Climate change and surface water flooding are a risk to all areas of the country and all growth typologies – from the rural seas to the urban islands within them, from what Localis previously identified as the ‘stuck’ areas hemmed down by the weight of long-term structural problems to the high growth ‘stifled’ powerhouses of the knowledge economy, high-functioning towns and cities where the need for commercial and residential housing is acute.

5 National Audit Office (2014) – Strategic flood risk management

6 National Infrastructure Commission (2022) – Water & Floods

7 The Guardian (2022) – Storms and flash floods hit southern England

Even in the absence of major capital investment programme cutbacks, resilience infrastructure will be subject to the impact of inflation, a shortage of materials and a lack of expert skills. Our report from last year 'Plain Dealing'⁸ noted how cuts to council planning services has resulted in a shortage of specialist knowledge to act confidently on unfamiliar topics of flood risk and climate change. This puts responsibility for surefooted decision-making into the hands of consultees such as the Environment Agency (EA) and Local Lead Flood Authorities (LLFAs).

When it comes to surface water flooding, as a growing area of risk, this skills deficit is compounded by the lack of understanding and availability of technology to detect flooding. For this, council planning departments must be better resourced to deal with immediate and long-term flood risk challenges.

Objective three of the 12 levelling up missions is to ensure that people feel 'pride in place' – with the goal of restoring 'a sense of community, local pride and belonging'. Ultimately, creating the conditions for local growth and instilling robust place resilience is about protecting and maintaining human dignity and safety. It is through this place policy prism that surface drainage must be understood and acted upon.

The extent of the challenge

Surface water flooding is a real and growing threat – to life, property, the economy, and the country writ large⁹. At least one in six people in England are at risk from flooding from rivers or the sea, with many more at risk from surface water flooding¹⁰. Floods in 2007 led to the Pitt Review in 2008, which in turn led to the Flood and Water Management Act (2010).

According to the Cross Report – a review of multi-agency responses to flooding by Major General (Retd) Tim Cross CBE¹¹ – in spite of local government cuts since 2010, central government spending on flood risk management has risen substantially in response to major flood events. The lion's share of that funding has been put into building and maintaining capital funded, permanent flood defences such as walls, culverts, and sea defences. The government invested £2.6bn from 2015-2021 on around 1,500 flood defence projects, in order to give increased protection to around 300,000 properties. The report notes that a much smaller proportion of government flood money was spent on flood emergency planning

8 Localis (2021) – Plain Dealing

9 Surface water: The biggest flood risk of all - GOV.UK (www.gov.uk)

10 FCERM Strategy Roadmap to 2026 (publishing.service.gov.uk)

11 Tim Cross CBE (2018) – Multi-Agency Flood Plan Review

and response, and most of that was via EA activities. Unsurprisingly perhaps, Cross suggested that focusing new funding through the EA, giving more direct support and dedicated staff to local and regional resilience forums would 'bolster preparedness' and local capability.

About this report

This report leverages successes around capital investment in infrastructure but also puts forward the argument that this alone will not make for effective response to surface water flooding. What is needed most of all is inter-agency collaboration and levers embedded in planning policy to enable government agencies, local government, housebuilders, and the water companies to deliver effectively. As a result, the driving methodology for this report is a cross-sector conversation on the issue of surface water flooding, involving stakeholders from government agencies, developers, councils, and the insurance industry. The aim is to present a clear outline of the roles and responsibilities around surface water flooding, explain how this connects to the planning system and put forward recommendations to deepen collaboration and better protect homes and homeowners from the devastating impact of surface water flooding.

CHAPTER ONE

Surface water flooding: an overview

Surface water flooding happens when the volume of rainwater falling cannot drain away properly from drainage networks or from filtering through the ground. It poses the greatest threat of all kinds of flooding to communities in England – due to factors including climate change and urbanisation, which can increase runoff¹².

12 [Blog: Should England Make Sustainable Drainage Systems \(SuDS\) Mandatory on New Developments Like Wales? | The Flood Hub](#)

1.1 The impact of climate change

The Met Office has predicted that there will be 2.6 million people living in areas of the UK at significant risk of river, surface water, or coastal flooding by the 2050s under a 2°C warming scenario and 3.3 million in a 4°C scenario¹³. This is especially stark data in the context of recent reports, including one from the UN, stating that the 1.5°C is not being met¹⁴. Under a high emission scenario, by 2070 rainfall in the UK could be as much as 47 percent lower in the summer and 35 percent higher in the winter than at present¹⁵. There will be increases in the intensity of heavy summer rainfall events where large volumes of water fall on dry, impermeable ground, upping the frequency and severity of surface water flooding. There will also be a significant future increase in the number of heavy winter rainfall events, and an intensification of hourly rainfall in summer. The accumulation threshold of rainfall in these predicated scenarios indicates that flash flooding will become much more frequent¹⁶.

The number of households at a significant risk of flooding due to change climate could be 570,000 in 2035¹⁷. As much as 130,000ha of high-quality horticultural and arable land is likely to be flooded at least once every three years by the 2080s in England and Wales, assuming no changes in flood and coastal erosion risk management measures occur¹⁸. Under a 3°C global warming scenario, by the 2050s flooding could cost the UK £3.3bn in annual damages¹⁹.

1.2 The urban drainage challenge

Urbanisation and surface water are intimately linked together²⁰. The impact of the former on the latter owes to an increase in built and manipulated surfaces, roads, and other physical infrastructure. This changes the spatial distribution of processes such as infiltration and recharge, evapotranspiration, and run-off production.

Sustainable drainage systems (SuDS) are increasingly seen as a solution to this challenge. They provide an alternative to the direct channelling of water through

13 Ibid.

14 The Guardian (2022) – UN finds ‘no credible pathway to 1.5C in place’

15 UKCP18-Overview-report.pdf (metoffice.gov.uk)

16 Heavier summer downpours with climate change revealed by weather forecast resolution model | Nature Climate Change

17 archive (nfonline.com)

18 UK Climate Change Risk Assessment 2012

19 archive (nfonline.com)

20 Eos (2022) – Urbanization and Surface Water Loss Go Together

networks of pipes to nearby watercourses. According to the British Geological Survey, 'SuDS aim to reduce surface water flooding, improve water quality and enhance the amenity and biodiversity value of the environment'²¹.

1.2.1 Case study: London 2021/2022

In July 2021, London was hit by widespread flash floods. At its worst, a month's worth of rain fell on parts of north and east London in an hour. The scale of the rainfall pushed the capital's infrastructure beyond its limits; drains and sewers overflowed, eight underground lines were suspended, stations closed including London Euston Station, and two hospitals closed – one of which was the Whipps Cross Hospital, having to evacuate 100 patients due to a power failure. Residential and commercial buildings had basements submerge in water, many of which storing high value possessions, and below ground-level car parks saw vehicles also plunge into floodwater. In worst case scenarios, some apartments were below ground-level and had to be evacuated, causing massive damage to these homes. Over 2,000 flood insurance claims were made in just over a fortnight and aggregated losses are estimated to be in excess of £100m.

Following the record-breaking heatwave in 2022, flash floods hit the capital again with some places in London experiencing more than 100mm of rainfall in just a few hours. Homes and businesses in north and east London were flooded again, and drivers had to abandon vehicles after roads in and around the area became submerged. National transport hub, Victoria station, had to run at significantly reduced capacity and the M25 was blocked by gridlock and surrounding flooded roads. Trains and buses, already under increased pressure due to difficult driving conditions, had to be cancelled and some areas of north and east London experienced power cuts and property damage.

1.2.2 Case study: Sheffield 2019

In 2019, an equivalent of an average months' worth of rain fell in Sheffield in just 24 hours. Roads became impassable and subsequently gridlocked including the M1 motorway, bus and train services were widely cancelled, and students living in university accommodation located on the banks of the River Don were forced to abandon cars due to them being submerged by flooding in underground car parks. Furthermore, Meadowhall, a shopping centre in Sheffield, was completely cut off by rising water from the torrential

rain, leaving dozens trapped in the centre overnight without information – the same shopping centre flooded in 2007, and again in 2021 and 2022.

Flooding in the city and surrounding area has continued in recent years. As early as 2022, flash floods hit the city post-heatwave. Cars were again stranded and submerged, medical centres were blocked by rising waters, and roads across the city and surrounding area ‘burst’ under the pressure of surface water – causing delay and damage to infrastructure.

1.3 Data review: urban areas and flood risk

The National Audit Office found in 2020 that 38 London or metropolitan boroughs had more than one in 100 properties at significant risk of flooding. The 38 boroughs include 16 of London’s 33 councils, the entirety of Greater Manchester, five authorities in the West Midlands and seven in Yorkshire. As urban areas, all these boroughs face increasing housing demand in the form of household growth over the next ten years, and all are currently building new homes to meet this demand. The figures below illustrate the challenge faced by these authorities.

Table 1: Significant flood risk (>1%) in major metropolitan areas

City region	Number of boroughs with significant risk	Average % of properties at significant risk
Greater Manchester Combined Authority	10	1.32%
London	16	2.23%
South Yorkshire Combined Authority	2	1.00%
West Midlands Combined Authority	5	2.18%
West Yorkshire Combined Authority	5	2.48%

Figure 1. Housing demand in at-risk urban areas

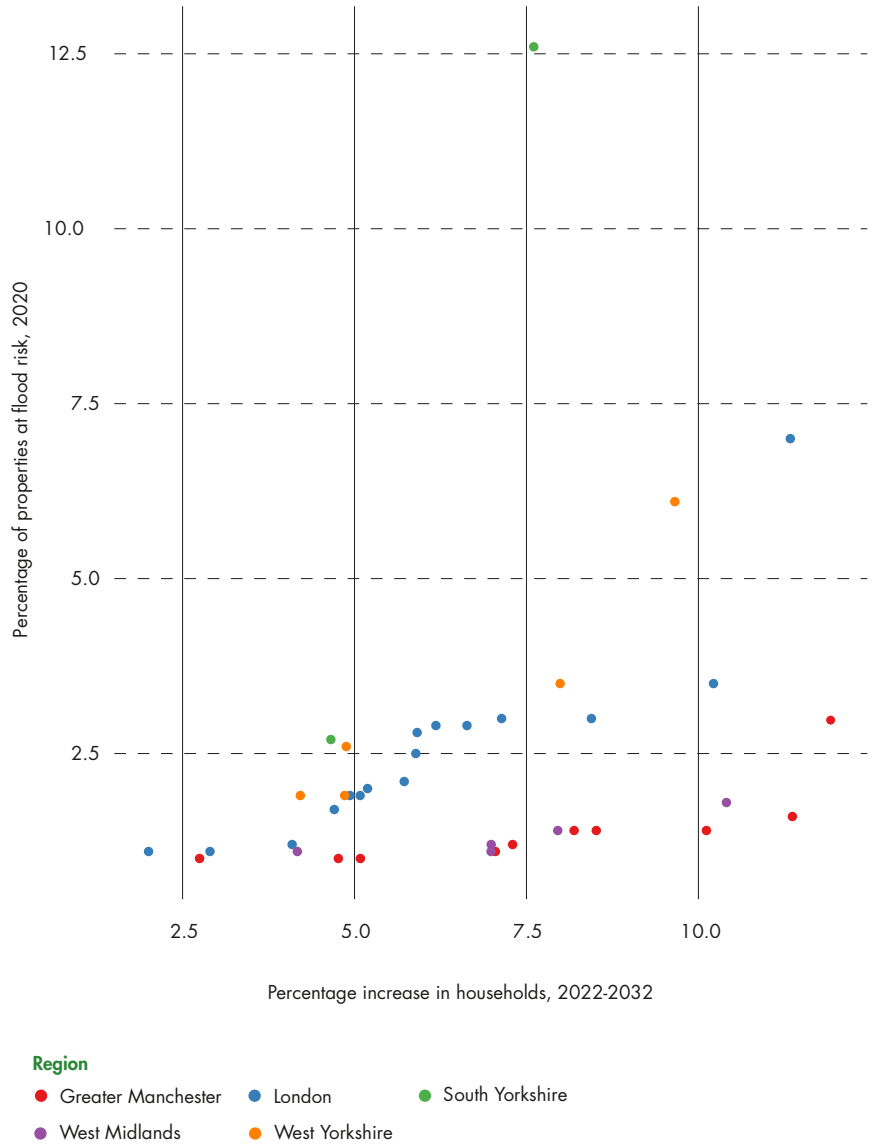
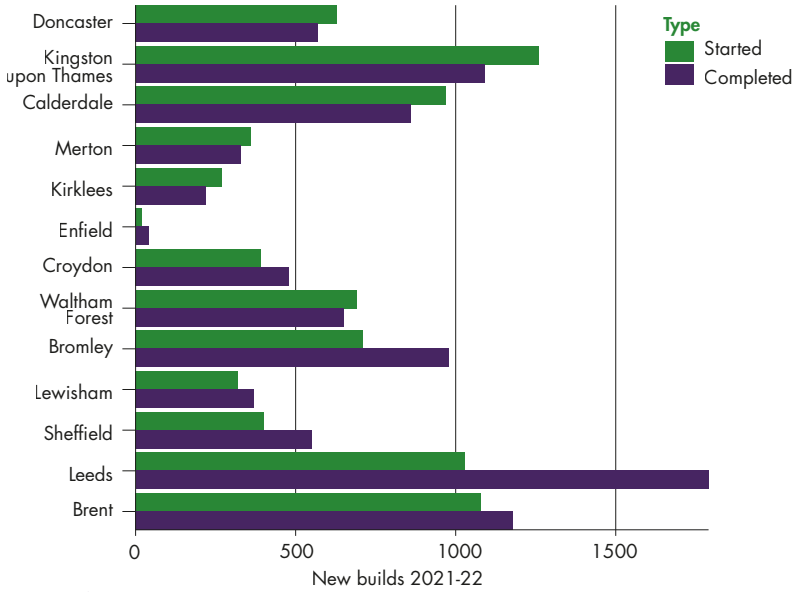


Figure 2. New builds in high-risk urban areas

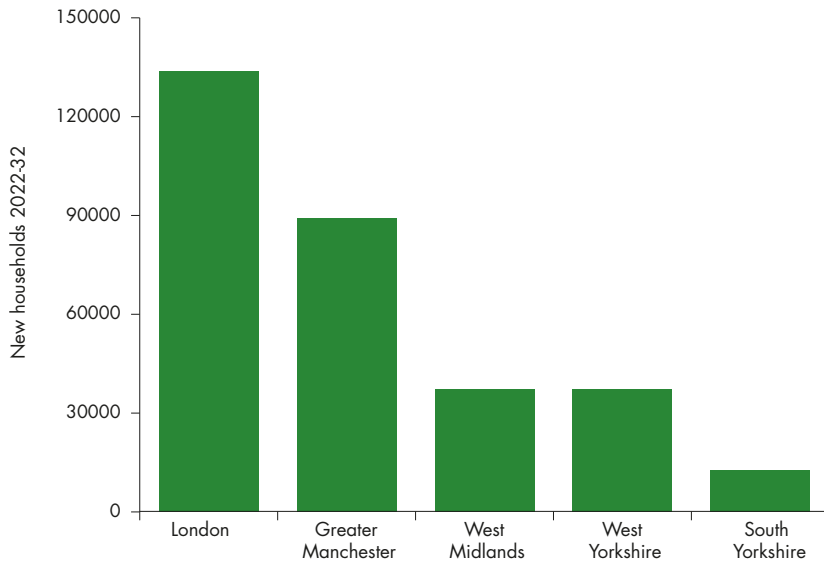
Boroughs with >2.5% of properties at risk



Source: NAO/DLUHC

Figure 3. Household projections in at-risk areas

Demand in at-risk borough by city region



Source: NAO/DLUHC

CHAPTER TWO

Institutional roles and responsibilities

This section outlines the key players in flood response, from the management of risk to incident response, with a focus on surface water flooding. The section concludes with the most important variable in dealing with flood risk, particularly from surface water, which is the ability to predict future occurrences.

2.1 Flood management responsibilities: gaps and overlaps

In England, Defra is the policy lead for flood and coastal erosion risk management. The Flood and Water Management 2010 Act sets out a number of responsibilities. The Act gives the Environment Agency (EA) the strategic overview for all sources of flooding and coastal erosion risk. It also provides many other bodies with distinct roles under the title of risk management authorities:

- Lead local flood authorities manage risks from local sources, for example surface water
- Highways England is responsible for motorways and major trunk roads.
- Local authorities or national park authorities are responsible for other roads.
- Water and sewerage companies are responsible for managing the risks of flooding from piped water and foul or combined sewer systems providing drainage from buildings, driveways and courtyards.
- Internal drainage boards manage water levels in their districts
- Environment Agency operations manage risks from main rivers and the sea. The EA is also responsible regulating reservoir safety and working in partnership with the Met Office to provide flood forecasts and warnings from main river and the sea.

The Flood and Water Management Act 2010 requires these risk management authorities to co-operate with each other, and act in a manner that is consistent with the National Flood and Coastal Erosion Risk Management (FCERM) Strategy for England. The Act also requires them to exchange information within an operating framework that gives them sufficient flexibility to form partnerships and to act on behalf of one another.

It can be argued that while the Act introduced structures and responsibilities for managing flood and coastal erosion risk, it reinforced a separation of responsibilities between local authorities and the EA. It has also created unintentional gaps as our understanding and needs have changed. For example, while the emergency response within a local resilience forum is well-practiced and rehearsed, there is little or no certainty over the responsibility for giving warnings about surface water flooding.

This is made harder by the fact many storms that lead to surface water flooding often develop with short timescales involved and much uncertainty over their location. Despite this there is a commitment within the FCERM Strategy Roadmap for the Environment Agency to work with the Met Office and Flood Forecasting

Centre to explore opportunities to improve its forecasting capabilities for surface water flood events. What is needed is a national challenge about the geography of specific flooding.

Flood management in practice: Hull

When Hull was last hit by tidal flooding in 2013, after a storm surge flooded 264 homes in the city, it brought memories of previous major flooding in 2007 when, during the UK's wettest summer on record, surface water and river flooding affected more than 55,000 homes and businesses across the country²². The 2013 floods in Hull were different - a storm surge combined with high spring tides created record water levels along coastlines and in tidal rivers. The city's solution involved moving away from the grey infrastructure of human-engineered barriers to blue-green sustainable systems which use natural drainage provided by green spaces that work to slow the flow of surface water during downpours to relieve pressure on drainage systems.

2.2 The role of communities and local resilience forums

Local resilience forums (LRFs) are the foundation of England's emergency planning and response arrangements for a wide range of resilience issues, including flooding. They bring together a number of organisations, including the emergency services and local authorities. The Multi-Agency Flood Plans (MAFPs) they produce aim to coordinate all of those involved in responding to flooding.

In 2017, Defra commissioned a review of the MAFPs produced by LRFs. Major General Tim Cross led that review and reported in 2018²³, underlining the need for the EA, local authorities, and emergency responders to work even more collaboratively in the LRFs to plan for and respond to surface water flooding and other local flood events. The report noted that LRFs are not yet legal entities and that variations existed across the country in terms of LRF capacity and effectiveness.

In 2018, Defra's surface water management action plan²⁴ sought to strengthen existing arrangements at the time by improving collective understanding of risk.

22 COP26: Flooding lessons from Hull, a city below sea level - BBC News

23 Multi-Agency Flood Plan (MAFP) review - GOV.UK (www.gov.uk)

24 Surface water management action plan - GOV.UK (www.gov.uk)

Defra promoted better partnership working across all the flood risk management authorities, called for ensuring that infrastructure was resilient, sought to clarify responsibilities for surface water management, argued for joining up planning for surface water management, and made the case for building local authority capacity. What was missing was long-term recovery planning. This extent of recovery planning was also missing in the 2010 Act, which did not address the support offered to communities after the waters had receded. Communities lacked support after the flooding, including for dealing with the emotional burden of loss, trauma, and stress. In Hull, it took five years to restore the city after the 2007 floods.

2.3 Understanding future risks

The EA has a strategic overview of all sources of flooding and coastal erosion. It is also responsible for flood and coastal erosion risk management activities on main rivers and the coast, regulating reservoir safety, and working in partnership with the Met Office to provide flood forecasts and warnings. It has been argued elsewhere that the EA best understands the overall flooding landscape, and holds, as the Cross Report noted, 'the intellectual firepower and expertise in modelling, forecasting and warning along with the Met Office'. However, in terms of the crossover with the planning system and permissions, the EA only maps current risks; it does not map future risks.

Under current arrangements, new development is being allowed to be delivered in places where future risks are not known, due to the lack of predictive mapping. This is consistently identified by stakeholders as the biggest concern for flood risk: that flood plains are being built on and consistently losing space for water. Civil society can only do so much with planning and mitigation under existing legislation and regulations. What is needed, as the Royal Town Planning Institute (RTPI) has argued, is sustained investment in and by local government to build capacity. What is needed is sustained investment in and by local government to build capacity. The RTPI has noted²⁵ how local authority net expenditure on planning has fallen by 43 percent, from £844m in 2009/10 to £480m in 2020/21 – a mere 0.45 percent of local government budgets are allocated to planning services.

While these figures offer a grim view on current spending levels, falling funding, and the possibility of further loss of funding, is a problem that exists across the system in other parts of local government and the EA. A lot is being asked of

planning teams, including delivering net zero. The political and technical context here is that there is strong political support for nature recovery and the access and availability of green space.

CHAPTER THREE

The planning system

The planning system, codified in the National Planning Policy Framework (NPPF), is the primary legislative underpinning of flood management in new and old developments.

This section outlines the framework in which councils operates, looks at the current risks embodied in the system and provides some case studies of improved resilience.

3.1 The policy framework: local plans and building regulations

The NPPF sets out measures for avoiding and managing risks from flooding, based on the central role of local planning authorities in preparing local plans and in deciding applications for planning permission. It makes clear that inappropriate development in areas at risk of flooding should be avoided by directing development away from these areas, towards where development is most necessary and safe without increasing flood risk elsewhere. The NPPF suggests that local plans should be supported by strategic flood risk assessments with policies in place to manage flood risk from all sources. Mitigation measures such as defences, landscaping or raising floor levels can sometimes make development acceptable. Such measures can be made a requirement of any planning consent.

Local plans should also apply a sequential, risk-based approach to the location of development to avoid flood risk to people and property, whilst effectively managing any residual risk, taking account of the impacts of climate change by:

- applying the Sequential Test
- if necessary, applying the Exception Test
- safeguarding land from development that is required for current and future flood management
- using opportunities offered by new development to reduce the causes and impacts of flooding
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations.

The NPPF was strengthened in April 2015, with a new expectation that sustainable drainage systems would be provided in all new major developments, regardless of location, unless demonstrated to be inappropriate.

What is still missing is that minor developments (nine houses or less, infill or permitted development) do not get seen by LLFAs and there are concerns that even in unitary authorities, these developments do not come under sufficient scrutiny from resource-stretched planning teams. Yet these developments can have, by virtue of their location and design, big impacts on surface water run-off – although they may individually be small developments, in aggregate they can increase the risk of surface water flooding across an area. In the year to June 2022, DLUHC planning statistics show that decisions were made on 35,282 dwellings, as part of minor developments, in areas where more than one percent of homes are already

at significant flood risk, with 6,777 of these in London or Metropolitan Boroughs²⁶²⁷. Given a national approval rate of 73 percent for minor developments, this could mean as many as 25,550 homes adding pressure to drainage infrastructure.

Table 2: Minor and permitted development in districts with >1% of homes at >1% flood risk, regional breakdown

Region	Number of flood-risk districts	Dwellings decisions in minor developments	Granted permitted development
East Midlands	29	3059	190
East of England	31	5401	311
London	16	4087	147
North East	6	564	33
North West	28	2417	183
South East	56	7370	576
South West	27	6635	516
West Midlands	27	3014	221
Yorkshire & the Humber	19	2735	134

While many of these dwellings will have been subject to flood impact assessments for the minor development itself, there is no obligation for their applications to be considered as part of the LLFA flooding strategy. The same is true of permitted development, which requires a flood impact assessment for anything in flood zone two or three, but again may avoid serious scrutiny for aggregate impact in the case of pre-approved applications. These made up 20 percent of all residential permitted development in districts with more than one percent of homes already at risk in the year to June 2022²⁸. LLFAs, the EA, and all other risk management authorities need to work closely together and ensure that the plans they are making, both locally and nationally, link up. An essential part of managing local

26 DLUHC Live Planning Tables

27 National Audit Office (2021) – Managing Flood Risk (raw datafiles)

28 Ibid.

flood risk is taking account of new development in land use plans and strategies.

Additionally, at present, there are no requirements in the building regulations themselves for flood resistant and resilient construction. Part H of the building regulations specifically covers drainage. It requires that surface water is infiltrated into the ground if practical. If infiltration is not practical, it should be disposed into a watercourse or, less preferably, a surface water sewer. Disposal into a combined sewer is the last resort in policy, compounding challenges by the water companies in how they manage combined sewage overflows and discharges into rivers and seas.

2022 Guidance update

The letter from the Chief Planner at DLUHC issued 2 September 2022²⁹ had relevant updates to policy on flooding. This update provides a significant refresh to the guidance and brings it up to date and in line with the latest policy position on flood risk introduced in the updates to the NPPF in 2018 and 2021.

Key themes of the updated guidance include:

- Elaboration of the hierarchical approach to flood risk of assess, avoid, control, mitigate and manage, that we want to see Local Planning Authorities following when allocating land for development through their Local Plans and when determining planning applications.
- Emphasis that the application of flood risk policy should be based on an up to-date strategic flood risk assessment and/or site-specific flood risk assessment.
- Greater detail on the purpose and application of both the Sequential Test and the Exception Test. Including detail on key terms such as “reasonably available” and “wider sustainable development objectives”.
- Encouragement of the use of Sustainable Drainage Systems (SuDS), advocating their multi-functional benefits including for water quantity, water quality, biodiversity, and amenity.
- Further information on safeguarding approaches, the role of planning in relocation in coastal settings, and unsustainable locations.

- Additionally, there is further detail on flood risk in relation to Neighbourhood Plans, Design Codes, article 4 direction, permitted development/change of use, and the call-in process.

3.2 Building for flood risk

The ongoing housing supply crisis in England requires more houses to be built, all of which have potential to increase the risk of surface water flooding. The challenge is in constructing modern infrastructure which does not increase the risk of surface water flooding and is more resilient to it when it occurs.

Publication of the EA's FCEM Strategy in 2020 was a major step forward in tackling the challenges of a changing climate. The strategy sets out a long-term vision for "a nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100", setting the direction to make the country more resilient to future flooding and coastal change. The strategy also contributes to net zero targets.

The strategy has three long-term ambitions underpinned by a set of strategic objectives and measures:

1. Climate resilient places: Working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the face of climate change.
2. Today's growth and infrastructure resilient in tomorrow's climate: Making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilience to flooding and coastal change.
3. A nation ready to respond and adapt to flooding and coastal change: Ensuring local people understand the risks posed by flooding and coastal change, are responsible for managing the impacts and know how to act.

The government announced in August 2022³⁰ that under the changes to the planning practice guidance developments, councils should be better enabled to apply government policy for new housing developments in areas at risk of flooding meeting recommended standards on flood resilience – for example, using flood resilient building materials or moving plug sockets higher up walls. Local areas will also have access to better guidance on how to control surface water run-off, with the use of sustainable drainage systems, to enhance the quantity

30 DLUHC, Defra (2022) – Better flood protections for new homes

and quality of water in the region, as well as protecting local biodiversity. The guidance also highlights the opportunities new developments can bring to reduce the causes and impacts of flooding using natural flood management techniques

3.3 Case studies: managing surface water

Below are some case studies, taken from Susdrain, which is an independent platform for information on sustainable drainage produced by the Construction Industry Research and Information Association.

3.3.1 Parkside development in Bromsgrove, Worcestershire

The site of the old Parkside Grammar School comprises five sub-catchments, each that produced different opportunities for SuDS components: the existing Georgian condition of the school frontage as a soakaway; the new car park north of the existing access road to the Health Centre with a series of lined permeable block double parking bays; a small access area behind the main central space with car parking and access pathways allowing partial collection of runoff; a civic square at the centre, wherein the central green space infiltrated water and had a wholly permeable surrounding space; the small entrance space acting as a collection route for some green roof runoff, collected in small planters that link directly to the path sub-base.

This SuDS is an example of fully integrated design. It has protected the buildings and surroundings from flooding and prevented polluted runoff from flowing to the stream that runs through Bromsgrove – the destination of drainage from this site.

The development retained existing conditions at the front of the school and included SuDS retrofit to the small access space behind the court and full SuDS provision where possible. In the civic space, all new surfaces act as infiltration surfaces: the peripheral pedestrian paths and central pavement are a mixture of permeable concrete block and slab paving. The central grass space was also used as an infiltrating surface, and due to being slightly lower than surrounding paving acts as a detention basin during exceptional rainfall. The swale basin is the only dedicated SuDS surface in the central area. Much of the new building has a green roof that mitigates flows and cleans the runoff before it flows to ground level infiltrating through low planters or permeable surfaces.

This was a SuDS scheme undertaken for Worcestershire County Council by Robert Bray Associates. Despite an early SuDS design meeting with the contractor, the SuDS planning was somewhat disjointed. A full SuDS

management plan was provided but in the mayhem of site handover due to a change of site agent during the contract, it was clear that the SuDS maintenance had been overlooked. The county council is now familiar with SuDS and the agreement from WCC was straightforward and supportive. Initial responses from the people now using the landscape for both occasional and daily use are very favourable, even without necessarily knowing that rainfall is managed at the same time.

3.3.2 Alma Road rain gardens in Enfield, London

At Alma Road in the London Borough of Enfield, five rain gardens were developed alongside permeable paving to reduce pressure on existing drainage and reduce flooding from intense rainfall. Surface water pollution to receiving water bodies was also reduced. Tree planting increased biodiversity and aesthetic improvement of the area, while the gardens had the added impact of traffic calming, improving safety for pedestrians.

The five rain gardens were built into the footway and carriageway of Alma Road, their areas maximised as far as possible while allowing for two-way traffic flow, bus route flows, and adequate space for footway traffic. The gardens were designed to maximise the infiltration of highway runoff into the ground, each draining a catchment area of 200m². Existing gullies were retained as an overflow mechanism. The largest garden was given a length of permeable paving to facilitate a safer crossing point and a tree to enhance the green space. The design of the gardens gives enough of an impression that the road has narrowed in order to slow traffic. Granite setts were installed at each inlet that reduce the erosion of topsoil and capture larger silt particles from road runoff. The plants in the gardens were picked for their tolerance to drought and ability to survive waterlogged conditions. These plants manage contaminants from road runoff.

Thames21 commissioned a mural by artist Jo Peel to describe the function of the rain gardens, and students from Alma Primary School contributed artwork to the final design. Local residents, students, and corporate volunteers helped with the painting, which served to promote community cohesion. Thames21 also led sessions on the water cycle, river pollution, and SuDS with Alma Primary School. The school has been keen to employ SuDS components on its premises and has retrofitted several Thames21 rain planters to intercept roof runoff. Local residents were provided with regular leaflets, posters, and had access to ward forums, with published updates in the regeneration scheme distributed to 2,000 people in local area. A mechanism exists for local people to report on flooding issues and

SuDS performance via a poster attached to the new tree and nearby lamp columns. Surveys to monitor change in public perception about the Highway SuDS have yet to be conducted, but there has been positive feedback from local residents on the look of the street, alongside positive public reception of green infrastructure and SuDS. The total cost of community engagement was £7,000.

The project was funded by the Greater London Authority, as part of investment into Green Infrastructure Sustainable Drainage Systems. Additional funding to install more rain gardens along Alma Road will be provided by the developer Countryside and London Borough of Enfield. All key stakeholders were consulted throughout and had opportunities to comment on proposals and the mural design: local residents, primary school, utility companies, TfL London Buses, developers of Alma Road Regeneration and relevant Highway and Traffic officers in the Local Authority. The Highway Services team from Enfield Council carried out adoption and maintenance of the rain gardens, and Enfield's Highway Engineers conduct site visits during and after rainfall events to monitor function of rain gardens and other flood risk assets.

CHAPTER FOUR

Moving forward

From climate change to urban development, a combination of factors has contributed to the increase in surface water flooding in English towns and cities. One thing is certain, the economics and impact look different for surface water flooding and the affected communities.

The EA has been looking at enabling smaller investments to come forward, building resilience when it comes to large amounts of rainfall in a short amount of time and the unpredictable nature of where this rainfall could occur.

The National FCERM Strategy for England³¹ sets out the overall approach for delivering flooding and coastal risk management. The Defra policy statement; 'appraisal of flood and coastal erosion risk management'³², contains the policies and guidance for operating authorities and others involved in managing flood and coastal erosion risk. The Treasury's Green Book³³ provides guidance on how to appraise and assess policies, projects and programmes. This forms the basis of FCERM³⁴ appraisal. The FCERM Handbook is a step-by-step guide for assessing the benefits of flood and coastal erosion risk management.

The FCERM Strategy Roadmap to 2026 describes how the strategy, its objectives and measures, will be acted upon over the next four years to 2026, and what will change as a result. This roadmap directly supports the implementation of the £5.2bn Flood and Coastal Erosion Risk Management Investment Programme which will offer better protection for many hundreds of thousands of properties over the next six years to 2028. The roadmap incorporates the government's £200m Flood and Coastal Resilience Innovation Fund³⁵ which funds three programmes:

- The Flood and Coastal Resilience Innovation Programme which will enable local authorities, businesses, and communities in 25 places to test and demonstrate innovative practical resilience actions.
- The Adaptive Pathways Programme which will develop long-term investment plans for managing flooding and coastal change to 2100 and beyond in strategic locations including the Thames Estuary, Humber Estuary, River Severn, and wider Yorkshire.
- The Coastal Transition Accelerators Programme which will support communities in areas at significant risk of coastal erosion to transition and adapt to a changing climate.

These innovation programmes will improve the evidence on the costs and benefits of innovative resilience actions as well as help inform future approaches to, and investments in, flood and coastal risk management.

At the national scale, the EA writes the FCERM appraisal guidance, and reviews it regularly, updating it where possible to address specific funding barriers. A project is ongoing to review and update the current guidance so that smaller schemes, including surface water management schemes, can better access FCERM Grant in Aid funding. Risk management authorities can appraise a FCERM project, prepare the business case and submit it for technical and financial approval.

31 Environment Agency (2020) – National Flood and Coastal Erosion Risk Management Strategy for England

32 Defra (2011) – Appraisal of flood and coastal erosion risk management: A Defra policy statement (June 2009)

33 HM Treasury (2022) – The Green Book: appraisal and evaluation in central government

34 MCM – The Handbook

35 Environment Agency, Defra (2022) – Flood and coastal resilience innovation fund

Funding is one of the major issues in delivering resilience against surface water flooding. Notwithstanding the capital investment in infrastructure previously mentioned, government criteria can be overly restrictive, especially for smaller projects. This tends to disproportionately impact deprived places that are left off the agenda and left behind. There is a need to help people understand what they can do themselves through flood action groups to recognise flood risk. Partnerships should start at grassroots with planning and talking to those who have experience of past flooding.

This research not only revealed that people should be at the heart of any surface water flooding response, it highlighted how there is also a case for stronger partnerships. The rationale for stronger partnerships revolves around a desire to not put more pressure on communities to make themselves resilient. With communities and residents already enduring the cost-of-living crisis, there is a reluctance or perceived unimportance amongst some to the thought of investing to make their homes flood resilient.

5. Recommendations

The most prominent finding of the engagement carried out with stakeholders as part of this research was the need for greater partnership working:

- There should be **more joined-up working and stronger communication** between lead local flood authorities and risk management authorities, particularly on matters of land use. This also involves the Environment Agency.
- Collaboration between developers, landowners, lead local flood authorities (LLFAs) and central government agencies to understand and manage flood risk and resilience must be **encouraged and incentivised across all new developments**.

Beyond that, there are actions to be taken by both central and local government to ensure greater resilience to flooding in general and surface water flooding in particular:

Central government:

- Produce **a comprehensive flood infrastructure funding programme** that is less restrictive and targeted toward places most at risk.
- Encourage 'bottom-up' practice by streamlining the funding process for smaller, district or community-based projects.
- Produce a **legal framework for local resilience forums** that is informed by local experiences.
- Strengthen **accountability and support mechanisms for communities** affected by flooding – ensuring that they are relative to the scale of the flooding and subsequent damage.
- Introduce provisions for **all, including minor, developments to be monitored** by lead local flood authorities regarding their flood risk management.
- **Training should be provided to planning departments** of lead local flood authorities as part of a more strategic push to ensure that infrastructure projects and their contracts have strong, actionable flood provisions.
- The next revision of the National Planning Policy Framework must require local plans to **demonstrate how lead local flood authorities have assessed aggregate risk across the whole area**, as well as how flood impacts will avoided, controlled, mitigated, and managed.

Local government:

- For infrastructure and procurements concerning flooding, lead local flood authorities should **move away from human-engineered barriers and toward natural drainage systems** that work to slow the flow of surface water and relieve pressure on sewers.
- Lead local flood authorities should identify land that is required for current and future flood management and safeguard it from other developments.
- In absence of flood resilience provisions in building regulations, lead local flood authorities should look to **build such provisions into infrastructure projects** and their constituent contracts.
- Lead local flood authorities should **ramp up public engagement in surface water flood risk localities** to produce a contextualised support package and contribute to a mapping of relative flood risk from neighbourhood to neighbourhood.



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