



London Climate Resilience Review

Interim Report

Emma Howard Boyd CBE with George Leigh and Johanna Sutton

January 2024

CONTENTS

- Foreword 2
- Executive summary 4
- Introduction 7
- London’s climate risks 10
 - Heat 10
 - Drought 10
 - Rising sea levels 11
 - Surface water flooding 11
 - Wildfires 12
 - Subsidence 12
 - Wider climate risks 12
- Key findings 13
- Recommendations 16
- Table of recommendations 36
- Acknowledgements 42
- References 44

FOREWORD

London is a modern city steeped in history, an international economic hub 21% of which is covered by trees, and it could be home to 10 million people by 2040.^{1 2} Resilience is woven into the fabric of London. For 2,000 years, people have chosen to live and work here side by side. That long-brokered network of connections between Londoners (95% of whom live within 400 metres of a bus stop) holds together like a web.³

The UK has been viewed as a global leader in climate change mitigation for nearly two decades. Many aspects of that leadership are still strong even if the political rhetoric has shifted since we began this Review. As heat, floods, droughts, sea-level rise, storms, and wildfires affect lives in cities all over the world, London can be a global trailblazer in showing how adaptation and resilience can deliver wellbeing, prosperity and support nature.

London is not an island; the whole country needs strategic leadership to adapt. The UK government's Third National Adaptation Programme addresses many of the right risks yet lacks serious strategic vision. Last year, 2023, was the world's warmest calendar year on record and the UK's second warmest on record.^{4 5} London can't wait for unassailable policy positions, we need pace not perfection. In the absence of national leadership, regional government has a more significant role to play. As Sam Freedman wrote for the Institute for Public Policy Research: "*Any politician who, looking at the data we have, concludes it's all too difficult and people are unpersuadable, is in the wrong job.*"⁶

The UK's public finances are stretched. Local authorities want to invest in projects that offer strategic value but are competing against neighbouring councils for ever smaller pots of money. Many are outsourcing work to fulfil their statutory responsibilities. The London Assembly's GLA Oversight Committee has urged further devolution to support regional growth,⁷ as has the Skidmore Review on Net Zero.⁸

Many countries experience more devastating climate events than the UK. At international climate summits adaptation plays second fiddle to net zero. Industrialised nations continue to undercut commitments to financing adaptation while others face catastrophic impacts. The Prime Minister of the Bahamas has said: "*Frankly, we do not understand why everyone does not share our sense of urgency. Doing what is needed to help us, also helps you.*"⁹

The people who have contributed the least in terms of carbon emissions usually suffer the most in terms of weather impacts. This is true in London where the poorest Boroughs are hit hardest.¹⁰ The climate crisis is a health crisis and will widen

inequalities. The pressures on different demographics need consideration, complex work that is the responsibility of governments but not exclusively. Partnership and collaboration can help ward against maladaptation. I've visited Boroughs where engagement with residents to create neighbourhoods with more green space is also reducing flood risk, providing shade, and supporting thriving communities.

London is currently underprepared for climate shocks but nowhere in the world is adapting fast enough. In the United States in 2023, there were 28 confirmed weather and climate disaster events collectively resulting in losses of at least \$92.9 billion, with losses as a result of each disaster event exceeding at least \$1 billion.¹¹ This is not only about avoided losses, action on adaptation and resilience can provide returns on investment between 2:1 to 10:1, and sometimes further.¹² London has a world-leading insurance market, pioneering scientific institutions, a thriving technology sector, international banking and around 19% of the UK's private sector businesses.¹³ London can be the world's lighthouse, lighting the way for global investment in preparing for climate impacts and improving the health, lives, and prosperity of millions of Londoners today, by 2030, and beyond.

Emma Howard Boyd CBE, Chair of the London Climate Resilience Review

EXECUTIVE SUMMARY

The London Climate Resilience Review (the Review) is an independent review commissioned by the Mayor of London to take stock of London's preparations for climate change and to make recommendations to advance London's climate resilience. The Mayor called for the Review following accelerating climate impacts in the UK and around the world. In London, the extreme flooding of July 2021 damaged homes and properties, costing local authorities tens of millions, with aggregate insured losses estimated to be over £100 million, displacing residents and disrupting critical services to vulnerable Londoners.¹⁴ In 2022, there were 3,271 heat related deaths in England and 387 in London.^{15 16} The 2022 heatwaves would not have happened without climate change but many of those deaths would have been preventable. The heatwaves caused widespread failure of green infrastructure including street trees. In Epping Forest alone a total of 76 fires were reported between 26 June and 16 August 2022. The extreme heat stretched water supplies, melted road surfaces and caused disruptions to rail infrastructure. Social care, education and healthcare face major disruptions across London. The aggregate costs are not known.

The Review is exploring actions needed at the national, regional and local level to reduce climate impacts on people, infrastructure, nature and the economy in London. The Review has run a comprehensive research and engagement process to deliver its assessment of London's climate resilience and to inform recommendations to guide London's preparation for more frequent and intense climate hazards. This includes a call for evidence with submissions from 89 organisations and individuals, 12 expert roundtables, and over 100 meetings with London organisations.

The Review's findings will be split into two parts. This is the Review's interim report, which will set out strategic and urgent recommendations. The Review's full report will be published later in 2024 and will include our full findings and complete set of recommendations. This report sets out 20 recommendations which call for strategic, delivery, capacity building or investment actions. The Review has indicated high level timeframes for recommendations. Recommendations are directed to stakeholders across London, including the Mayor of London, UK government, local authorities and the community and voluntary sector. We are keen to hear any feedback on this report by **16 February 2024**.

The Review has found that significant climate adaptation and resilience action is underway across London. Examples include the delivery of adaptation actions and plans for schools across London through the Climate Resilient Schools programme and the work with Boroughs and other stakeholders to develop London's first surface water

flooding strategy plus a variety of programmes to better prepare London for hotter temperatures and heatwaves.

However, due to the degree of global heating which is projected a step change is needed. Current policies mean that the world is on track for a 2.5-2.9°C temperature rise above pre-industrial levels this century¹⁷ a rise that will have disastrous consequences and London is underprepared. Climate hazards are increasing in severity and frequency, and London faces significant risks including more intense and frequent heatwaves, more intense rainfall, the risk of flash flooding and sea level rise. Our key recommendations in the interim report are about governance and strategic planning for London as well as ensuring investment for adaptation is prioritised and delivered.



Flooding on Tower Bridge

Climate change will not impact Londoners equally, but we can ensure preparations work to protect the Londoners at highest risk. Climate change intersects with health, social and economic inequalities. We must work to identify those

who are exposed to climate hazards, and more vulnerable to them, with the least means to adapt by themselves. Adaptation action should contribute to a more equal, sustainable and climate resilient London.

Throughout our work the following principles have evolved. We believe they should guide action on climate adaptation and the implementation of our recommendations:

1. Adapting London to climate change must take a people centered approach, be locally led, work to reduce vulnerability and to address socio-economic and racial inequality.
2. Climate change adaptation must be embedded across decision making and organisations should ensure adaptation is owned at the strategic level, with responsibility for adaptation clearly assigned.
3. Climate change adaptation must be integrated with work to achieve net zero for coherent action.
4. Adaptive pathways approaches should be used. Climate change is unpredictable, while we act on known risks and critical thresholds, it is important to be flexible.
5. Nature-based solutions must always be considered and prioritised.

INTRODUCTION

This is the interim report of the London Climate Resilience Review (the Review). It features some headline findings about strategic gaps and opportunities in London's preparations for climate impacts like flooding, storms, extreme heat, drought and more.

The Greater London Authority (GLA) has a legal duty to take account of climate change in undertaking its functions. The GLA does not have the powers or resources to directly deliver all of London's required climate adaptation solutions, but the GLA Group and Boroughs have a combined procurement spend of around £19bn per year.¹⁸ All of that money must be used in a way that builds resilience to climate shocks.

The Mayor commissioned an independent review in mid-2023 to advance London's adaptation to increasing climate change impacts. Despite action, climate hazards are increasing in severity, frequency, and duration. As the climate changes we learn more about how we should prepare; this affects our long-term decision making. For example, London is well protected from tidal flooding by the Thames Barrier and other flood defences. Today, effective monitoring of sea level rise means we know the deadline for raising flood defences upstream (west) of the Thames Barrier has been brought forward 15 years to 2050.¹⁹

We are using the London Environment Strategy's definitions of adaptation and resilience. The London Environment Strategy says: "*Adaptation is the process (or outcome of a process) that leads to a reduction in harm or risk of harm, or realisation of benefits associated with climate variability and climate change. Adaptation policies can lead to greater resilience of communities and ecosystems to climate change (see 'Resilience').*" And "*Resilience is the ability of a system to recover from the effect of an extreme load that may have caused harm. Adaptation policies can lead to greater resilience of communities and ecosystems to climate change.*"²⁰

The Review team have been provided with evidence from organisations and communities who play interconnecting roles in London's day-to-day activities and long-term planning. This includes London anchor institutions²¹ such as the NHS, functional bodies like Transport for London (TfL), the London Fire Brigade, and the Metropolitan Police Service. Also, unions; the voluntary and community sector; local, regional and national government; businesses such as utilities companies, insurance firms, banks, private and public property owners, sports clubs and venues, cultural institutions, and environmental NGOs.



Flooding in London, November 2022

The Review has worked to understand London’s preparedness for physical climate impacts and to identify next steps to enhance climate resilience and nature. This is not a comprehensive audit or cost-benefit analysis of all climate impacts and adaptation action. London can be viewed as a system made up of many interdependent and interconnected parts. London’s transport infrastructure is dependent on energy infrastructure which is dependent on water infrastructure and vice versa; disruption to one part of the system has cascading effects. These interdependencies extend beyond London’s boundaries, so we have considered impacts and solutions beyond London. For example, research on integrated water management has shown how water supply in East London is dependent on nature-based solutions in Hertfordshire.

We will hand a full report to the Mayor later in 2024. We are publishing this interim report now to allow our key findings and overarching recommendations to inform all Mayoral candidates’ manifestos. Our final report will cover governance and climate

adaptation; the built environment and supporting systems; communities and climate adaptation, and London's economy.



Langdon Park, East London in the middle of a heatwave, July 2018 ([Matt Buck](#))

LONDON'S CLIMATE RISKS

HEAT

As late as January 2022, the Climate Change Committee was saying there was a “small chance” of temperatures reaching 40°C in England before 2040.²² In July 2022, London hit 40°C. During that heatwave, the London Fire Brigade received 2,496 calls, including 740 relating to wildfires, and operations were cancelled at Guy's and St Thomas' hospitals as IT servers broke down in record heat.²³ The East Coast mainline was disconnected from King's Cross as trainlines buckled and overhead lines sagged. In 2022, there were 3,271 heat related deaths in England and 387 in London.^{24 25} The 2022 heatwaves would not have happened without climate change²⁶ but many of those deaths would have been preventable.

Heat exposure led to 470 billion potential labour hours lost globally in 2021 and 6 million potential labour hours were lost in the UK to heat exposure in 2021, costing an estimated £94m.^{27 28} A growing body of international research suggests that rising temperature increases some violent crimes, such as intentional homicides, sex offences, and assaults.²⁹ The Review has been told by senior staff in the NHS that hot weather results in more people in mental health crisis. Air quality is also affected, particularly with wildfires. In the Mayor's report, “Climate Adaptation Plans for Schools”, schools said that overheating had a significant impact on students' learning, productivity or behaviour.³⁰

In 2021, the Climate Change Committee said: “*Since CCRA2 [Climate Change Risk Assessment 2] was published [2017], over 570,000 new homes have been built in England alone that are not resilient to future high temperatures. These will require costly retrofit to make them safe, habitable and water efficient in the future. In the next five years, at least another 1.5 million homes are due to be built across the UK; these will also lock in increased climate vulnerability unless planning and building policy is changed now.*”³¹ Heatwaves also cause damage to trees which provide shade. Analysis carried out for Friends of the Earth, found that inner-city areas with fewer trees and green spaces were up to five degrees hotter in July 2022 than those with more tree cover and plant life.³²

DROUGHT

In England, if no action is taken by 2050 the nation's public water supply will face a shortfall of nearly 4 billion litres of water per day.³³ London is already an area of serious

water stress.³⁴ Thames Water said: *“London saw temperatures exceed 40 degrees, a 50% increase in water consumption and our reservoirs were at their lowest for 30 years.”* The National Audit Office said: *“The economic costs of the 2012 drought in England were £165 million in revenues and £96 million in profits, based on a 2013 estimate.”*³⁵ It has been estimated that not having enough water to go around would cost London's economy alone £500 million each day.³⁶ It would also kill wildlife and concentrate pollution in rivers. London needs a new reservoir, significant investment to reduce leaks, smart metering, and greater public education about water efficiency actions. We will say more about drought risk in our final report.

RISING SEA LEVELS

London's existing river defences currently protect homes, critical infrastructure, and businesses. Sea level in the Thames Estuary is expected to rise by around 1.15 metres by the end of this century.³⁷ Of the total 330 kilometres of flood defences in the Thames Estuary there are 126 kilometres upstream (west) of the Barrier and just 9 kilometres of these (7%) are sufficiently high to last beyond 2050. Proactive action to strengthen the Thames' defences presents an opportunity to invest in London's riverside.

SURFACE WATER FLOODING

Flooding poses a lethal risk to Londoners. In July 2021, London was hit by two extreme rainstorms; some parts of the city received more than twice the average July rainfall in two hours causing major disruption and over 2,000 properties flooded with stormwater and sewage. More than 30 tube stations were affected; hospital wards were evacuated. Of all properties at risk of flooding (coastal, fluvial, groundwater and surface water) across England, 60% are at risk of surface water flooding.³⁸ At a roundtable hosted for the Review by the Better Buildings Partnership a major commercial real estate provider in London said 20% of their occupied commercial properties had to be vacated due to flooding from summer rainfall. Analysis from Zurich UK said flooding from torrential rain threatens 42% of the capital's 301,000 commercial buildings.³⁹ The average cost of flooding to a home is £30,000 and £82,000 to a business.⁴⁰ In its report on the impact of climate change on sports in the UK, BASIS (the British Association for Sustainable Sport) said: *“For football and rugby union, the 25% overall increase in winter rainfall means experiencing wetter conditions more often.”* And *“In evidence provided to a Select Committee in the UK Parliament, the Chair of the FA Debbie Hewitt revealed that “we have something like 120,000 games a season cancelled because the pitches are not playable”.*⁴¹

WILDFIRES

Wildfires are a growing threat at London's rural/urban interface, as shown at Wanstead Flats in 2018 and Wennington in July 2022. These events highlight the importance of informed land management where planning boundaries meet the natural environment. Wildfires are increasing in frequency and intensity around the world. For understandable reasons the public focus on this risk tends to be through the lens of emergency response (i.e. after ignition). More focus should be on prevention. Havering Borough Council told the Review: "*The very infrastructure of Boroughs like Havering (and villages like Wennington) – with a significant level of rural-urban interface – presents a substantive challenge to preventing and managing the ever-increasing likelihood of wildfires.*" The Wildlife Trust also told us wildfires pose a significant risk to nature, and the preservation of biodiversity must be considered in any wildfire strategy. England does not yet have a national strategy or action plan for managing wildfires.⁴²

SUBSIDENCE

Around 43% of properties are likely to be affected by subsidence in London by 2030.⁴³ The British Geological Survey says this problem is exacerbated by climate change. Thames Water said: "*The weather conditions during 2022/23 have challenged us operationally and we're not where we'd like to be on leakage. The hot and dry summer last year created an unprecedented 'soil moisture deficit'. As the ground dried out, our pipes and our customers' pipes moved and cracked, leading to an increase in leakage.*"⁴⁴ London is especially vulnerable due to its clay rich soil, its density of infrastructure and buildings and high exposure to heat and drought.

WIDER CLIMATE RISKS

Even though these are not the focus of the Review it is important to note that London is vulnerable to climate shocks elsewhere in the world. For example, storms and floods can cause failures in energy and food supply chains; droughts can cause migration and conflict. The College of Policing cites global conflict, particularly where UK populations have heritage in affected regions, as "*a factor which may indicate or cause changes in community tension.*"⁴⁵ There are also many risks to London in need of further scientific research. For instance, the rise of tropical diseases is covered in 2023's "Health Effects of Climate Change" report.⁴⁶ We have focussed on the main risks highlighted in evidence submitted to the Review.

KEY FINDINGS

The UN says the world is on track for a 2.5-2.9°C temperature rise above pre-industrial levels this century and the World Meteorological Organization says Europe is warming faster than anywhere else in the world.^{47 48} While we should redouble global efforts to reduce greenhouse gas emissions, London's climate adaptation strategy should be aligned with this overarching trajectory. Preparing for anything less would be an unacceptable gamble with people's lives and taxpayers' money. In 2023, the UN Environment Programme said: *"Even if the rise in temperature eventually slows as a result of more ambitious collective climate change mitigation efforts, climate risks will accelerate with every fraction of a degree because of the compounding and cascading nature of climate-related impacts."*⁴⁹

The whole world is underprepared for extreme weather. In 2023, temperature records toppled, while floods, droughts and heatwaves caused devastation. The UN Environment Programme Adaptation Gap Report 2023 found that progress on climate adaptation is slowing when it should be accelerating to catch up with rising climate impacts.⁵⁰

The Third National Adaptation Programme (NAP3)⁵¹ published in 2023, is inexcusably lacking in ambition given the floods and rising temperatures we now see in England. A lack of international and national strategy is holding back local and regional actors from delivering more and securing long-term investment.

Failure to prepare for climate impacts heightens risks and threatens efforts to reach net zero.⁵² Without due regard to climate adaptation, risk is "baked-in" to the lifetime of assets, projects become less viable, and the benefits reduce over time. The cost of unmitigated climate impacts will divert away from investment in net-zero.

Vulnerability to climate hazards is unequal in London. Research by CDP (Carbon Disclosure Project) has found that across the UK's local authorities low income households, elderly people, marginalised and minority communities, children and youth and vulnerable health groups are consistently the most vulnerable to climate hazards.⁵³ The percentage of the population aged 65 and above is growing and *"climate impacts pose a significant challenge to the health and wellbeing of older people, particularly those who live in vulnerable locations or lack the physical, mental, social, and financial resources needed to avoid or minimise the effects of extreme weather."*⁵⁴ Disability Rights UK told us that people are disabled by barriers in society, not by their impairment or difference; adaptation can build in accessibility by actively engaging disabled

Londoners. Around the world women's health and incomes are disproportionately vulnerable to climate impacts; the UK Health Security Agency (UKHSA) has said pregnant women are a key group at risk from hot weather and is currently considering the effects of hot weather on menopausal health.^{55 56}

The poorest and minority communities are among those who will be hit the hardest by climate impacts.⁵⁷ Poorer Londoners are more likely to live in housing that is not well adapted to high temperatures, meaning they are more vulnerable to heat, and more likely to live in areas vulnerable to flooding and less likely to have flood insurance. UK statistics show that people in Bangladeshi, Pakistani and Black ethnic groups are the most likely to be living in deprived neighbourhoods.⁵⁸ The Office for Health Improvement and Disparities told us: "*Climate change will exacerbate and widen existing inequalities. This is because people who experience health inequalities have poorer health and are more likely than the general population to have health conditions that are made worse by, for example, extreme heat and cold.*"

Ensuring the most vulnerable benefit from adaptation should be a guiding principle. Adaptation action will help all Londoners prepare for and to recover from climate events, such as flooding or extreme heat. The London Borough of Newham's Just Transition Plan is a new approach to adaptation and net zero that says "*climate stress in Newham is an intersectional issue*" and commits to "*leveraging the Just Transition to improve the employment opportunities, living conditions, health and wellbeing of all Newham residents.*"⁵⁹ The GLA's Climate Risk Map helps the Mayor and other London-based organisations to target resources to support communities at highest risk of the impacts of climate change.⁶⁰

In September 2023, the GLA's Public Health Unit hosted a workshop bringing together leads from across the healthcare system in London to inform the Review. There was widespread appreciation that climate change is increasingly having an impact on the sector but attempts to forward plan were often side-lined by immediate pressures on acute care, the elective surgery backlog, industrial action, and significant resource constraints as well as lack of awareness and strategic oversight about how local authorities and the NHS should be working together. The "Health Effects of Climate Change" report 2023, said: "*The total costs of heat-related mortalities from climate change and related socio-economic change in England have been estimated at approximately £6.8 billion per year in the 2020s, rising to £14.7 billion per year in the 2050s.*"⁶¹ It has been estimated that Londoners avoid £950m per year in health costs due to public parks. This figure is made up of reduced disease risk due to higher levels of physical activity and improved mental health due to access to parks.⁶² The Mayor could incorporate adaptation in the Health Inequalities Strategy.⁶³

Adaptation to climate change should be a part of all decision making at the GLA, including its functional bodies, and London Boroughs. The Mayor does not need to wait for national government to provide strategic priorities for adaptation. Exemplary urban climate resilience in London will help other decision-makers to accelerate action. The Mayor has brought ambition to London's institutional efforts to reach net zero, and including climate adaptation in the GLA's climate budgets is a step in the right direction.

Adaptation isn't just about new initiatives, continuity and maintenance are vital. Communities need spaces to keep cool and streets with good drainage. Big capital projects and new schemes attract attention but preparing for climate change is also about investing in long-term maintenance and jobs for people with the skills to carry it out.

Adapting London will benefit the whole UK. London is home to critical national infrastructure, including key hospitals and transport hubs. In 2021 the gross value added per job in London was on average £81,400, 40% higher than the UK average.⁶⁴ This is vital to the Treasury. Lost output from heat and humidity related reductions in labour productivity are already significant in London, losses in a typical year are valued at £577 million by research carried out by Vivid Economics for Arsht-Rock.⁶⁵ During the week of the July 2022 heatwave, TfL lost £8.4 million in revenue across their operations.⁶⁶

Preparations for severe weather are taking place all over London, but now a step change is needed. The Review recommends an adaptive pathways approach, supporting decision-makers to identify what actions can be taken now and in the future.⁶⁷ Adaptive pathways enable places and organisations to better plan for future climate hazards by being agile to the latest climate science, growth projections, investment opportunities and other changes to the local environment.⁶⁸ At a roundtable hosted for the Review by AtkinsRéalis one participant said: "*Adaptation is powerful when people imagine the future they want rather than tweaking the edges of the system we have.*" The London Plan drives action with policies on areas such as overheating and cooling, urban greening, and flood risk management.⁶⁹ London must retain its ability to go further than national minimum standards.

RECOMMENDATIONS

The Mayor can provide regional strategic leadership but success depends on collaboration and implementation. In the following pages we set out recommendations for the Mayor and others.

1. Recommendation for the Mayor of London: The Mayor leads collaborative work with local authorities, the private sector and others to set out a clear strategic vision for what it means for London to be adapting well to climate impacts by 2030 and beyond.

The Mayor should lead collaborative work to set a vision for a London that is adapting well to climate change. This should guide the development of a strategic approach, or regional framework, to increase London's climate resilience to physical impacts. It should support policymakers and stakeholders in the development of coherent and effective policies and action. The UK's expert climate advisers have said much remains to be done to improve planning for a minimum rise in global temperature and the UN says the world is on track for a 2.5-2.9°C temperature rise above pre-industrial levels this century.^{70 71} While continuing to deliver the highest net zero ambitions, preparations should be guided by up-to-date climate change projections. This should include a minimum global temperature rise that London organisations should plan for, and that will help them set their own thresholds for action. As a part of this, the Mayor could support London to prepare for more frequent and extreme acute events not just steady change.

The need for the Mayor to set this out is particularly important because of the absence of a clear strategic vision from the UK's national government. The National Audit Office report "Government resilience: extreme weather" praises the UK government's Resilience Framework but says *"the framework does not set out a well-defined vision for what a resilient UK looks like, including targets and standards for the desired level of national, local or sectoral resilience. For three of the four extreme weather risks we examined (all except drought), government has not specified what outcome it is looking to achieve, such as target levels of preparedness or resilience, or the amount of risk that it is willing to accept in the pursuit of those outcomes (risk appetite). Without these, government cannot make informed decisions about trade-offs between long- and short-term priorities, investment or funding allocation of priority areas. It also makes it difficult for government or other stakeholders to track progress and evaluate how effectively and efficiently government is using public funds to improve national resilience."*⁷²

The UK government's Third National Adaptation Programme (NAP3), published in July 2023, does provide a vision for England: "*The UK government's vision for adaptation is for a country that effectively plans for and is fully adapted to the changing climate, with resilience against each of the identified climate risks.*"⁷³ However, "*fully adapted to the changing climate*" lacks clarity and precision so this does not support alignment among all those who play a role in delivering the ambitions of NAP3.

This is disappointing because in 2022, the Department for Environment, Food and Rural Affairs (Defra), alongside the UK Research and Innovation's Sciencewise Programme, Ipsos and the University of Leeds, developed a more precise vision. As part of a public dialogue to explore the public's perspectives of how they think the government, businesses and civil society should address adaptation, participants' concluding vision for a well-adapted England "*was one of human safety and well-being where people have access to basic services and well-maintained infrastructure. They live in a prosperous economy that capitalises on green opportunities and provides green jobs, sustainable agriculture and increased urban green space. Economic impacts of adaptation have been distributed fairly with no exacerbation of existing inequalities. This England is adaptable and well-prepared; everyone is well-informed; net zero and adaptation measures are carried out in tandem and given equal importance.*"⁷⁴

A clear national strategic vision is needed, but in its absence the Mayor can take a regional lead. The London Sustainable Development Commission has said: "*London needs a shared vision of how to achieve a fair, net-zero city.*"⁷⁵ That should be a complementary piece of work. We are keen to hear, by 16 February 2024, from Londoners and London organisations about who should be consulted in creating the vision.

2. Recommendation for UK government: In line with the Second National Infrastructure Assessment (Recommendations 28 to 31) by 2025, government should work with relevant sectors and update resilience and technical standards above and beyond the minimum projected rise in global temperatures.

A 2.5-2.9°C global temperature rise above pre-industrial levels this century will increase disruption to services from severe weather in London so people should be informed about the levels of service they can expect in the future. Recommendation 1 shows how the Mayor can help prepare people and infrastructure in London, but national government has a vital role in setting resilience standards and targets for key climate risks such as flooding and heat.

For example, in July 2022's heatwave the East Coast mainline was temporarily disconnected from King's Cross; this was not an acceptable level of service but given more regular and severe hot weather in the south east, it may be that rail operators are permitted to run a slower, reduced service in the future. TfL has said to the Review that they would like more clarity about minimum levels of service UK passengers should expect under different extreme event conditions in the future as this would help all transport providers to align their plans. The London Borough of Havering suggested to the Review that the Mayor "*share technical experience on infrastructure resilience given the predicted increases in temperatures which may require new materials and techniques to build in resilience in the future.*"

The Institution of Mechanical Engineers has said: "*although it is relatively easy to agree at an early stage of project procurement that the design needs to be 'resilient' to hazards, the reality is that heat impacts, vulnerability and risks cannot be addressed using many current standards and design codes, due to their reliance upon data for the past climate.*"⁷⁶ The Institution for Civil Engineers, the Climate Change Committee, and the Fabian Society with the Association of British Insurers (ABI) have all called for resilience standards.^{77 78 79}

The Second National Infrastructure Assessment makes practical recommendations (Recommendations 28 to 31) for how resilience standards and technical standards should be updated.⁸⁰ Deciding appropriate timelines for action is a sector specific activity. Decisions should depend on the lifetime of assets. Government and regulators should be working with experts to set basic expectations and legal requirements, but it is currently losing time. The Second National Infrastructure Assessment said: "*The government has committed to publishing resilience standards by 2030, but this will miss the next round of regulatory cycles...*" so "*if government does not set out clear service standards until 2030, around £400 billion of future investment in infrastructure may not be optimised fully for resilience.*"⁸¹

3. Recommendation for the Mayor of London and London Boroughs: The GLA and London Boroughs' finance processes should include a set of questions about climate risks to ensure spending is climate resilient, and the GLA Group's functional bodies should set adaptation plans and measurable targets.

The GLA Group and Boroughs have a combined procurement spend of around £19bn per year.⁸² The Mayor does not have complete discretion in how London's budget is spent due to restricted funding requirements but where the Mayor and Boroughs have decision making power, spending should be climate resilient to, at least, minimum climate projections. A 'comply or explain'⁸³ model should be used for the GLA's

investment to ensure that all spending by GLA functional bodies is able to withstand foreseeable climate events. Nature-based solutions should be prioritised.

Where the Mayor has decision making power over budgets, the GLA Group's departments and functional bodies should aim to lead on climate adaptation. This should include developing climate adaptation plans which consider minimum climate projections and set out targets as well as directives to embed nature-based solutions (where possible). This could be supported with the GLA's Climate & Equalities Tool which asks users questions about possible climate and equalities impacts of projects to help integrate the Mayor's statutory requirements on climate and equalities. The GLA Environment and Energy Unit's adaptation team could lead on internal capacity building.

The GLA's leading climate budgets process should be used to monitor progress towards targets. The Mayor should also continue to support local authorities to explore climate budgets as a useful process for ensuring short-term actions (typically annual budgets) deliver long-term climate targets (in line with the city's climate action plan or Net Zero Pathway). We would like local authority feedback on this recommendation by 16 February 2024.

4. Recommendation for UK government: Develop funding programmes and increase fiscal devolution for regional and local organisations to accelerate climate adaptation.

Public money in the UK is stretched and plans need resources, or at least a clear route to secure resources. The Local Government Association said "*It is understood how stretched local authorities are on officer resource and budget, and that a key priority at the moment is just survival. As such, if there is no funding or finance provided for non-statutory activity it is likely to be overlooked by finance directors.*"⁸⁴

Whereas climate mitigation is a global priority, adaptation is place-based work and local communities are often best placed to understand their priorities. Local authorities who want to invest in projects that offer long-term strategic value are competing against neighbouring councils for increasingly small pots of money and outsourcing work to fulfil their statutory responsibilities. Greater fiscal devolution and flexibility would allow local authorities more freedom to put in place frameworks and policies to incentivise investment in locally led action. For example, tax incentives & rebates, risk sharing for investments, and programmes that cover upfront investment costs which can be paid off over time.

If aspects of climate change adaptation become statutory requirements for local authorities, this should be matched with long term, non-competitive funding. Funding could be distributed using climate vulnerability assessments (whereby the most climate

vulnerable local authorities receive the most support) but also based on applications for innovative, revenue generating projects. The London Sustainable Development Commission has said: “*National government should devolve the further funding and powers needed to accelerate local action tailored to residents’ needs.*”⁸⁵

5. Recommendation for the Mayor of London: A regional strategic plan for adapting to higher temperatures in London could be developed with a governance framework that sets out roles and responsibilities.

In September, the Met Office told the Review that for London “*analysis, using the latest, high emissions scenario, UKCP-Local (2.2 km) data from convection permitting climate projections, show that the frequency, duration, and peak temperature of heatwaves, increase in the future climate. Also, the number of days above 30°C is 2 and 6 times larger in the 2030s and 2070s, compared with the 1990s.*”

We are entering a new era, but the UK is culturally more familiar with preparing for cold winters than treating hot weather as a hazard. The UK does not have a national heat strategy. The Adverse Weather and Health Plan⁸⁶ concerns arrangements for planning and response in the health system to deliver the best outcomes possible during adverse weather, including heatwaves. The Adverse Weather and Health Plan is not for other sectors, like housing and buildings. There is no national strategy to adapt people and communities, business, infrastructure, and nature to the higher temperatures and extreme heat we expect to see with climate change. ad

Many cities around the world already have heat strategies and London could quickly learn from work underway elsewhere. Kate Gallego is the Mayor of Phoenix, the hottest city in the USA. Gallego has said: “*We have probably 30 ideas about how to respond to heat. If New Orleans already knows 25 of them but they benefit from five new ones, that could be incredible. It’s the same for mayors in Texas, who have lost too many lives already.*”⁸⁷ Many heat related deaths are preventable, actions such as registers of vulnerable people; local heat plans; capacity building to help keep vulnerable groups safe, education, urban greening, and warning and informing can all increase resilience.

National strategic leadership on adapting to hotter temperatures is needed, but in the absence of national action, the Mayor can take a regional lead. After the surface water floods in 2021, the Mayor convened the London Surface Water Strategic Group, bringing together public and private sector partners to decide how to address surface water flood risks strategically throughout London. That Group is now at the stage where we believe it could be put on a statutory basis (see Recommendation 13). No similar group yet exists for heat.

Key partners need to be convened, especially in public health and social care, the built environment and infrastructure, as well as academia, local, regional, and national government. The strategic plan could be worked on at an expert level. The strategic plan would consider preventing and reducing overheating in infrastructure (for example, Hammersmith Bridge which became unsafe during 2020's heatwave⁸⁸) and social infrastructure, such as care homes and hospitals. It would also look at reducing health impacts and provide strategic leadership for Borough level heat plans.

The strategic plan should support London's economy by ensuring London continues to see healthy footfall in hot weather, and support London's sporting and cultural institutions to manage higher temperatures. At a roundtable held for the Review by South Ken ZEN+, employees of a popular museum told us: *"We are often a safe haven for members of the public wanting to escape heatwaves and find a cold place to sit or spend the day as some of our rooms are air conditioned. If heatwaves continue to be more frequent, this could impact on us as we cannot exceed maximum safe numbers of visitors at any one time."*

6. Recommendation to the London Resilience Partnership⁸⁹: Conduct an exercise to test London's preparedness for a severe heat episode and identify potential cascading and concurrent risks.

The Joint Committee on the National Security Strategy's report "Readiness for storms ahead? Critical national infrastructure in an age of climate change" said: *"We recommend that the Government oversees a programme of 'exercises' to plan for major regional extreme weather events with multiple cascading effects. It should involve local and regional actors in these exercises, including key CNI [critical national infrastructure] operators, and use them to clarify and communicate roles and responsibilities at a national, regional and local level."*⁹⁰

Last year, 2023, was the world's warmest calendar year on record and the UK's second warmest on record.^{91 92} In October 2023, Paris ran an exercise that simulated a 10-day 50°C heatwave event in 2 districts of the city.⁹³ The London Climate Resilience Review believes a similar heat exercise could be a useful stress test for London. It would help clarify roles, responsibilities, and primacy of command in the event of multiple failures of infrastructure, for instance in transport, power, and water.

We know extreme events will occur more frequently in the future and often overlap, 2022's heatwave occurred at the same time as drought and wildfires, sometimes heatwaves are followed by flash flooding. The Review has previously suggested that now London has already experienced 40°C it would be sensible to prepare for 45°C

among other possible events.⁹⁴ We recommend bodies in London also make severe weather a consideration for all business-as-usual resilience exercises.

7. Recommendation to the Mayor of London, local authorities, the voluntary and community sector, and faith and belief partners: Continue to grow London's spaces for resilience initiatives and drive a coherent approach.

London's local authorities, voluntary and community sector and faith and belief partners should consider how they can support the use of their spaces for community resilience. They should engage directly with the Mayor's emerging resilience hub initiatives, Cool Spaces programme and Warm and Welcoming Spaces programme. The Review encourages partners to build a strong engagement around these initiatives in order to increase community resilience and improve provision of climate ready spaces, including by registering suitable spaces to grow existing networks.

The GLA's Cool Spaces map helps the public find places of refuge during hot weather and summer heatwaves.⁹⁵ There were 485 indoor and outdoor cool spaces, including those provided by mature tree canopy cover, available during 2022's extreme heat episodes. During the Level 4 heat alert in July 2022, page views on the environment section of the GLA's website reached 36,000 on 19 July (from a daily average of 2.2k). The GLA is currently supporting work with Aviva, Groundwork and the British Red Cross on Resilience Hubs. This is being trialled with Havering Volunteer Centre and Havering Council.⁹⁶ The Mayor could build on the strong foundation of the Cool Spaces and Warm and Welcoming Spaces programmes to promote a consistent approach across London, using community spaces to build local climate resilience.



Trees providing shade in a London park

- 8. Recommendation for the UK government: UK government delivers its commitment to a new process for assessing chronic risks by the end of 2025 and appoints a Cabinet Office Minister for Adaptation and Resilience with responsibility for the National Adaptation Programme.**

The UK government's National Risk Register, published by the Cabinet Office, covers acute risks, worst-case scenarios and the responses citizens can expect. The 2023 edition of the National Risk Register is the first edition that does not feature a chapter on longer-term "chronic" risks like climate change which it said: "*can make acute risks*

more likely and serious".⁹⁷ Examples could include: long term reduction in water availability; long term increase in humidity and rainfall; irreversible damage to nature, pests & disease, and subsidence.

This is a significant gap. Treating only acute events as representative of the threat climate change poses to the UK undermines the National Risk Register's analysis of acute risks, because they occur in the context of chronic vulnerabilities. The National Risk Register says: "*As outlined in the Integrated Review Refresh the government is establishing a new process for identifying and assessing a wide range of chronic risks... As a first step, we will run a cross-government exercise to identify and understand the UK's current and future vulnerabilities, with recommendations for action.*"

That exercise must be prioritised within UK government and given a timeline, we suggest by the end of 2025, because it is increasingly important to look at acute and chronic climate risks in the round, to ensure long-term climate readiness is informed by concurrent responses and vice versa. Currently, adaptation is owned by Defra while the Cabinet Office assigns ownership of acute national risks to lead government departments preparation and emergency response, and recovery.⁹⁸ The Government told the Joint Committee on the National Security Strategy (JCNSS) that Ministers from both departments meet regularly.⁹⁹

The JCNSS's report "Readiness for storms ahead? Critical national infrastructure in an age of climate change" recommended: "*the government establishes a Minister of State for CNI Resilience and a team within the Cabinet Office to focus on this issue.*"

Launching that report the Committee said: "*It appears that no Minister is taking responsibility for this topic, and there are no cross-Cabinet Committees driving forward the Government's work on adaptation and CNI resilience. This may be why the Government has accepted the Climate Change Committee's finding that it is moving backwards on adaptation, and has failed to implement any of that Committee's latest adaptation recommendations in full. It is hard to imagine the Government taking such a lax approach to any other recognised national security risk.*"¹⁰⁰

The National Audit Office said: "*Government cannot provide an estimate of how much it spends to manage the risks for droughts, high temperatures and heatwaves, surface water flooding and storms, because action is taken by a wide range of government departments and agencies, and no one collects this information.*"¹⁰¹

The UK government Resilience Framework said: "*Resilience is a 'whole of society' endeavour, so we must be more transparent and empower everyone to make a contribution.*"¹⁰²

A Cabinet Office Minister of State for Climate Adaptation and Resilience with responsibility for the National Adaptation Programme would help ensure ownership of adaptation actions are assigned across lead government departments alongside ownership of acute national risks. They would also improve join up between the UK's work on adaptation and resilience internationally and domestically.

9. Recommendation for the Mayor and TfL: Support the Transport Adaptation Steering Group to connect with transport providers in other cities nationally and internationally to develop best practice adaptation for city transport.

TfL's Climate Change Adaptation Plan 2023 said: *"We recognise that we cannot operate a resilient transport network by ourselves. Managing our interconnected systems in the face of climate change will require engagement, support and collaboration with a wide range of organisations."*¹⁰³

TfL's officers share knowledge and best practice with industry stakeholders, such as Network Rail and Highways England, through the quarterly Transport Adaptation Steering Group.¹⁰⁴ Cities have considerable powers and resources to invest in public transport, the Mayor should use his convening power to bring together Mayors from other UK cities with major transport infrastructure including roads, rail, trams and buses, and connect the Transport Adaptation Steering Group with transport providers and experts to share expertise and best-practice. London would have a lot of expertise to share but could learn a lot, perhaps particularly to support London Boroughs on the rural-urban interface. If this delivery group proves successful, it should be considered as a model for other groups looking at similar challenges such as retrofit. International expertise could also be sought via C40 Cities.¹⁰⁵

10. Recommendation for UK government: As part of the Defra review of the statutory powers and responsibilities to map, monitor, inspect and maintain all assets across all flood risks and coastal erosion, (including watercourses and riparian landowners' role and responsibilities), due in March 2024, Defra should reconsider the Thames Estuary 2100 10-Year Review Advisory Group's recommendations.

Effective monitoring in the Thames Estuary means we now know flood defences must be adapted upstream (west) of the Barrier by 2050, which has been brought forward 15 years from 2065 in the original plan.¹⁰⁶

Those who own land bordering the Thames are responsible for providing and maintaining tidal flood defences. At a roundtable hosted for the Review by the Better Buildings Partnership, major London landowners said they didn't see the rising tide as a

pressing risk to property along the Thames because their understanding was that the Thames Barrier would be effective until 2070. But the Barrier is only one part of a much bigger system of river defences.

Of the total 330 kilometres of flood defences in the Thames Estuary there are 126 kilometres upstream (west) of the Barrier and just 9 kilometres of these (7%) are sufficiently high to last beyond 2050. The Environment Agency owns only 12% of the defences in the Thames Estuary. Third parties are responsible for maintaining 88% of the flood risk assets and 77% of the Estuary's 'Below Required Condition' assets. The Environment Agency currently pursues landowners "to act" but there is often an assumption that if part of the Thames riverbank is at risk of failure, the authorities will step in. This needs to be addressed in law.

The Thames Estuary 2100 10-Year Review Advisory Group's recommendations are: *The Thames Estuary 2100 Plan should be placed on a statutory footing in spatial planning; A long term funding solution is essential to ensure the sustainable implementation of the plan; A Government review of how best to maintain and fund third party flood defences in the estuary to ensure a consistent and comprehensive approach which keeps pace with rising sea levels; Local authorities and the Environment Agency need ongoing resources and support for the science and evidence gathering, innovation and research, engagement and collaboration that is essential to an adaptive planning approach.*

11. Recommendation for the GLA, local authorities and London Anchor

Institutions: The GLA and those who own land bordering the Thames west of the Thames Barrier conduct an audit of land they own on the riverbank. They should understand where defences need to be raised and maintained and develop an action plan by 2025 setting out financing and delivery options for raising defences, creating nature-based solutions and sacrificial zones, before 2050.

As the Environment Agency pursues all landowners to act on sea-level rise in London, the GLA must demonstrate best practice. This will help communicate the need to act to other public and private landowners. The GLA told the Review: *"As a property owner the Mayor will work with the EA [Environment Agency] to understand what's needed to ensure embankments, barriers and other equipment is maintained, and site owners understand their responsibilities to maintain."*

This could be helped if all local authorities with frontages on the Thames were to produce a Riverside Strategy. At present only the City of London Corporation has done so. We would like to hear feedback from relevant local authorities on the challenges and

opportunities in producing a Riverside Strategy and how they could collectively be better supported to do this work. The Environment Agency is currently producing guidance for creating Riverside Strategies. Requirements include redesigning defences so that upgrades will improve the local area and make it greener, identifying opportunities to create and enhance intertidal habitat and enabling people to have uninterrupted access to the riverside with views of the river.¹⁰⁷ More green spaces along the river could provide shade and breeze for residents and workers during increasingly high summer temperatures (the Mayor has committed to increasing tree canopy cover by 10% by 2050)¹⁰⁸ and improve water quality by creating a break between road runoff and the river.

12. Recommendation for UK government: Enact Schedule 3 to The Flood and Water Management Act to ensure that Sustainable Drainage Systems (SuDS) are considered and used to manage surface water, ensuring resilient drainage systems for new developments in both urban and rural areas.

Schedule 3 to the Flood and Water Management Act “*provides a framework for the approval and adoption of drainage systems, an [Sustainable Drainage Approval Body] approving body (SAB), and national standards on the design, construction, operation, and maintenance of SuDS. Also, it makes the right to connect surface water runoff to public sewers conditional upon the drainage system being approved before any construction work can start.*”¹⁰⁹

To manage and prepare for increased surface water flood risk to London you need to bring many thousands of small projects together. SuDS are a greener and more natural approach to managing drainage in and around developments where surfaces are often sealed and impermeable. They are designed to temporarily store water during storm events and reduce surface water runoff.¹¹⁰ SuDS also improve water quality and enhance nature. SuDS can take the form of rain gardens, green roofs, urban wetlands, or ponds.

The National Audit Office’s report “Resilience to flooding” said: “*...until June 2023, the amount of work required to include projects in the capital programme was not related to the size of the project. For example, the amount of analysis needed to support business cases was the same for small and large projects and was therefore disproportionately burdensome for smaller projects. This is despite the increased importance of smaller projects to the capital programme. It is only now, almost halfway through the second six-year programme, that Defra and EA [Environment Agency] are considering changes to ensure a more proportionate approach for smaller projects.*”¹¹¹

The Chartered Institution of Water and Environmental Management (CIWEM) have said: "*There has been progress in taking SuDS forward in new development, but not enough. This needs to become standard practice and properly mandated by finally implementing Schedule 3 of the Flood and Water Management Act 2010.*"¹¹²

In the foreword to Defra's "Review for implementation of Schedule 3 to The Flood and Water Management Act 2010", the previous Secretary of State wrote: "*The Government will now consider how Schedule 3 will be implemented, subject to final decisions on scope, threshold and process. A public consultation later this year will help to shape the new approach, with implementation expected during 2024.*"¹¹³ London needs to see this expectation realised.

13. Recommendation for UK government: Based on the work of the London Surface Water Strategic Group, UK government creates a Strategic Surface Water Authority for London, led by an independent and non-political Chair, to promote, enforce, and allocate funds in-line with a strategic London-wide approach to flooding.

Defra's Surface Water Action Plan says: "*Defra will review the funding sources which are available for surface water risk management, considering how spending by water and sewerage companies, local and central government and others can best be directed to reduce surface water flood risk and whether the mechanisms are appropriate for these types of projects.*"¹¹⁴

The Review team believe the UK government should review mechanisms for funding surface water projects, taking into consideration the most appropriate mechanisms for cities. London is an appropriate place to pioneer a new approach for urban areas: it is the smallest region in the UK by land area but with the highest population density and 33 separate Lead Local Flood Authorities all operating within the Thames catchment. Of these, we understand that six currently don't have a flood officer and outsource the work.

The strategic, physical and governance problems are recognised by key actors in managing London's surface water flood risk. The London Surface Water Strategic Group is funded by organisations including TfL, the GLA, Thames Water, local authorities via local levy and the Thames Regional Flood and Coastal Committee. This voluntary group shows that organisations can agree and be productive. To accelerate delivery a strategic approach should be embedded in law.

A Strategic Surface Water Authority would help ensure a joined-up approach was locked-in to London's governance and could direct partnership funding to the most impactful projects across the 33 local authorities.

This would lead to many more benefits than reduced flood risk. The Review team visited the Firs Farm Wetland Scheme in the London Borough of Enfield which has created a community green space by de-culverting a lost river and allowing it to run through wetland basins. Before the scheme was delivered, Firs Farm was an underutilised open space. By incorporating footpaths and seating areas alongside the wetlands, the park is now full of dog walkers, children, families, and is supported by an active group of community volunteers.¹¹⁵



Rain gardens in Enfield, London

14. Recommendation for the Mayor of London: Work with public and private sector organisations to introduce a market-based system to enable the delivery of Sustainable Drainage Systems (SuDS) with funding through planned Street Works Programme.

There are more than 160,000 planned street works in London every year (excluding emergency works).¹¹⁶ The GLA's Infrastructure Coordination Service is working with utilities and highways authorities to ensure that a "Dig Once approach" means that there is reduced road network congestion and fewer days of disruption.¹¹⁷ If a hole needs to be dug (for say roadworks), they make sure other organisations also use that hole (for

say fixing pipes or cables) before it gets covered up again, reducing the need to dig another hole in the same place two weeks later.

Dig Once is now being used to ensure that SuDS are integrated as part of the reinstatement of street works. If this work were better mapped against a strategic plan for managing surface water flood risk across the city, it could deliver significant results at pace. Not only that, but it could also create a market-based system to help pay its own way. The Review recommends the Mayor convenes partners to introduce a market-based system to pair SuDS with funding through the Street Works Programme. The objective of a market would be to provide incentives for utilities companies (suppliers) to efficiently deliver SuDS in conjunction with planned street works across London. These could be financed by the sale of credits based on a measurable reduction in impermeable area to buyers like private landlords, local authorities, or utilities companies like Thames Water.

The Environmental Markets Board could oversee an independent market operator to provide assurance of market integrity; the Mayor, a Strategic Surface Water Authority (see Recommendation 12) or another public-sector body could ensure the market meets strategic needs.

15. Recommendation for the Mayor of London: Continue work on the development of sub-regional integrated water management strategies and convene partners to deliver the East London pilot strategy.

The UK government's Plan for Water says: "*The best way to manage supply and pollution pressures is by taking an integrated approach across a whole catchment.*"¹¹⁸ The pilot Subregional Integrated Water Management Strategy for the Lower Lea [the East London pilot strategy] is a leading example of integrated water management.¹¹⁹ It has been developed in partnership between the GLA, Environment Agency, Thames Water, Natural England, Enfield, Waltham Forest, Hackney, Haringey, Tower Hamlets, Newham and the City of London. The strategy is a non-statutory, dynamic planning level framework that sets out actions and is responsive to changing conditions. The GLA could undertake research into how the methodology for the East London pilot could help develop further integrated water management strategies for London and at what scale (for example, the Thames Basin, sub-regional or catchment scales).

The Mayor could convene partners to deliver the East London pilot strategy. This could be through a place-based integrated water management forum, with executive level support from partners and enabling officers to confidently dedicate their time to implementation. Stakeholders could explore options for investment.

16. Recommendation for the Mayor of London: The Mayor’s Green Finance Programme should develop a workstream to facilitate investment in climate adaptation.

This workstream should address barriers to investment in nature-based solutions (NBS) such as the lack of financial models that create markets for investment in NBS, the lack of effective capture of adaptation benefits in financial decision-making, the need for a pipeline of investible adaptation projects, and the lack of financial expertise at project level.

Responding to events and repairing damage is much more costly than investing in adaptation and climate resilience. The benefits of NBS can be spread over many stakeholders but nature-based projects can be seen as higher risk than grey infrastructure which deters investors who want immediate returns and expect governments to act as insurer of last resort. The Mayor can play a unique role in strengthening project development and take steps towards increasing mainstream finance for NBS projects.

An adaptation finance workstream should build on existing work by the GLA and London’s local authorities towards the development of financial models which enable investment in NBS and can standardise benefits and returns, for example de-risking mechanisms. The Mayor should also deliver financial and project support to build technical knowhow and local authority capacity on adaptation finance. The Mayor could introduce grants or concessional financing for local authorities to pay for technical assistance services. While it is not necessary for local authorities to have the same financial knowledge as a financier, the Mayor should work towards increasing the financial knowledge of local authority staff as this will improve communications and collaboration between local authorities and financiers.

Through the London Green Finance Fund, the Mayor has already made £15m worth of technical assistance available to help organisations achieve net zero by 2030.¹²⁰ The Mayor’s existing and forthcoming project development support must consider climate resilience, and net zero projects financed through the Mayor’s green finance programme should have climate resilience requirements. The Green Finance Fund was one of the recommendations from the Green Finance Institute report *“Mobilising Capital at Scale for Net-Zero Projects”*.¹²¹ The criteria of future rounds of the Mayor’s Green Finance Fund should be expanded to support adaptation projects.

17. Recommendation for the UK government: The Decent Homes Standard and Future Homes Standard should set out specific measures for climate resilience with explicit requirements for actions like managing excess heat (cooling), water efficiency, flood resilience and biodiversity. The updated Decent Homes Standard must be accompanied by investment from UK government to bring existing homes to this standard.

The “Monetary Valuation of Risks and Opportunities in CCRA3” report said the impact of extreme heat, notably in terms of health and wellbeing (including fatalities) and overheating in the built environment (residential and business), impacting either in terms of discomfort / reduced productivity, or increasing cooling demand for households and business could run into the billions per year.¹²² The average cost of flooding to a home is £30,000.¹²³

The updated Decent Homes Standard (DHS) and Future Homes Standard (FHS) should ensure homes are fit for the UK’s changing climate. They should consider up-to-date climate projections and require that housing can maintain safe and healthy temperatures in extreme heat. This should involve updating Part O of the building recommendations. The standards should also have a presumption in favour of passive design, nature-based solutions, and adherence to the ‘cooling hierarchy’ wherever possible, to ensure mechanical ventilation is prioritised over air conditioning.

Standards should specify flood resilience measures for homes in areas of high flood risk. The UK government must provide clear guidance and incentives for landlords to support them to meet standards, and to local authorities to support them to enforce the DHS and FHS standards. The UK government must invest in bringing existing homes to higher standards, funding should be available to social landlords and housing associations to meet these standards. The UK government is currently consulting on the Future Homes Standard and Buildings Regulations (Part O) in relation to heat.¹²⁴

18. Recommendation to the Mayor of London: Create an “adaptation accelerator” programme which supports organisations to develop climate action plans, as well as the development and delivery of projects.

Adaptation action is underway across London but it is inconsistent and there are barriers. Organisations need support to understand current and future climate risks, to identify, assess and select actions to take at a local level, and support to develop and implement projects. The Mayor should develop an ‘accelerator programme’ which provides direct support. The accelerator programme should build adaptive capacity in organisations, require locally led action and community engagement where possible. It should be informed by climate risk assessments.

The accelerator should prioritise organisations facing high climate risk, and could be identified using leading work by the Mayor including the GLA's Climate Risk Maps,¹²⁵ the Properties Vulnerable to Heat Impacts in London analysis [due to be published on 17 January 2024], and the Mayor's Care Homes Overheating Audits.¹²⁶ Supported projects should share findings on the costs and benefits of adaptation action in London to build data, support decision makers, and catalyse wider action.

The accelerator programme could build on existing good work such as the Climate Resilient Schools Programme which provides a model for taking a place-based approach to adaptation.¹²⁷ The programme could roll this model of support out to other settings, such as social housing or care facilities. An adaptation accelerator should support locally led adaptation plans and build community engagement: the Future Neighbourhoods 2030 programme funded delivery of community co-designed plans and strategies in twelve climate vulnerable communities, including Somers Town and Notting Dale, to shape greener, healthier, more resilient neighbourhoods.¹²⁸ An adaptation accelerator could support development of such neighbourhood strategies, as well as implementing adaptation actions in strategies.

19. Recommendation for the Mayor of London: Launch a Climate Resilience Challenge to promote innovation in the capital and help find solutions to address the impacts faced by Londoners as a result of climate change.

The Greater London Authority runs an open innovation programme, Challenge LDN, that seeks to pioneer a new way of working with Boroughs, Business Improvement Districts, charities and third sector organisations to solve the city's challenges through innovation designed with diverse Londoners.¹²⁹ An innovation competition focused on adaptation and climate resilience would support London to become a leader in climate readiness. It could link to green finance work on quantifying the benefits of specific measures, support an adaptation cluster and reinforce London's position as a green finance leader.

One example of this kind of work was the Climate Resiliency Challenge in the United States which distributed \$1m in prize money to 13 organisations creating solutions to help frontline communities prevent, prepare for and recover from events like wildfires, floods, and extreme weather.¹³⁰ Another model could be the Global Challenge Lab, a competition for students to generate innovation towards the UN Sustainable Development Goals.¹³¹ The Global Challenge Lab is in part run by Undaunted, a partnership between two world-renowned scientific institutions: Imperial College London and the Royal Institution with private sector funding and support.¹³² Should an innovation competition secure funding, it could be run from the GLA as part of Challenge LDN's open innovation challenges.

20. Recommendation for the Mayor of London, local authorities, London Anchor Institutions, the voluntary and community sector: The Mayor identifies appropriate partners to develop public engagement work, informed by behavioral science, to help Londoners make climate ready choices.

Londoners have a key role to play in preparing themselves and their neighbours for climate impacts. The “Health Effects of Climate Change” report 2023 said: *“Given the lead time needed for shifts in population behaviour, as well as policies, practices, and infrastructure, early planning will be necessary, and may be ineffective if delayed.”*¹³³

In June, the Mayor sent leaflets to 45,000 basement properties to raise awareness about what to do in a flood.¹³⁴ The Mayor can support Londoners to prepare for climate impacts by leading work to engage local communities and incentivise people to reduce vulnerability. To be effective this requires local engagement, enabling and trusting local leaders to innovate, learn, and build relationships, prioritising the needs of communities and places.

The Review has identified three areas which could be fast tracked. These are: keeping safe in the heat, water efficiency, and de-paving front gardens, public and community spaces for water attenuation and to support wildlife. For these, much of the relevant information already exists but needs to be targeted at the best audiences. Campaigns should be supported by behavioural science and evaluated based on action, not social media engagement. For instance, a water efficiency campaign would be based on “litres, not likes”.



Streets trees and community spaces

TABLE OF RECOMMENDATIONS

| TIMING | |
|-------------------------------|--|
| Immediate | Action commences immediately in the 2024 Mayoral term for delivery in the 2024-25 year |
| Urgent | Action commences as soon as possible - for delivery by 2025 |
| Long-term | Action commences as soon as possible - long term action |
| TYPE | |
| Strategic (S) | A strategic action which will guide decisionmakers across London to take climate resilient decisions, drive investment and provide a coherent framework and direction. |
| Delivery (D) | A recommendation which results in direct delivery of adaptation action. |
| Capacity Building (CB) | A recommendation which will build understanding about climate resilience across London and build organisations' adaptive capacity. |
| Investment (I) | A recommendation which will facilitate public or private investment in London's climate resilience. |

| RECOMMENDATION | OWNER | TIMING | TYPE |
|--|--|---|------|
| <p>1. Climate Resilient London</p> <p>The Mayor leads collaborative work with local authorities, the private sector and others to set out a clear strategic vision for what it means for London to be adapting well to climate impacts by 2030 and beyond.</p> | <p>Collaborative Lead: Mayor of London and local authorities.</p> <p>Support: London's local authorities, London Council and London Partnership Board</p> | <p>Immediate</p> <p>For action from start of Mayoral term 2024</p> | S |
| <p>2. National Infrastructure Assessment</p> <p>In line with the Second National Infrastructure Assessment (Recommendations 28 to 31) by 2025, government should work with relevant sectors and update resilience and technical standards above and beyond the minimum projected rise in global temperatures.</p> | UK government | <p>Urgent</p> <p>By 2025</p> | S |

| | | | |
|--|---|----------------------------------|----------------|
| <p>3. Climate Resilient Budget</p> <p>The GLA and London Boroughs' finance processes should include a set of questions about climate risks to ensure spending is climate resilient, and the GLA Group's functional bodies should set adaptation plans and measurable targets.</p> | <p>The Mayor of London; GLA Group and London Boroughs</p> | <p>Urgent By 2025</p> | <p>S, I, D</p> |
| <p>4. Invest in Climate Resilience</p> <p>Develop funding programmes and increase fiscal devolution for regional and local organisations to accelerate climate adaptation.</p> | <p>UK government</p> | <p>Urgent By 2025</p> | <p>I</p> |
| <p>5. Strategic Plan for Heat</p> <p>A regional strategic plan for adapting to higher temperatures in London to be developed with a governance framework that sets out roles and responsibilities.</p> | <p>Collaborative</p> <p>Lead: Mayor of London</p> <p>Support: Local authorities, London Councils, London Partnership Board, London health sector</p> | <p>Urgent By 2025</p> | <p>S</p> |
| <p>6. Heat Exercise</p> <p>Conduct an exercise to test London's preparedness for a severe heat episode and identify potential cascading and concurrent risks. (Recommendation 5).</p> | <p>London Resilience Partnership</p> | <p>Urgent By 2025</p> | <p>S</p> |

| | | | |
|---|--|----------------------------------|-------------|
| <p>7. Spaces for Resilience</p> <p>Continue to grow London's spaces for resilience initiatives and drive a coherent approach. (Recommendation 5).</p> | <p>Local authorities, community and voluntary sector</p> | <p>Long-term</p> | <p>CB</p> |
| <p>8. Minister for Adaptation and Resilience</p> <p>UK government delivers its commitment to a new process for assessing chronic risks by the end of 2025 and appoints a Cabinet Office Minister for Adaptation and Resilience with responsibility for the National Adaptation Programme.</p> | <p>UK government</p> | <p>Urgent By 2025</p> | <p>S</p> |
| <p>9. Adaptation of Transport</p> <p>Support the Transport Adaptation Steering Group to connect with transport providers in other cities nationally and internationally to develop best practice adaptation for city transport.</p> | <p>Collaborative</p> <p>Lead: The Mayor of London</p> <p>Support: Transport for London, other Mayors and regional authorities</p> | <p>Urgent By 2025</p> | <p>CB</p> |
| <p>10. TE2100 Plan</p> <p>As part of the Defra review of the statutory powers and responsibilities to map, monitor, inspect and maintain all assets across all flood risks and coastal erosion, (including watercourses and riparian landowners' role and responsibilities), due in March 2024, Defra should reconsider the Thames Estuary 2100 10-Year Review Advisory Group's recommendations.</p> | <p>UK government</p> | <p>Urgent By 2025</p> | <p>D, I</p> |

| | | | |
|---|---|-------------------------|-------------|
| <p>11. Riverside land audit</p> <p>The GLA and those who own land bordering the Thames west of the Thames Barrier conduct an audit of land they own on the riverbank. They should understand where defences need to be raised and maintained and develop an action plan by 2025 setting out financing and delivery options for raising defences, creating nature-based solutions and sacrificial zones, before 2050.</p> | <p>Collaborative</p> <p>Lead: Mayor of London</p> <p>Support: Local authorities, London Anchor Institutions, private land owners</p> | <p>Long-term</p> | <p>D, I</p> |
| <p>12. A step-change in Sustainable Urban Drainage</p> <p>Enact Schedule 3 to The Flood and Water Management Act to ensure that Sustainable Drainage Systems (SuDS) are considered and used to manage surface water, ensuring resilient drainage systems for new developments in both urban and rural areas.</p> | <p>UK government</p> | <p>Immediate</p> | <p>S, D</p> |
| <p>13. Strategic Surface Water Authority</p> <p>Based on the work of the London Surface Water Strategic Group, UK government creates a Strategic Surface Water Authority for London, led by an independent and non-political Chair, to promote, enforce, and allocate funds in-line with a strategic London-wide approach to flooding.</p> | <p>UK government</p> | <p>Immediate</p> | <p>S</p> |

| | | | |
|--|---|-------------------------|-------------|
| <p>14. Streetworks and Sustainable Drainage</p> <p>Work with public and private sector organisations to introduce a market-based system to enable the delivery of Sustainable Drainage Systems (SuDS) with funding through planned Street Works Programme.</p> | <p>Mayor of London</p> | <p>Immediate</p> | <p>D, I</p> |
| <p>15. Integrated Water Management Strategies</p> <p>Continue work on the development of sub-regional integrated water management strategies and convene partners to deliver the East London pilot strategy.</p> | <p>Collaborative</p> <p>Lead: Mayor of London</p> <p>Support: Thames Water, local authorities, Environment Agency, Natural England</p> | <p>Immediate</p> | <p>S, D</p> |
| <p>16. Green Finance</p> <p>The Mayor’s Green Finance work programme should as a priority develop a workstream to facilitate investment in climate adaptation.</p> | <p>The Mayor of London</p> | <p>Immediate</p> | <p>I, D</p> |
| <p>17. Decent and Future Homes Standards</p> <p>The Decent Homes Standard and Future Homes Standard should set out specific measures for climate resilience with explicit requirements for actions like managing excess heat (cooling), water efficiency, flood resilience and biodiversity. The updated Decent Homes Standard must be accompanied by investment from UK government to bring existing homes to this standard.</p> | <p>UK government</p> | <p>Immediate</p> | <p>S, I</p> |

| | | | |
|--|--|-------------------------|--------------|
| <p>18. Adaptation Accelerator</p> <p>Create an “adaptation accelerator” programme which supports organisations to develop climate action plans, as well as the development and delivery of projects.</p> | <p>Mayor of London</p> | <p>Immediate</p> | <p>D, I</p> |
| <p>19. Adaptation Challenge</p> <p>Launch a Climate Resilience Challenge to promote innovation in the capital and help find solutions to address the impacts faced by Londoners as a result of climate change.</p> | <p>Mayor of London</p> | <p>Immediate</p> | <p>D, I</p> |
| <p>20. Engaging London for Climate Resilience</p> <p>The Mayor identifies appropriate partners to develop public engagement work, informed by behavioral science, to help Londoners make climate ready choices.</p> | <p>Collaborative</p> <p>Lead: Mayor of London</p> <p>Support: local authorities, London anchor institutions, London partnership board, the voluntary and community sector</p> | <p>Immediate</p> | <p>D, CB</p> |

ACKNOWLEDGEMENTS

We would like to thank everyone who has helped us understand how climate impacts like floods, storms, heatwaves, and wildfires are affecting Londoners' lives and livelihoods, how people are preparing for more intense and frequent weather events, and how adaptation and resilience can make this great city even better. Thank you to all who submitted evidence, your work has informed this interim report and will continue to shape our full report. We would like to explicitly thank organisations who have provided advisory support, hosted visits and dedicated time and resources to contribute to our work.

- AtkinsRéalis
- Bloomberg Associates
- C40 Cities
- Environment Agency
- Headland Consultancy
- London Climate Change Partnership
- London Councils
- London Sustainable Development Commission
- Met Office
- Mott MacDonald
- National Infrastructure Commission
- National Trust
- Ricardo
- Transport for London

We would like to thank partners that have hosted roundtables and working groups, convening their members and partners to inform our work.

- The Association of British Insurers (ABI)
- AtkinsRéalis
- Better Buildings Partnership (BBP)
- The British Association for Sustainable Sport (BASIS)
- Business LDN
- Exhibition Road Cultural Group, the South Kensington ZEN + Programme
- The GLA Group Public Health Unit
- Institution of Civil Engineers (ICE)
- The London Climate Change Partnership (LCCP)
- Thames21
- Victoria and Albert Museum (V&A)

We would also like to thank some individuals who have given us support throughout the Review: Kathy Baughman McLeod, Kathryn Brown OBE, Jon Chappell, Francis Heil, Professor Anusha Shah, Ashok Sinha, Richard Smithers, Bob Ward, Clare Wildfire, Charlie Wood, Susanna Voyle.

Unless credited, all images are copyright to the Greater London Authority. Front cover image [Alisdare Hickson](#)

Last but not least, we would like to thank the adaptation team at the Greater London Authority for their support.

REFERENCES

- ¹ [The State of London - June 2023 \(airdrive-secure.s3-eu-west-1.amazonaws.com\)](#)
- ² [Tree canopy cover map | London City Hall](#)
- ³ [Using buses in London - Transport for London \(tfl.gov.uk\)](#)
- ⁴ [Global Climate Highlights 2023 | Copernicus](#)
- ⁵ [2023 was second warmest year on record for UK - Met Office](#)
- ⁶ [Politicians have a public mandate for climate leadership | IPPR](#)
- ⁷ [MISSION ZERO - Independent Review of Net Zero \(publishing.service.gov.uk\)](#)
- ⁸ [Devolution in London](#)
- ⁹ [BAHAMAS_cop28cmp18cma5_HLS_ENG.pdf \(unfccc.int\)](#)
- ¹⁰ [London's Just Transition | London City Hall](#)
- ¹¹ [2023: A historic year of U.S. billion-dollar weather and climate disasters | NOAA Climate.gov](#)
- ¹² [Race-to-Resilience-2023-Progress-Report_29112023.pdf \(unfccc.int\)](#)
- ¹³ [State of London - London Datastore](#)
- ¹⁴ [A retrospective look at summer 2021 London flash floods | JBA Risk Management](#)
- ¹⁵ [Excess mortality during heat-periods - Office for National Statistics \(ons.gov.uk\)](#)
- ¹⁶ [Heat mortality monitoring report: 2022 - GOV.UK \(www.gov.uk\)](#)
- ¹⁷ [Nations must go further than current Paris pledges or face global warming of 2.5-2.9°C \(unep.org\)](#)
- ¹⁸ [London's just transition report - 2023.pdf](#)
- ¹⁹ [Major updates to Thames Estuary 2100 from 2012 to 2023 - GOV.UK \(www.gov.uk\)](#)
- ²⁰ [London Environment Strategy | London City Hall](#)
- ²¹ [London Anchor Institutions' Network \(anchors.london\)](#)
- ²² <https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Chapter-5-FINAL.pdf>
- ²³ [Guy's and St Thomas' systems hit by 'ludicrous' heatwave - BBC News](#)
- ²⁴ [Excess mortality during heat-periods - Office for National Statistics \(ons.gov.uk\)](#)
- ²⁵ [Heat mortality monitoring report: 2022 - GOV.UK \(www.gov.uk\)](#)
- ²⁶ [One year on from record-breaking 40 degrees heat in the UK and we're still not prepared - Grantham Research Institute on climate change and the environment \(lse.ac.uk\)](#)
- ²⁷ [The Key Findings of the 2022 Report - Lancet Countdown](#)
- ²⁸ [Impact of heat exposure cost UK six million potential working hours \(telegraph.co.uk\)](#)
- ²⁹ [Interpersonal violence associated with hot weather - The Lancet Planetary Health](#)
- ³⁰ [Date \(london.gov.uk\)](#)
- ³¹ [Independent-Assessment-of-UK-Climate-Risk-Advice-to-Govt-for-CCRA3-CCC.pdf \(theccc.org.uk\)](#)
- ³² [New heat maps reveal cooling effect of trees and green space | Friends of the Earth](#)
- ³³ [A summary of England's draft regional and water resources management plans - GOV.UK \(www.gov.uk\)](#)
- ³⁴ <https://www.gov.uk/government/publications/water-stressed-areas-2021-classification>
- ³⁵ <https://www.nao.org.uk/reports/government-resilience-extreme-weather/#:~:text=Extreme%20weather%20events%20are%20becoming,UK%20faces%20from%20these%20risks.>
- ³⁶ [Water is essential - Thames Water Resources Management Plan \(thames-wrmp.co.uk\)](#)
- ³⁷ [Thames Estuary 2100: 10-year monitoring review \(2021\) - GOV.UK \(www.gov.uk\)](#)
- ³⁸ <https://www.nao.org.uk/reports/government-resilience-extreme-weather/#:~:text=Extreme%20weather%20events%20are%20becoming,UK%20faces%20from%20these%20risks.>
- ³⁹ [42% of London firms at risk of climate-fuelled flash floods \(zurich.co.uk\)](#)
- ⁴⁰ [London Flood Awareness Week 2021 | London City Hall](#)
- ⁴¹ [Game Changer II | The latest Sports Sustainability news from BASIS](#)
- ⁴² [assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1172931/The_Third_National_Adaptati on_Programme.pdf](#)
- ⁴³ [Maps show the real threat of climate-related subsidence to British homes and properties - British Geological Survey \(bgs.ac.uk\)](#)
- ⁴⁴ [Response to online representations \(thameswater.co.uk\)](#)
- ⁴⁵ [Community engagement and tension | College of Policing](#)
- ⁴⁶ [Climate change: health effects in the UK - GOV.UK \(www.gov.uk\)](#)
- ⁴⁷ [Nations must go further than current Paris pledges or face global warming of 2.5-2.9°C \(unep.org\)](#)
- ⁴⁸ [Climate change impacts scar Europe, but increase in renewables signals hope for future \(wmo.int\)](#)
- ⁴⁹ [Adaptation Gap Report 2023 | UNEP - UN Environment Programme](#)
- ⁵⁰ [Adaptation Gap Report 2023 | UNEP - UN Environment Programme](#)
- ⁵¹ [The Third National Adaptation Programme \(NAP3\) and the Fourth Strategy for Climate Adaptation Reporting \(publishing.service.gov.uk\)](#)
- ⁵² ['Action cannot be delayed further': UK Government 'unprepared' to deliver climate adaptation - edie](#)

⁵³ https://cdn.cdp.net/cdp-production/cms/reports/documents/000/006/915/original/CDP_UK_Cities_Report_EN_%282%29.pdf?1678720265
⁵⁴ [Healthy Ageing in a Changing Climate \(ageandclimate.com\)](https://www.ageandclimate.com)
⁵⁵ [The scorching divide: How extreme heat inflames gender inequalities in health and income - Arsht-Rock \(onebillionresilient.org\)](https://www.onebillionresilient.org)
⁵⁶ committees.parliament.uk/writtenevidence/125741/html/
⁵⁷ <https://www.london.gov.uk/press-releases/mayoral/bame-londoners-bear-brunt-of-climate-emergency>
⁵⁸ [Ethnic disparities in the major causes of mortality and their risk factors – a rapid review - GOV.UK \(www.gov.uk\)](https://www.gov.uk)
⁵⁹ [What is our Just Transition Plan? – Our Just Transition Plan – Newham Council](https://www.newham.gov.uk)
⁶⁰ [Climate Risk Map | London City Hall](https://www.london.gov.uk)
⁶¹ [Health Effects of Climate Change in the UK: state of the evidence 2023 \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)
⁶² [London Green Spaces Commission Report | London City Hall](https://www.london.gov.uk)
⁶³ [London Health Inequalities Strategy | London City Hall](https://www.london.gov.uk)
⁶⁴ [State of London - London Datastore](https://data.london.gov.uk)
⁶⁵ [https://www.onebillionresilient.org/hot-cities-chilled-economies-london/](https://www.onebillionresilient.org)
⁶⁶ [Annual Report and Statement of Accounts 2022/23 \(tfl.gov.uk\)](https://www.tfl.gov.uk)
⁶⁷ [Adaptation Pathway Programme | Engage Environment Agency \(engagementhq.com\)](https://www.engageenvironment.com)
⁶⁸ [Environment Agency – National Flood and Coastal Erosion Risk Management Strategy for England \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)
⁶⁹ [The London Plan | London City Hall](https://www.london.gov.uk)
⁷⁰ [Nations must go further than current Paris pledges or face global warming of 2.5-2.9°C \(unep.org\)](https://www.unep.org)
⁷¹ [Advice on adapting to climate change - Climate Change Committee \(theccc.org.uk\)](https://www.theccc.org.uk)
⁷² <https://www.nao.org.uk/reports/government-resilience-extreme-weather/#:~:text=Extreme%20weather%20events%20are%20becoming,UK%20faces%20from%20these%20risks.>
⁷³ [The Third National Adaptation Programme \(NAP3\) and the Fourth Strategy for Climate Adaptation Reporting \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)
⁷⁴ [Ipsos report \(sciencewise.org.uk\)](https://www.sciencewise.org.uk)
⁷⁵ [London's Just Transition | London City Hall](https://www.london.gov.uk)
⁷⁶ [imeche.org/docs/default-source/1-oscar/reports-policy-statements-and-documents/imeche-heat-adaptation-report-digital-110723_2.pdf?sfvrsn=6](https://www.imeche.org/docs/default-source/1-oscar/reports-policy-statements-and-documents/imeche-heat-adaptation-report-digital-110723_2.pdf?sfvrsn=6)
⁷⁷ [ICE policy position statement: how can the UK's infrastructure system be made more climate resilient? | Institution of Civil Engineers \(ICE\)](https://www.ice.org.uk)
⁷⁸ [NIC and CCC call for urgent action to protect infrastructure from climate risks - NIC](https://www.nic.org.uk)
⁷⁹ [FINAL-COPY-WHATEVER-THE-WEATHER-CLIMATE-RESILIENCE-AND-ADAPTATION-final.pdf \(fabians.org.uk\)](https://www.fabians.org.uk)
⁸⁰ [Final-NIA-2-Full-Document.pdf \(nic.org.uk\)](https://www.nic.org.uk)
⁸¹ [nic.org.uk/app/uploads/Final-NIA-2-Full-Document.pdf](https://www.nic.org.uk/app/uploads/Final-NIA-2-Full-Document.pdf)
⁸² [London's just transition report - 2023.pdf](https://www.london.gov.uk)
⁸³ [What is comply or explain? - The Corporate Governance Institute](https://www.cgi.org.uk)
⁸⁴ [Accelerating adaptation action: Councils preparing for climate change | Local Government Association](https://www.local.gov.uk)
⁸⁵ [London's Just Transition | London City Hall](https://www.london.gov.uk)
⁸⁶ [Adverse Weather and Health Plan - GOV.UK \(www.gov.uk\)](https://www.gov.uk)
⁸⁷ [Sweltering weather has left swaths of the US baking. A 'heat tsar' could help, experts say | Climate crisis | The Guardian](https://www.theguardian.com)
⁸⁸ [Heatwave causes full closure of Hammersmith Bridge - The Transport Network \(transport-network.co.uk\)](https://www.transport-network.co.uk)
⁸⁹ [London Resilience Partnership | London City Hall](https://www.london.gov.uk)
⁹⁰ committees.parliament.uk/publications/30507/documents/175976/default/
⁹¹ [Global Climate Highlights 2023 | Copernicus](https://www.copernicus.eu)
⁹² [2023 was second warmest year on record for UK - Met Office](https://www.metoffice.gov.uk)
⁹³ [Paris at 50°C: City prepares for extreme heatwaves of the future - France 24](https://www.france24.com)
⁹⁴ [London facing 45C days 'in foreseeable future', mayor Sadiq Khan warns | London | The Guardian](https://www.theguardian.com)
⁹⁵ <https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/climate-change/climate-adaptation/cool-spaces>
⁹⁶ [https://resiliencehubs.org.uk/](https://www.resiliencehubs.org.uk/)
⁹⁷ [2023 NATIONAL RISK REGISTER NRR.pdf \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)
⁹⁸ <https://www.nao.org.uk/reports/government-resilience-extreme-weather/#:~:text=Extreme%20weather%20events%20are%20becoming,UK%20faces%20from%20these%20risks.>
⁹⁹ [Readiness for storms ahead? Critical national infrastructure in an age of climate change: Government response to the Committee's First Report \(parliament.uk\)](https://www.parliament.uk)
¹⁰⁰ [Readiness for storms ahead? Critical national infrastructure in an age of climate change \(parliament.uk\)](https://www.parliament.uk)
¹⁰¹ [Government resilience: extreme weather \(nao.org.uk\)](https://www.nao.org.uk)
¹⁰² [The UK Government Resilience Framework \(HTML\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk)
¹⁰³ [Climate Change Adaptation Plan 2023 \(tfl.gov.uk\)](https://www.tfl.gov.uk)
¹⁰⁴ [Transport & Climate Change | London City Hall](https://www.london.gov.uk)
¹⁰⁵ [C40 Cities - A global network of mayors taking urgent climate action](https://www.c40cities.org)
¹⁰⁶ [Thames Estuary 2100: Time to Plan and Time to Act - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

- ¹⁰⁷ [Creating benefits and riverside strategies: Thames Estuary 2100 - GOV.UK \(www.gov.uk\)](#)
- ¹⁰⁸ [Tree canopy cover map | London City Hall](#)
- ¹⁰⁹ [The review for implementation of Schedule 3 to The Flood and Water Management Act 2010 \(publishing.service.gov.uk\)](#)
- ¹¹⁰ [An Introduction to Sustainable Drainage Systems \(SuDS\) \(thefloodhub.co.uk\)](#)
- ¹¹¹ [Resilience to flooding \(nao.org.uk\)](#)
- ¹¹² [FRESH WATER FUTURE MAIN REPORT WEB.pdf \(afreshwaterfuture.org\)](#)
- ¹¹³ [The review for implementation of Schedule 3 to The Flood and Water Management Act 2010 \(publishing.service.gov.uk\)](#)
- ¹¹⁴ [surface-water-management-action-plan-july-2018.pdf \(publishing.service.gov.uk\)](#)
- ¹¹⁵ [Thames21 and Enfield Council win global climate award for their Enfield nature-based solutions work - Thames21](#)
- ¹¹⁶ [New boost for road users as Mayor announces £10m of funding to cut delays from roadworks | London City Hall](#)
- ¹¹⁷ <https://www.london.gov.uk/programmes-strategies/better-infrastructure/infrastructure-coordination/streets-service/dig-once-approach?ac-63591=63590>
- ¹¹⁸ [Plan for Water: our integrated plan for delivering clean and plentiful water - GOV.UK \(www.gov.uk\)](#)
- ¹¹⁹ [london.gov.uk/sites/default/files/2023-07/Sub-regional integrated water management strategy East London - July 2023.pdf](#)
- ¹²⁰ [The Green Finance Fund | London City Hall](#)
- ¹²¹ [REPORT \(greenfinanceinstitute.com\)](#)
- ¹²² [Monetary-Valuation-of-Risks-and-Opportunities-in-CCRA3.pdf \(ukclimaterisk.org\)](#)
- ¹²³ [Flood Forecasting Centre: a working partnership - GOV.UK \(www.gov.uk\)](#)
- ¹²⁴ [The Future Homes and Buildings Standards: 2023 consultation - GOV.UK \(www.gov.uk\)](#)
- ¹²⁵ [Climate Risk Map | London City Hall](#)
- ¹²⁶ [Care Home Overheating Audit Pilot Project | London City Hall](#)
- ¹²⁷ [Climate Resilient Schools | London City Hall](#)
- ¹²⁸ [Future Neighbourhoods 2030 | London City Hall](#)
- ¹²⁹ [Challenge LDN | London City Hall](#)
- ¹³⁰ [Open IDEO | Climate Resiliency Challenge](#)
- ¹³¹ [Global Challenge Lab | Imperial Enterprise Lab](#)
- ¹³² [About us | Research groups | Imperial College London](#)
- ¹³³ [Health Effects of Climate Change in the UK: state of the evidence 2023 \(publishing.service.gov.uk\)](#)
- ¹³⁴ [Mayor warns Londoners in basement properties about flooding risk | London City Hall](#)

Other formats and languages

For a large print, Braille, disc, sign language video or audio-tape version of this document, please contact us at the address below:

Greater London Authority
City Hall
Kamal Chunchie Way
London E16 1ZE
Telephone **020 7983 4000**

www.london.gov.uk

You will need to supply your name, your postal address and state the format and title of the publication you require.

If you would like a summary of this document in your language, please phone the number or contact us at the address above.