Climate Adaptation Guidance

A guide to embedding climate adaptation into projects and policies

West Midlands Combined Authority

ARUP

October 2025

Cover note

The West Midlands Combined Authority (WMCA) commissioned this Climate Adaptation Guidance to support partners in embedding climate risk and adaptation considerations across project and policy life cycle stages.

The WMCA engaged partners from across the West Midlands and England in the development and design of this document to ensure it is useful, applicable and practical.

The WMCA would like to thank the following partners for their contributions:

- Bath and Northeast Somerset Council
- Birmingham City Council
- Bristol City Council
- Coventry City Council
- Department for Energy Security and Net Zero (DESNZ)
- Department for Environment, Food & Rural Affairs (Defra)
- Dudley Metropolitan Borough Council
- Greater Manchester Combined Authority (GMCA)
- Ministry of Housing, Communities and Local Government (MHCLG)
- Oldham Council
- Rochdale Council

- Sandwell Metropolitan Borough Council
- Solihull Metropolitan Borough Council
- South Gloucestershire Council
- Transport for Greater Manchester
- Transport for West Midlands (TfWM)
- West of England Combined Authority (WECA)
- Wolverhampton City Council

Disclaimer: application of this guide

Though some content is regionally specific, most of the information and the framework that it sits within can be applied to policy and project delivery anywhere in the UK.

Most pages should be kept the same as this original document, however, local and strategic authority partners are permitted to use and adapt the following sections to suit their local/regional context:

- Climate hazards and projections for the West Midlands (page 7)
- The impacts of climate change in the West Midlands (page 8)
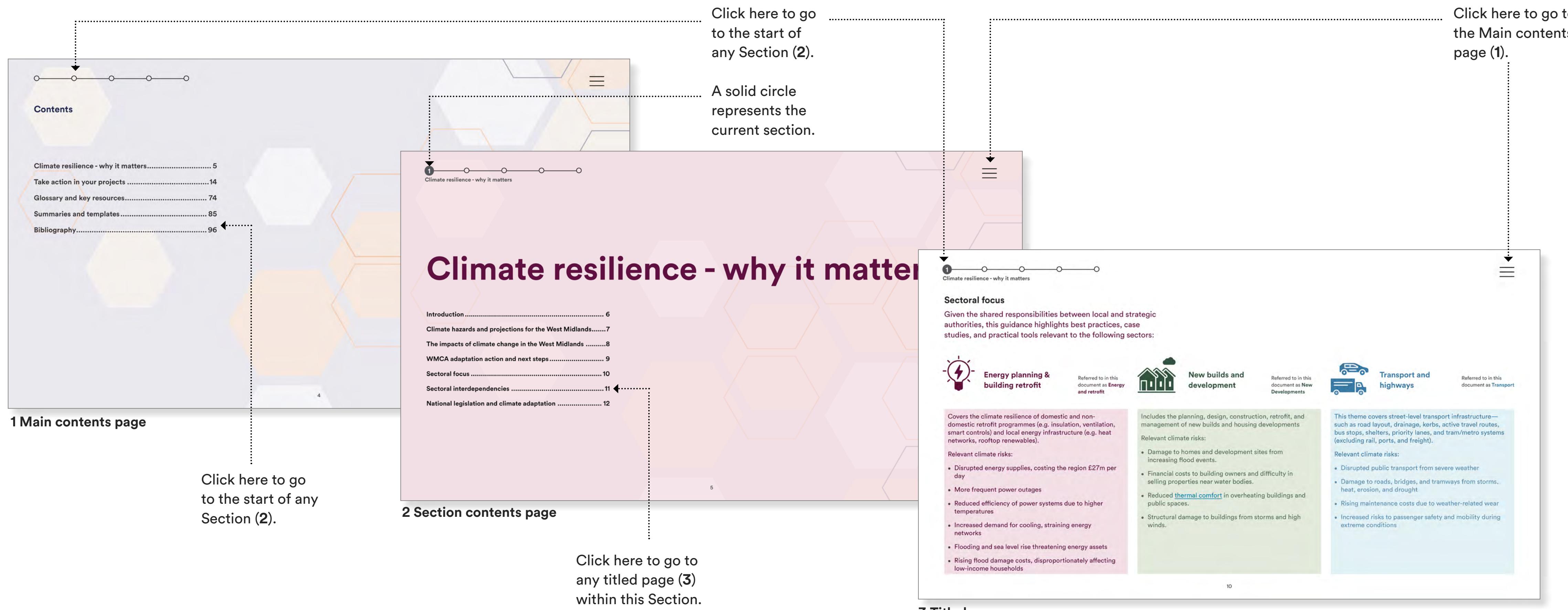- WMCA adaptation action and next steps (page 9)

Amendments to this document can be made on the condition that this Cover Note remains in all further iterations of the resource. Amendments will need to be resourced by the local or strategic authorities seeking to make the changes.

For further information contact environment@wmca.org.uk
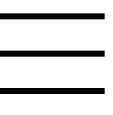
How to use this document

This in an interactive document. Please use the features highlighted below to navigate the document when viewing on-screen.

Click here to go to the start of any Section (**2**).

A solid circle represents the current section.

Click here to go to the Main contents page (**1**).

1 Main contents page

Click here to go to the start of any Section (**2**).

2 Section contents page

Climate resilience - why it matter

Click here to go to any titled page (**3**) within this Section.

3 Titled page

Sectoral focus

Given the shared responsibilities between local and strategic authorities, this guidance highlights best practices, case studies, and practical tools relevant to the following sectors:

Energy planning & building retrofit
Referred to in this document as Energy and retrofit

Covers the climate resilience of domestic and non-domestic retrofit programmes (e.g. insulation, ventilation, smart controls) and local energy infrastructure (e.g. heat networks, rooftop renewables).

Relevant climate risks:

- Disrupted energy supplies, costing the region £27m per day
- More frequent power outages
- Reduced efficiency of power systems due to higher temperatures
- Increased demand for cooling, straining energy networks
- Flooding and sea level rise threatening energy assets
- Rising flood damage costs, disproportionately affecting low-income households

New builds and development
Referred to in this document as New Developments

Includes the planning, design, construction, retrofit, and management of new builds and housing developments

Relevant climate risks:

- Damage to homes and development sites from increasing flood events.
- Financial costs to building owners and difficulty in selling properties near water bodies.
- Reduced thermal comfort in overheating buildings and public spaces.
- Structural damage to buildings from storms and high winds.

Transport and highways
Referred to in this document as Transport

This theme covers street-level transport infrastructure—such as road layout, drainage, kerbs, active travel routes, bus stops, shelters, priority lanes, and tram/metro systems (excluding rail, ports, and freight).

Relevant climate risks:

- Disrupted public transport from severe weather
- Damage to roads, bridges, and tramways from storms, heat, erosion, and drought
- Rising maintenance costs due to weather-related wear
- Increased risks to passenger safety and mobility during extreme conditions

Contents

Climate resilience - why it matters

Introduction

Under current policies, the planet could experience as much as 3.1°C of warming above pre-industrial baselines by the end of the century.

Even if every country took additional action, global temperatures may still increase by 2.6°C by 2100. This global warming brings changes to the climate and to weather patterns at a local level. Urgent action is needed to reduce or remove carbon emissions (the causes of global warming) and to adapt to the impacts, increasing our resilience to climate change and extreme weather.

The West Midlands is already experiencing climate-related hazards such as flooding and heatwaves, which are becoming more frequent and severe. These events disrupt daily life — from travel delays to school closures, financial losses to health impacts —and are projected to intensify. Local and strategic authorities have a pivotal role in shaping place-based responses that protect infrastructure, maintain essential services, and support community health and climate resilience.

The UK's Climate Change Committee (2025) reports that adaptation progress is too slow, stalled, or regressing, highlighting the need for local and strategic authorities to act. Climate change risks will impact everything that strategic and local authorities do. To deliver climate resilience across sectors, the WMCA believes that climate adaptation must be embedded directly in project and policy-level processes.

Purpose and Scope of the Guidance

This guidance has been developed as a practical resource for the West Midlands Combined Authority (WMCA) and its partners. It is designed to help local and strategic authorities and delivery partners embed climate adaptation across project and policy life cycle stages.

The content is organised to support practical application and includes:

- Different types of adaptation measures

- Sector-specific considerations for energy and retrofit, new builds and development and transport

- Key lifecycle stages where climate risk and resilience can be integrated

The guidance is intended to:

- Support local and strategic authority officers, planners, designers, engineers, and delivery partners with a checklist of climate adaptation considerations

- Support the identification of adaptation measures appropriate to different stages of the project lifecycle - from setting the brief to concept development, design, procurement, delivery, and maintenance.

- Provide examples of climate resilience metrics to monitor progress and evaluate effectiveness

- Increase awareness of key regulatory and policy considerations (including technical standards and guidance) to inform climate resilient policies and projects.

This document is not intended to:

- Serve as a highly technical manual with engineering or design specifications

- Replace existing planning or infrastructure frameworks; rather, it aligns with and supports national and regional policies and local climate resilience initiatives

- Mandate specific adaptation measures or policies. These should be tailored locally.

Climate hazards and projections for the West Midlands

Exposure and vulnerability to climate hazards and what it means for the West Midlands.

Based on Met Office projections and the WMCA Climate Adaptation Report (ARP4) , these include;

Increased rainfall variability and heavy rainfall

Main hazards

Winters are expected to become wetter (up to 30% more rainfall by the 2080s), with summers drier.

Annual projected rainfall is up to 25% greater than present day.

Impacts

The frequency and intensity of extreme rainfall events are projected to rise, leading to greater flood risk for urban areas, transport networks, and energy infrastructure.

Drainage systems would be overwhelmed more frequently, increasing the risk of flash floods, transport shutdowns.

Dry periods affect water supply, ground conditions and ecosystems, which can lead to risk of wildfires and infrastructure damage.

Temperature increase and heatwaves
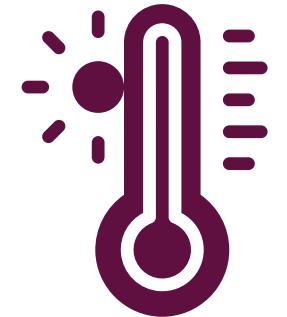
Average summer temperatures could rise by up to 4.5°C by the 2080s.

Heatwaves are projected to increase from one event per year today to three per year by 2100, with longer duration.

Urban areas like Birmingham and Coventry will experience amplified heat stress due to dense built environments.
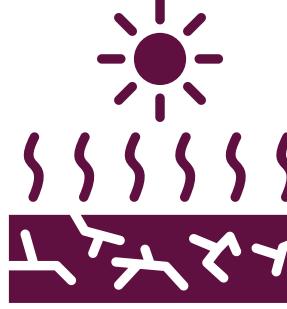
Risks of prolonged indoor overheating in homes, schools and hospitals, alongside higher energy use and sleep disruption.

Softened asphalt during heatwaves could lead to moor potholes, higher resurfacing costs and increased traffic disruption.

Older people and people with pre-existing health conditions are of greater risk to adverse health effects which could lead to high health service demands.

Sea level rise and river flooding
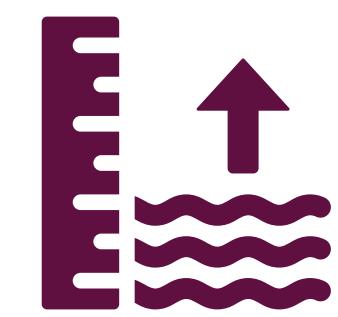
Although the West Midlands is inland, river systems such as the Severn and Trent will be affected by upstream and downstream changes, increasing the risk of fluvial flooding in low-lying areas.

The impacts of climate change in the West Midlands

Climate hazards can affect people, infrastructure, and ecosystems, leading to economic, social, and environmental consequences.

By **2035**, climate change is projected to result in an annual **reduction** in expected regional GDP (in the WMCA area) of approximately **0.75%** annually for a central warming scenario

There were **100** excess deaths for two heat periods between June and August 2022, across the WMCA area (ONS)

The **growth** of **invasive** non-native species (INNS) as a result of changing weather patterns has been estimated to cost the UK economy **£1.7 billion a year.**

Flooded electricity **substations** can cause widespread **power cuts**, which then **halt transport and telecommunications services.**

Costs of flooding damage for Staffordshire, Warwickshire and the West Midlands are projected to rise to approximately **£230m/ year** by the **2050s**.

The July 2023 floods affected **80 properties** across the West Midlands and were estimated to have caused **£0.26 million** in mental health related impacts.

The current rate of soil erosion is estimated at **2.9Mt per year** in England and Wales with losses in productivity estimated at **£40m** per year.

Storm Arwen (Nov 2021) knocked out power for nearly **1 million customers in the North East**, with around 40,000+ consumers off supply for over 3 days and **~4,000 homes without electricity**. This led to prolonged **telecoms outages** and hampered emergency communications.
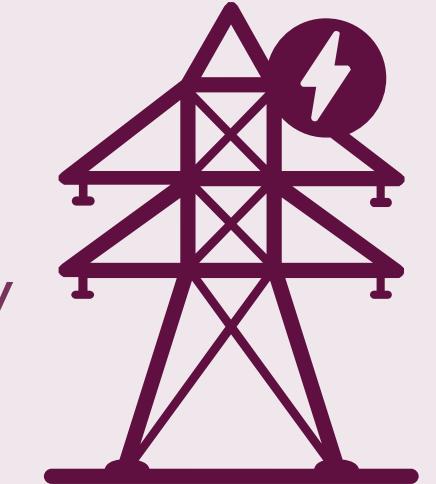
WMCA adaptation action and next steps

Milestones to date mark the start of a collective journey toward climate resilience. As climate risks intensify, sustained action is essential to scale delivery and prepare communities and infrastructure for future challenges.

2019

West Midlands Combined Authority (WMCA) declared a climate emergency.

2021

Publication of West Midlands Natural Environment Plan (2021–2026)
This plan outlines WMCA's strategy to enhance the region's natural environment, emphasizing its role in climate resilience.

2023

WMCA appointed responsible authority for delivering the West Midlands Local Nature Recovery Strategy (LNRS)
This will be a spatial strategy for nature and environmental improvement, as well as wider environmental goals including climate adaptation.

Local Investment in Natural Capital (LINC) programmes
WMCA announced as one of four pilot regions for delivering the LINC programme aimed at attracting and facilitating private finance in natural capital projects.

Publication of the Nature-based Sustainable Drainage Guidance
WMCA published a guidance document on the types and benefits of nature-based Sustainable Drainage Systems.

UK Research and Innovation (UKRI) projects announced for Maximising UK Adaptation to Climate Change funding
WM-Adapt – research project aiming to enhance local adaptation efforts by integrating community perspectives, improving climate modelling and convening a Regional Adaptation Network.

ATTENUATE – exploring financing options for climate adaptation delivery.

2020

Launch of WM2041 Green Paper
Introduction of the WM2041 initiative, outlining 74 proposed actions to guide the region towards net-zero emissions.

This includes a key principle to 'boost regional resilience to locked-in climate change'.

2022

WMCA published a high-level Summary of Climate Impacts facing the organisation's seven constituent authorities.

Defra launch third National Adaptation Programme (NAP3)
Adaptation actions for the third, 5-year National Adaptation Programme span government departments and sectors.

2024

Launch of the English Devolution White Paper
Government propose reforms for local government structures, functions and powers. For the WMCA this includes the introduction of Strategic Development Strategies, an Integrated Settlement and various powers across the themes covered in this resource.

Local Authority Climate Adaptation Reporting Pilot under ARP4
WMCA participated in the pilot round of local authority adaptation reporting. Identifying the climate risks facing the organisation and accompanying adaptation options

Sectoral focus

Since both local and strategic authorities work across similar themes, this guidance focus on the following common sectors of interest:

Energy planning & building retrofit

Referred to in this document as **Energy and retrofit**

Covers the climate resilience of domestic and non-domestic retrofit programmes (e.g. insulation, ventilation, smart controls) and local energy infrastructure (e.g. heat networks, rooftop renewables).

Relevant climate risks:

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New builds and development

Referred to in this document as **New developments**

Includes the planning, design, construction, retrofit, and management of new builds and housing developments

Relevant climate risks:

- Damage to homes and development sites from increasing flood events.
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Transport and highways

Referred to in this document as **Transport**

This theme covers street-level transport infrastructure—such as road layout, drainage, kerbs, active travel routes, bus stops, shelters, priority lanes, and tram/metro systems (excluding rail, ports, and freight).

Relevant climate risks:

- Disrupted public transport from severe weather
- Damage to roads, bridges, and tramways from storms, heat, erosion, and drought
- Rising maintenance costs due to weather-related wear
- Increased risks to passenger safety and mobility during extreme conditions

Sectoral interdependencies

Proactively planning for interdependencies between sectors, coordinating action, data sharing and clear communication - are key to building resilience.

Energy and retrofit
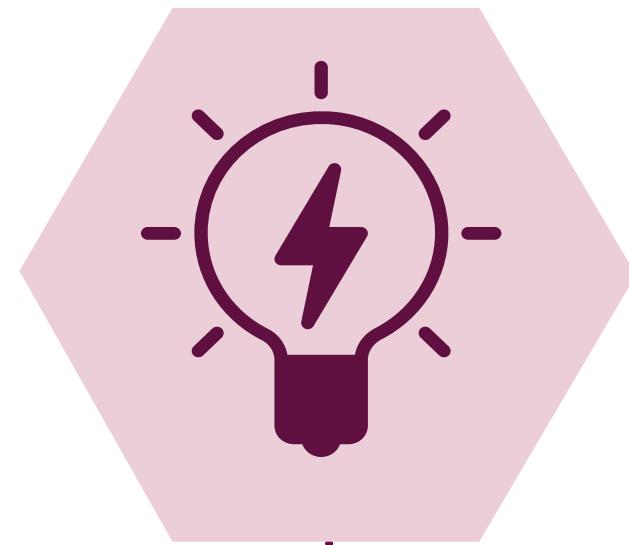
New developments

Transport

Energy and transport dependency example:

- Transport systems increasingly reliant on electricity are vulnerable to energy disruptions during climate events.

Risks

- Energy disruptions can hinder transport services, affecting mobility and emergency response.

- EV infrastructure is vulnerable to flooding and heavy rainfall.

Mitigations

- Resilient charging infrastructure is essential to avoid grid overload during peak times or extreme weather.

- Design and locate EV infrastructure with future climate impacts in mind.

New developments and energy dependency example:

- Electrifying heating and cooling increases reliance on a stable electricity supply.

Risks

- Power outages during extreme weather can compromise thermal comfort and safety.

- Rising summer temperatures may drive up energy use for cooling, challenging decarbonisation goals.

Mitigations

- Integrate renewable energy systems.

- Increase thermal insulation to reduce reliance on mechanical cooling. Insulation retrofits must suit housing layout and type e.g. tailored approaches in older homes to prevent moisture build-up.

Transport and New developments dependency example:

- Keeping people connected depends on reliable, weather resilient transport services..

Risks

- Poor integration between housing and transport can leave communities isolated during floods or heatwaves, especially where active travel routes are inaccessible or poorly maintained.

- Climate shocks and stressors may reduce appeal of active transport, leading to less sustainable travel choices.

Mitigation

- Strategically locate and densify housing to support access to essential services.

- Well-designed active travel networks offer alternative mobility during fuel shortages or transit disruptions.

National legislation and climate adaptation

This section outlines the legal obligations for local authorities and public bodies to consider climate risks and incorporate climate-resilient design.

Unlike voluntary standards (e.g. PAS 2035, ISO 14090), these are legally binding. While not exhaustive, this section covers the most relevant frameworks.

Climate Change Act (2008)

This act makes climate adaptation a legal requirement.

Every five years, the government are required to conduct:

- a Climate Change Risk Assessment (CRA) every five years

- a National Adaptation Programme (NAP) to address the risks

- rounds of national adaptation reporting using the adaptation reporting power (ARP)

Oversight and accountability for the delivery of these duties is provided by an independent advisory body – the Climate Change Committee (CCC).

Environment Act (2021)

This Act sets legally binding targets to improve ecosystem health, boosting resilience to climate hazards like flooding, drought, and heatwaves. It requires local authorities to act through Local Nature Recovery Strategies—key levers for delivering climate resilience.

Flood and Water Management Act (2010)

This Act improves flood and coastal erosion management in England and Wales. It defines responsibilities for authorities like the Environment Agency (EA) and Lead Local Flood Authorities (LLFAs), and includes provisions on SuDS, reservoir safety, and water use restrictions.
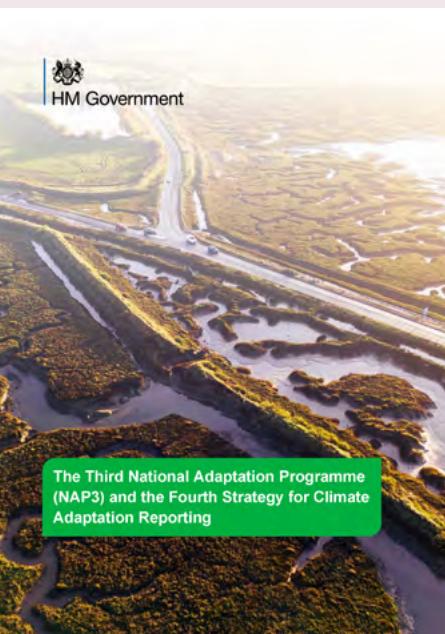
The UK's National Adaptation Programme (NAP3), 2023

NAP3 outlines the UK's strategic approach to building climate resilience, responding to priorities set by the Climate Change Committee under the Climate Change Act 2008. It focuses on key sectors like infrastructure and health.

While legally binding for central government, it guides—rather than mandates—local authorities. It supports local adaptation through improved climate data, hazard mapping, and stakeholder engagement.

The programme emphasises integrating climate risk into all stages of project and policy lifecycles, providing a framework to embed adaptation into planning and delivery.
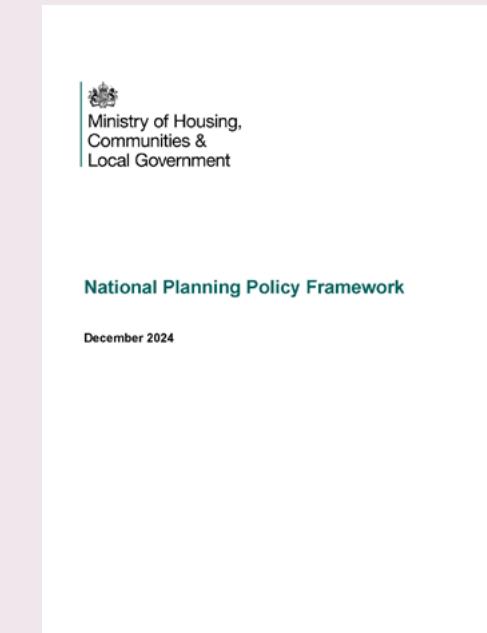
National Planning Policy Framework (NPPF), 2024

The NPPF embeds sustainable development into planning, requiring climate risks to be considered at every stage.

It promotes:

- Avoiding flood-prone development (sequential test)

- Climate-responsive design (e.g. overheating mitigation)

- Sustainable Drainage Systems (SuDS)

- Integrated risk assessments

- Green infrastructure for ecosystem services

- Resilient, low-carbon transport

While supporting housing delivery, the NPPF and Planning Practice Guidance stress early use of climate data and strategic, place-based planning—especially to avoid high-risk areas.

Supporting guidance helps local authorities assess risks early and apply adaptation measures throughout project lifecycles.

Flood Risk Regulations (2009)

These regulations implement the EU Flood Directive in England and Wales. The Environment Agency and LLFAs are required to produce a Flood Risk Assessment, mapping of flood hazard and risk and Flood Risks Management Plans to mitigate the risk.

Planning and Infrastructure Bill (Under proposal)

This proposed bill aims to streamline major infrastructure and housing delivery by enabling regional coordination through Strategic Planning Boards (SPBs). These boards would develop Spatial Development Strategies (SDSs) to tackle regional planning challenges and support climate-resilient infrastructure and nature-based solutions, while also strengthening delivery of plans like Local Nature Recovery Strategies.

Planning Act (2008)

This document establishes a framework for approving major infrastructure projects. It requires planners to consider sustainable development and supports infrastructure that can withstand climate hazards.

Adaptation Reporting Power (Climate Change Act 2008)

This legal mechanism requires public bodies and infrastructure operators to report on climate risks and resilience actions. It is the main route through which adaptation is embedded in the energy sector.
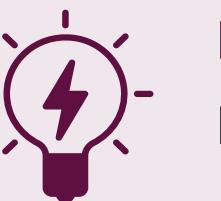
Energy and retrofit

Energy Act (2023)

While primarily focused on energy transition and security, the Act includes references to energy system resilience, such as protections for critical supply and fuel sectors. These support long-term system planning under changing climate conditions.

New developments

The Building Regulations (2010)

The regulations set minimum standards for building design and construction to ensure buildings are safe, healthy and energy efficient. Regulations require energy efficiency improvements, overheating mitigation and ventilation.

Technical guidance on how to meet the Building Regulations is provided in the Approved Documents. In addition, implementation of the regulations is supported by the Manual to the Building Regulations (2020).

Transport

Rights of Disabled Passengers on Transport (2022)

This document ensures accessibility and rights for disabled passengers. It highlights the need for resilient transport systems to benefit vulnerable users during extreme weather.

Highways Act (1980)

This Act governs the management and maintenance of public highways. It sets out maintenance powers of district councils and the general improvements to highways which can be leveraged to deliver resilience improvements.

Department for Transport (DfT) Climate Adaptation Strategy

The DfT Climate Adaptation Strategy outlines how to embed climate resilience across the UK transport system. It promotes mainstreaming adaptation through cultural change, new tools, and cross-sector collaboration. Key actions include risk-based asset management, clear leadership via named senior responsible officers (SROs), and regular progress reporting—aiming to strengthen resilience across all transport modes and regions.
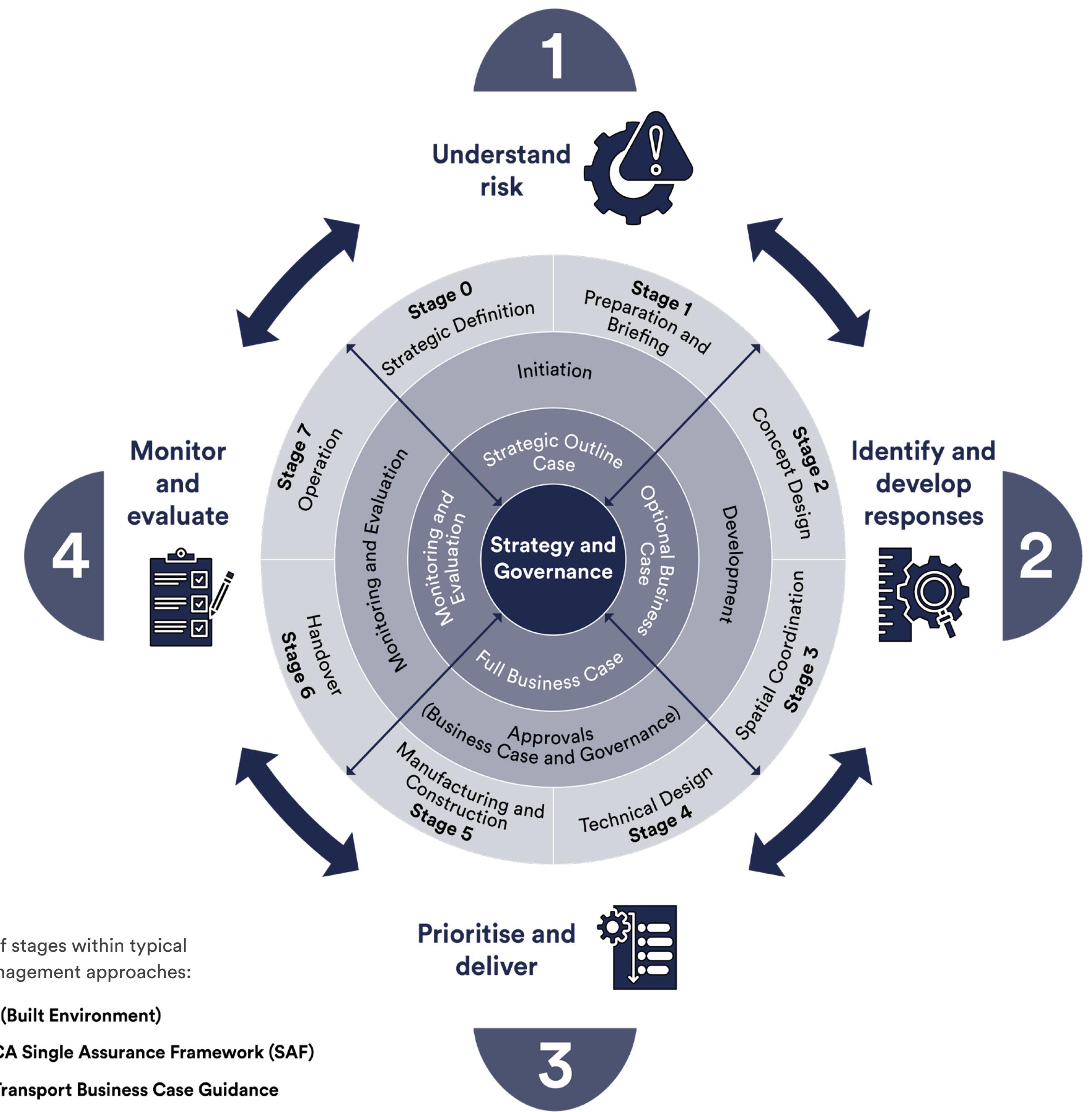
Take action in your projects

Climate Resilient Projects Framework

Local and strategic authorities often follow similar project management processes to develop policies, plans, and deliver projects.

This diagram shows a Climate Resilient Projects Framework, designed to align with typical project stages across various project lifecycle approaches.

This framework is intended to be applied flexibly, with several key features to guide its use:

- Application should be tailored to each project context

- The process is cyclical and adaptive based on new learnings from previous stages.

- Elements of the Climate Resilient Projects Framework will apply across several project lifecycle stages.

- Checklist, metrics, measures, resources and case studies have been presented throughout this guidance against different lifecycle stages.

- It should be noted that the "Strategy and governance" element spans each of the framework stages.

Examples of stages within typical project management approaches:

�	RIBA (Built Environment)
	WMCA Single Assurance Framework (SAF)
	DfT Transport Business Case Guidance

Navigating the guidance elements

Each stage of the Climate Resilient Projects Framework
includes the following elements:

Checklists provide a series of high-level prompts to support users identify climate risks, select context-appropriate measures, and guide monitoring and evaluation. A checklist is a flexible non-mandatory tool designed to help project teams embed climate resilience throughout project planning, design and delivery.

Metrics are suggested to track how well climate resilience is being integrated. They support learning and on-going management by offering insights at both project and programme levels. Metrics also enable accountability, ensuring any commitments to climate adaptation can be monitored.

Technical standards and guidance are signposted to help project teams in identifying relevant resources and best practices that enable practical implementation of steps highlighted in the checklist.
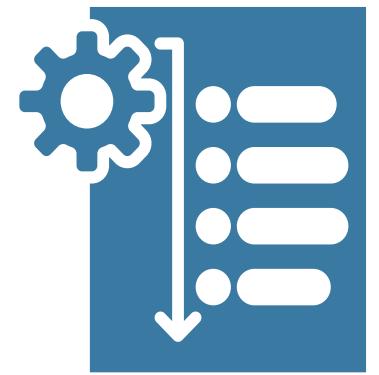
Measures are adaptation options that can be selected, analysed, designed and implemented throughout the Climate Resilient Projects Framework. It should be noted that this list is not exhaustive, but aims to spark ideas for implementation.

Case studies highlight examples of climate adaptation integration and delivery. Each is aligned to specific Climate Resilient Projects Framework stage and case studies are local to the UK if not the West Midlands.

How this guidance relates to project roles

Although developed with strategic and local authority officers, this guidance is relevant to a broad range of roles within a project team. The Summaries and templates provide a quick guide to which project roles the checklists, metrics, and measures best apply to..

Role		Typical Projects/ Tasks	Key climate resilience considerations (These may be shaped by each organisation's internal culture and structure - for e.g. different attitudes toward risk, investment priorities, or how decisions are made. The Guidance is designed to be flexible to support this variation.)
Planners		• Developing spatial or local plans • Reviewing planning applications • Conducting site allocations and assessment	• How to integrate climate risk data into spatial planning • Key sector specific standards to apply
Design Teams		• Developing building/site designs • Specifying materials and construction methods • Preparing technical documentation and tender packages	• How to improve climate resilience through design • Key sector specific standards to apply
Operations & Maintenance (O&M)		• Writing/maintaining O&M manuals • Updating maintenance protocols	• What to include in the O&M manuals for climate resilience • How to track climate resilience performance of assets
Land/Estate Managers		• Estate management • Land development projects	• How can land and estate portfolios build resilience to climate risk
Policy Decision Makers		• Policy and strategies formulation • Funding programmes	• How to ensure the funding has been utilised for long term resilience benefits • How to measure climate resilience performance
Project Managers		• Project delivery • Managing multidisciplinary consultant and contractor teams	• How to integrate climate resilience into the delivery plan and design scope • Which climate adaptation measures are feasible within timeline and budget
Procurement Officers		• Managing procurement strategies • Managing contracts and supplier performance frameworks • Evaluating bids and supplier compliance	• How to include climate resilience requirements in supplier selection and technical specifications
Operation Managers		• Running day-to-day building or infrastructure services • Responding to climate-related service disruptions • Integrating climate adaptation in asset management plans	• How to plan and implement climate resilience into maintenance regimes • How to ensure operational continuity during extreme weather events • How to monitor climate-related operational performance indicators during and after extreme weather events
Sustainability Teams		• Supporting climate assessment for projects • Shaping local climate and environment policy • Supporting other roles to integrate sustainably	• How to build capacity and support other teams • How to develop and deliver climate resilience plans
Public Transport Operators		• Managing service operations and route planning • Managing assets (e.g. vehicles, trackway, stations)	• How to minimise service disruption • How to plan and communicate alternative routes in the event of disruption

Navigating the measures cards

Measure cards provide a quick reference to understand different climate resilience responses — helping users apply them at the right time, in the right way.

How to use the measures cards

❶ Relevant project lifecycle stage

❷ Adaptation measure name

❸ Intended impact of the adaptation measure

❹ Type of measure: adaptation measures are categorised as follows:

- Policy and strategy
- Behavioural or cultural
- Regulatory
- Physical or technical

❺ Description of measure including hyperlinks where relevant

❻ Owners: who is responsible for delivering the measure?

❼ Relevant sectors: is the measure relevant to energy and retrofit; new developments and/or transport?

❽ Indicative cost: High-level cost bands that indicate the scale of investment required.

- £ - Low cost (e.g. guidance, desktop analysis, staff time)
- ££- Medium cost (e.g. retrofit upgrades, site-specific design or tech)
- £££ - High cost (e.g. infrastructure build, grid upgrades, major works)

Example of a measures card

18

Strategy and governance

Understand risk

Identify and develop responses

Strategy and Governance

Monitor and evaluate

Prioritise and deliver

1

2

3

4

Checklist

Strategy and governance - This checklist offers examples of factors you could consider when establishing the strategy and governance supporting a project.

Strategic and organisational checklist and metrics are cross-cutting or organisational-level metrics that do not sit within a specific project or Climate Resilient Projects Framework stage. The related checklist and metrics support wider climate governance, capacity building, and strategic oversight.

The checklist is designed to be applicable both at the organisational level and within individual projects – supporting strategic oversight while also guiding project-level delivery.

Have roles and responsibilities for climate resilience been clearly defined across all Climate Resilient Projects Framework stages?

Are climate resilience metrics integrated into Key Performance Indicators (KPIs), delivery frameworks, or performance dashboards?

Do your risk registers include climate-related risks?

Is there a clear plan showing how the project will adapt to climate change?

Are the appropriate governance structures in place to ensure the implementation and long-term monitoring and management of adaptation measures e.g. working groups, partnerships with academic and charitable organisations?

Plans to ensure long term sustainable delivery of adaptation options may require agreement on funding models, governance, review frequency and stakeholder engagement to develop buy in and ensure effective on-going implementation and management of adaptation measures.

Metrics

Strategy and governance - These metrics illustrate how progress on strategy and governance can be tracked and reported.

Owners:

Planners | Design Teams | Project Managers | Policy Decision Makers | Operation Managers | Procurement Officers | Sustainability Teams

Example metrics to track	Possible data sources	Owners
Presence of continuity/ emergency plans addressing relevant climate hazards	Business continuity plans, emergency plans	Operation Managers
% of projects primarily focused on adaptation outcomes as stated in objectives or scope	Project business cases (e.g. SOBC/OBC), investment planning records	Planners, Policy Decision Makers
% of projects aligned with WMCA Adaptation Plan objectives	Project deliverables (e.g. Inception Report)	Planners, Design Teams, Project Managers
% of tenders or contracts that include climate adaptation or future climate performance requirements	Tender documents, contract clauses referencing adaptation criteria	Planners, Design Teams, Procurement Officers
Number of staff completing climate resilience training	Training platform completion, course attendance.	Project Managers, Sustainability Teams

Capturing the proportion of projects with explicit adaptation objectives helps demonstrate progress towards mainstreaming climate adaptation.

Embedding adaptation and performance requirements into procurement ensures climate considerations are factored into design, construction and operations. This creates a supply chain that is future-proof and aligned with long-term resilience objectives.

Building workforce capability is crucial to implementing climate resilience. Tracking training completion helps ensure staff have the skills to apply climate resilience principles consistently across projects.

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Technical standards and guidance

Strategy and governance

BS EN ISO 14090:2019

BSI Standards Publication

Adaptation to climate change – Principles, requirements and guidelines (ISO 14090:2019)

bsi.

ISO 14090:2019 - Adaptation to Climate Change: Principles, Requirements and Guidelines

Provides a framework for integrating climate change adaptation into organizational policies, strategies, and operations by addressing impacts, uncertainties, and decision-making processes across all sectors and scales.

BS EN ISO 14091:2021

BSI Standards Publication

Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment

bsi.

ISO 14091:2021 - Adaptation to Climate Change: Guidelines on Vulnerability, Impacts and Risk Assessment

Offers a structured approach for assessing climate-related risks by identifying vulnerabilities, evaluating potential impacts, and supporting adaptation planning across sectors and scales.

Technical standards and guidance

Strategy and governance

PD ISO/TS 14092:2020

BSI Standards Publication

Adaptation to climate change. Requirements and guidance on adaptation planning for local governments and communities

bsi.

...making excellence a habit.™

ISO/TS 14092:2020 - Adaptation to Climate Change: requirements and Guidance on Adaptation Planning for Local Governments and Communities

Provides structured guidance for local governments and communities to develop climate adaptation plans based on vulnerability, impact, and risk assessments, supporting inclusive, locally tailored climate resilience strategies.

BS 8631:2021

BSI Standards Publication

Adaptation to climate change — Using adaptation pathways for decision making — Guide

bsi.

BS 8631:2021 – Adaptation to Climate Change: Using Adaptation Pathways for Decision Making

Provides a structured nine-step approach for organisations to plan and implement climate adaptation strategies using adaptation pathways, enabling flexible, long-term decision-making under uncertainty.

Stage 1: Understand risk

1

Understand risk

Monitor and evaluate

4

Strategy and Governance

Identify and develop responses

2

Prioritise and deliver

3
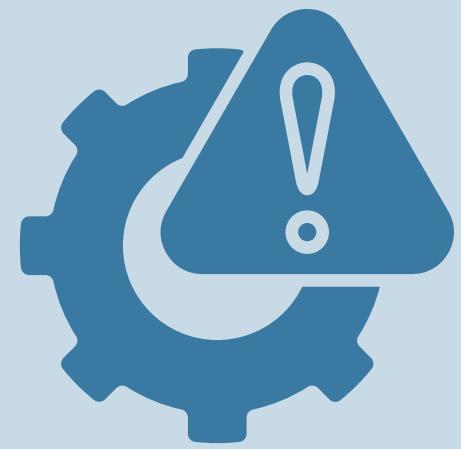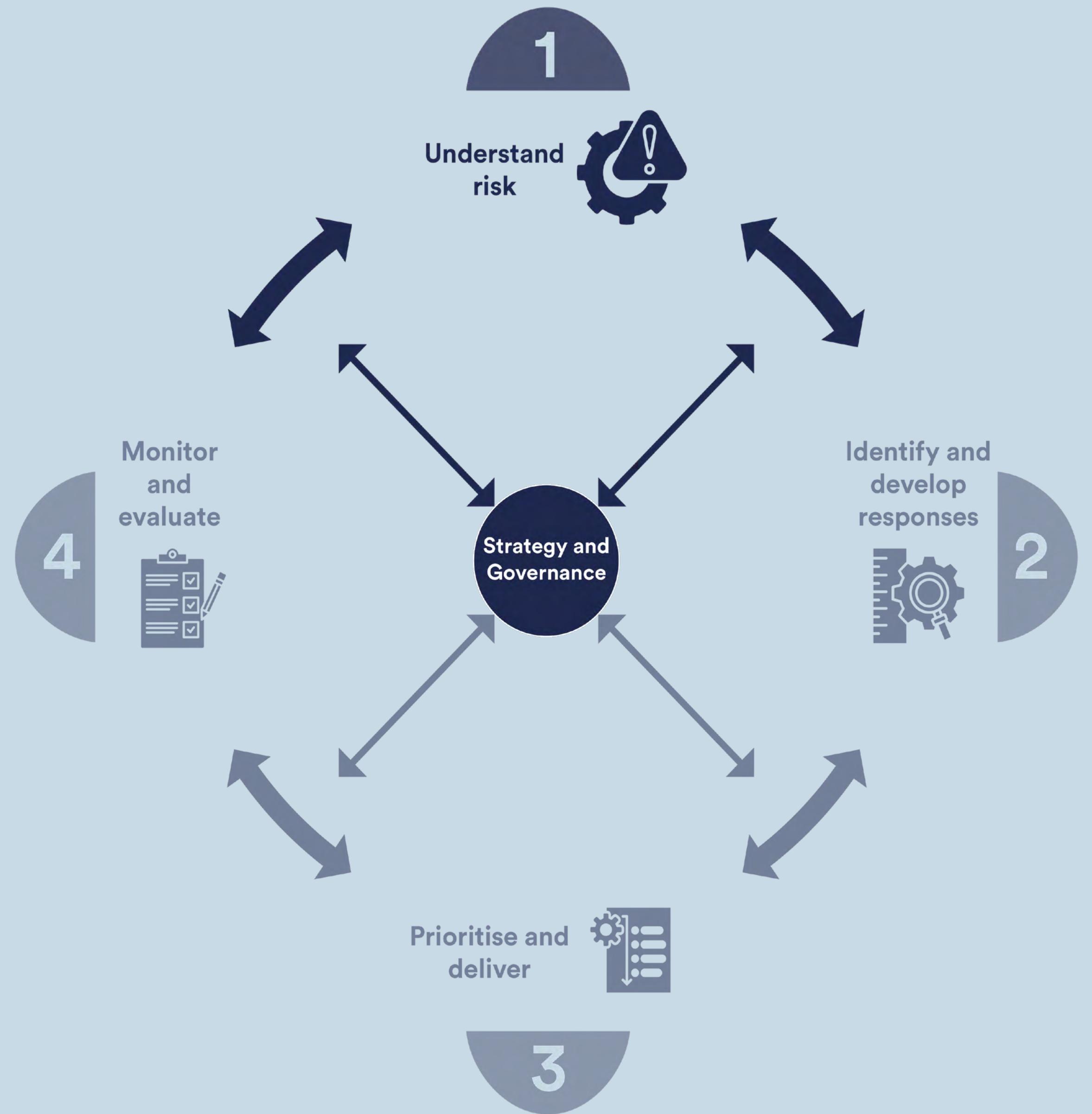
Checklist

Understand risk - This checklist offers examples of factors you could consider when understanding the climate risk facing your project.

— Have the key climate hazards relevant to the project's type and location been identified?

— Have future climate projections (e.g. scenarios for the 2030s, 2050s and 2100s) been used to inform the project's risk profile? *

— Has a high-level climate risk screening or assessment been completed? Does it include cascading impacts (See Met Office Local Authority Climate Service, Climate Risk Indicators) **

— Have climate resilience objectives been considered as part of broader sustainability goals within the strategic brief or business case?

— Is the project aligned with wider objectives such as net zero, social value, or health outcomes?

— Have stakeholders and key delivery partners been engaged to help identify risks and dependencies?

— Has the site location and layout been assessed for exposure and vulnerability to future climate risks (e.g. flooding, overheating, water stress)? (See Flood risk assessment climate change allowances, Spatial planning for climate resilience and Net Zero, Climate Change Committee)

— Have you conducted a cost-benefit analysis for implementing adaptation measures, to support the value case, drawing on relevant guidance and benchmarks e.g. HM Treasury The Green Book supplementary guidance?

Example:

— Have UKCP18 climate projections been used to assess overheating scenarios that need to be considered in design?

— Have future climate scenarios (e.g. 2050s/2080s) been used to assess overheating and surface water risks in new developments?

— Have future rainfall projections (e.g. 2100s) been applied to model drainage systems or rail embankment vulnerability?

Sectors:

Energy and retrofit

New developments

Transport

Example:

— Have asset locations taken account of future flood extents or temperatures?

— Have flood overlays been used to identify vulnerable corridors or interchanges?

— Have potential project sites been assessed for future flooding, high temperatures and water stress?

Sectors:

Energy and retrofit

New developments

Transport

* The UK Climate Projections (UKCP) is a Met Office project, providing climate change data and projections. UKCP helps decision makers understand future climate change and plan for its impacts. The latest iteration is UKCP18.

** Climate impacts will be specific to the system, network and asset in question. Assessing impacts must consider their context within the system, and the impacts on the assets and systems they are dependent on to understand the full extent of climate impacts.

25

Metrics

Understand risk - These metrics illustrate how risk identification and understanding can be monitored over time.

Owners:

Planners   Design Teams   Project Managers   Policy Decision Makers

Example metrics to track	Possible data sources	Ownership
% of business cases that follow the H.M. Treasury Green Book supplementary guidance and model for both +2° and +4° Global Warming Levels (GWLs) beyond 2024	Strategic or outline business cases (e.g. SOBC, OBC)	Planners, Policy Decision Makers
% of projects incorporating climate risk screening or assessment (e.g. UKCP, LA tool)	Climate screening forms, pre-feasibility reports, or project scoping templates	Planners, Design Teams, Project Managers
% of sites mapped for key climate hazards such as surface water flooding, heat, or drought exposure	Project reports or design review checklists	Project Managers, Design Teams

Example:

% of business cases assessing asset vulnerability to extreme weather (e.g. heat, storms, flooding)

% of transport business cases incorporating future climate scenario analysis (e.g. drainage risk)

Sectors:

Energy and retrofit

Transport

Example:

% of energy infrastructure projects screened for overheating, storm, or flood risk

% of housing developments with site-specific flood, heat, or water stress screening

% of new transport routes assessed for extreme rainfall and heat impacts at concept stage

Sectors:

Energy and retrofit

New developments

Transport

26

Technical standards and guidance

Understand risk

Cross-sectoral

Spatial planning for climate resilience and Net Zero, Climate Change Committee

Provides a detailed overview of the current capability of the spatial planning system (with a focus on England) to tackle the climate crisis and specifically how the system can support the government's legal obligations in relation to climate mitigation and adaptation.

A Framework for the measuring and reporting of climate, UKGBC

The UK Green Building Council's report on measuring and reporting physical climate risks provides a framework for real estate and built environment stakeholders to assess, disclose, and manage risks from climate-related hazards like flooding, heat, and subsidence.

Technical standards and guidance

Understand risk

GOV.UK

Home > Environment > Climate change and energy > Climate change adaptation

Guidance

Green Book supplementary guidance: climate change and environmental valuation

Supplementary guidance to the Green Book covering the consideration of the impacts of climate change in policy appraisal to ensure value for money of government spending.

From: **Department for Environment, Food & Rural Affairs**
Published 21 April 2013
Last updated 8 April 2025 — See all updates

[Green Book supplementary guidance: climate change and environmental valuation](#)

This supplementary guidance enhances the integration of climate resilience into policies, programmes and projects. It builds on the Green Book appraisal methodology to account for climate effects, it supports identification of climate risks and supports design and evaluation of adaptation measures.
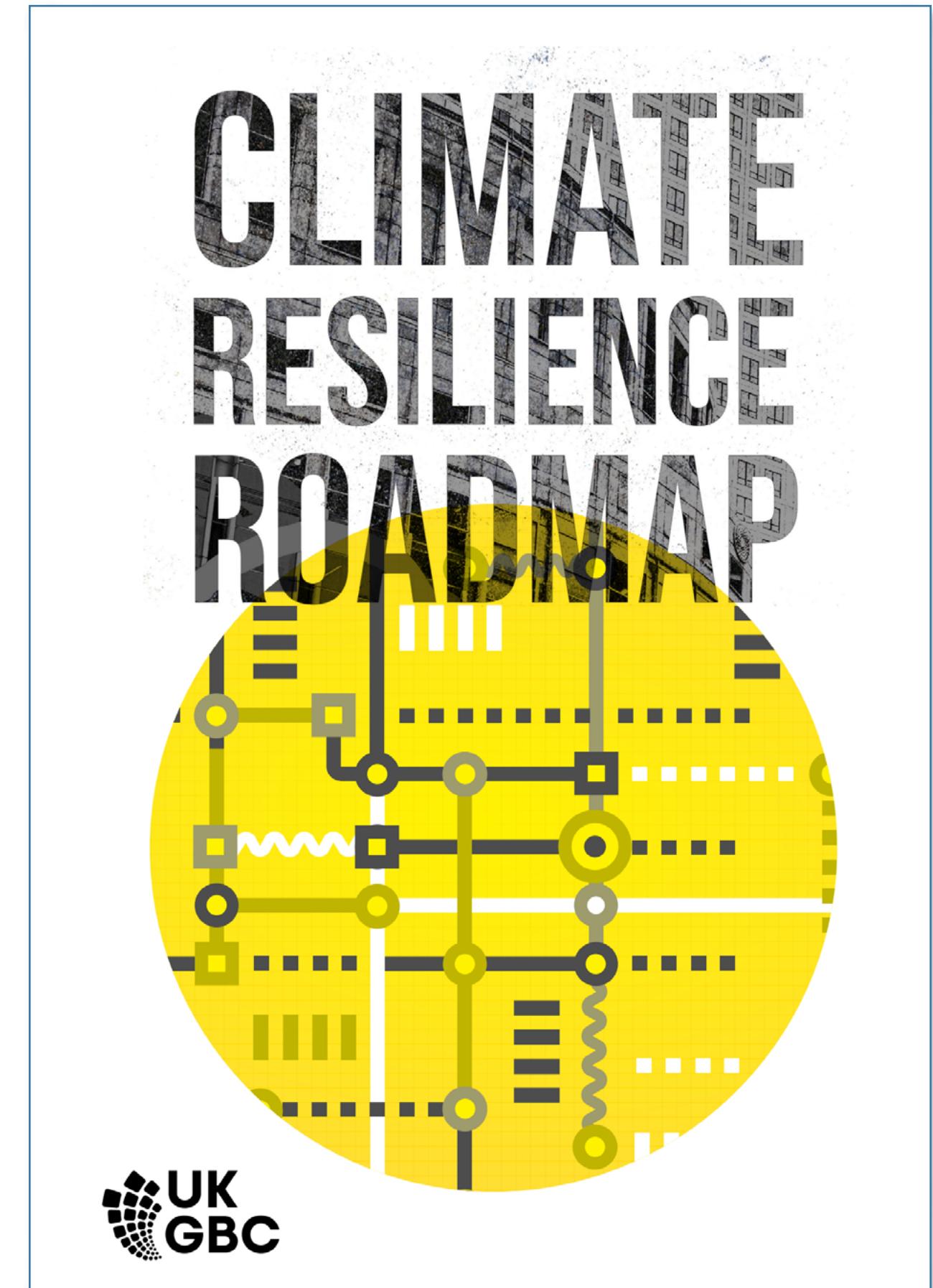
[UK Climate Resilience Roadmap, UKGBC](#)

This newly released Roadmap sets out a vision for a climate resilient built environment, sharing clear recommendations for the industry and policy, and next steps needed to increase the climate resilience of our built environment. Other resources related to this tool include the Policy Recommendations, Technical Report, GIS Vulnerability Web Map and Urban Heat Island Web Map.

Technical standards and guidance

Understand risk

Energy and retrofit

National grid future energy scenarios

These scenarios outline regional projections for electricity demand and supply across sectors like heating, transport, and renewables, based on four national decarbonisation pathways to inform local network planning.

Climate Change Risks and Hazards, Historic England

Outlines how climate change poses escalating risks to historic environments, such as flooding, sea-level rise, and extreme weather, and provides tools, definitions, and guidance to help heritage professionals assess, monitor, and adapt to these hazards using internationally aligned methodologies

Technical standards and guidance

Understand risk

New developments

Design methodology for the assessment of overheating risk in homes

CIBSE

TM59: 2017

[TM59 Design methodology for the assessment of overheating risk in homes (2017), CIBSE](#)

Standard methodology for assessing overheating risk in homes using dynamic thermal modelling, focusing on factors like solar gains, ventilation, and occupancy, and recommends early-stage design interventions to protect occupant health and comfort in a warming climate

The Houndwood Development sustainable housing, Somerset © Arup

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Technical standards and guidance
Understand risk

Transport

Climate Risk Assessment Guidance for the Transport Sector, Department for Transport

Provides an eight-step methodology for assessing climate risks to transport infrastructure, helping organisations identify vulnerabilities, evaluate future climate impacts, and develop targeted adaptation actions to ensure long-term climate resilience.

Department for Transport

Climate Risk Assessment Guidance for the Transport Sector

WM-AIR

UNIVERSITY OF BIRMINGHAM

West Midlands Combined Authority

Greenham, SV., Ferranti, EJS., Cork, NA., Jones, SA., Zhong, J., Haskins, B., Higgins, W., Grayson, N., Needle, S., Acton, WJF., Mackenzie, AR., Bloss, WJ., 2024. Mapping climate risk and vulnerability in the West Midlands. A guidance document produced by the WM-Air project, University of Birmingham. Funding provided by NERC innovation grant NE/S003487/1. Ferranti acknowledges EPSRC Fellowship EP/R007365/1.
https://doi.org/10.25500/epapers.bham.00004371

MAPPING CLIMATE RISK AND VULNERABILITY IN THE WEST MIDLANDS

Contents	Page
Introduction	1
How the map is built	2
Data used	3
The map	4
Utilising the map	5
Layer processing	6
GIS techniques	10

A guidance document from the WM-Air project
Version 1.0 November 2024

The climate is changing. As mean global surface temperatures rise, it brings changes to the climate and weather patterns. In the West Midlands, the likely changes are warmer, wetter winters; hotter, drier summers; and more extreme weather events.

We need to adapt to a changing climate. Some of the weather events we are currently experiencing is unprecedented. Without adaptation, people, infrastructure and the natural environment are more at risk to the impacts of climate change.

The impacts of climate change are felt differently across the West Midlands, as climate hazards and socio-economic factors affecting people's ability to cope are unevenly spread across the region. It is therefore important to understand the spatial patterns.

Modern society faces several challenges. These include more people living in cities[1], income and wealth inequality[2], increases in the cost of living[3], as well as the changing climate[4]. Below are examples of five hazards connected to these challenges, which are all interlinked.

These challenges do not affect all people and places equally. Those of disadvantaged socio-economic backgrounds may have less ability to cope with hazards and are therefore more likely to be more negatively affected by climate change[5].

Hazards
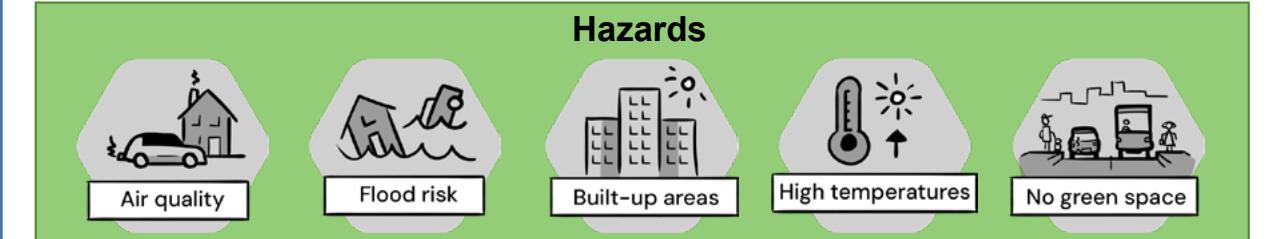
Air quality | Flood risk | Built-up areas | High temperatures | No green space

Climate change brings about many different impacts on people. On the right are eight examples of these, which citizens must be protected from as much as possible. To achieve this, local and regional authorities that make decisions for its citizens need to know where climate risk is greatest so appropriate actions can be taken.

This guidance document describes the methodology used to develop a Climate Risk and Vulnerability Assessment map for the West Midlands; co-created by the WM-Air project group and the West Midlands Combined Authority (WMCA).

Climate impacts on people include:

- Respiratory diseases
- Cardiovascular diseases
- Loss of income
- Overheating risk
- Poorer mental health
- Vector-borne diseases
- Damage or loss of homes and possessions
- Bacterial and viral infections

References

1. UN Habitat (2022) World Cities Report 2022: Envisaging the future of Cities. Available at: https://unhabitat.org/wcr/ (last accessed 18/07/2024)

2. Chancel et al. (2022) World Inequality Report 2022, World Inequality Lab. Available at: https://wir2022.wid.world/ (last accessed 19/08/2024)

3. IMF (2023) IMF Annual Report 2023. Available at: https://www.imf.org/external/pubs/ft/ar/2023/english/ (last accessed 19/08/2024)

4. IPCC (2021) Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the IPCC. Available at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf (last accessed 10/01/2024)

5. IPCC (2022) Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the IPCC. Available at: https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf (last accessed 13/03/2023)

Mapping climate risk & vulnerability onto the West Midlands transport network, University of Birmingham

Presents a GIS-based methodology for mapping climate risk and vulnerability across the West Midlands transport network, combining data on hazards, exposure, and social vulnerability to support climate-resilient infrastructure planning

Technical standards and guidance

Understand risk

UK Climate Risk (CCRA3) Transport Briefing

It highlights how climate change threatens UK transport systems through flooding, heat, and cascading infrastructure failures, urging urgent adaptation over the next five years to avoid widespread disruption, economic loss, and safety

UK CLIMATE RISK

TRANSPORT BRIEFING

Findings from the third UK Climate Change Risk Assessment (CCRA3) Evidence Report 2021

TRANSPORT

This briefing summarises how transport has been assessed in the latest UK Climate Change Risk Assessment (CCRA) Technical Report, and what types of action to adapt to climate change risks would be beneficial in the next five years.

ukclimaterisk.org

GOV·UK

Home > Environment > Climate change and energy > Climate change adaptation

Guidance

Flood risk assessments: climate change allowances

When and how local planning authorities, developers and their agents should use climate change allowances in flood risk assessments.

From: **Environment Agency**
Published 19 February 2016
Last updated 27 May 2022 — See all updates

🔔 Get emails about this page

Applies to England

Contents

— What climate change allowances are

Flood risk assessment climate change allowances

It explains how to incorporate climate change allowances, such as increased peak river flow, rainfall intensity, and sea level rise, into flood risk assessments to ensure new developments remain resilient to future flooding and coastal change
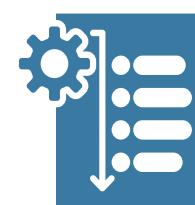
Measures

Understand risk - These measures provide examples of responses that can improve how risks are identified and assessed.

Share climate risk tools

Impact:
Enhance organisational readiness and capacity

Measure type:
Behavioural and cultural

Description:
Identify and share recommended climate risk tools tailored to different stakeholder groups (e.g. project managers, designers, contractors). See examples of tools and databases here.

Owners:

Sustainability Teams

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£

Mandate climate risk assessments

Impact:
Build a climate resilient value chain

Measure type:
Regulatory

Description:
Assign categories of projects and policies that require Climate Risk Assessments (CRAs) for current and future climate scenarios (e.g. flood, temperature and drought risks) to identify key risks and inform the development of appropriate climate resilience measures. Use CRA findings to guide business cases, bids, tender submissions and planning applications, and include them as part of the evaluation process. If teams consider CRAs unnecessary, agreement must be obtained from the climate action team. See CRA template.

Owners:

Project Managers

Sustainability Teams

Procurement Officers

Policy Decision Makers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £
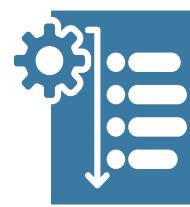
Measures

Understand risk

Identify critical climate and weather-related thresholds for assets and operations

Impact:
Robust and durable infrastructure and homes

Measure type:
Policy and strategy

Description:
Identify and document critical thresholds beyond which assets may no longer operate safely or effectively under climate extremes. These thresholds will vary by sector and asset type, for example:

- Transport: Determine weather conditions under which roads begin to deform, such as rutting or softening during high heat;

- Energy and retrofit: Maximum temperatures for transformer performance, or wind thresholds for overhead line shutdown

- New developments: Indoor temperature thresholds beyond which thermal discomfort or health risks emerge

Owners:

Planners   **Design Teams**   **Policy Decision Makers**

Operation Managers

Sectors:

Energy and retrofit   **New developments**   **Transport**

Indicative cost:

£ £

Communicate early warnings

Impact:
Ensure operational continuity and emergency response

Measure type:
Behavioural and cultural

Description:
Set up communication protocols to deliver early warnings and climate hazard alerts for weather-related hazards to relevant stakeholders. This includes establishing clear procedures on how to disseminate warnings (e.g. from Met Office) and notify staff or partners in a timely and accessible way (e.g. through dedicated channels, identify responsible persons). This measure focuses on communication processes rather than the response actions triggered by those warnings.

Owners:

Operation Managers

Sectors:

Energy and retrofit   **New developments**   **Transport**

Indicative cost:

£ £
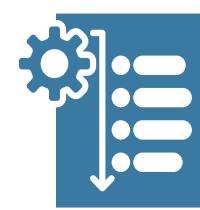
Measures

Understand risk

Ensure transport signs and signals account for weather extremes

Impact:

Users have the right information to develop adaptive behaviours

Measure type:

Physical and technical

Description:

Review existing road signs and signals to ensure they remain visible, legible and structurally sound during extreme weather events such as high winds. This may include checking mounting strength, wind loading and materials used. Where appropriate, signs can also be used to provide warnings or guidance to users in response to such events.

While no specific technical standard mandates or prescribes adaptation measures for signage or wind loading, the DfT's Transport Hazard Summary highlights increased exposure of transport infrastructure to high winds and other climate-related hazards. In the absence of detailed technical guidance, delivery teams may need to rely on local knowledge and situational judgement to inform practical securing methods – for example, using additional weights, temporary fixings or location-specific anchoring techniques.

This recommendation highlights a resilience gap that is not currently addressed by national standards. Acknowledging and planning for these operational challenges helps reduce the risk of signage failure during extreme events.

Owners:

Design Team

Procurement Officers

O&M Engineers

Operation Managers

Sectors:
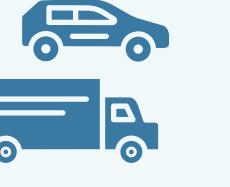
Transport

Indicative cost:

£ £

© Chris Gallagher, Unsplash
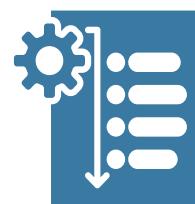
Measures

Understand risk

Use available climate hazard and risk maps for development planning

Impact:

Planning decisions are cognisant of climate hazards and risks

Measure type:

Physical and technical

Description:

Mapped layers such as flood risk zones, heat related risks can be used to inform development, including site selection, site layout and potential relocation opportunities for energy assets, transport assets and housing developments.

Owners:

Planners

Design Teams

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Case study:

Mapping Climate Risk and Vulnerability Assessment (CVRA) in the West Midlands
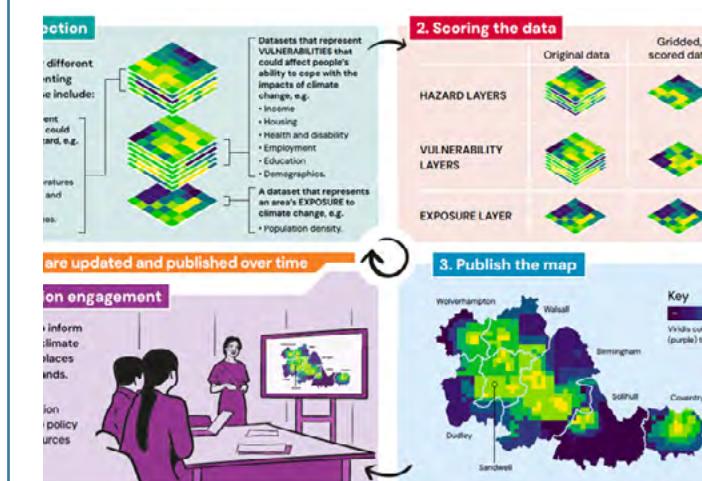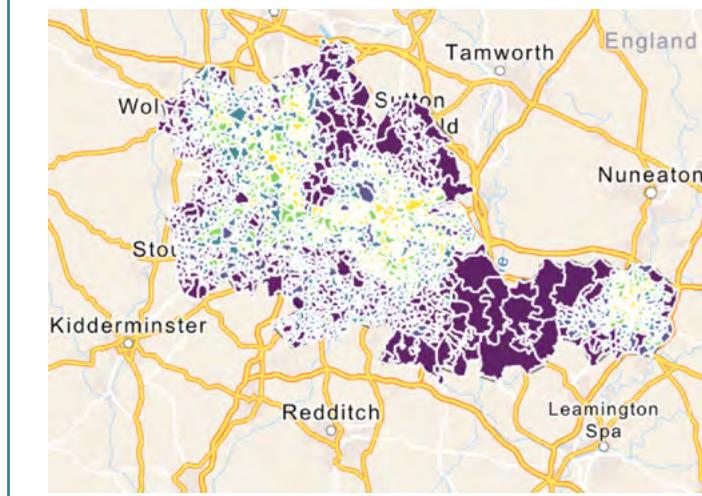
Since October 2023, the West Midlands Combined Authority (WMCA) has been working with researchers at the University of Birmingham to develop two region-wide Climate Risk and Vulnerability Assessment (CRVA) mapping tools. These tools identify areas across the seven constituent authorities where climate risks are likely to be concentrated.

Each CRVA map combines three key components:

- Climate hazards (e.g. flooding, heat)

- Socio-economic vulnerability (e.g. income, health)

- Exposure (e.g. population density in risk-prone areas)

Each layer is scored individually, and the combined scores produce an overall map that highlights relative climate risk and vulnerability across the region.

Stage 2: Identify and develop responses
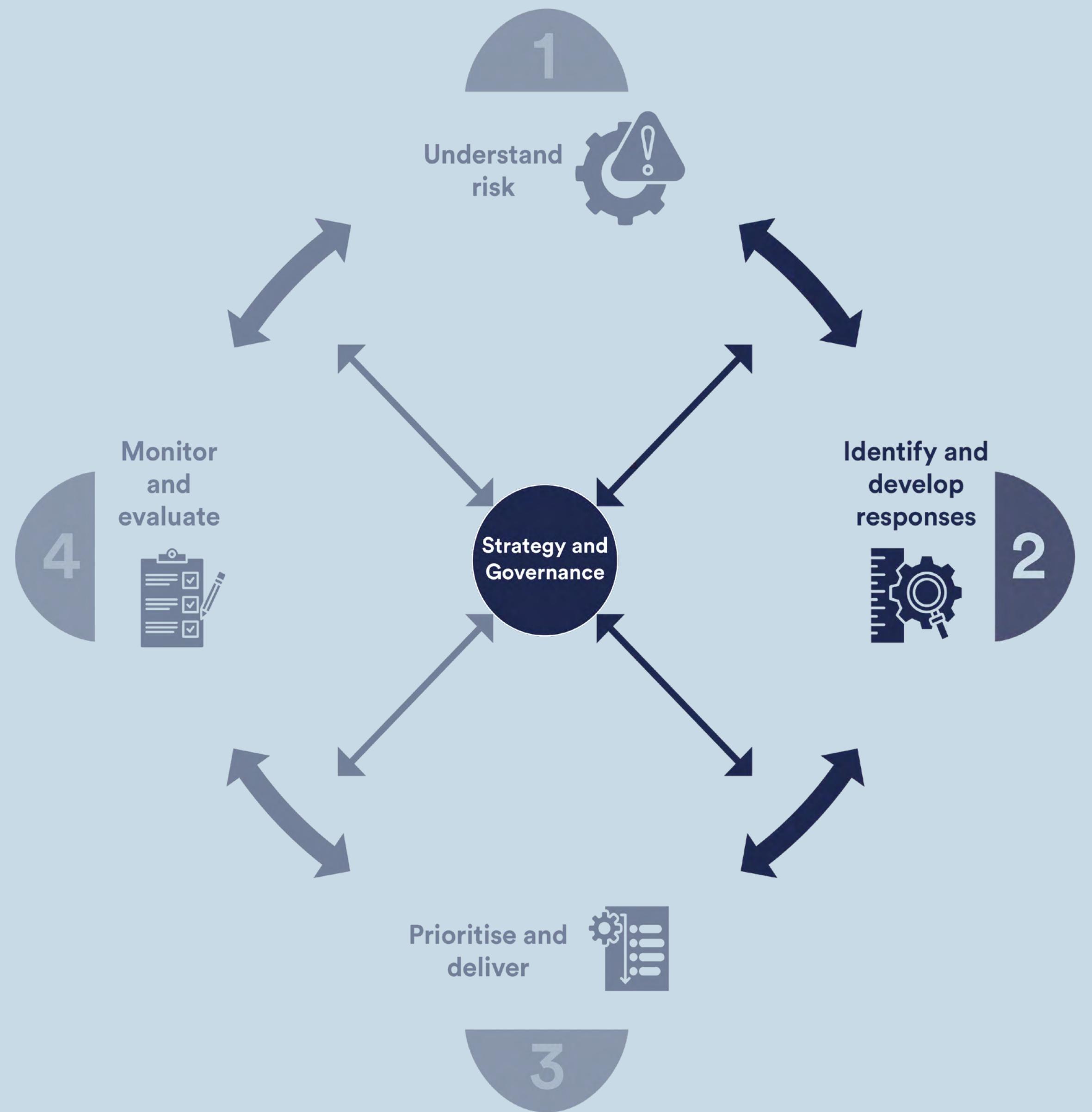
Checklist

Identify and develop responses - This checklist offers examples of factors you could consider when identifying and developing adaptation responses.

Have options that address priority climate risks and system vulnerabilities been shortlisted?

Have potential adaptation options been assessed against future climate scenarios to inform initial selection?

Have mapping tools or overlays (e.g. CRVA mapping) been used to support site and option assessment?

Have relevant technical standards been applied (e.g. TM59, ISO 14090, ISO 14091, BS 8631) to guide your decisions?

*Have potential trade-offs or unintended impacts of the adaptation measures been reviewed and mitigated (e.g. energy use, social equity, downstream effects)?

Have adaptation co-benefits (e.g. health, biodiversity, economic) been factored into the appraisal?

Have low-regret and adaptive options been integrated to ensure the design can flexibly support future adaptation in the face of uncertain climate impacts (e.g. modularity, upgrade capacity)?

Has the spatial layout been optimised to enhance climate resilience (e.g. building orientation, green infrastructure integration)?

Example:

— Has future flood or heat risk been considered in assessing potential impacts on energy systems such as cables, energy storage, or heating networks?

— Have drainage concepts been reviewed to assess if modifications are needed under future climate conditions?

— Has future rainfall or heat risk been evaluated for its potential impacts on transport infrastructure, such as drainage systems?

Sectors:

Energy and retrofit

New developments

Transport

Example:

— Are relevant technical standards (e.g. ISO 14091) referenced for climate-aligned energy planning?

— Are TM59 and PAS 2035 standards referenced in assessing overheating risk and guiding retrofit strategies?

— Has guidance from the SuDS Manual from the Construction Industry Research and Information Association (CIRIA) been referenced in designing road drainage systems?

Sectors:

Energy and retrofit

New developments

Transport

Example:

— Is the network designed for scalability or future climate-related demand increases?

— Are modular construction methods considered to accommodate future system upgrades or changes?

— Are road corridors planned with allowances for future widening, green buffers, or drainage improvements?

Sectors:

Energy and retrofit

New developments

Transport

Example:

— Has substation or cable routing been evaluated for exposure to flood-prone zones or urban heat islands?

— Are infill or estate regeneration sites screened for exposure to overheating and water stress under future climate scenarios?

— Are flood-prone corridors or interchanges mapped, and are opportunities for integrating green buffers explored?

Sectors:

Energy and retrofit

New developments

Transport

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* While adaptation measures are designed to reduce risk, they can sometimes create new issues if not carefully managed or maintained. Over-insulation can lead to overheating, poorly maintained green infrastructure can compromise the aesthetic value and ecological quality, and inappropriate materials can undermine carbon goals. Consider potential trade-offs and maintenance needs early on — and look for co-benefits wherever possible. Guidance such as Part O and the Good Homes Alliance (GHA) Overheating Toolkit provide design checks to avoid over-insulation or inadequate ventilation, which may introduce new risks under warmer climates.

Metrics

Identify and develop responses - These metrics illustrate how the identification and development of adaptation responses can be tracked.

Owners:

Planners | Design Teams | Project Managers | Procurement Officers | Sustainability Teams

Example metrics to track	Possible data sources	Ownership
% of projects designed with sustainable drainage systems (SuDS) to manage surface water flood risk	Design documentation, Procurement briefs	Design Teams, Procurement Officers, Sustainability Teams
% of projects where adaptation measures are included in costed shortlist of options	Options appraisal documents	Planners, Design Teams, Project Managers
% of projects applying relevant guidance/standards (e.g. ISO 14091, BS 8631)	Design documentation, procurement briefs, tender specifications	Design Teams, Procurement Officers

Example:

% of adaptation measures that are nature-based rather than hard or engineered

% of housing schemes prioritising SuDS, shading, or green roofs over engineered solutions

% of corridor designs incorporating tree planting or permeable surfaces rather than conventional drainage

Sectors:

Energy and retrofit

New developments

Transport

Technical standards and guidance

Identify and develop responses

Cross-sectoral

Green Infrastructure design guide, Natural England

Natural England's new Green Infrastructure Framework aims to help urban areas increase green space coverage to 40%, ensuring everyone can access quality nature-rich environments within a 15-minute walk, supporting health, climate resilience, and biodiversity

Spatial planning for climate resilience and Net Zero, Climate Change Committee

Provides a detailed overview of the current capability of the spatial planning system (with a focus on England) to tackle the climate crisis and specifically how the system can support the government's legal obligations in relation to climate mitigation and adaptation.

Technical standards and guidance

Identify and develop responses

A Framework for the measuring and reporting of climate, UKGBC

The UK Green Building Council's report on measuring and reporting physical climate risks provides a framework for real estate and built environment stakeholders to assess, disclose, and manage risks from climate-related hazards like flooding, heat, and subsidence.

UK Climate Resilience Roadmap, UKGBC

This newly released Roadmap sets out a vision for a climate resilient built environment, sharing clear recommendations for the industry and policy, and next steps needed to increase the climate resilience of our built environment. Other resources related to this tool include the Policy Recommendations, Technical Report, GIS Vulnerability Web Map and Urban Heat Island Web Map.

Technical standards and guidance

Identify and develop responses

Urban Greening Factor (UGF) guidance, London City Hall

Sets out how new developments in London must incorporate nature-based features like green roofs and trees, using a scoring system to ensure urban greening is a core part of design and planning.

Future Drainage data and user guidance, UK Climate Resilience Programme

This guidance supports UK organisations in adjusting stormwater design for climate change by providing high-resolution rainfall intensity projections for sub-daily to daily durations. It applies to new developments and transport infrastructure to ensure drainage systems are sized for future extreme rainfall.

Technical standards and guidance
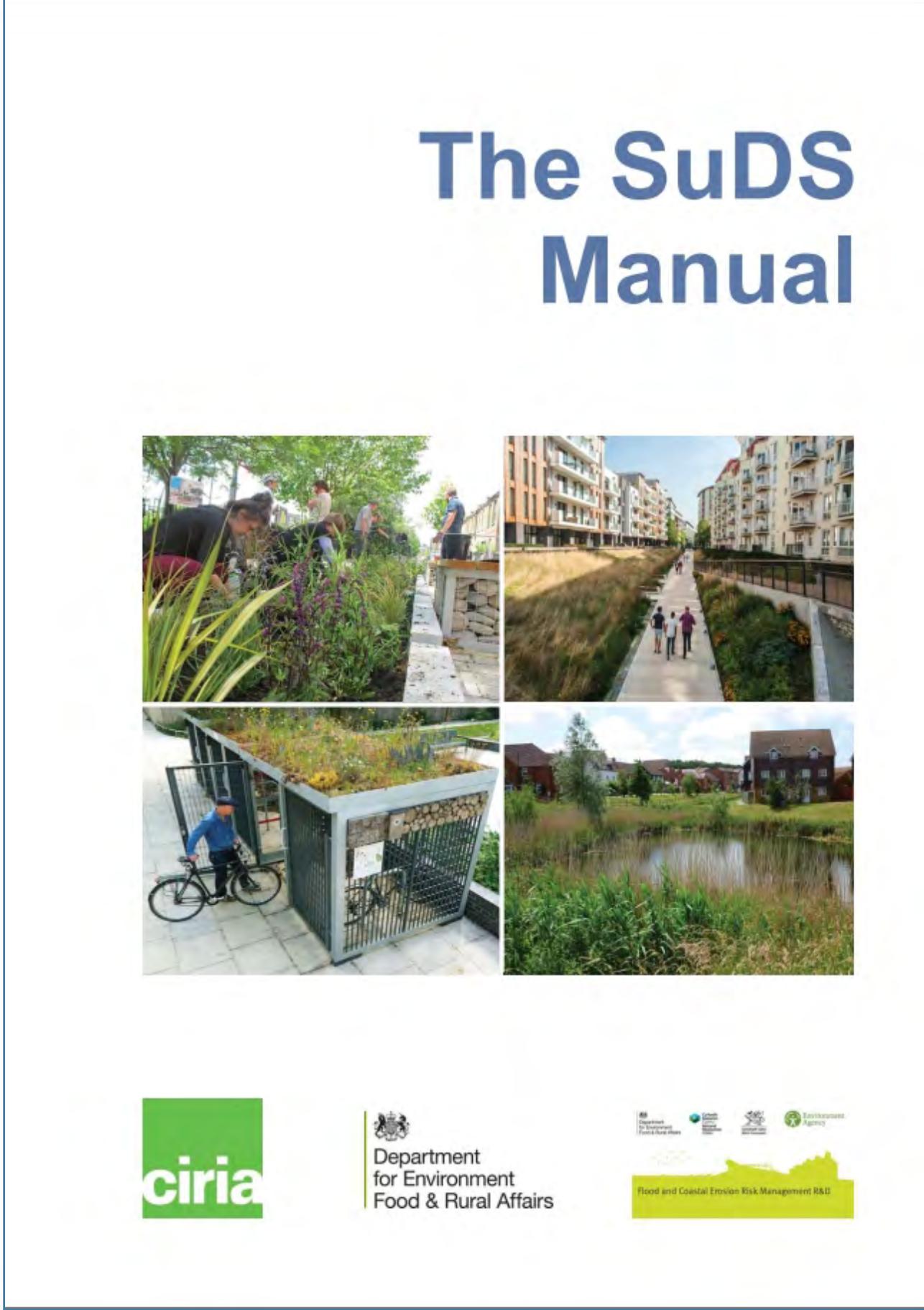
Identify and develop responses

The SuDS Manual, CIRIA

This is a technical guidance for Sustainable Drainage Systems (SuDS). It covers planning, design, construction and maintenance aspects to ensure effective implementation of interventions.

Mayfield Park, Manchester © Arup

Technical standards and guidance

Identify and develop responses

New developments

Shading for housing, GHA

Advocates for integrating shading into housing design from the outset to combat overheating risks, improve energy efficiency, and enhance occupant comfort, offering practical guidance, product comparisons, and performance data tailored to the UK's changing climate.

Building Regulations (2021), Part O

Avoid overheating, Future Homes Hub

Practical guidance on complying with updated UK building regulations, preparing for biodiversity net gain, improving building performance, and supporting the transition to low-carbon, climate-resilient homes.

Technical standards and guidance

Identify and develop responses

Overheating in Retrofit and Existing Homes – Tool and Guidance, GHA

Helps non-specialists assess and mitigate overheating risks in existing homes and retrofit projects by identifying key design factors early on, promoting holistic solutions that also enhance ventilation, air quality, and energy efficiency.

CIBSE TM59:2017 – Design Methodology for the Assessment of Overheating Risk in Homes

Provides a standardised dynamic thermal modelling approach to assess overheating risk in new and refurbished homes, guiding early design decisions to protect occupant health and comfort in a warming climate.

Technical standards and guidance

Identify and develop responses

PAS 2035:2023
Incorporating Corrigendum No.1

Retrofitting dwellings for improved energy efficiency – Specification and guidance

Department for Energy Security & Net Zero

bsi.

[PAS 2035:2023 - Retrofitting dwellings for improved energy efficiency](#)

Sets out a whole-dwelling, fabric-first approach to retrofitting homes for energy efficiency, requiring coordinated assessments, design, installation, and evaluation by qualified professionals to ensure performance, occupant safety, and long-term sustainability.

Transport

CIHT

Delivering a resilient transport network

Maintaining and future proofing highway infrastructure from extreme weather events

October 2024

[Delivering a resilient transport network maintaining, Chartered Institution of Highways and Transportation (CIHT)](#)

Calls for urgent investment and policy action in the face of increasing extreme weather events. Setting out how resilience can be delivered, for example through mandatory resilience assessments, incremental adaptation and proactive maintenance.

Measures

Identify and develop responses - These measures provide examples of actions that can be taken to develop and refine adaptation responses.

Inform residents of risk-reduction and resource-saving behaviours

Impact:
Residents are prepared for climate-related stresses (e.g. heatwaves, drought, energy disruption) and pressures on critical services are reduced

Measure type:
Behavioural and cultural

Description:
Provide education and information to residents on habits that reduce climate-related risks and resource use. This includes summer cooling tips, insurance awareness, flood alert sign-up (e.g. EA alerts), and energy/water saving behaviours that enhance resilience during heatwaves, drought, or service disruption. Examples of practical risk-reduction habits can be seen in the Good Homes Alliance (GHA) Overheating in Retrofit and Existing Homes tool and guidance. Particular attention should be given to vulnerable residents.

Owners:

Operation Managers

Sustainability Teams

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ — £ £

Shading and passive cooling strategies for transport networks

Impact:
Heat resilient public transport infrastructure

Measure type:
Physical and technical

Description:
Reduce the impacts of overheating across public transport networks by implementing infrastructure and environmental design strategies:

- Introduce street trees, grass under tram corridors, and greening or shading along key pedestrian and cycling routes to reduce ambient temperatures

- Where relevant, apply passive cooling features on associated structures (e.g. shelters, platforms) such as reflective surfaces, ventilation systems, or monitoring technologies.

Relevant design references may include urban design guidance or transport-focused climate resilience resources, such as the SuDS Manual (CIRIA) or ISO 14091 for climate risk-informed planning.

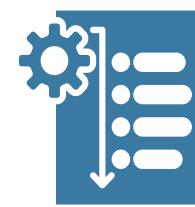**Owners:**

Planners

Design Teams

Public Transport Operators

Operation Managers

Sectors:

Transport

Indicative cost:

£ £ — £ £ £

Measures

Identify and develop responses

Use live traffic data during adverse weather

Impact:
Operational continuity and rapid recovery

Measure type:
Physical and technical

Description:
Use real-time traffic and disruption data to support rerouting and public communication during adverse weather. Monitor this data over time and stress-test it under future extreme scenarios to inform proactive route planning and reduce repeated disruptions on known hotspots.

Owners:

Design Teams   Operation Managers   Public Transport Operators

Sectors:

Transport

Indicative cost:

£ £

Design electrical systems for future flood risk

Impact:
Reduced asset vulnerabilities

Measure type:
Physical and technical

Description:
Adapt and design electrical systems to reduce their flood vulnerability through:

- Elevation above future flood levels

- Waterproofing (submersible rated cables for example)

- Isolation – to prevent cascading failures in the event of damage.

Consider developing or integrating decentralised renewable energy system backups to maintain local energy supply during flood-related disruptions.

Owners:

Design Teams   Operation Managers

Sectors:

Energy and retrofit   New developments   Transport

Indicative cost:

£ £
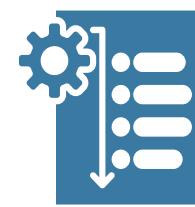
Measures

Identify and develop responses

Implement nature-based solutions (NbS)

Impact:

Schemes maximise the use of nature as part of the solution and deliver co-benefits

Measure type:

Physical and technical

Description:

Implement NbS and sustainable drainage systems (SuDS) to reduce flood risk and urban heat island effects, while delivering multiple co-benefits across sectors. Examples include:

- For energy and retrofit infrastructure – implement nature-based solutions to reduce flood risks, such as restoring natural flow paths, enhancing upstream storage, or creating buffer zones to protect downstream assets;

- For new developments – apply swales, tree planting and green roofs to reduce surface water runoff and overheating;

- For transport networks – use tree pits and rain gardens to manage stormwater and reduce localised flooding.

The Green Infrastructure Design Guide (Natural England) and Urban Greening Factor guidance (London City Hall) provide useful frameworks to guide the integration of SuDS and nature-based design strategies across sectors.

Owners:

Design Teams

Planners

Project Managers

Sectors:

New developments

Transport

Indicative cost:

£ £

Case study:

Mansfield Sustainable Flood Resilience SuDS programme

© Arup (2023)

Severn Trent is carrying out a SuDS programme in Mansfield Nottinghamshire.

This design captures rainwater and carries it down to various raingardens and bio-retention tree pits. These measures are located in a green public space transformed from a car park adding social value to the area.

They are also implementing green and brown roofs which attenuate rainwater and enhance biodiversity.

Additional measures being developed within this programme include detention basins, bio swales and permeable paving.
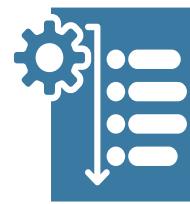
Measures

Identify and develop responses

Design resilient active travel

Impact:

Active travel routes are safeguarded against future climate risks

Measure type:

Physical and technical

Description:

Deliver climate resilient active travel networks through upgrades to existing networks and in the design of new networks and site layouts for housing developments. Example measures include, integrating safe walking and cycling routes with nature corridors, shaded routes, cool pavings (like reflective coatings or light-coloured concrete) and permeable surfaces.

The Urban Greening Factor guidance supports integration of nature-based features such as trees and green corridors into active travel networks.

Owners:

Design Teams   Planners

Sectors:

New developments   Transport

Indicative cost:

£

Protect green infrastructure

Impact:

Climate regulating features are maintained

Measure type:

Physical and technical

Description:

Avoid removal of natural features that contribute to climate resilience (e.g. mature trees, wetlands), with exceptions where for example trees present a safety risk. Where natural features are removed, seek to mitigate this loss where safe to do so, leveraging resources such as Environmental Delivery Plans and the Nature Restoration Fund to support nature recovery. This approach also supports the objectives of the Planning and Infrastructure Bill by promoting durable, climate-resilient infrastructure and reducing future disruption.

Owners:

Design Teams   Land/Estate Managers

Sectors:

Energy and retrofit   New developments   Transport

Indicative cost:

£ £
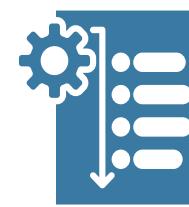
Measures

Identify and develop responses

Consider passive building solutions

Impact:

Greater comfort of residents during temperature extremes

Measure type:

Physical and technical

Description:

New builds and retrofits should maximise thermal comfort under future climate conditions while minimising increases in energy demand:

- Passive design- Optimise building orientation, window placement and internal zoning to reduce heat gain and improve cross-ventilation;

- Fabric upgrades- Improve insulation of walls and roofs, replace glazing with low-emissivity options;

- Shading and landscaping- Introduce tree planting and external shading devices to block summer sun;

- Ventilation and heating- Integrate passive ventilation strategies where feasible and complement with mechanical systems using high-efficiency heat pumps.

Owners:

Design Teams

Sectors:

Energy and retrofit

New developments

Indicative cost:

£ £

Case study:

Lilac co-housing scheme, Leeds

The LILAC (Low Impact Living Affordable Community) project in Leeds is a pioneering example of climate-resilient housing. It uses ModCell construction, combining timber, straw bales, and lime to create super-insulated, airtight homes that regulate temperature naturally. Large south-facing windows maximise solar gain in winter, while the building fabric helps reject excess heat in summer—reducing the need for mechanical heating or cooling.

Each home is equipped with Mechanical Ventilation Heat Recovery (MVHR) systems, maintaining indoor air quality without opening windows, which is especially beneficial during extreme weather. The use of natural, breathable materials and passive solar design makes LILAC highly resilient to both heatwaves and cold snaps, while also lowering energy demand and supporting long-term affordability and comfort.

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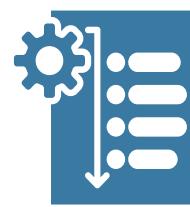
Measures

Identify and develop responses

Use climate resilient materials

Impact:

Climate resilient supply chain

Measure type:

Physical and technical

Description:

Standardise, specify and procure (in procurement and commissioning briefs) heat and flood resilient materials. Example materials include:

- Consider the climate resilience benefits of innovative materials such as self-healing concrete

- Flood-resistant flooring materials in homes (e.g. ceramics, bricks, temperature resistant asphalt)

- Permeable paving (e.g. grasscrete, permeable asphalt)

- Reflective surfaces (e.g. reflective rooftop coating).

Establishing consistent specifications across the West Midlands can help strengthen supply chain readiness and improve value for money in resilient construction.

Relevant guidance includes Part O of the Building Regulations (Future Homes Hub) for overheating mitigation, and PAS 2035 for retrofit material selection.

Owners:

Design Teams   Procurement Officers

Sectors:

Energy and retrofit   New developments   Transport

Indicative cost:

£ £

Plan for emergency resource provision in asset and infrastructure operations

Impact:

Operational continuity and emergency response readiness

Measure type:

Physical and technical

Description:

'Secure resources, suppliers and delivery plans that enable a prompt and sufficient response under different types of emergency situations. This protects assets and communities from damages. Examples of emergency resources include temporary bund, snow plough, sandbags and emergency door defences.

Owners:

O&M Engineers   Operation Managers   Land/Estate Managers

Sectors:

Energy and retrofit   New developments   Transport

Indicative cost:

£ £
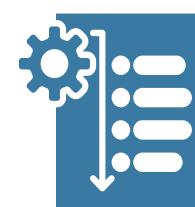
Measures

Identify and develop responses

Integrate nature into infrastructure design

Impact:

Reduced vulnerabilities through suitable nature specific adaptations

Measure type:

Policy and strategy

Description:

Consider a nature and landscape strategy that works together with infrastructure strategy e.g. the role of vegetation in verges or slopes to reduce erosion. Identify and mitigate risks to infrastructure (e.g. overhead lines, road users) by applying measures such as species selection, planting away from critical assets, and regular inspection to manage height, spread or potential debris.

Relevant guidance on integrating green infrastructure and vegetation strategies includes Natural England's Green Infrastructure Design Guide and London's Urban Greening Factor guidance. These support effective species selection, siting and management of vegetation for climate resilience.

Owners:

Design Teams

Operation Managers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£

Case study:

Leicestershire County Council – Proactive roadside tree management

Tree Management Strategy 2020-2025

Leicestershire County Council has adopted a comprehensive approach to managing roadside vegetation as part of its Tree Management Strategy 2020–2025. The Council inspects its road-side trees every three years - covering approximately 40,000 trees adjacent to public highways—to assess structural health, height, proximity to infrastructure (e.g., power lines, road surfaces), and disease .

When hazards are identified, they take action through pruning, removing, or working with private landowners to reduce risk. These proactive steps reduce storm-related damage, risk to road users, and potential disruption to transport infrastructure.
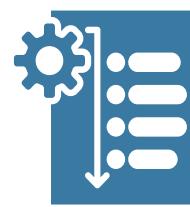
Measures

Identify and develop responses

Minimise disruption risks to critical services during climate events

Impact:

Rapid and reliable operation of critical services during climate-related transport disruptions

Measure type:

Policy and strategy

Description:

Ensure end to end transport routes remain operational for critical for emergency response and essential services. This includes identifying vulnerabilities within the transport network, planning for alternative routes depending on vulnerabilities identified and enhancing real-time monitoring and dynamic routing.

Owners:

Design Teams   Operation Managers

Sectors:

Transport

Indicative cost:

£ £

Mandate adherence to resilient design standards

Impact:

Best practice approaches to resilient building

Measure type:

Regulatory

Description:

Apply and require adherence to national or local design standards (e.g. ISO 14091:2021, SuDS Manual) through procurement and commissioning requirements

Owners:

Design Teams   Policy Decision Makers

Project Managers   Procurement Officers

Sectors:

Transport   New developments

Indicative cost:

£ £

Stage 3: Prioritise and deliver

Understand risk

1

Identify and develop responses

2

Strategy and Governance

Prioritise and deliver

3

Monitor and evaluate

4
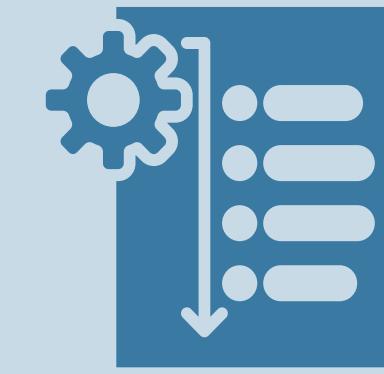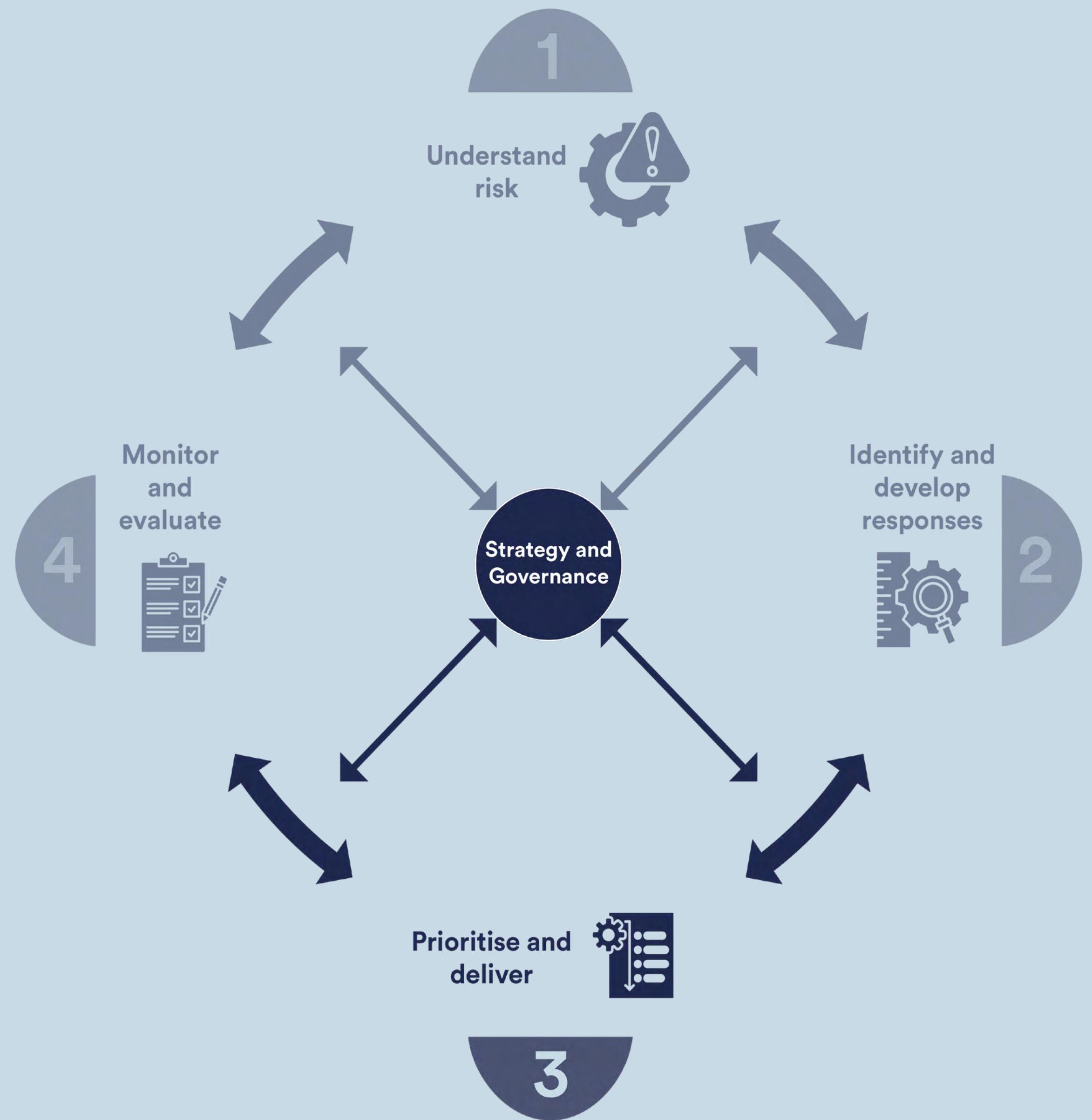
Checklist

Prioritise and deliver - This checklist offers examples of factors you could consider when prioritising and delivering adaptation responses.

Have design features been tested under future climate stressors (e.g. overheating, flooding)?

Has analysis been conducted to understand how designs might impact the most vulnerable at the system level, recognising interdependencies to prevent maladaptation?

Have materials and construction approaches been specified for climate durability?

Have adaptation features been retained through value engineering and procurement phases?

Have options been prioritised that are passive (e.g. design-led cooling), nature-based, low regret or adaptive (e.g. flexible design to accommodate future change)? *

Has a cost-benefit analysis (e.g. using HM Treasury Green Book supplementary guidance) been carried out to assess the proposed adaptation measures?

*Low regret and adaptive options allow us to avoid 'lock-in' and design for future uncertainties without requiring high-carbon and high-cost designs.

Example:

- Have backup generator locations been checked against flood risk maps?

- Have flood-resistant entrances or raised thresholds been assessed against future flood level projections?

- Have drainage systems been tested to determine whether they can cope with projected storm events?

Sectors:

Energy and retrofit

New developments

Transport

Example:

- Has heat- and flood-resilient casing been chosen for critical installations?

- Have reflective or breathable materials been used for roofs and walls respectively to improve thermal performance?

- Have surfacing materials been selected to minimise heat degradation?

Sectors:

Energy and retrofit

New developments

Transport

Example:

- Have passive cooling or natural ventilation strategies been considered before specifying mechanical cooling systems?

- Have natural drainage options been prioritised over piped systems where feasible?

- Has the building orientation or window design been optimised to reduce overheating without relying on mechanical cooling?

Sectors:

Energy and retrofit

New developments

Transport

Metrics

Prioritise and deliver - These metrics illustrate how adaptation considerations are carried through into project delivery and reflected in outcomes.

Owners:

Design Teams   Project Managers   Procurement Officers   Sustainability Teams

Example metrics to track	Possible data sources	Ownership
% of identified adaptation measures retained post-design or procurement review	Meeting records, design documentation	Design Teams, Project Managers, Procurement Officers
% of projects prioritising nature-based or passive-first options	Meeting records, design documentation	Design Teams, Project Managers, Sustainability Teams
Portion of KPIs that integrate adaptation	Project delivery plans	Project Managers, Sustainability Teams

Example: **Sectors:**

% of energy infrastructure sites using green roofs / vegetative cover

Energy and retrofit

% of new developments selecting design-led overheating solutions

New developments

% of urban roads with additional SuDS to increase stormwater drainage capacity

Transport

Technical standards and guidance

Prioritise and deliver

Cross-sectoral

Green Infrastructure design guide, Natural England

Natural England's new Green Infrastructure Framework aims to help urban areas increase green space coverage to 40%, ensuring everyone can access quality nature-rich environments within a 15-minute walk, supporting health, climate resilience, and biodiversity

Spatial planning for climate resilience and Net Zero, Climate Change Committee

Provides a detailed overview of the current capability of the spatial planning system (with a focus on England) to tackle the climate crisis and specifically how the system can support the government's legal obligations in relation to climate mitigation and adaptation.

Technical standards and guidance

Prioritise and deliver

A Framework for the measuring and reporting of climate, UKGBC

The UK Green Building Council's report on measuring and reporting physical climate risks provides a framework for real estate and built environment stakeholders to assess, disclose, and manage risks from climate-related hazards like flooding, heat, and subsidence.

Urban Greening Factor (UGF) guidance, London City Hall

Sets out how new developments in London must incorporate nature-based features like green roofs and trees, using a scoring system to ensure urban greening is a core part of design and planning.

UK GBC

A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets

FEBRUARY 2022

MAYOR OF LONDON

London Plan Guidance

Urban Greening Factor

February 2023

Technical standards and guidance

Prioritise and deliver
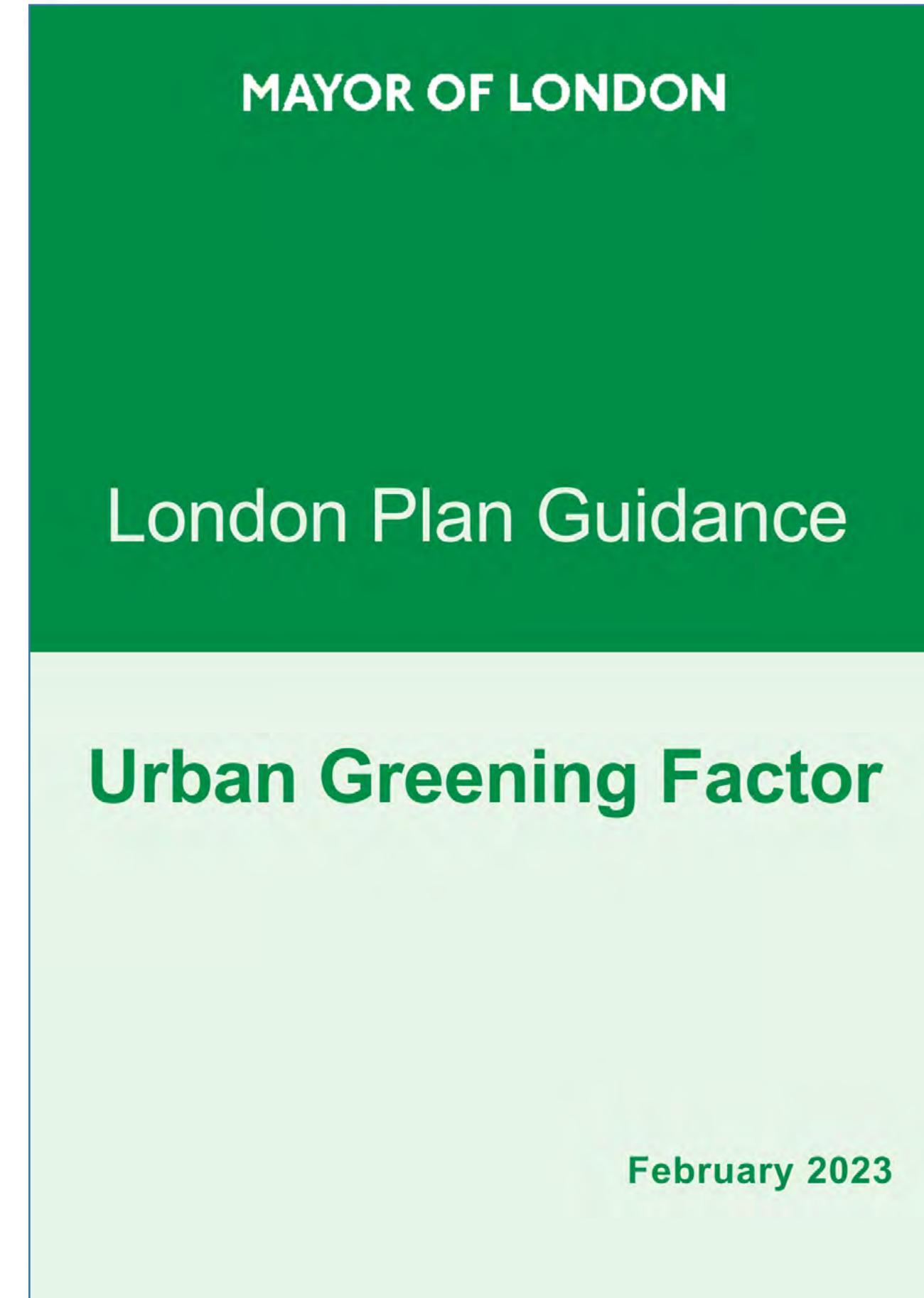
Triple Dividend of Resilience, World Resources Institute (WRI)

This working paper introduces the Triple Dividend of building climate resilience. It analyses the benefits of climate change adaptation investments according to this framework, demonstrating how to interrogate investments holistically.

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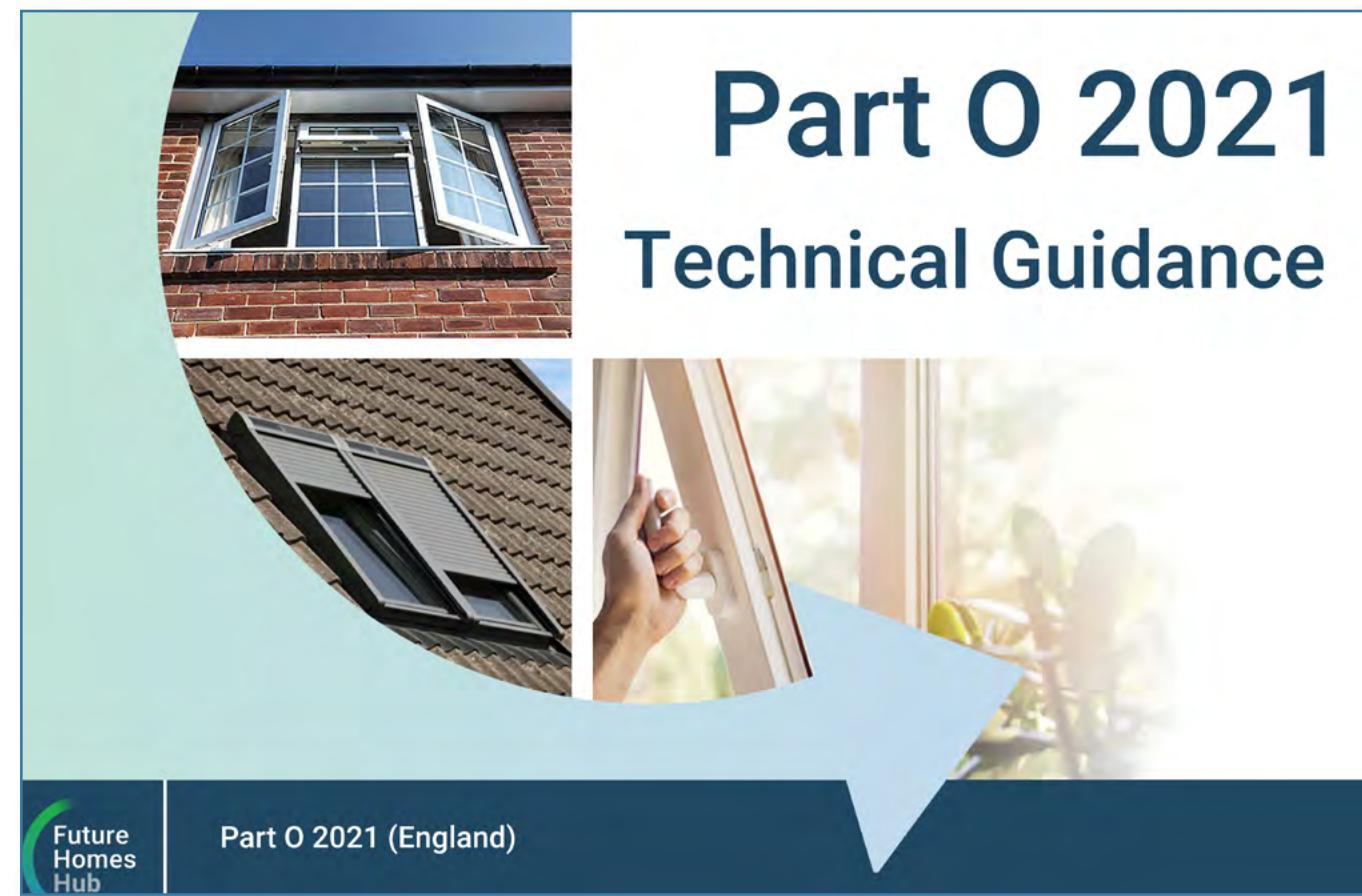
Technical standards and guidance

Prioritise and deliver

New developments

Shading for housing, GHA

Advocates for integrating shading into housing design from the outset to combat overheating risks, improve energy efficiency, and enhance occupant comfort, offering practical guidance, product comparisons, and performance data tailored to the UK's changing climate.

Building Regulations (2021), Part O
Avoid overheating, Future Homes Hub

Practical guidance on complying with updated UK building regulations, preparing for biodiversity net gain, improving building performance, and supporting the transition to low-carbon, climate-resilient homes.

Technical standards and guidance

Prioritise and deliver

Overheating in Retrofit and Existing Homes – Tool and Guidance, GHA

Helps non-specialists assess and mitigate overheating risks in existing homes and retrofit projects by identifying key design factors early on, promoting holistic solutions that also enhance ventilation, air quality, and energy efficiency.

CIBSE TM59:2017 – Design Methodology for the Assessment of Overheating Risk in Homes

Provides a standardised dynamic thermal modelling approach to assess overheating risk in new and refurbished homes, guiding early design decisions to protect occupant health and comfort in a warming climate.

Measures

Prioritise and deliver - These measures provide examples of practical steps that can support effective delivery of adaptation responses.

Prioritise investment to maximise spend on climate resilience

Impact:

Cost-effective climate resilient investment

Measure type:

Policy and strategy

Description:

Review and allocate investment between maintenance and capital expenditure, prioritising maintenance where it provides greater resilience returns. Resilience returns can be assessed using the "triple dividend of resilience" framework, which considers avoided losses, economic benefits from reduced disruption, and social and environmental co-benefits.

Owners:

Project Managers

Policy Decision Makers

Operation Managers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Analyse adaptation and disruption costs

Impact:

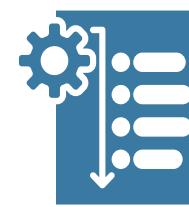Cost-effective climate resilient investment

Measure type:

Policy and strategy

Description:

Use system wide benefit analysis to compare adaptation costs against projected disruption costs. Utilise HM Treasury The Green Book supplementary guidance to understand how to approach cost benefit analysis.

Owners:

Project Managers

Policy Decision Makers

Procurement Officers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Measures
Prioritise and deliver

Identify funding and resource for adaptation plans

Impact:

Organisational readiness and capacity to respond

Measure type:

Policy and strategy

Description:

Funding and resources may be required across multiple stages of adaptation – from planning and strategy development (e.g. staffing, coordination) to the delivery of specific measures (e.g. planting trees, retrofitting buildings). These different needs often require different types of funding support.

Funding and resources to support adaptation may come from a mix of internal budgets and external pots managed by or accessible to local authorities. These include locally managed funds such as the UK Shared Prosperity Fund, as well as opportunities to collaborate or partner on applications to external programmes like the Nature Recovery Fund or the National Lottery Climate Action Fund.

Owners:

Project Managers

Policy Decision Makers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£

Case study:

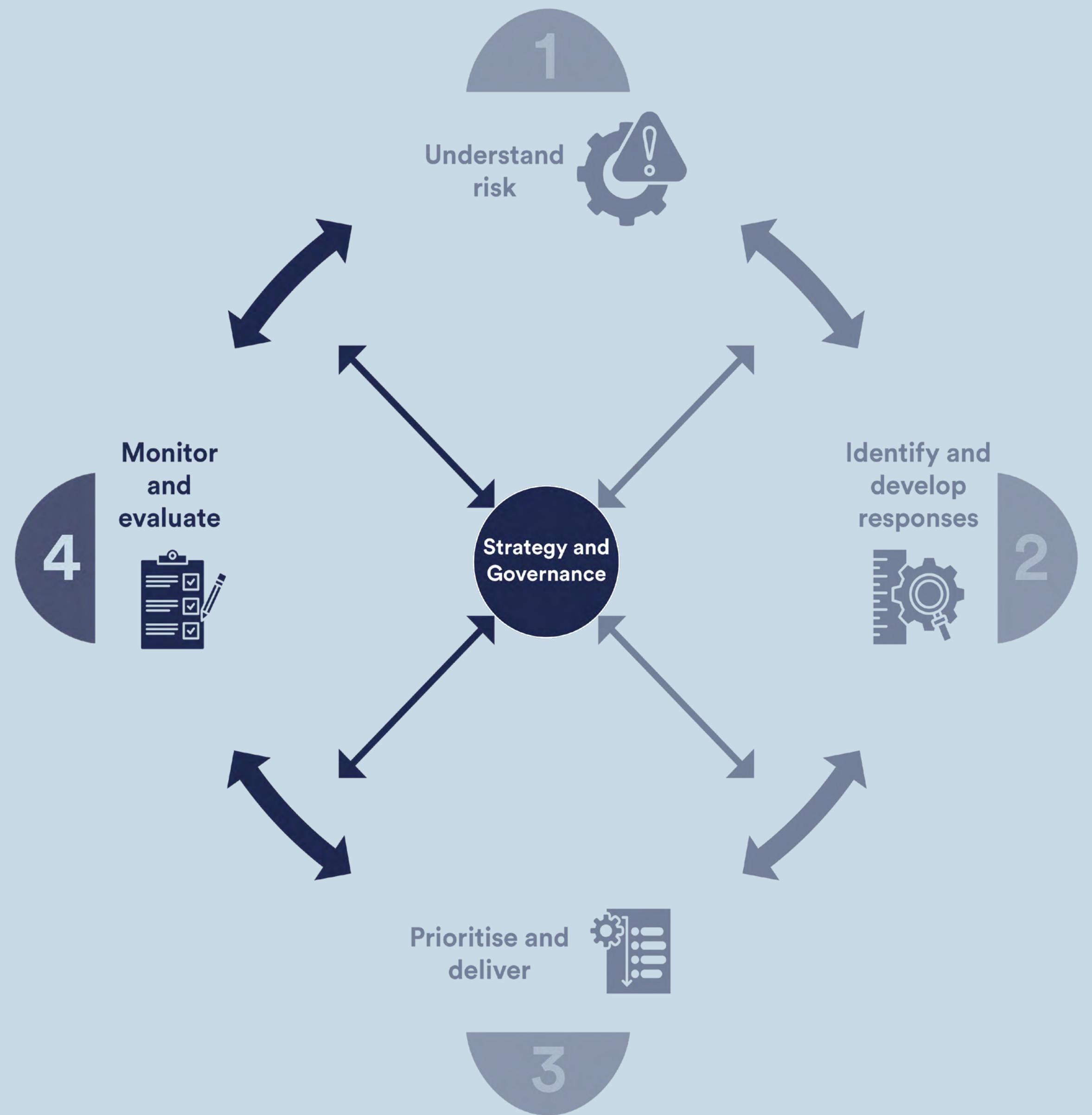### West Midlands Climate Adaptation Literacy Training

Source: Screenshot of West Midlands Adaptation Literacy Training

The West Midlands Climate Adaptation Literacy Training is a free, Continued Professional Development (CPD)-certified online course developed by the West Midlands Combined Authority in partnership with the University of Birmingham. It is designed for local councillors and authority officers to build understanding of climate risks in the region and how to take practical action to improve climate resilience.

The course is structured into three self-paced modules covering: the science of climate change and its UK impacts; specific climate risks facing the West Midlands; and adaptation strategies, including best practice examples. Upon completion and passing an assessment, participants receive a digital badge and certificate to recognise their climate adaptation literacy.

Stage 4: Monitor and evaluate

Understand risk

Identify and develop responses

Monitor and evaluate

4

Strategy and Governance
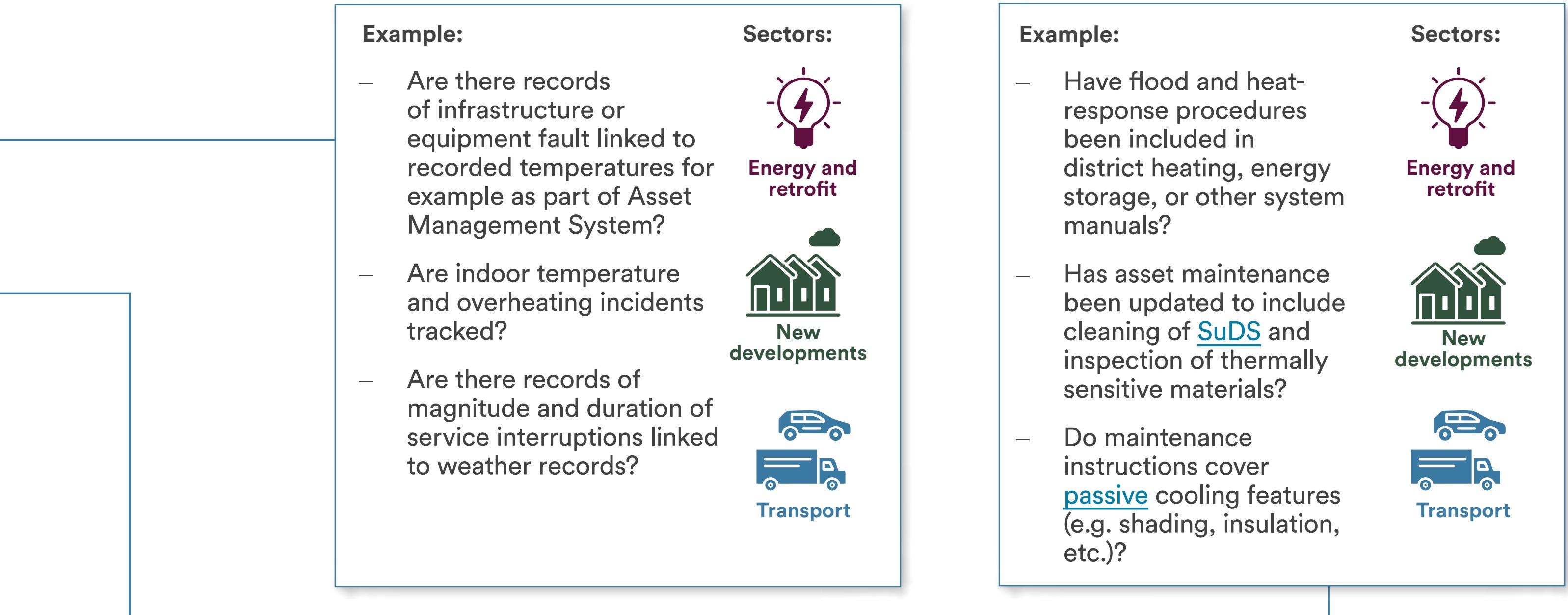
Prioritise and deliver

1

2

3

Checklist

Monitor and evaluate - This checklist offers examples of factors you could consider when monitoring and evaluating adaptation performance.

Is a monitoring framework in place to track the implementation and impact of adaptation measures over time?

Have whole life cycle metrics been set up to track climate resilient performance?

Have operational roles and responsibilities for climate adaptation features been clearly defined?

Have maintenance plans and O&M manuals been updated to include adaptation components?

Is the effectiveness of adaptation measures included in the post-handover evaluation or review?

Have thresholds been set which define an acceptable level of performance?*

*When a threshold is exceeded, it triggers a decision point wherein teams must reassess whether to adjust maintenance regimes or implement additional resilience measures. This restarts the Climate Resilient Projects Framework.

Example:

— Are there records of infrastructure or equipment fault linked to recorded temperatures for example as part of Asset Management System?

— Are indoor temperature and overheating incidents tracked?

— Are there records of magnitude and duration of service interruptions linked to weather records?

Sectors:

Energy and retrofit

New developments

Transport

Example:

— Have flood and heat-response procedures been included in district heating, energy storage, or other system manuals?

— Has asset maintenance been updated to include cleaning of SuDS and inspection of thermally sensitive materials?

— Do maintenance instructions cover passive cooling features (e.g. shading, insulation, etc.)?

Sectors:

Energy and retrofit

New developments

Transport

Metrics

Monitor and evaluate - These metrics illustrate how monitoring and evaluation can be captured and tracked.

Owners:

Project Managers | Policy Decision Makers | Operation Managers | Procurement Officers | Sustainability Teams | Public Transport Operators

Example metrics to track	Possible data sources	Ownership
% of projects with post-occupancy or post-delivery climate resilience evaluation	Post-occupancy evaluation reports, project closure documents	Policy Decision Makers, Project Managers, Procurement Officers
% of climate-related faults, complaints, or disruptions reported	Incident logs, maintenance reports, fault records, complaints record	Operation Managers, Sustainability Teams, Public Transport Operators
Climate-related impacts on assets and operations – including damage, service disruption, and system faults linked to extreme weather or climate stress	Incident logs, maintenance reports, fault records, smart sensors	Operation Managers, Sustainability Teams, Public Transport Operators
Cost of climate related damages	Procurement records	Operations Managers, Procurement Officers

Example:

% of systems/infrastructure with post-installation heat or flood resilience evaluation

% of housing developments with post-occupancy overheating or flood impact review

% of new schemes with post-completion climate resilience performance review (e.g. drainage)

Sectors:

Energy and retrofit

New developments

Transport

Example:

Number of reported faults in systems, facilities or underground cables due to heat or flood events

Number of tenant complaints related to indoor temperature or drainage capacity in extreme weather

Number of heat-related rail failures or road closures due to surface water flooding

Sectors:

Energy and retrofit

New developments

Transport

Technical standards and guidance

Monitor and evaluate

A Framework for the measuring and reporting of climate, UKGBC

The UK Green Building Council's report on measuring and reporting physical climate risks provides a framework for real estate and built environment stakeholders to assess, disclose, and manage risks from climate-related hazards like flooding, heat, and subsidence.

**Guidance on Valuing and Monitoring the Economic Benefits of Climate Services**
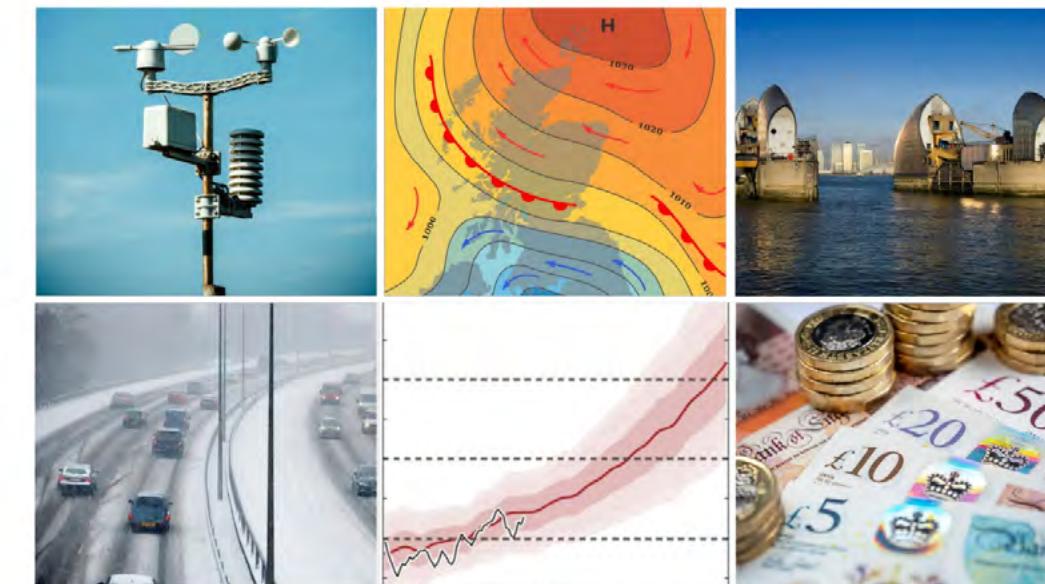
Paul Watkiss and Alistair Hunt

Output from the project
'Climate Resilience – CR20-2 Standards for climate services and monitoring and valuing climate services'

Guidance on Valuing and Monitoring the Economic Benefits of Climate Servies, UK Climate Resilience Programme

This guidance was developed by the UK Climate Resilience Programme. It provides a methodology for assessing the value for money and economic impact of climate services.
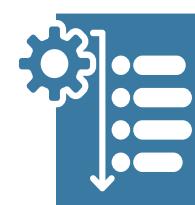
Measures

Monitor and evaluate - These measures provide examples of actions that can strengthen monitoring and evaluation in practice.

Use weather forecasts and mid-to long-term trends asset management

Impact:
Robustness and durable networks

Measure type:
Physical and technical

Description:
Integrate weather forecasts into asset management systems to trigger proactive inspections and climate-related maintenance activities

Owners:

Operation Managers

O&M Engineers

Sectors:

Energy and retrofit

Transport

Indicative cost:

£ £

Detect high risk hazards

Impact:
Evidence-based decision making

Measure type:
Physical and technical

Description:
Introduce monitoring systems that detect relevant climatic variables that could cause damage to asset/surrounding infrastructure and impact user safety e.g. hydrometeorological detection systems, critical systems temperature detection. Use data to trigger response and log impacts of climate events.

Owners:

Design Teams

Operation Managers

O&M Engineers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Measures

Monitor and evaluate

Implement climate sensitive maintenance regimes

Impact:
Robust and high-performance infrastructure systems

Measure type:
Behavioural and cultural

Description:
Establish and maintain appropriate frequencies for key maintenance and monitoring activities (e.g. drain inspection, vegetation clearance, pump checks) based on asset risk profiles and climate exposure. Where maintenance costs are a constraint, adopt a phased or risk-based approach to prioritise the most critical assets. Update maintenance programmes regularly to reflect evolving climate risks and ensure long-term serviceability.

Owners:

Operation Managers

O&M Engineers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Test and rehearse emergency procedures for climate events

Impact:
Operational continuity and emergency response readiness

Measure type:
Behavioural and cultural

Description:
Establish frequency to test and update emergency response procedures. For example, testing emergency communications with stakeholders to identify communication failures or gaps in messaging, testing coordination between emergency services, councils, utilities and the public. These activities help ensure people and systems are ready to act during different climate hazards.

Owners:

Operation Managers

O&M Engineers

Public Transport Operators
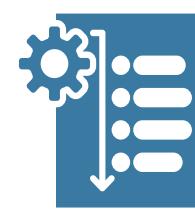
Policy Decision Makers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Measures

Monitor and evaluate

Mandate monitoring and reporting of climate-related risks

Impact:

Robust and high-performance infrastructure systems

Measure type:

Regulatory

Description:

Require ongoing monitoring and reporting of climate-related risks across projects or infrastructure assets to understand how climate impacts effect project outcomes and assets. Agree appropriate monitoring periods and define ownership models to ensure ongoing monitoring and maintenance.

Owners:

Operation Managers

Policy Decision Makers

Project Managers

Sustainability Teams

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Include contractual requirements for climate resilience monitoring and reporting

Impact:

Climate resilient value chain

Measure type:

Regulatory

Description:

Include requirements in contracts for monitoring and evaluation of climate resilient performance. For example, contractors may be required to report on operational continuity during extreme weather, progress on drainage maintenance during heavy rainfall seasons, or adaptive measures during heatwaves. These requirements help ensure climate risks are tracked and managed throughout the project lifecycle.

Owners:

Operation Managers

Project Managers

Procurement Officers
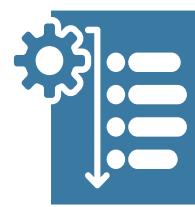
Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£ £

Measures

Monitor and evaluate

Drive climate focused governance

Impact:

Organisational readiness and capacity to respond

Measure type:

Policy and strategy

Description:

Establish governance to deliver climate resilient projects throughout the organisation. Governance structures may be required to guide investments, maximise cross-departmental opportunities and ensure continual improvement. E.g. establish working groups, collaborate with Local Resilience Forums.

Owners:

Sustainability Teams

Policy Decision Makers

Sectors:

Energy and retrofit

New developments

Transport

Indicative cost:

£

Investigate setting differentiated targets

Impact:

Proportionate climate adaptation ambition

Measure type:

Policy and strategy

Description:

Assess the feasibility of setting differentiated climate adaptation targets for housing developments and transport assets.

For housing this could be based on development scale, location, and typology (e.g. new homes, retrofit), with targets such as limiting internal temperatures or requiring minimum green infrastructure.

For transport, adaptation ambition could vary by asset type (e.g. stations, vehicles), mode (e.g. bus vs. metro), and location — such as setting higher standards for critical routes or climate-vulnerable areas.

At a strategic scale, such differentiated targets help align adaptation with local risks and ensure proportionate climate action.

Owners:

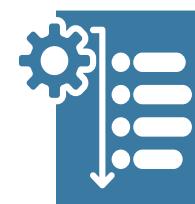Sustainability Teams

Policy Decision Makers

Sectors:

New developments

Transport

Indicative cost:

£

Measures

Monitor and evaluate

Develop climate resilience investment benchmarks

Impact:

Cost-effective climate resilience investment

Measure type:

Policy and strategy

Description:

Develop benchmarks for energy and transport to guide decisions on whether to maintain, replace or upgrade across different project types and scale. Types of benchmarks may include asset condition (e.g. age, Road Condition Index), service performance (e.g. temperature within public transport), and disruption level benchmarks (e.g. hours of transport delays, hours of power outages).

Owners:

Sustainability Teams

Policy Decision Makers

Sectors:

Energy and retrofit

Transport
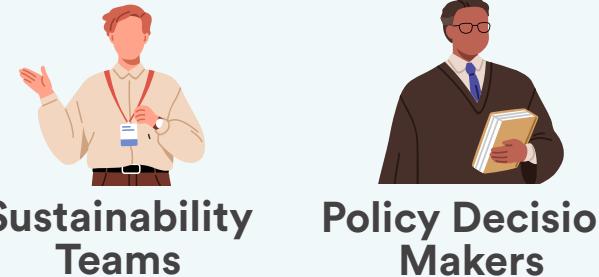
Indicative cost:

£ £

Case study:

Greater Manchester Spatial Framework – Differentiated Climate Targets

GREATER MANCHESTER SPATIAL FRAMEWORK

GMCA | BOLTON BURY | MANCHESTER OLDHAM | ROCHDALE SALFORD | STOCKPORT TAMESIDE | TRAFFORD WIGAN
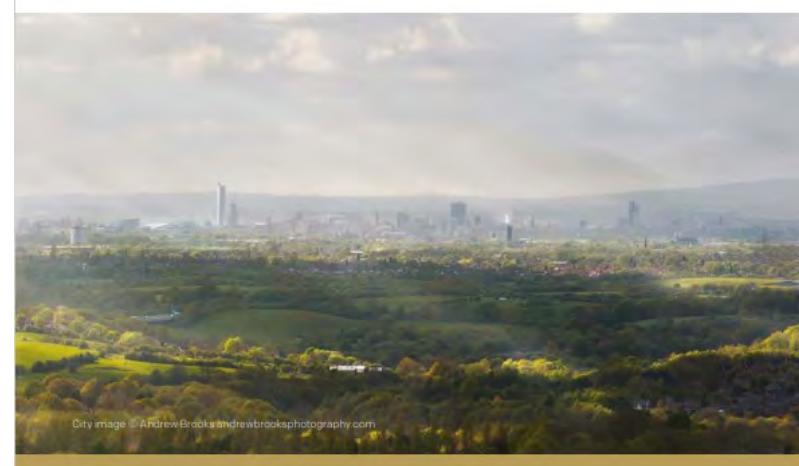
EXECUTIVE SUMMARY
PLANNING FOR AN EVEN GREATER MANCHESTER

Source: Greater Manchester

The Greater Manchester Spatial Framework (GMSF) embeds climate resilience into its local planning policies by requiring different levels of risk assessment and adaptive measures depending on development type, scale, and geography. For instance, large-scale housing estates in flood-prone or urban heat hotspot zones are mandated to deliver bespoke climate risk assessments and implement tailored resilience actions—such as enhanced SuDS, green space quotas, or passive cooling features—while smaller infill developments may adhere to simpler, standardized climate-proofing protocols.

This flexible approach ensures proportionate resilience—ensuring each housing project follows climate-smart best practice without overstretching resources. It aligns statutory planning levers with local environmental risk intelligence accessed through vulnerability mapping.

Glossary and key resources

Glossary

Key resources

Adaptation - The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities (UK CCC, 2021)

Adaptation Pathway - A decision-focused approach involving trade-offs between short term and long-term goals and values - enabling flexible decision making to account for future uncertainties (IPCC, 2018)

Climate Change Committee (CCC) - The UK's Climate Change Committee, an independent body reviewing the country's progress and gaps in climate action

Climate Hazard - The potential occurrence of a climate-induced weather event to cause harm to human health or loss of life, as well as damage or loss of property (IPCC, 2014)

Climate Risk Assessment (CRA) - A process that evaluates the potential impacts of climate change by analysing exposure, sensitivity, and adaptive capacity to climate-related hazards (HM Treasury Guidance)

Co-benefits, also known as wider benefits - The additional positive impacts, beyond the primary goal, that result from actions or policies (IPCC, 2018)

Critical infrastructure - Systems and assets vital to national security, economy, public health or safety, including energy, transport, and water networks (National Protective Security Authority, 2025)

Critical threshold - The point at which existing systems, practices, or infrastructure can no longer cope with climate-related stresses or shocks — and require a fundamental change or new adaptation measures to remain effective (CCC, 2021)

Climate mitigation - Actions taken to 'reduce or prevent greenhouse gases from entering the atmosphere, or to enhance carbon sinks that remove these gases from the atmosphere' (UNDP, 2024)

Ecosystem services - Services provided by the natural environment that benefit people. They provide outputs or outcomes that directly and indirectly affect human wellbeing. (Millennium Ecosystem Assessment, 2003)

Exposure - The presence of people, infrastructure, housing, and other tangible assets in areas that are prone to hazards (IPCC, 2014)

Global warming level (GWL) - The increase in average global temperature above the average during the pre-industrial period (1850-1900) (Met Office, 2025)

Lock-in - 'Where actions or decisions are taken that have long-term effects, but where these effects are not included in the decision itself which potentially increases future risk or causes irreversible change' (CCC, 2021)

Maladaptive Designs - Poorly planned adaptation that unintentionally causes an increase in climate vulnerability either from the same or different risks (CCC, 2021)

Mandatory requirements - Enforceable objectives and targets set by regulatory bodies

Nature based Solutions - Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (European Commission, 2025)

Net Zero - A company reaches net-zero when it reduces its greenhouse gas emissions by at least 90% across its value chain by no later than 2050 and neutralizes any remaining emissions with permanent carbon removals. (SBTi, 2025)

Passive design - The use of natural resources and environmental conditions to create a comfortable and energy efficient indoor environment, without the need for mechanical systems (Passivehaus Trust, 2025)

Resilience - The capacity of people and places to plan for, better protect, respond to and recover from flooding and coastal erosion, all the time adapting to climate change. (IPCC, Annex 1, 2023)

Risk - The potential for adverse consequences of a hazard, resulting from the interaction of vulnerability, exposure, and hazard severity (IPCC, 2023)

Sustainable Drainage Solutions (SuDS) - Nature-based techniques designed to manage surface water fun off in urban areas. (CIRIA, 2023)

Thermal Comfort - A condition of mind that is evaluated by person's subjective sense of being satisfied with the thermal conditions of their surrounding environment. (CIBSE, 2017)

Voluntary guidance - Non-mandatory advice, objectives, targets, and ways of operating, aiming to serve as frameworks for best practice

Vulnerability - The propensity or predisposition to be adversely affected (IPCC, Annex 1, 2023)

Warming scenario - A projected future climate condition based on different levels of greenhouse gas emissions, which describe potential radiative forcing outcomes. A high warming scenario refers to a future pathway leading to substantial global temperature increases (4 degrees or more above pre-industrial levels) by the end of the century, which contrasts to a central warming scenario (2 degrees) (IPCC, AR6 Synthesis Report, 2023)

Mansfield Sustainable Flood Resilience © Arup

Acronyms

Key resources

ARP - Adaptation Reporting Power

CCC - Climate Change Committee

CRA - Climate Change Risk Assessment

CIBSE - Chartered Institution of Building Services Engineers

CIHT - Chartered Institution of Highways and Transportation

CIRIA - Construction Industry Research and Information Association

CPD - Continued Professional Development

CRA - Climate Risk Assessments

Defra - Department for Environment, Food & Rural Affairs

DfT - Department for Transport

EA - Environment Agency

EVs - Electric Vehicles

GDP - Gross Domestic Product

GHA - Good Homes Alliance

GIS - Geographic Information System

GMSF - Greater Manchester Spatial Framework

INNS - Invasive Non-Native Species

KPIs - Key Performance Indicators

LA - Local Authority

LILAC - Low Impact Living Affordable Community

LINC - Local Investment in Natural Capital

LLFAs - Lead Local Flood Authorities

LNRS - Local Nature Recovery Strategy

MVHR - Mechanical Ventilation Heat Recovery

NAP - National Adaptation Programme

NHS - National Health Service

NPPF - National Planning Policy Framework

OBC - Outline Business Case

O&M - Operations and Maintenance

ONS - Office for National Statistics

SDSs - Spatial Development Strategies

SOBC - Strategic Outline Business Case

SPBs - Strategic Planning Boards

SROs - Senior Responsible Officers

UGF - Urban Greening Factor

UKCP - UK Climate Projections

UKGBC - UK Green Building Council

UKRI - UK Research and Innovation

WRI - World Resources Institute

Tools and databases

Key resources
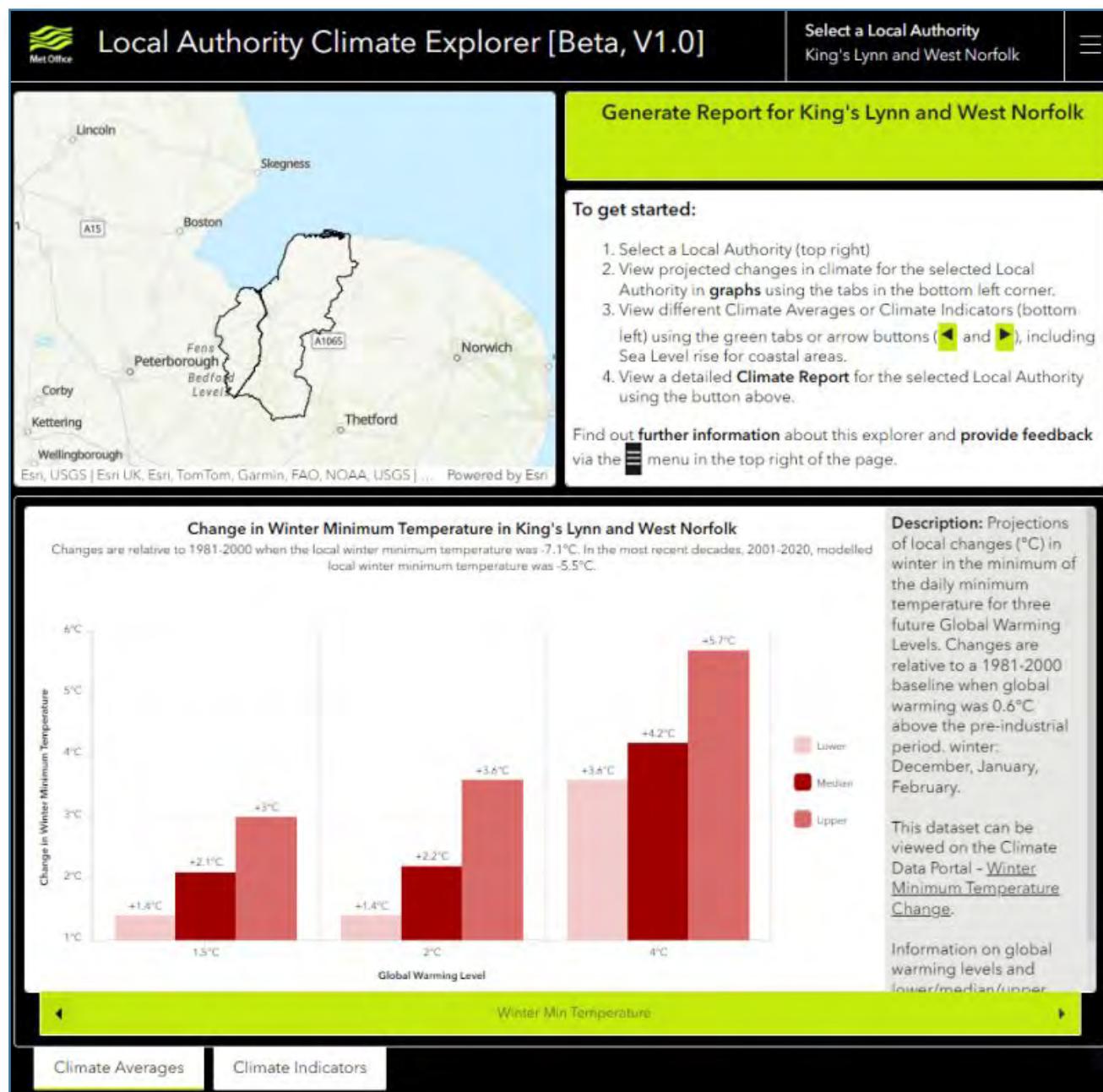
Met Office Local Authority Climate Service

The Met Office's Local Authority Climate Service (LACS) provides tailored climate data and insights to support UK local authorities in climate risk planning, adaptation, and resilience decision-making, using high-resolution projections and localised summaries.
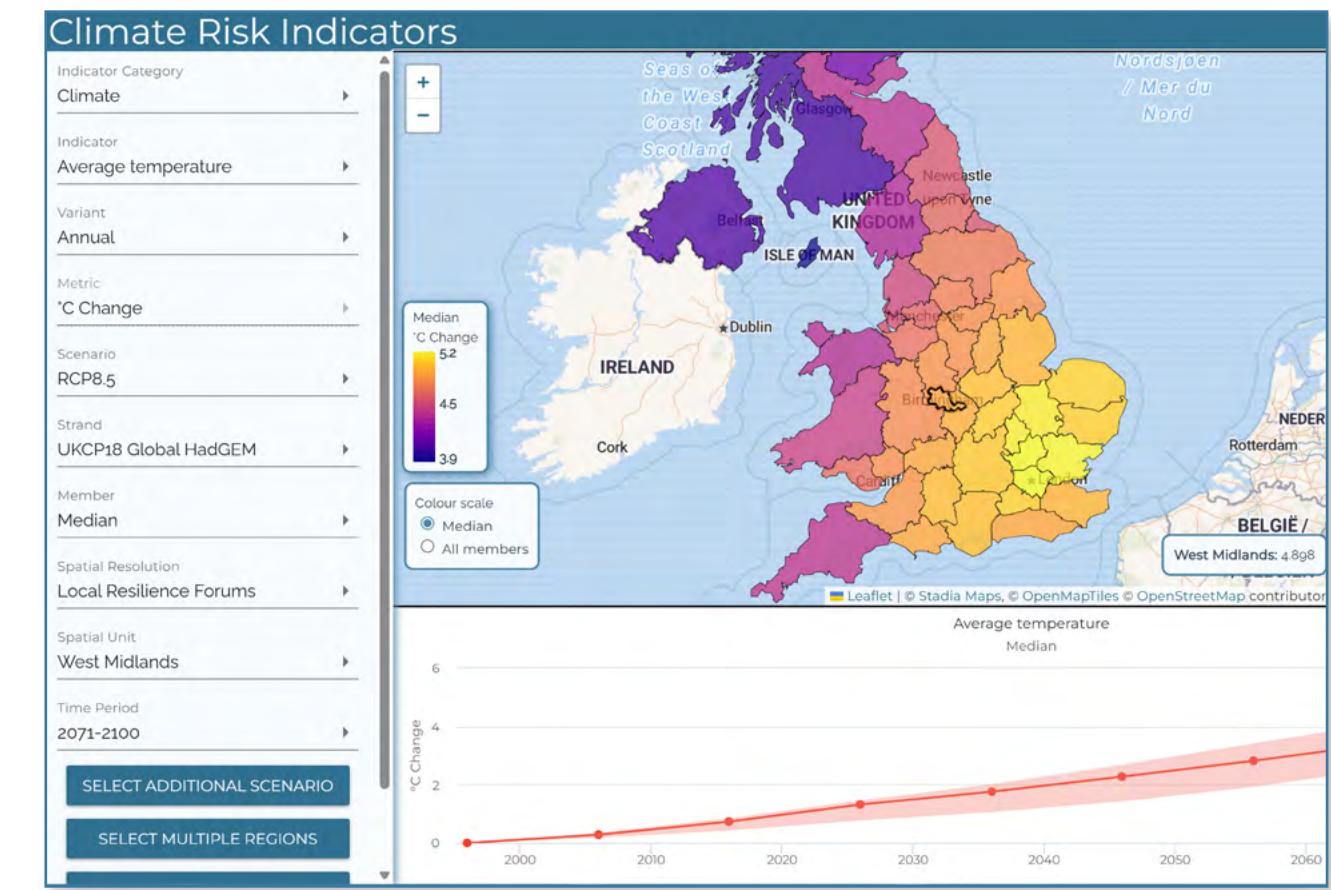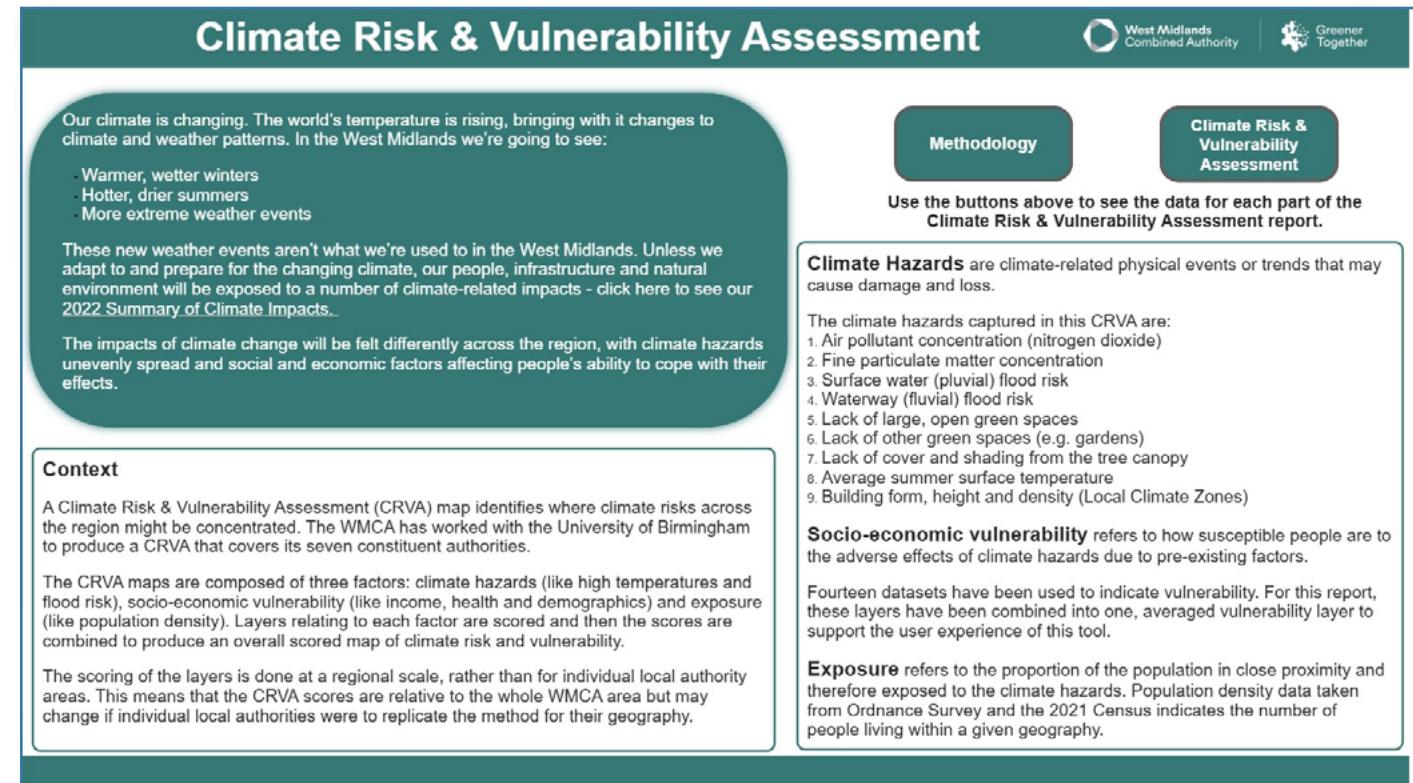

Climate Risk Indicators

The UK Climate Resilience Information (CRI) service provides access to datasets, tools, and resources to support local authorities and other users in understanding and responding to climate risks, helping embed climate resilience into planning, infrastructure, and service delivery decisions.

Climate Adaptation Toolkit and Risk and Opportunities Matrix, Local Partnerships 2025

This is a five-step framework designed to help UK local authorities assess climate risks and develop strategies to adapt to current and future climate impacts on their services, residents, and operations. This toolkit is integrated with other resources like the Met Office Local Authority Climate Service to enhance understanding of local climate risks.

Climate Risk and Vulnerability Assessment (CRVA) Mapping tool, West Midlands Combined Authority, Greener Together

The CRVA map identifies where climate risks across the region might be concentrated. The CRVA maps are composed of three sectors: climate hazards (high temperatures and flood risk), socio-economic vulnerability (income, health and demographics) and exposure (population density).
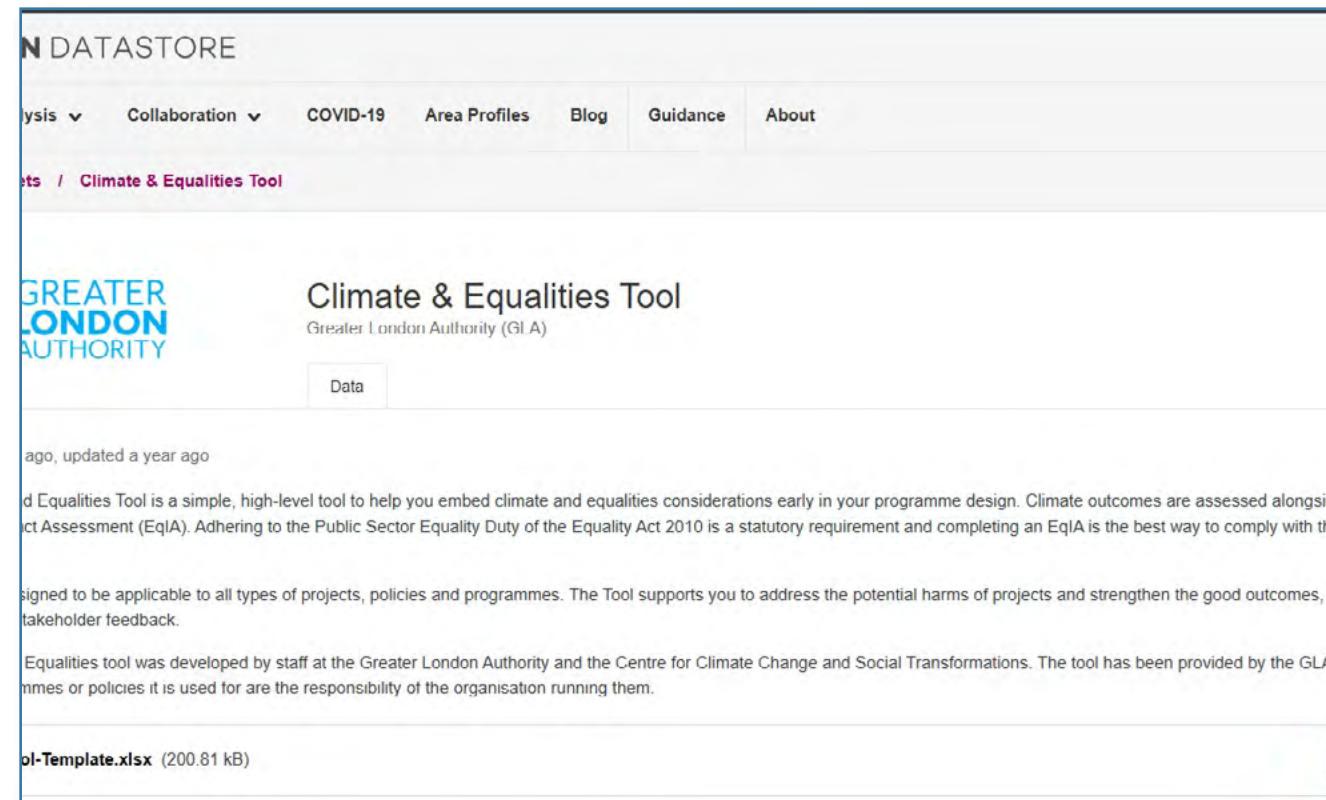
Climate & Equalities Tool, Greater London Authority (GLA)

This is a planning resource to help organisations integrate climate and equalities considerations early in the design of projects, policies, and programmes. Adhering to the Public Sector Equality Duty of the Equality Act 2010 is a statutory requirement and completing an EqIA is the best way to comply with these requirements.
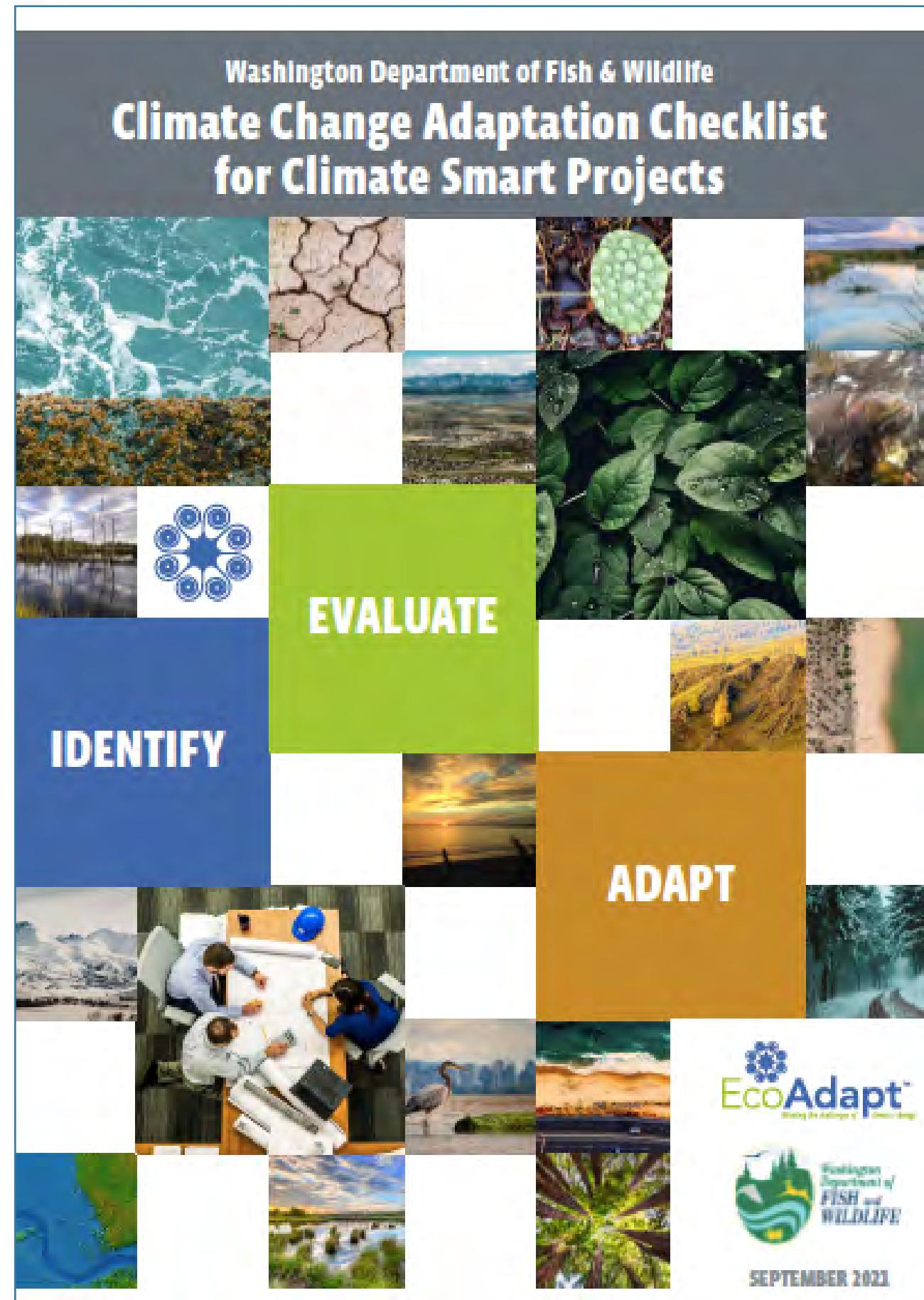
Climate Change Adaptation Checklist for Climate Smart Projects: A Tool for the Washington Department of Fish & Wildlife, Climate Adaptation Knowledge Exchange

This tool was developed to help evaluate how climate change may impact a project and if the project will continue to be able to deliver its intended benefits. It evaluates the implications of future conditions on project function, longevity and impact, builds climate consideration directly into funding, permitting and planning phases and reduces liabilities that will be ineffective under future conditions.

EA Flood Zone Map for Planning, Environmental Agency

These maps demonstrate the areas of land at risk of flooding from rivers and sea, when the presence of flood defences are ignored. This dataset is designed to support flood risk assessments in line with Planning Practice Guidance. It also raises awareness of the likelihood of flooding to encourage people living and working in areas prone to flooding to find out more and take appropriate action.

Climate Matching Tool, Forestry England

This tool matches geographic locations so that we are able to see which places in the world currently experience the climate we are projected to have in future. We can compare these different places to help us plan which tree species will be suited to a site, now and in future.

Climate Impacts Tool, Environment Agency

Climate impacts tool: guidance for Environment Agency staff

Understanding the risks and impacts from a changing climate

October 2023

The climate impacts tool provides a simple description of current and potential future challenges. It shows changes to weather, climate, and environmental variables for 4 scenarios. Scenario 1: Present day (the climate has already changed), Mid-century (+2°C by 2050), Managed transition (+2°C by 2100), Runaway change (+4°C by 2100). The tool also provides more information on a large range of climate impacts, including cascading risks to the environment, society, and infrastructure.

The National Risk Register, Cabinet Office

National Risk Register 2025 edition

HM Government

The NRR s the government's assessment of the most serious risks facing the UK. It provides the government's updated assessment of the likelihood and potential impact of a broad range of risks that may directly affect the UK and its interests. The NRR is aimed at risk and resilience practitioners, including businesses and voluntary and community sector organisations.

Use this tool to see what the scientific research is saying about:

- **How** local climates will change
- **What** health and community impacts may occur as a result
- **Who** will be most vulnerable and why
- **Which** adaptations to consider

LCAT is **evidence-based** and designed with and for **local decision makers.**

Helpful resources:

- Introduction to Local Climate Adaptation

Local climate adaptation tool, University of Exeter's European Centre for Human Health, Cornwall Council, Then Try This and The Alan Turing Institute

This tool can be used to see how local climates will change, what health and community impacts may occur as a result, who will be most vulnerable and why and which climate adaption measures should be considered. It is evidence-based and is designed with and for local decision makers.

LAEP+ Tool, West Midlands Combined Authority

This spatial planning approach helps local authorities identify the energy system changes needed to achieve net zero, covering electricity, gas, and heat networks, while supporting investment, infrastructure planning, and decarbonisation at a local level. LAEP+ is a digital mapping tool developed under Planning Regional Infrastructure in a Digital Environment (PRIDE) project.
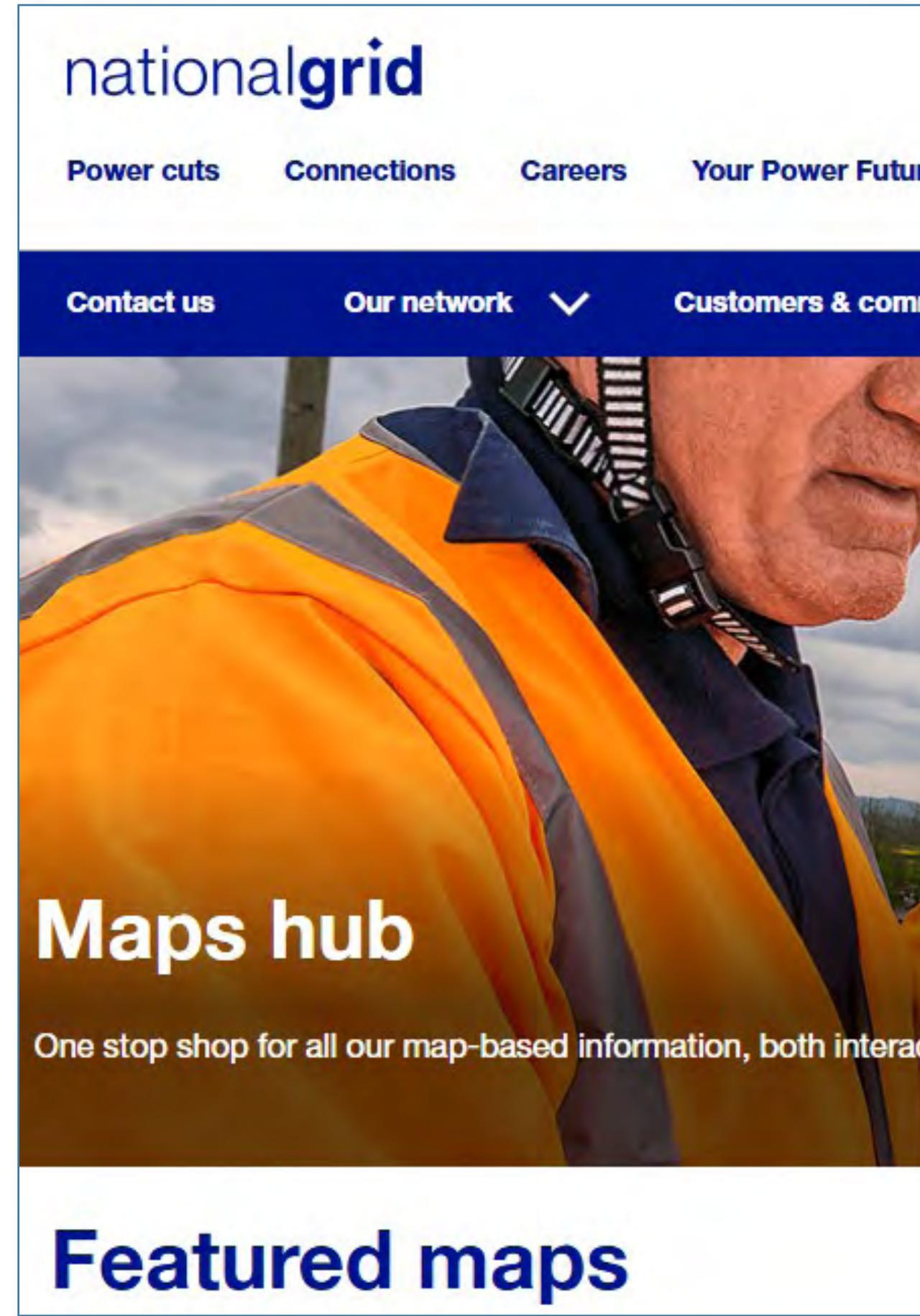
Maps Hub, National Grid

The National Grid Maps Hub provides all map-based information, both interactive and document based; for example, showing live and historic data for demand and generation, current power cut activity, a network opportunity map, a network flexibility map and a Distribution Future Energy Scenarios (DFES) map.

Overheating and retrofit tool, Good Homes Alliance (GHA)

This tool responds to demand from designers, housing associations, environmental health officers, and other parties concerned with overheating risks in the existing housing stock, which are likely to increase further due to climate change and higher temperatures. It is intended for use at the early stages of residential retrofit projects, or on existing homes, in order to identify key factors contributing to overheating risk and possible mitigation measures.

Summaries and templates

Climate Resilient Projects: Checklist

Strategy and governance

Have roles and responsibilities for climate resilience been clearly defined across all Climate Resilient Projects Framework stages?

Are climate resilience metrics integrated into KPIs, delivery frameworks, or performance dashboards?

Do your risk registers include climate-related risks?

Is there a clear plan showing how the project will adapt to climate change?

Are the appropriate governance structures in place to ensure the implementation and long-term monitoring and management of adaptation measures e.g. working groups, partnerships with academic and charitable organisations?

Stage 1: Understand risk

Have the key climate hazards relevant to the project's type and location been identified?

Have future climate projections (e.g. scenarios for the 2030s, 2050s and 2100s) been used to inform the project's risk profile?

Has a high-level climate risk screening or assessment been completed? Does it include the cascading impacts? (See Met Office Local Authority Climate Service, Climate Risk Indicators)

Have climate resilience objectives been considered as part of broader sustainability goals within the strategic brief or business case?

Is the project aligned with wider objectives such as net zero, social value, or health outcomes?

Have stakeholders and key delivery partners been engaged to help identify risks and dependencies?

Has the site location and layout been assessed for exposure and vulnerability to future climate risks (e.g. flooding, overheating, water stress)? (See Flood risk assessment climate change allowances, Spatial planning for climate resilience and Net Zero, Climate Change Committee)

Have you conducted a cost-benefit analysis for implementing adaptation measures, to support the value case, drawing on relevant guidance and benchmarks e.g. HM Treasury The Green Book supplementary guidance?

Stage 2: Identify and develop responses

Have options that address priority climate risks and system vulnerabilities been shortlisted?

Have potential adaptation options been assessed against future climate scenarios to inform initial selection?

Have mapping tools or overlays (e.g. CRVA mapping) been used to support site and option assessment?

Have relevant technical standards been applied (e.g. TM59, ISO 14090, ISO 14091, BS 8631) to guide your decisions?

Have potential trade-offs or unintended impacts of the adaptation measures been reviewed and mitigated (e.g. energy use, social equity, downstream effects)?

Have adaptation co-benefits (e.g. health, biodiversity, economic) been factored into the appraisal?

Have low-regret and adaptive options been integrated to ensure the design can flexibly support future adaptation in the face of uncertain climate impacts (e.g. modularity, upgrade capacity)?

Has the spatial layout been optimised to enhance climate resilience (e.g. building orientation, green infrastructure integration)?

Stage 3: Prioritise and deliver

Have design features been tested under future climate stressors (e.g. overheating, flooding)?

Has analysis been conducted to understand how designs might impact the most vulnerable at the system level, recognising interdependencies to prevent maladaptation?

Have materials and construction approaches been specified for climate durability?

Have adaptation features been retained through value engineering and procurement phases?

Have options been prioritised that are passive (e.g. design-led cooling), nature-based, low-regret or adaptive (e.g. flexible design to accommodate future change)?

Has a cost-benefit analysis (e.g. using e.g. HM Treasury The Green Book supplementary guidance) been carried out to assess the proposed adaptation measures?

Stage 4: Monitor and evaluate

Is a monitoring framework in place to track the implementation and impact of adaptation measures over time?

Have whole life cycle metrics been set up to track climate resilience performance?

Have operational roles and responsibilities for climate adaptation features been clearly defined?

Have maintenance plans and O&M manuals been updated to include adaptation components?

Is the effectiveness of adaptation measures included in the post-handover evaluation or review?

Have thresholds been set which define an acceptable level of performance?
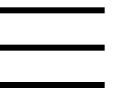
Metrics with proposed ownership

Owners: Planners (P), Design Teams (DT), O&M Engineers (OME), Land/Estate Managers (LEM), Policy Decision Makers (PDM), Project Managers (PM), Procurement Officers (PO), Operation Managers (OM), Sustainability Teams (ST), Public Transport Operators (PTO)

Strategy and governance

Metrics	Possible Data Sources	P	DT	OME	LEM	PDM	PM	PO	OM	ST	PTO
Presence of continuity/emergency plans addressing relevant climate hazards	Business continuity plans, emergency plans								X		
% of projects primarily focused on adaptation outcomes as stated in objectives or scope	Project business cases (e.g. SOBC/OBC), investment planning records	X				X					
% of projects aligned with WMCA Adaptation Plan objectives	Project deliverables (e.g. Inception Report)	X	X				X				
% of tenders or contracts that include climate adaptation or future climate performance requirements	Invitation to Tender documents, contract clauses referencing adaptation criteria	X	X					X			
Number of staff completing climate resilience training	Training platform completion, course attendance.						X			X	

Stage 1 : Understand risk

Metrics	Possible Data Sources	P	DT	OME	LEM	PDM	PM	PO	OM	ST	PTO
% of business cases that follow the H.M. Treasury Green Book supplementary guidance and model for both +2° and +4° GWLs beyond 2024	Strategic or outline business cases (e.g. SOBC, OBC)	X				X					
% of projects incorporating climate risk screening or assessment (e.g. UKCP, LA tool)	Climate screening forms, pre-feasibility reports, or project scoping templates	X	X				X				
% of sites mapped for key climate hazards such as surface water flooding, heat, or drought exposure	Project reports or design review checklists		X				X				

Stage 2: Identify and develop responses

Metrics	Possible Data Sources	P	DT	OME	LEM	PDM	PM	PO	OM	ST	PTO
% of projects designed with sustainable drainage systems (SuDS) to manage surface water flood risk	Design documentation, Procurement briefs		X						X	X	
% of projects where adaptation measures are included in costed shortlist of options	Options appraisal documents	X	X				X				
% of projects applying relevant guidance/standards (e.g. ISO 14091, BS 8631)	Design documentation, procurement briefs, tender specifications		X						X		

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Owners

Metrics	Possible Data Sources	Planners (P)	Design Teams (DT)	O&M Engineers (OME)	Land/Estate Managers (LEM)	Policy Decision Makers (PDM)	Project Managers (PM)	Procurement Officers (PO)	Operation Managers (OM)	Sustainability Teams (ST)	Public Transport Operators (PTO)
Stage 3: Prioritise & deliver											
% of identified adaptation measures retained post-design or procurement review	Meeting records, design documentation		X				X	X			
% of projects prioritising nature-based or passive-first options	Meeting records, design documentation		X				X			X	
Portion of KPIs that integrate adaptation	Project delivery plans						X			X	
Stage 4: Monitor & evaluate											
% of projects with post-occupancy or post-delivery climate resilience evaluation	Post-occupancy evaluation reports, project closure documents					X	X	X			
% of climate-related faults, complaints, or disruptions reported	Incident logs, maintenance reports, fault records, complaints record								X	X	X
Climate-related impacts on assets and operations – including damage, service disruption, and system faults linked to extreme weather or climate stress	Incident logs, maintenance reports, fault records, smart sensors								X	X	X
Cost of climate related damages	Procurement records						X	X			

Measures with proposed ownership

Owners

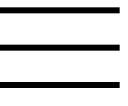| Measure	Typology	Cost	Energy and Retrofit	New developments	Transport	Planners (P)	Design Teams (DT)	O&M Engineers (OME)	Land/Estate Managers (LEM)	Policy Decision Makers (PDM)	Project Managers (PM)	Procurement Officers (PO)	Operation Managers (OM)	Sustainability Teams (ST)	Public Transport Operators (PTO)
⚠ Stage 1 : Understand risk															
Share climate risk tools	Behavioural and cultural	£	X	X	X									X	
Mandate climate risk assessments	Regulatory	££	X	X	X					X	X		X	X	
Identify critical climate and weather-related thresholds for assets and operations	Policy and strategy	££	X	X	X			X	X	X				X	
Communicate early warnings	Behavioural and cultural	££	X	X	X									X	
Ensure signs and signals account for weather extremes	Physical and technical	££			X			X	X					X	
Use available climate hazard and risk maps for development planning	Physical and technical	££	X	X	X			X	X						
⚙ Stage 2: Identify and develop responses															
Inform residents of risk-reduction and resource-saving behaviours	Behavioural and cultural	£-££	X	X	X									X	X	
Shading and passive cooling strategies for transport networks	Physical and technical	££-£££			X		X		X					X		X
Use live traffic data during adverse weather	Physical and technical	££			X				X					X		X
Design electrical systems for future flood risk	Physical and technical	££	X	X	X				X					X	
Implement nature-based solutions (NbS)	Physical and technical	££		X	X			X	X		X				
Design resilient active travel	Physical and technical	£		X	X			X	X						
Protect green infrastructure	Physical and technical	££	X	X	X				X			X			
Consider passive building solutions	Physical and technical	££	X	X					X						
Use climate resilient materials	Physical and technical	££	X	X	X				X			X			
Plan for emergency resource provision in asset and infrastructure operations	Physical and technical	££	X	X	X			X	X					X	
Nature and landscape strategy to support climate resilience	Policy and strategy	£	X	X	X				X					X	
Minimise disruption risks to critical services during climate events	Policy and strategy	££			X				X					X	
Mandate adherence to resilient design standards	Regulatory	££		X					X		X	X	X	

Owners

Measure	Typology	Cost	Energy and Retrofit	New developments	Transport	Planners (P)	Design Teams (DT)	O&M Engineers (OME)	Land/Estate Managers (LEM)	Policy Decision Makers (PDM)	Project Managers (PM)	Procurement Officers (PO)	Operation Managers (OM)	Sustainability Teams (ST)	Public Transport Operators (PTO)
Stage 3: Prioritise & deliver															
Prioritise investment to maximise spend on climate resilience	Policy and strategy	££	X	X	X					X	X		X		
Analyse adaptation and disruption costs	Policy and strategy	££	X	X	X					X	X	X			
Identify funding and resource for adaptation plans	Policy and strategy	£	X	X	X					X	X				
Stage 4: Monitor & evaluate															
Use weather forecasts and mid- to long-term trends asset management	Physical and technical	££	X		X				X				X		
Detect high risk hazards	Physical and technical	££	X	X	X		X		X				X		
Implement climate sensitive maintenance regimes	Behavioural and cultural	££	X	X	X				X				X		
Test and rehearse emergency procedures for climate events	Behavioural and cultural	££	X	X	X				X	X			X		X
Mandate monitoring and reporting of climate-related risks	Regulatory	££	X	X	X					X	X		X	X	
Include contractual requirements for climate resilience monitoring and reporting	Regulatory	££	X	X	X						X	X	X		
Drive climate focused governance	Policy and strategy	£	X	X	X					X				X	
Investigate setting differentiated targets	Policy and strategy	£		X	X					X				X	
Develop climate resilience investment benchmarks	Policy and strategy	££	X		X					X				X	

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Climate change projections

[Insert Location] Summary

This is an editable page to summarise projected climate risks relevant to the site or location in question for the project, plan or policy.

Users can go to Met Office Local Authority Climate Service Portal and selection location to view projected changes under 1.5°C, 2°C and 4°C global warming levels (GWL) for indicators such as temperature, precipitation, and extreme weather days.

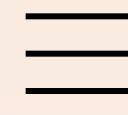|	1.5°C GWL	2°C GWL	4°C GWL
Changes to climate			
Avg. Annual Temp.			
Summer Max Temp.			
Winter Min Temp			
Summer. precipitation			
Winter. precipitation			
Climate Indicators			
No. Summer days (over 25°C)			
No. Hot Summer days (over 30°C)			
No. Extreme Summer days (over 35°C)			
Tropical Nights (Daily minimum temperature > 20°C)			
No. Frost days (Daily minimum temperature < 0°C)			
No. Icing Days (Daily maximum temperature < 0°C)			

Setting up a CRA template

Guidance

The table below illustrates a basic CRA. The CRA assessment should be carried out in excel and shared with climate teams for centralised data management. The CRA represented here is to be adapted depending on project scale, project lifecycle and potential scale of risks. Adaptations include further details such as future risk assessments under different climate scenarios, full consideration of interdependencies and considerations of risks to different groups.

Likelihood and impact ratings are typically assessed using a 1-5 scale. These ratings should be defined in alignment with the organisation's risk management framework - a good example is presented in WMCA's ARP4. The overall risk rating should be derived from a combination of likelihood and impact ratings and used to determine the level of action required.

Thresholds for action should be established, again in line with organisational risk processes. Importantly, these thresholds should be specific to project type, recognising that risk tolerances vary depending on risk sensitivities and varying consequences of failure.

*Where project design life extends this far

Risk Number	Risk Name	Hazards leading to the risk	Current risk			Risk 2050s			Risk 2080s*		
			Likelihood rating	Impact rating	Risk rating	Likelihood rating	Impact rating	Risk rating	Likelihood rating	Impact rating	Risk rating

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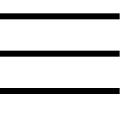
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Mondays, Tuesdays, Thursdays and Fridays, 8am to 6pm

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