

# MANCHESTER CLIMATE READY: DEVELOPING PROGRESSIVE RESILIENCE ACROSS THE CITY

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## The purpose of this appendix

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This appendix details the strategy of the city to develop and embed adaptation and resilience across Manchester. It has been prepared by Dr Paul O'Hare<sup>1</sup>, who was seconded to Manchester Climate Change Agency in 2021, and it has been discussed and agreed with the Adaptation and Resilience Advisory Group, which advises the Agency and the Manchester Climate Change Partnership.

## The importance of adaptation and resilience

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In 2021 the UK Committee on Climate Change warned that a 2°C increase in global temperature remains possible in the second half of this century<sup>2</sup>. More ominously, the Committee warned that even though global climate mitigation commitments are strengthening, warming of up to 4°C above pre-industrial levels cannot be ruled out.

Bold policy and action on climate change mitigation is vital to fulfil our global obligations to those that will face the most acute consequences of climate change and to meet the ambition of the Paris Agreement to limit emissions.

However, no matter how effective efforts to drive down emissions will be, the global climate will change with significant implications for cities and regions across the world.

UK-wide projections suggest we will experience warmer and wetter winters, hotter and drier summers, and more incidents of extreme heat and heavy rainfall. Manchester is no exception to these broader climatic forecasts. Meteorological observations indicate we are already experiencing climate change. Recent years have been warmer, wetter and sunnier than in the 20th Century. 2020 was the third warmest, fifth wettest and eighth sunniest since records began. In fact, no other year has fallen in the 'top-10' across all three variables for the UK<sup>3</sup>. In July 2022, the UK recorded its highest heavy temperature, with almost 40°C recorded in Manchester.

We are not prepared for, nor do we yet fully understand, the impacts that climate change will have on our city's people, our environments and our buildings and infrastructure. Many climate impacts are already 'locked in'<sup>4</sup>; irreversible even under the most ambitious climate mitigation scenario.

So, whilst we have a vital role to play in limiting our climate changing emissions, adaptation to climate change at the city-scale is urgent.

This appendix of the Update to the Climate Change Framework outlines the overarching approach to resilience and adaptation. It establishes the global, national and city necessity for resilience and adaptation, and briefly outlines the impacts that climate is likely to have on Manchester. It proposes a broad vision for resilience for Manchester, one that takes account not just of the climate challenge but that resonates with parallel ambitions to create a city

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<sup>1</sup> Funded by the UKRI Strategic Priority Fund 'Climate Resilience Programme'

<sup>2</sup> CCC Independent Assessment of UK Climate Risk, June 2021 <https://www.theccc.org.uk/wp-content/uploads/2021/07/Independent-Assessment-of-UK-Climate-Risk-Advice-to-Govt-for-CCRA3-CCC.pdf>

<sup>3</sup> <https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.7285>

<sup>4</sup> [https://gca.org/wp-content/uploads/2021/09/Communique\\_High-Level-Dialogue.pdf](https://gca.org/wp-content/uploads/2021/09/Communique_High-Level-Dialogue.pdf)

that is more socially and economically inclusive, and that is greener, healthier and happier. The vision is elaborated on through a series of seven principles that will guide our ambition and frame practical action for realising a more resilient Manchester.

## MCR: Manchester Climate Ready

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The success of mitigation efforts and the necessity of adaptation is correlated. The further global efforts to reduce global warming to pre-industrial levels fall short, the more adaptation we must integrate into the city and across our communities.

Positive action though can still reduce the level of adaptation required. Every fraction of a degree of global warming we can avoid is likely to decrease our long-term climate risk and will make the prospect of adapting to climate change marginally less daunting.

Work on climate resilience must not be undertaken in isolation. Adaptation is necessary to support our other ambitions as a society and for national and sub-national policy. Being more resilient to climate change could ensure we are better equipped to deal with current and future risks and uncertainties, both known and unknown. Work on adaptation must also be carefully integrated with our expenditure on net-zero goals which, where at all possible, should be made as resilient as possible.

We must, therefore, also exploit the co-benefits of climate adaptation, reaping dividends for biodiversity, improving health and equality, and enhancing quality of life and inclusive, equitable economic development. Urban greening, for example, will help reduce flood risk and provide urban cooling benefits, but will simultaneously improve air quality and create spaces for recreation and physical activity. A further vital co-benefit of adaptation is for climate change mitigation. Nature-based solutions, such as tree planting and urban greening, will capture carbon and create spaces to support low impact travel such as walking and cycling.

Adaptation will also bring economic opportunities that we must ensure are shared across society. More broadly, aspects of climate adaptation may also create the space and time required for us to make bolder, long-term progress on climate mitigation.

**Consequently, we must integrate the principles of resilience and adaptive practice across everything we do. Innovative climate adaptation must be used to catalyse the creation of a city that is more socially just, healthier, and better placed to face any manner of potential future risks.**

We must not wait until we are experiencing the brunt of climate impacts before taking adaptive action. Pre-emptive, informed and concerted **action taken now** will not only save lives and livelihoods, but it could better position Manchester to avail of the opportunities of transitioning to a climate resilient, socially inclusive economy. This entails action to not only address the **direct impacts** of a warming climate, but to anticipate the consequences arising from global instability caused by climate change, including food and other supply chains and economic disruption and the potentially profound implications of population displacement.

It will take time to develop and implement effective adaptation initiatives. Moreover, there will be a significant financial outlay to adaptation. But the costs of future economic and reputational damage caused by climate change and of failing to incorporate adaptation and resilience into our policies and practice across the city will be even more significant. We should be clearer regarding how the local authority has to bear the costs of climate change. For instance, recent flooding and wildfire events accounted for substantial unplanned

damage costs. We must, therefore, develop convincing business cases for taking bold climate action, including identifying and accounting for the co-benefits of adaptation.

Some organisations are already taking action to adapt to the climate of the future. We must ensure these efforts are reported and acknowledged, that we learn lessons from them and that - where appropriate - they are replicated. But across the city this is piecemeal: progress is inconsistent and lacks co-ordination.

Manchester must follow the lead of cities across the world to develop a coherent adaptation plan for Manchester and encourage and support citizens, businesses, and other stakeholders to work towards its implementation.

This appendix of the Framework establishes a coherent vision for a more climate resilient Manchester in the most **progressive sense of the term**. This includes the development of a series of principles for resilience, and a set of related actions for strategic stakeholders, businesses, and communities.

We have termed this work **MCR: Manchester Climate Ready**.

### Our vision for progressive resilience

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Our vision for a more climate resilient Manchester will enhance the capacity of the entire city - our buildings, infrastructure, green and blue space, businesses, services and people - to adapt to future climate shocks and stresses.

Our pursuit of climate resilience will be aligned with other progressive agendas that aspire to create a healthier, happier, and a more socially just city, support biodiversity and produce sustainable, inclusive, and green economic growth.

The vision is supported by the identification of the characteristics of progressive resilience, and through seven guiding principles designed to coalesce action, and by the identification of a series of headline actions.

### What is resilience and adaptation?

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Resilience and adaptation are complex terms that are often used interchangeably.

**Resilience** is a rather generic concept referring to the extent to which a system withstands or absorbs impacts, and how it might evolve to become better placed to endure, and ideally to thrive, amidst adversity. It is often applied across a range of threats including, but not limited to, climate change. More progressive interpretations of resilience emphasise the potential for reorganisation; not just 'bouncing back' to a previous status following a shock, but evolving, 'bouncing-forward' or transforming to a state that is inherently less vulnerable<sup>5</sup>.

**Adaptation** is more specific than resilience and is often rather more orientated around building capacity and taking action. In the context of climate change, adaptation refers to effort to reduce the impacts of hazards that are predicted to be intensified or exacerbated by a changing climate. In practice, it refers to the activities and interventions that can be used to absorb – and beyond to adapt to - shocks and stresses that have either already occurred or that are predicted to occur in the future. Adaptation can be anticipatory or reactive, or incremental or transformative<sup>6</sup>.

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<sup>5</sup> O'Hare, P., White, I. & Connelly, A. (2105) Insurance as maladaptation: Resilience and the 'business as usual' paradox. *Environment and Planning C: Government and Policy*. 34(6), pp.1175-1193.

<sup>6</sup> [https://report.ipcc.ch/ar6wg2/pdf/IPCC\\_AR6\\_WGII\\_SummaryForPolicymakers.pdf](https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_SummaryForPolicymakers.pdf)

A further dimension of adaptation refers to **adaptability**; remaining agile and able to respond to not yet fully understood or appreciated risks.

Resilience and adaptation are complex terms that are often used interchangeably.

### Addressing the Manchester ‘adaptation gap’

Climate resilience and climate adaptation is emerging as a vital dimension of climate policy across governmental scales. There is, however, a significant adaptation gap<sup>7</sup> between the action required to make significant progress on creating a more resilient future, and the action currently being taken. That is partly because we are becoming better informed about the severity and implications of climate risk. But fundamentally adaptation action is falling considerably short of what we will require in a climate changed world.

To inform and enable Manchester’s response to the impacts of climate change, we should first acknowledge the by now expansive and expanding policy context at global, national and city-regional scales.

#### ***The Global context -***

Adaptation has gradually emerged as a key strand of global climate policy frameworks. The 2015 Paris Climate Agreement established adaptation and resilience as a global imperative. Six years later, the Conference of the Parties 26 (CoP26, Glasgow, November 2021) had adaptation to protect communities and natural habitats as one of its four key goals<sup>8</sup>. The Conference called for a ‘step change’ to deliver adaptation to avert, minimise and address loss and damage, ultimately to ensure climate adaptation reaches parity with - and complements - climate mitigation.

#### ***Paris Climate Agreement 2015 – Article 7***

*“Parties hereby establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal....”*

The Glasgow Climate Pact which emerged from the CoP26 climate negotiations emphasised the urgency of scaling up action and support for climate adaptation, and urged parties to integrate adaptation planning into local, national and regional planning (Articles II: 6 & 8)<sup>9</sup>.

Prior to the Conference, five pillars for adaptation action were developed, designed to close the adaptation gap and to address local climate impacts. These were to build resilience across all of society; to build more effective risk management; to transform climate adaptation finance; to catalyse locally-led action; and to harness the power of nature<sup>10</sup>.

The latest June 2022 report of the Committee on Climate Change reiterates the urgent need for developing robust climate adaptation and resilience projects.<sup>11</sup>

<sup>7</sup> <https://www.unep.org/resources/adaptation-gap-report-2021>

<sup>8</sup> <https://ukcop26.org/cop26-goals/>

<sup>9</sup> [https://unfccc.int/sites/default/files/resource/cop26\\_auv\\_2f\\_cover\\_decision.pdf](https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf)

<sup>10</sup> [https://ukcop26.org/the-uk-cop26-presidency-glasgow-imperative-closing-the-adaptation-gap-and-responding-to-climate-impacts/#:~:text=Building%20on%20initiatives%20launched%2C%20and,v\)%20Harnessing%20the%20power%20of](https://ukcop26.org/the-uk-cop26-presidency-glasgow-imperative-closing-the-adaptation-gap-and-responding-to-climate-impacts/#:~:text=Building%20on%20initiatives%20launched%2C%20and,v)%20Harnessing%20the%20power%20of)

<sup>11</sup> <https://www.theccc.org.uk/publication/2022-progress-report-to-parliament/>

## National policy

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Resilience and adaptation are gaining a higher profile at a national scale and they are increasingly being integrated across policy areas.

The Climate Change Act (2008)<sup>12</sup> provides a framework for mitigating and adapting to climate change. It requires the completion of a five-yearly Climate Change Risk Assessment (CCRA)<sup>13</sup>, with a National Adaptation Programme establishing how risks will be addressed. Additionally, the Act provides an 'Adaptation Reporting Power' requiring public bodies and infrastructure operators providing key services to report actions being taken to address climate impacts.

The 2017 CCRA<sup>14</sup> identified six priority areas of risk (and opportunity): flooding and coastal change; to health and well-being from high temperatures; due to water shortages; to natural capital; to food production and trade; and from pests and diseases and invasive non-native species. Detailed actions to address these priorities were outlined in the 2018 National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting<sup>15</sup>, including actions for local authorities, mayors, cities and city regions (section 6.4).

The most recent CCRA<sup>16</sup>, published in January 2022, cites research suggesting that by 2045 the cost of climate change to the UK could be over 1% of GDP. The report noted that there are serious barriers to adaptation, including limitations in information and awareness of climate risk; a lack of clarity on ownership of risks and responses; the complexity of adapting for a future containing innate uncertainty; and the need to ensure holistic solutions are applied to avoid maladaptation of assets.

The 2020 Committee on Climate Change Progress Report to Parliament set out a series of recommendations aligned with broad goals. These goals are summarised in the table below (CCC, 2020: 174)<sup>17</sup>.

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<sup>12</sup> <https://www.legislation.gov.uk/ukpga/2008/27/contents>

<sup>13</sup> <https://www.gov.uk/government/publications/climate-change-risk-assessment-ccra>

<sup>14</sup> <https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2017>

<sup>15</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/727252/national-adaptation-programme-2018.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727252/national-adaptation-programme-2018.pdf)

<sup>16</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1047003/climate-change-risk-assessment-2022.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf)

<sup>17</sup> CCC 2020 progress report to Parliament

### Transparency

A full assessment of climate risk and exposure and appropriate adaptation measures are required to deliver wider climate resilience goals.

### Enabling policies

Many actions to prepare for the changing climate will be taken by households and businesses. These should be enabled, for example by ensuring that households are aware of their risk from flooding, water scarcity and overheating. Support services for adaptation have been eroded over the past ten years.

### Incentives and investments to strengthen resilience

Many adaptation measures require up-front investment yet benefits might accrue over the longer-term. Incentives, particularly for households, must encourage early uptake to avoid lock-in and significant damage costs later. There are few incentives for property-level flood protection, passive cooling, sustainable urban drainage, and urban greening.

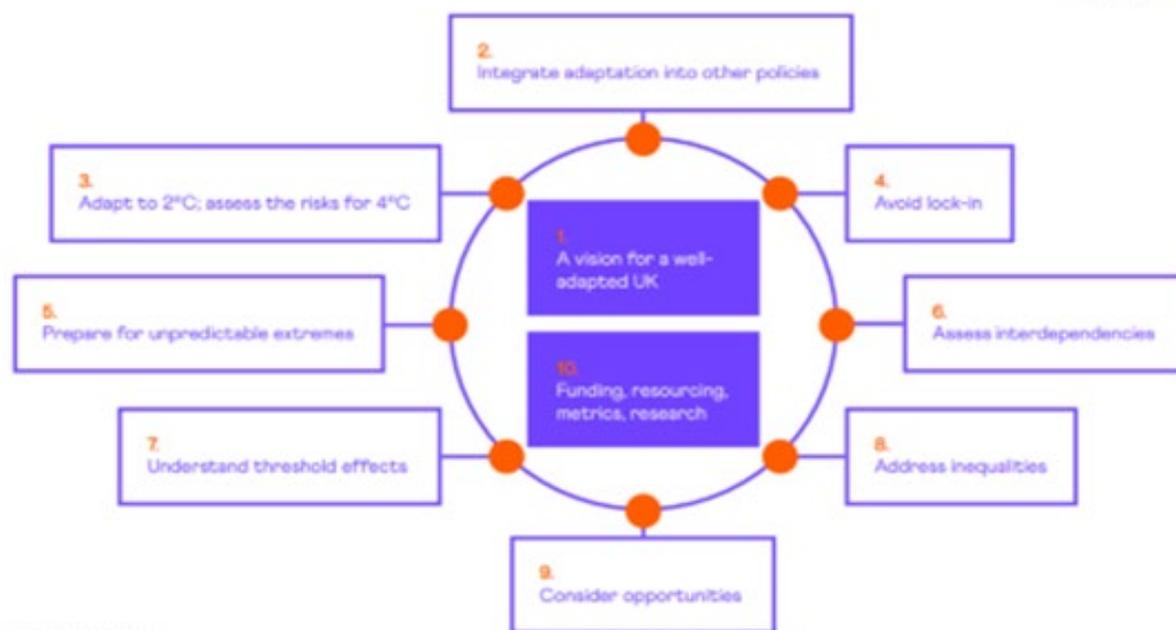
### Ensuring all policies, regulations and standards include climate resilience

Adaptation is needed to deliver other government goals. It needs to be integrated into policies to ensure they can be met in the face of climate change, and not added on as an after-thought or simply mentioned in passing.

Despite increasing national emphasis on climate change, collective action is falling short of what is required given the scale of the challenge. In its role as an independent advisory body, the Climate Change Committee makes annual reports to Parliament on the UK's preparation for climate change. The 2021 report stated that **“Adaptation policy needs a step change in ambition and action.”**<sup>18</sup> (CCC, 2021: 10).

In 2021 the Committee on Climate Change published the Independent Assessment of UK Climate Risk (to inform the UK's third Climate Change Risk Assessment (CCRA3) due in 2023). It identified ten principles for good adaptation policy (see below).

Figure 2 Ten principles for good adaptation



<sup>18</sup> [Progress-in-adapting-to-climate-change-2021-Report-to-Parliament.pdf](#)

## Greater Manchester's resilience programme

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National frameworks are vital in establishing the strategic context for resilience and adaptation action. But effective action will be realised in cities and communities, necessitating clear, coherent policy from local and city-regional government.

Led by the Chief Resilience Officer for Greater Manchester, the Greater Manchester Resilience Unit (GMRU) sits within the Greater Manchester Combined Authority (GMCA). The GMRU holds the secretarial responsibility for the Greater Manchester Resilience Forum (GMRF) which coordinates emergency planning, enabling an effective multi-agency response to emergency incidents.

The Civil Contingencies Act 2004 places a legal duty on Category 1 responders (the police, fire, ambulance, health and local authorities) to undertake risk assessments and maintain them in a Community Risk Register. This is conducted by the Greater Manchester Resilience Forum<sup>19</sup>.

Work at the city-regional tier has culminated in the Greater Manchester Resilience Strategy (2021). Drawing on widely accepted models of disaster risk reduction (i.e., the Sendai Framework for Disaster Risk Reduction 2015-2030 targets) and aligned with the UN Sustainable Development Goals, the Strategy acknowledges that emergencies and longer-term stresses compound pre-existing societal challenges such as the degradation of the natural environment, or a lack of community cohesion. These cycles, the GMCA Chief Resilience Officer proposes, “can be mitigated by our approach to urban resilience and by baking resilience considerations into every investment decision we make.” (GMCA, 2021: 4).

The Strategy has five inter-related dimensions (see Table below – GM Dimensions of Resilience), across three outcomes:

1. Reduced impact of shocks and stresses on people, the physical environment and economy, accelerating recovery and improving quality of life.
2. Avoidance of new risks, reduction of existing risks and effective management of residual risks.
3. Co-benefits realised on investments across sectors and stakeholders, in particular benefitting the poorest and most vulnerable.

<b>Communities:</b> Building cohesive, healthy and resilient communities
<b>Discovery:</b> Enhancing resilience understanding
<b>Leadership:</b> Shaping resilience within Greater Manchester
<b>Place:</b> Being ready for future challenges
<b>Responding:</b> Sustaining effective preparedness, response and recovery from emergencies

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<sup>19</sup> <https://www.gmemergencyplanning.org.uk/about-us/greater-manchester-resilience-forum/>

Specific action on climate change is traceable through other policy initiatives. The Greater Manchester 5-Year Environment Plan (2019)<sup>20</sup> has a section dedicated to ‘our resilience and adaptation to climate change’. It states “...we need to ensure that, as a result of any activities, we do not increase the level of climate risk faced by future generations and work in ways which proactively reduces climate risks and increases our resilience.” (Page 70). It has four resilience and adaptation priorities, summarised below.

Summary of our priorities- resilience and adaptation to climate change	
Greater Manchester 5-Year Environment Plan, 2019 – 2024	
<b>Priority 1:</b> Embedding climate change resilience and adaptation in all policies	<b>Priority 2:</b> Increasing the resilience of, and investment in, our critical infrastructure
<b>Priority 3:</b> Implementing a prioritised programme of nature-based climate action	<b>Priority 4:</b> Improving monitoring and reporting

The Greater Manchester spatial strategy - Places for Everyone - pays particular attention to resilience under Policy JP-S 4. This includes retrofitting existing buildings and infrastructure for resilience, increasing the size, spread, quality and interconnectedness of the green infrastructure network, and taking an integrated catchment-based approach to managing flood risk.

Given that Manchester is reliant on infrastructure, networks, and catchments that extend beyond the city boundaries, co-ordinated effort at the city-regional scale is vital if we are to make progress in creating a more climate resilient Manchester. This resonates with the Greater Manchester Strategy which emphasises how the city-region must prioritise tackling both inequalities *and* the climate emergency.

#### Climate action at the city scale

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The Manchester City Council Climate Change Action Plan 2020-2025 notes a commitment “to ensuring that climate change adaptation, including green and blue infrastructure, is included in new developments and across Council owned buildings and land.”<sup>21</sup> The strategy recognises that further work must be done through ward plans, Neighbourhoods teams, Highways and through improved communication information and guidance to make communities more resilient to climate change.<sup>22</sup>

Other elements of Manchester City Council policy notes how green and blue infrastructure enhancement is effective in reducing climate impacts whilst assisting benefits for climate mitigation and deriving co-benefits for biodiversity, health and well-being.

The city’s ten-year green and blue infrastructure strategy – Manchester’s Great Outdoors – establishes a vision for a sustainable and liveable city<sup>23</sup>. The strategy states: “Interconnected green infrastructure is vital for managing a range of climatic changes, particularly in urban

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<sup>20</sup> [https://www.greatermanchester-ca.gov.uk/media/1986/5-year-plan-branded\\_3.pdf](https://www.greatermanchester-ca.gov.uk/media/1986/5-year-plan-branded_3.pdf)

<sup>21</sup> <https://democracy.manchester.gov.uk/documents/s16275/Final%20MCC%20Climate%20Change%20Action%20Plan%202020-25.pdf>

<sup>22</sup> <https://democracy.manchester.gov.uk/documents/s16275/Final%20MCC%20Climate%20Change%20Action%20Plan%202020-25.pdf>

<sup>23</sup> [https://www.manchester.gov.uk/download/downloads/id/23418/green\\_and\\_blue\\_action\\_plan.pdf](https://www.manchester.gov.uk/download/downloads/id/23418/green_and_blue_action_plan.pdf)

areas, where it can reduce the impact of heavy rainfall or the urban heat island effect.” (Page 15).

It has four objectives: to enhance the quality and function of green and blue infrastructure; to integrate green and blue infrastructure into new developments; improve connectivity and accessibility; and improve and promote the benefits of green and blue infrastructure to residents, the economy and the local environment. The Strategy has an associated Action Plan with detailed objectives and actions aligned to specific stakeholders<sup>24</sup>.

Manchester City Council recently published a Green and Blue Infrastructure Strategy Review, summarising key initiatives and outlining the latest iteration of an associated implementation plan. Key initiatives include:

- **My Wild City**<sup>25</sup> - a four-year partnership between Manchester City Council and the Wildlife Trust, to develop a strong new mandate for biodiversity in the city.
- **Our Rivers Our City**<sup>26</sup> - a comprehensive appraisal of Manchester’s three main river valleys. It develops concepts such as sponge-city thinking, where permeability and landscape-led approaches are normalised. In addition to an overarching strategy for the City, individual long term action plans have been co-developed for the Rivers Irk, Mersey and Medlock Valley. This was funded through the EU Grow Green project.<sup>27</sup>
- **Managing Manchester’s Trees** - an authoritative evaluation of the way the city’s treescape has evolved, how it functions and how it can be improved.

Climate risk in Manchester

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### ***Climate hazards***

Manchester’s future climate is expected to reflect the projections for climate change and climate vulnerability for the UK. The Meteorological Office City Pack<sup>28</sup> for Manchester suggests that, on average, Manchester is likely to be wetter and warmer, though some modelling suggests that we will experience a reduction in rainfall, particularly in the summer. Severe weather ‘events’ will become more extreme and more frequent<sup>29</sup>. The city will also face medium-term variations in climate patterns, and anomalies outside the headline climate change trends. It is likely that we are already experiencing some of the effects of climate change in Manchester.

The changing climate will exacerbate weather-related risks for the city. Flooding is Manchester’s most prominent extreme weather and climate change threat. Floods in February 2020 and ‘near-misses’ in January 2021 and February 2022 are just the latest indicators of the damage and disruption that these events can cause. Storms and high winds will also pose an increasing risk. Although currently relatively rare, droughts, heatwaves and wildfires will also occur more frequently and must be given greater attention. Of particular concern is the impact that very hot summer days and ‘tropical nights’ will have on the city and its inhabitants. In July 2022, a severe heatwave saw recorded temperatures reach almost 40°C for the first time in Manchester. Temperatures in this range can cause serious

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<sup>24</sup> [https://www.manchester.gov.uk/downloads/download/6314/manchester\\_green\\_and\\_blue\\_strategy](https://www.manchester.gov.uk/downloads/download/6314/manchester_green_and_blue_strategy)

<sup>25</sup> <https://www.lancswt.org.uk/our-work/projects/my-wild-city>

<sup>26</sup> [Our-Rivers-Our-City-Strategy\\_Final.pdf \(growgreenproject.eu\)](https://www.growgreenproject.eu/our-rivers-our-city-strategy-final.pdf)

<sup>27</sup> <https://growgreenproject.eu/>

<sup>28</sup> [https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/spf/manchester-city-pack\\_august-2022.pdf](https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/spf/manchester-city-pack_august-2022.pdf)

<sup>29</sup> See <https://www.manchesterclimate.com/sites/default/files/Climate%20vulnerability%20framework.pdf> for further information on Manchester’s weather and climate hazards.

health problems or even pose a risk of death for residents. It also has significant implications for the delivery of services and the functioning of infrastructure.

### A framework for understanding the city's climate risk

Few elements of the city or our lives will be untouched by the direct and indirect impacts of weather hazards exacerbated by climate. Additionally, there is a need to consider how risk can cascade throughout the city, particularly in terms of infrastructure and utility risks. We must also consider how Manchester may be impacted by the international effects of climate change including potential disruption to global supply chains and trading, forced human migration and the introduction of invasive species. These could have significant consequences for social cohesion, service provision, green infrastructure functionality, and for social and economic development.

Despite the complexity of doing so, we must intensify our collective effort to understand the complex, interactive implications of climate change risk. Further work on assessing Manchester's climate risk will help us to prioritize where adaptation action will have the most benefit, and relatedly, identify windows of opportunity that will enable and catalyse more effective adaptation.

In 2021 MCCA has started this work by publishing 'Manchester's climate risk: a framework for understanding hazards & vulnerability'<sup>30</sup>. This document is a reference point establishing a structure for climate risk assessments at city-scale and by individual sectors and organisations.

### Managing flood risk in Manchester

Across Manchester, flooding is our most serious current climate risk. Flood risk will only increase with climate change, potentially putting pressure on already existing flood defence infrastructure.

There are already well-established governance and operational structures for flood risk management.

Greater Manchester's Strategic Flood Risk Assessment<sup>31</sup> provides a framework for flood risk management across the city-region. It identifies key strategic flood risks, particularly those with potential to affect its economic, social and environmental sustainability. It also identifies previous, existing and planned flood risk management interventions.

The Environment Agency has lead responsibility for operational response to flooding. They attend command meetings and give technical advice, issue Flood Alerts & Warnings, operate flood control structures and pumping stations, and routinely clear debris from channels, screens and culverts on main rivers and monitor/repair defences. 9,629 properties are in Flood Warning Areas in Manchester.

Manchester has relatively extensive flood defences along its waterways. For instance, the River Mersey has two water retention reservoirs that can be used to manage river levels and prevent flooding; the Didsbury basin and the Sale Ees with excessive flood water sluiced into reservoirs to maintain the river at optimum capacity.

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<sup>30</sup> [https://www.manchesterclimate.com/sites/default/files/Manchester%20Climate%20Risk\\_A%20Framework%20For%20Understanding%20Hazards%20and%20Vulnerability.pdf](https://www.manchesterclimate.com/sites/default/files/Manchester%20Climate%20Risk_A%20Framework%20For%20Understanding%20Hazards%20and%20Vulnerability.pdf)

<sup>31</sup> <https://www.greatermanchester-ca.gov.uk/media/1726/gmca-final-strategic-sfra-framework-january-2019.pdf>

In mid-January 2021, after a period of heavy rainfall, flood warnings were issued with particular concern regarding Didsbury and Northenden given the anticipated levels of the River Mersey. An evacuation took place against the added complexity of Covid restrictions. Flood water peaked at approximately 5am on Thursday 21st January. It did not overtop the flood basin; however, it was reported that it did come within millimetres of doing so<sup>32</sup>. A similar near miss incident also occurred in the same area in February 2022.

We may have inherited some extent of in-built resilience to weather hazards through protective infrastructure that was constructed many years ago. Yet these incidents serve as a reminder that the defences we have relied upon for so long may need to be reviewed in light of a world that is experiencing the impacts of climate change.

### Progressive resilience

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We must rise to the challenge posed by climate change and ensure the city that we create today and will leave future generations that succeed us, is fit for the future.

Coherent climate adaptation necessitates the development of a vision characterising the future city we want. The vision should align with our other goals and priorities for the city and our partners, exploiting synergies within other policies and initiatives and ultimately ensuring climate adaptation action becomes mainstreamed. This resonance is vital given that we are all responsible for taking the practical action to adapt the city to climate change.

We must, therefore, exploit synergies within other policies and initiatives and ultimately ensure climate adaptation is integrated throughout all of our activities.

### MCR: Manchester Climate Ready – characteristics of Progressive Resilience

Like all cities, Manchester faces many challenges including, but by no means limited to, climate change. The pursuit of a **progressive resilience** agenda across policy and action will nurture a society, economy, and a city better equipped to meet all the challenges – both known and unknown – that we will encounter in the future.

But what is resilience, and more particularly, what are the characteristics of progressive resilience?

#### **Progressive resilience for climate adaptation:**

- Extends beyond merely *coping* with climate change and instead **promotes adaptive action that is transformative**. Action should reduce the systemic causes of vulnerability, and privilege genuinely sustainable and socially and environmentally progressive cultures, practices and innovation.
- Is pursued by the **whole of society working together** in the common cause of creating a more resilient city. This includes citizens and communities, statutory bodies and strategic partners, neighbouring and associated local authorities, the private sector and the voluntary and community sector.
- Is informed by a **spatially informed, holistic and comprehensive assessment of climate risk**. This will ensure pre-emptive, targeted action is taken to adapt to climate change, ensuring we support the places, people, and organisations that are at greatest risk, not just of climate change, but by all manner of other risks as well.
- **Takes account of future risk**. For instance, communities that are at risk of experiencing climate related disasters should be supported to adapt to a future where exposure to climate change is increased.

<sup>32</sup> <https://democracy.manchester.gov.uk/documents/g3976/Public%20reports%20pack%2011th-Nov-2021%2010.00%20Environment%20and%20Climate%20Change%20Scrutiny%20Committee.pdf?T=10>

- Ensures we are **leaving a legacy of climate resilience to future generations**. In particular, the construction of new buildings and infrastructure must consider the likely risk of over-heating and flooding across their lifespan.
- Recognises that inequality and disadvantage mean that some communities and individuals are at greater risk. We must therefore **prioritise inclusive adaptation**. This includes considering the distribution of climate change impacts and targeting interventions accordingly, toward those most in need.
- **Avoids unintended adverse consequences ('maladaptation') and 'lock-in'** to decisions that may prove to be counter-productive to ensuring future resilience.
- Delivers **co-ordinated resilience and climate adaptation interventions at scale and for the maximum number of beneficiaries** through careful strategic planning and implementation of adaptation initiatives.
- Considers how, whilst individual action is important, **adaptation must be delivered for the collective benefit of the entire city and for our neighbours beyond the city's administrative boundaries**. For instance, developments that are not themselves at significant climate risk should take account of how climate adaptation can be delivered for their wider communities and workforces, lowering the climate risk profile of the city, and collaborating with and deriving benefits for neighbouring local authorities and the wider region.
- Takes account of - and capitalises on - **the co-benefits of climate adaptation interventions**, or what is increasingly referred to as 'multiple resilience dividends'. These include:
  - Benefits for realising the city's **climate change mitigation targets**, for instance through the integration of trees and green infrastructure into the urban landscape, providing adaptation benefits and capturing carbon.
  - **Improving physical and mental health and well-being** of our people by creating urban spaces that prevent flood risk and will be used for recreation and encouraging active modes of transport.
  - **Exploiting social and economic benefits** generated through the drive for climate change adaptation and resilience practices and technologies, and in supporting the growth of the green technology and services sector. This must take place with a **'just transition'** in mind, ensuring opportunities are distributed fairly. For example, where feasible, education, training and investment should be targeted at the places, people and businesses at greatest socio-economic disadvantage.
  - Stimulate **innovation and sustainable, inclusive growth** for our small and medium sized enterprises by supporting their engagement with the climate adaptation economy.
  - Bring broader **environmental and public amenity benefits** including the creation of better quality, bio-diverse and resilient green and blue space and habitats.

## Objectives for progressive resilience – our guiding principles

To coalesce effort to create a more resilient city in the most progressive sense of the term, a series of objectives/ principles have been developed. These will catalyse coherent action and provide a reference point for assessing progress in enhancing climate resilience and adaptation. They are strategic, designed to prompt action, but are neither prescriptive nor exhaustive.

### 1. Enhance leadership and strategic capacity to pursue progressive resilience and adaptation agendas and action across the city.

Creating a city that is better able to deal with our projected future climate and associated weather shocks through progressive resilience and adaptive interventions will, first and foremost, require ambition, innovation, agile leadership, and strategic co-ordination across Manchester, the city region (Greater Manchester) and beyond. Individuals and organisations must meet the challenge of climate change, and champion ambitious action for city-wide resilience and adaptation.

**2. Develop detailed understandings of the implications of - and vulnerabilities to – exposure to climate change.**

Effective climate resilience and adaptation action must be informed by a detailed, and where appropriate, spatial understanding of climate risk. Ultimately, this will assist in determining targeted resilience interventions and will demonstrate our progress towards creating a more climate resilient city.

**3. Embed progressive climate resilience ambition and action across the city, including in governance, policy and practice.**

We must develop plans for how climate resilience and adaptation can be harnessed to create a Manchester better equipped for all the challenges of the future. This should be place-based and include an understanding of practical action that could be taken to embed resilience in everyday life, in organisational practice and in our buildings, places and communities. This should be integrated into a coherent plan for adaptation across the city.

**4. Enable individuals, communities, service providers and businesses to adopt and integrate adaptation measures.**

As our understanding of climate risk and the range of potential means to address it expand, the capacity to act with speed and at scale must be bolstered. Although some adaptation measures are relatively straightforward, the creation of a more resilient Manchester requires foresight, innovation, ambition, and co-operation. It also requires technical expertise and financing.

**5. Embed and enhance green and blue infrastructure to support climate resilience and adaptation.**

Manchester's green and blue spaces serve a vital purpose not only in assisting with climate mitigation and adaptation, but in improving the liveability and the social and health well-being of the city. We must both protect the climate functionality of these existing spaces and ensure that new spaces that embolden climate resilience are integrated at scale into the city.

**6. Ensure our urban environment, including buildings and urban infrastructure, is climate resilient.**

Many of the buildings and much of the infrastructure that is currently being financed, planned, and constructed across Manchester is likely to still be in use throughout this century and beyond. Similarly, we have inherited much of our current and future risk due to decisions taken by past generations. We must, therefore, consider the likely future impacts of climate change into the planning of the city through climate sensitive land use and development control decisions. We must also take steps to retrofit our current built environment and infrastructure to ensure they are fit for purpose in the future. This includes the use of innovative design and material in construction, innovative building management, and through the integration of green and blue infrastructure in the urban and built environment.

**7. Encourage research, innovation, and reflective practice to support our progress in creating a more resilient Manchester.**

We must harness the knowledge and expertise in our universities, the technical abilities and entrepreneurial spirit of our private sector, the creativity of our arts and cultural

sectors, and the energy of our people through youth groups, civil society and impassioned, engaged communities to build a more resilient, more adaptive Manchester.

## Next steps

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Together the vision, the principles and the headline actions should be used by partners to guide more effective and more co-ordinated action on resilience and adaptation. MCCA and MCCP will play integral roles in marshalling and taking action and in influencing others who are not yet formally aligned with the Partnership. Other partners, such as the local authority, will have enabling functions beyond instilling resilience and adaptive practice within their own organisations, operations and services.

However, our collaborative effort to create a more resilient city is a work in progress. Resilience is not a destination, but a journey. MCCA will revisit and refine this work in subsequent years, ensuring it is effectively raising our ambition to create a more resilient city, and that is prompting effective action throughout our partners and beyond.

To this end, we have developed a series of themes to be considered by the Agency with the support of the Adaptation & Resilience Advisory Group:

### **Dissemination and promotion**

Work is being undertaken in 2022 and beyond to disseminate and promote resilience and adaptation across the city. This will include encouraging members of the Partnership and individuals in the City Council to champion climate resilience action and practice.

### **Monitoring and reporting**

Metrics and monitoring can be used to stimulate progress and frame reporting. But monitoring and evaluating progress on resilience and adaptation is notoriously challenging<sup>33</sup>. Further work will take place to identify how we can do this across the city, possibly with reference to global initiatives such as the UN's Race to Resilience. In the meantime, we will provide opportunities for stakeholders to report their progress against the seven principles, and seek to integrate with other monitoring frameworks.

### **Integration with policy and practice**

We will enhance our integration with pre-existent networks and forums working on resilience and adaptation. We will enhance relationships with resilience forums in Manchester and at GMCA. We will support MCC policy makers (particularly in planning, development and green and blue infrastructure) to engage with climate risk and adaptation through policy development and support elected members in scrutinising climate resilience policy.

### **Developing city-wide risk assessments**

We will work to develop accurate assessments of climate risk for sectors across the city, and encourage partners and stakeholders to do likewise. This will ensure our adaptation and resilience planning appreciates the extent of climate risk faced by our residents and businesses so we can focus our efforts on the key risks and locations most in need.

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<sup>33</sup> "a lack of consensus on definitions and approaches to their assessment" Adaptation Gap report

## Annex 1: Manchester's main climate hazards

CLIMATIC & WEATHER HAZARD	POTENTIAL IMPLICATIONS OF CLIMATE CHANGE ON HAZARDS
<b>Short- &amp; medium-term heat waves</b>	Climate projections suggest that Manchester will face warmer summers in the future. There is an associated increased likelihood that we will face intense very hot spells (heatwaves). Some summer days could potentially be extremely hot. Higher night-time temperatures will be a particular problem in cities where buildings retain heat overnight. Increased frequency and intensity of intense convective rainfall.
<b>Long periods of hot &amp; dry weather</b>	Summers are, generally, expected to be drier in the future. Prolonged dry and warm periods may lead to drought conditions, exacerbated by increased demands on dwindling water supplies. Some projections suggest that this hazard is more extreme than any of the historical events referred to above.
<b>Summer storms</b>	Although it is anticipated that, generally, the climate will be drier in Summer in the future, data from UKCP 2018 also indicates future increases in short-lived heavy rainfall events. There is an increased likelihood that there will be greater intensity in hourly precipitation extremes. More particularly, the impacts of increased convective rainfall events could be exacerbated by significant surface water run-off with precipitation falling on very dry ground.
<b>Autumnal &amp; Winter storms and prolonged periods of precipitation</b>	Winters are likely to be wetter. In particular, successive mid-Atlantic lows have the potential to bring considerable amounts of rain to the region. Groundwater levels and soil saturation could remain high all winter, particularly in the hills and moorlands around Manchester that feed rivers. It is worth noting that UKCP 2018 warns "Users may wish to take the precautionary approach of considering the implications of a very large winter precipitation increase being more likely than the probabilistic projections suggest" (Met Office, 2019: 8).
<b>Cold snaps &amp; lying snow</b>	Climate projections indicate winters will generally be warmer. UKCP 2018 suggest that by the end of the century there will be very few, if any, incidents of snowfall lying on the ground, except for on higher ground. This does not, however, entirely preclude periods of relatively prolonged cold snaps and accumulations of ground-lying snow in the short to medium term.

## Annex 2: Manchester's exposure and vulnerability to climate change – an overview

<b>People &amp; society</b>	The health and well-being of everyone in society are fundamental indicators of the success and vitality of the city. Manchester is a complex and diverse city, composed of many communities with contrasting characteristics. These communities will be affected by climate change in different ways, and some people will have greater capacity to respond.
<b>Economic activity</b>	Manchester faces considerable economic challenges. Moreover, wealth and economic opportunity is not shared across the city or its people. Climate change will bring both threats and opportunities to the economic sustainability and the competitiveness of the city and will have significant implications for social justice and inclusive growth.
<b>Place &amp; the built environment</b>	The places that we inhabit, and more specifically our built environment, is a key element of our exposure to the impacts to climate change. We need to consider how our urban spaces, public places and parks and green spaces are vulnerable to the impacts of climate change.
<b>Infrastructure</b>	The effective functioning of our infrastructure is vital for economic and social well-being of all those that live and work in the city. Climate change threatens to both exacerbate long-standing vulnerabilities and introduce new vulnerabilities to the city's infrastructure networks.
<b>Natural environment, biodiversity and green &amp; blue infrastructure</b>	Manchester has a vast range of green and blue space and biodiversity. However, these spaces are of varying quality, and will come under increasing pressure from future development and fragmentation.
<b>Cross-cutting themes</b>	There are a number of cross-cutting factors that should be considered when assessing Manchester's sensitivity and vulnerability to climate change. These include interdependencies that will frame any efforts to adapt to climate change such as the management of risk across the city's boundaries, and evaluating the understanding of climate risk, resilience and adaptation.

**1. Enhance leadership and strategic capacity to pursue progressive resilience and adaptation agendas and action across the city.**

Creating a city that is better able to deal with our projected future climate and associated weather shocks through progressive resilience and adaptive interventions will, first and foremost, require ambition, innovation, agile leadership, and strategic co-ordination across Manchester. Individuals and organisations must meet the challenge of climate change, and champion ambitious action for city-wide resilience and adaptation.

Efforts to realise progressive resilience will require significant co-ordination not just across scale but also through integration within pre-existing and emerging policy agendas. For instance, climate resilience should not just entail building our capacity to respond to future climate shocks and stresses but should engage with broader inclusive growth and social justice agendas, and with efforts to create a healthier, happier, more prosperous city. This will also require careful integration

More broadly, the principles of progressive resilience should be embedded within all our activities and initiatives to ensure we are infusing progressive interventions across everything we do. For instance, strategic policy and organisational planning and finance programmes should identify where efforts to achieve resilience and to adapt to climate change could be maximised.

This will require foresight to identify co-benefits and to realise multiple resilience dividends, but also necessitates leadership and influence to build effective collaboration for resilience and adaptation delivery.

**2. Develop detailed understandings of the implications of - and vulnerabilities to – exposure to climate change.**

Effective climate resilience and adaptation action must be informed by a detailed understanding of climate risk. Ultimately, this will assist in determining targeted resilience interventions and will demonstrate our progress toward creating a more climate resilient city.

Climate risk assessments should be comprehensive, include built assets, facilities and business critical infrastructure, staff, service users and customers and supply chains. Where necessary they should be informed by spatial analysis, as well as in consultation with internal and external stakeholders. Risk assessments should also include evaluations of the indirect impacts of climate change elsewhere in the world on Manchester, for instance population displacement and interruptions to food and water supplies. Risk assessments should be iterative and dynamic, being regularly updated and developed as climate science becomes clearer and as we become more aware of the extent of the impacts of climate change for Manchester.

At the outset, bespoke climate risk assessments should be undertaken to ensure that particular risk is given specific due consideration in line with the most up to date climate science. However, as far as possible, the findings should then be integrated into already well-established risk management and business planning activities and early warning systems which themselves should be regularly updated and reviewed.

Identifying and mapping vulnerability is challenging and nuanced. Different sectors do not necessarily share the same sensitivity to climate change or may not be vulnerable in the same way. Moreover, vulnerability is dynamic, altering across time and due to the changing conditions and circumstances. There is a need to consider risk beyond the administrative

boundaries of the city, for instance across catchments, supply systems, and across the wider region.

There is, too, a need to consider the possible opportunities that might be derived from climate change, limited though they might be. Further information on the climate hazards, impacts and vulnerabilities for Manchester is available in 'Manchester's Climate Risk: a framework for understanding hazards & vulnerability'<sup>34</sup>.

### **3. Embed progressive climate resilience ambition and action across the city, including governance, policy and practice.**

We must collectively increase our understanding of how climate resilience and adaptation can be harnessed to create a Manchester better equipped for all the challenges of the future. This should be place-based and include an understanding of practical action that could be taken to embed resilience in everyday life, in organisational practice and in our buildings, places and communities. This should be integrated into a coherent plan for adaptation action across the city.

Planning for adaptation should be twofold: partners across the city should take proactive action on the primary impacts that climate change could have on their assets, organisations, people, service users and customers and supply chains. This should be informed by a climate risk assessment that takes account of current and future climate hazards and their impacts.

Critically, however, collective action is necessary if we are to deliver the benefits of climate resilience and adaptation across the entire city. This should also be conducted in conjunction with neighbouring local authorities, recognising that climate risks will pay little regard to administrative boundaries. In the vision of progressive resilience, this must leave us better placed to meet other risks as well. For instance, property owners not at direct risk from severe heat stress or flooding should, where possible, integrate quality greenspace and sustainable urban drainage to help lower the risk profile of the wider city. These principles extend to organisational and business practices as well, particularly across emergency, contingency and continuity planning.

Climate resilience and adaptation should be given specific attention at the outset, then integrated into already well-established risk management and business planning activities. They should be updated and reviewed as we become better attuned to the climate risk profile of the city, and as we learn more about the possible climate resilience interventions that could be taken.

In some instances, sectoral specific adaptation plans should be developed. Small and medium sized enterprises might be agile, yet it may not be well equipped to respond to climate risk and opportunities. Equally, disadvantaged communities will require specific support and guidance in navigating their futures in a world exposed to the perils of climate change.

### **4. Enable individuals, communities, service providers and businesses to integrate effective and equitable adaptation measures.**

As our understanding of climate risk and the range of potential means to address it expand, the capacity to act with speed and at scale must be bolstered. Although some adaptation

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<sup>34</sup>[https://www.manchesterclimate.com/sites/default/files/Manchester%20Climate%20Risk\\_A%20Framework%20For%20Understanding%20Hazards%20and%20Vulnerability.pdf](https://www.manchesterclimate.com/sites/default/files/Manchester%20Climate%20Risk_A%20Framework%20For%20Understanding%20Hazards%20and%20Vulnerability.pdf)

measures are relatively straightforward, the creation of a more resilient Manchester requires foresight, innovation, ambition, and co-operation.

There should be collaborative efforts to identify and share barriers and best practice, to identify how innovation can become common practice, and to build decision-making and societal capacity to realise climate adaptation. This should take place across a range of themes, and facilitate concerted action across scale:

- Technical and engineering: A consideration of the technical feasibility of adaptation within different contexts and an identification of how research and development can be deployed to create a more climate resilient Manchester.
- Political and administrative: An assessment of how the administrative, political and policy context of climate resilience facilitates and frustrates efforts to integrate climate adaptation across sectors and stakeholders.
- Financial: Innovative funding arrangements will be required to make the cost-benefit business case for interventions. This will entail a detailed consideration of how innovative investment and procurement across public and private sectors can be used to leverage financing for climate adaptation and resilience.
- Societal & cultural: Consideration should be given to how climate adaptation initiatives are framed by social and cultural factors. Effort should be tailored to ensure progressive resilience addresses socio-economic vulnerability and enhances diversity and equality.
- Regulatory and legal: Co-operation and innovation is required to ensure regulations, issues around maintenance, easements and access do not constrain the realisation of effective adaptation and resilience.

## **5. Embed and enhance green and blue infrastructure to support climate resilience and adaptation.**

Manchester's green and blue space serve a vital purpose not only in assisting with climate mitigation and adaptation, but in improving the liveability and social and health well-being of the city. We must both protect the climate functionality of these existing spaces and ensure that new spaces that embolden climate resilience are integrated at scale into the city.

Our green and blue spaces are of great social, economic, and cultural value to the city and its inhabitants, and are often held in high affection by locals and visitors alike. However, these spaces are of varying quality, and will come under increasing pressure from future development and fragmentation. Moreover, the functionality of these spaces are themselves vulnerable to climate change. We must enhance our existing green and blue spaces not only in terms of their climate services but to also unleash the full potential of their co-benefits.

New development must have high-quality green and blue space integrated at the planning stage. These should not only service the development sites themselves but should also be an asset to neighbouring communities, to the city and to the city region. Particular attention should also be given to how these spaces will be used, maintained, and financed in the future.

Analysis should take place of where green and blue infrastructure and nature-based climate solutions should be embedded across the city both in terms of future planning and where interventions could be retrofitted within the existing fabric of the city. This would ensure that

the integration of green and blue features is deployed as and when opportunities arise, while ensuring that there is also a strategy to get the right features in the right places.

This should take place at various scales, from area master-planning and large-scale development proposals, through to how building owners, residents and communities can install smaller scale – but no less vital – micro-interventions in their properties, gardens and local street scenes.

## **6. Ensure our urban environment, including buildings and urban infrastructure, is climate resilient.**

Many of the buildings and much of the infrastructure that is currently being financed, planned, and constructed across Manchester is likely to still be in use throughout this century and beyond. Similarly, we must appreciate that much of our current and future risk is inherited due to decisions taken by past generations. We must, therefore, consider the likely future impacts of climate change into the planning of the city through climate sensitive land use and development control decisions. We must also take steps to retrofit our current built environment and infrastructure to ensure they are fit for purpose in the future.

Standards and regulation for climate resilience should be enhanced to ensure we are not leaving a legacy of vulnerability to future generations. We must also retrofit existing buildings and infrastructure to ensure it is better able to withstand short- and medium-term climate impacts. Particular attention should be paid to buildings that are crucial for the functioning of the economy or society, and to heritage buildings that pose particular challenges for sensitive retrofit. Care should be taken, however, to ensure that any ‘fixes’ are neither short-term nor maladaptive. They should, as far as possible, ensure they fulfil the criteria outlined in the earlier conceptualisation of progressive resilience, particularly in terms of bringing co-benefits to society and beyond.

Work should be undertaken to assess the level of investment required to deliver more resilience in our existing buildings and infrastructure. This will be necessary to inform the business case for investment and should be linked to how interventions will address vulnerability and used to ‘future-proof’ buildings.

The creation of climate resilient infrastructure is vital. We need to ensure the infrastructure that the city and our society and economy depends on can withstand the impacts of climate change. Particular attention should be paid to intersecting and interdependent infrastructure. Additionally, we should ensure that current infrastructure for managing weather hazards (such as flood defences) is evaluated in terms of their future performance, that they are maintained and, if necessary, are renewed.

Innovation and best practice in design, construction and in cultures across the development industry should be shared. This must be achieved at scale and be distributed equitably. So, although the adaptation of vulnerable buildings and particular places will be vital to this, we must also support collective action to ensure the entire city, and everyone living and working in it, become climate resilient.

## **7. Encourage research, innovation, and reflective practice to support our progress in creating a more resilient Manchester.**

We must harness the knowledge and expertise in our universities, the technical abilities and entrepreneurial spirit of our private sector, the creativity of our arts and cultural sectors, and the energy of our people through youth groups, civil society and impassioned, engaged communities to build a more resilient, more adaptive Manchester.

We will need to work hard, and work together, to create a city that is more climate resilient in the most progressive sense of the term. We will need to exploit ideas and concepts from places that are also striving to become more climate resilient, and develop bespoke interventions that can be integrated within, and made appropriate for, our city.

This requires close co-operation with international and national collaborators and across city-wide stakeholders. It also requires infusing a spirit of learning and collaboration throughout the city. It necessitates engagement in reflective practice and mutual learning. We will be required to develop macro and neighbourhood indicators to demonstrate our progress in decreasing the vulnerability of the places and people of our city that are most exposed to climate hazards, and to enhance the overall climate resilience of the city.

## Annex 4: Headline actions on climate resilience and adaptation

Objective	MCCA actions	City & city region actions	Strategic partners actions	Business actions	Civil society group actions	Communities & individual actions
1. Enhance leadership and strategic capacity to pursue progressive resilience and adaptation agendas and action across the city.	<p>Provide <b>leadership</b> and <b>strategic direction</b> for progressive climate resilience</p> <p><b>Co-ordinate</b> Manchester Climate Change Partnership activities on climate resilience</p> <p>Persuade and <b>influence</b> city-wide actors to take progressive resilience action</p>	<p>Provide <b>political and administrative leadership</b> for climate resilience and adaptation</p> <p>Develop <b>strategic agendas</b> to realise progressive climate resilience</p> <p><b>Integrate</b> the principles of climate resilience across policies and agendas</p>	<p>Provide <b>organisational leadership</b> on climate resilience</p> <p>Establish a clear <b>vision and ambition</b> for realising greater climate resilience</p> <p>Develop <b>internal mechanisms</b> to enable action on climate resilience</p>	<p>Provide <b>organisational leadership</b> on climate resilience</p> <p>Establish a clear <b>vision and ambition</b> for realising greater climate resilience</p> <p>Develop <b>internal mechanisms</b> to enable action on climate resilience</p>	<p>Provide <b>organisational leadership</b> on climate resilience</p> <p>Establish a clear <b>vision and ambition</b> for realising climate resilience</p> <p>Develop <b>internal mechanisms</b> to enable action on climate resilience</p>	<p>Develop <b>community leadership</b> on climate resilience and adaptation</p> <p>Identify how local action could <b>catalyse greater climate resilience</b></p> <p><b>Lobby &amp; influence</b> political representatives, officers, and organisations to take climate resilience action</p>
2. Develop detailed understandings of the implications of - and vulnerabilities to - climate change.	<p>Provide <b>research &amp; guidance</b> on climate risk</p> <p><b>Facilitate networking and collaboration</b> to develop climate risk assessments</p> <p>Catalogue &amp; <b>disseminate</b> Partnership risk assessments</p>	<p>Develop a <b>comprehensive city-wide climate risk assessment</b></p> <p>Conduct <b>detailed, comprehensive climate risk assessments</b> for local authority services and internal operations</p> <p>Integrate a Resilience and Adaptation section into <b>ward climate action plans</b></p>	<p>Conduct and maintain a <b>detailed, comprehensive climate risk assessment</b></p> <p>Ensure <b>risk assessments and risk management procedures</b> take account of climate change</p> <p><b>Share climate risk information</b> with partners and stakeholders</p>	<p>Conduct and maintain a <b>detailed, comprehensive climate risk assessment</b></p> <p>Ensure <b>risk assessments and risk management procedures</b> take account of climate change</p> <p><b>Share climate risk information</b> with partners and stakeholders</p>	<p>Conduct and maintain a <b>detailed, comprehensive climate risk assessment</b></p> <p>Ensure <b>risk assessments and risk management procedures</b> take account of climate change</p> <p><b>Share climate risk information</b> with partners and stakeholders</p>	<p><b>Understand individual, household, and community vulnerabilities</b> to climate change</p> <p>Where climate risk is high, seek to undertake <b>detailed climate risk assessments</b></p> <p><b>Liaise with political representatives, statutory agencies, and service providers</b> to assess climate risk and opportunity</p>
3. Embed progressive climate resilience ambition and action across the city, including in governance, policy and practice.	<p>Develop a <b>strategic vision and action plan</b> to underpin climate resilience across the city</p> <p><b>Co-ordinate strategic approaches</b> to climate adaptation across MCCA and beyond</p> <p>Catalogue and <b>disseminate</b> collective efforts to realise greater climate resilience</p>	<p>Develop a <b>strategy</b> to integrate climate resilience across all policy areas (risk and opportunities)</p> <p>Develop an <b>implementation plan</b> to take action to address primary climate risks and vulnerabilities</p> <p><b>Identify, promote and co-ordinate action</b> that can be taken to increase city-wide resilience</p>	<p>Develop a <b>strategic vision</b> for climate resilience across the organisation</p> <p>Develop an <b>implementation plan</b> to respond to primary climate risks and opportunities</p> <p>Identify <b>actions</b> that can be taken to increase the <b>resilience of the wider city</b></p>	<p>Develop a <b>strategic vision</b> for climate resilience across the organisation</p> <p>Develop an <b>implementation plan</b> to respond to primary climate risks and opportunities</p> <p>Identify <b>action</b> that can be taken to increase the <b>resilience of the wider city</b></p>	<p>Develop a <b>strategic vision</b> for climate resilience across the organisation</p> <p>Develop an <b>implementation plan</b> to respond to primary climate risks and opportunities</p> <p>Identify <b>action</b> that can be taken to increase the <b>resilience of the wider city</b></p>	<p><b>Become aware</b> of possible responses to climate risk and opportunities (adaptation and resilience)</p> <p><b>Plan to take action</b> to address individual, household and community climate vulnerability</p> <p>Consider <b>taking local action to lower the overall risk profile of the city</b></p>

	<b>Facilitate</b> information, support, and networking to enhance stakeholder engagement in city wide resilience	(including in committee scrutiny)				
<b>4. Enable individuals, communities, service providers and businesses to integrate effective and equitable adaptation measures.</b>	<p>Promote the <b>principles and potential</b> of adaptation and resilience</p> <p><b>Support and facilitate</b> city-wide partners in realising greater climate resilience</p> <p><b>Identify and disseminate</b> opportunities and barriers for integrating climate resilience across the city</p> <p><b>Work across</b> research and innovation, business, local government, community and civil society sectors to identify synergies and opportunities to progress the climate resilience agenda</p>	<p><b>Co-ordinate climate resilience and adaptation action</b> through service delivery plans and policy development</p> <p><b>Enhance capacity and knowledge</b> to enable and support climate resilience and adaptation</p> <p>Support <b>resourcing actions</b> on climate resilience (e.g. financing resilience)</p>	<p><b>Implement plans</b> for climate resilience plan across the organisation</p> <p><b>Support and enable action</b> by staff, service users, and wider networks</p> <p><b>Network and collaborate</b> with stakeholders and partners to take a lead on climate resilience</p>	<p><b>Implement plans</b> for climate resilience plan across the organisation</p> <p><b>Support and enable action</b> by staff, service users, and wider networks</p> <p><b>Network and collaborate</b> with stakeholders and partners to take a lead on climate resilience</p>	<p><b>Implement plans</b> for climate resilience plan across the organisation</p> <p><b>Support and enable action</b> by staff, service users, and wider networks</p> <p><b>Network and collaborate</b> with stakeholders and partners to take a lead on climate resilience</p>	<p><b>Take action</b> to adapt individuals, properties and communities to climate change</p> <p><b>Support</b> friends, family members, neighbours in taking climate resilience action</p> <p><b>Network and collaborate</b> with others engaged in local climate resilience</p>
<b>5. Embed and enhance green and blue infrastructure to support climate resilience and adaptation.</b>	<p><b>Advocate</b> for more green and blue infrastructure across the city</p> <p><b>Support schemes</b> to integrate new and enhance existing green and blue infrastructure across the city</p> <p><b>Identify and promote</b> the co-benefits (multiple resilience dividends) of green and blue infrastructure</p> <p><b>Catalogue and disseminate</b> good practice in</p>	<p><b>Identify</b> how local authority assets can embrace high quality green and blue infrastructure</p> <p><b>Develop policy, standards and regulations</b> that support the integration of green and blue infrastructure across the city</p> <p><b>Support and facilitate schemes</b> to integrate new and enhance existing green and blue infrastructure across the city</p>	<p>Develop a <b>strategy</b> for green and blue infrastructure across holdings and estate</p> <p><b>Plan and implement</b> specific green and blue infrastructure projects</p> <p><b>Work with stakeholders and partners</b> to enhance cross-sectoral adoption of green and blue infrastructure</p>	<p>Develop a <b>strategy</b> to integrate and enhance green and blue infrastructure across holdings and estate</p> <p><b>Plan and implement</b> specific green and blue infrastructure projects</p> <p><b>Collaborate with stakeholders and partners</b> to enhance cross-sectoral adoption of green and blue infrastructure</p>	<p>Develop a <b>strategy</b> to integrate and enhance green and blue infrastructure across holdings and estate</p> <p><b>Plan and implement</b> specific green and blue infrastructure projects</p> <p><b>Collaborate with stakeholders and partners</b> to enhance cross-sectoral adoption of green and blue infrastructure</p>	<p><b>Identify how properties</b> (gardens, roofs, drainage systems) can be adapted to integrate small scale blue and green features and spaces</p> <p><b>Support and volunteer</b> with charities and others to enhance local green and blue space</p>

	the integration of green and blue infrastructure	<b>Co-ordinate and facilitate</b> multi-stakeholder efforts to enhance green and blue infrastructure				
<b>Ensure our urban environment, including buildings and urban infrastructure, is climate resilient.</b>	<p><b>Advocate</b> for greater consideration of climate resilience in our built environment</p> <p><b>Catalogue buildings and infrastructure</b> that might be particularly vulnerable to climate change</p> <p><b>Identify and lobby</b> for further resources and opportunities to enhance resilience in the built environment</p> <p><b>Facilitate networking and collaboration</b> across key stakeholders (particularly for cascading risks and interdependent infrastructure)</p>	<p>Take action to ensure local authority buildings and infrastructure that are vulnerable are <b>adapted to climate change</b></p> <p>Ensure <b>broader climate resilience measures are integrated</b> into buildings and infrastructure in direct control of the local authority</p> <p>Develop <b>clear, ambitious policy</b> for adapting new buildings and infrastructure to climate change</p> <p>Enhance <b>standards and regulation</b> for climate resilience across the city</p> <p>Support policies and initiatives for <b>retrofitting</b> climate resilience into <b>existing buildings and infrastructure</b></p>	<p>Identify facilities and infrastructure that are vulnerable to climate change to be <b>prioritised for adaptation</b></p> <p>Identify <b>interdependent elements of infrastructure</b> that could introduce <b>cascading risks</b> due to climate change impacts</p> <p>Develop a <b>clear, ambitious strategy and business plans</b> for adapting new and existing buildings and infrastructure to climate change</p> <p>Identify opportunities to <b>integrate broader climate resilience</b> in buildings and infrastructure (both new build and retrofit)</p>	<p>Identify facilities that are vulnerable to climate change to be <b>prioritised for adaptation</b></p> <p>Develop a <b>clear, ambitious strategy and business plans</b> for adapting new and existing buildings and infrastructure to climate change</p> <p>Identify opportunities to <b>integrate broader climate resilience</b> in buildings and infrastructure (both new build and retrofit)</p>	<p>Identify facilities that are vulnerable to climate change to be <b>prioritised for adaptation</b></p> <p>Develop a <b>clear, ambitious strategy and business plans</b> for adapting new and existing buildings and infrastructure to climate change</p> <p>Identify opportunities to <b>integrate broader climate resilience</b> in buildings and infrastructure (both new build and retrofit)</p>	<p>Identify <b>which local buildings and infrastructure</b> could be made more resilient to climate change</p> <p><b>Communicate concerns with the safety and functionality</b> of buildings and infrastructure with those responsible for its maintenance</p> <p>Identify <b>building and infrastructure adaptations applicable</b> in local neighbourhoods</p> <p><b>Consider adapting properties to future climate change</b> when undertaking building projects or refurbishments</p>
<b>7. Encourage research, innovation, and reflective practice to support our progress in creating a more resilient Manchester.</b>	<p><b>Identify, showcase and demonstrate</b> new and innovative approaches to climate resilience</p> <p><b>Identify, support and co-ordinate</b> responses to funding schemes and opportunities for research and practical action on climate resilience</p>	<p><b>Participate</b> in regional, national and global <b>networks and initiatives</b> to enhance climate adaptation and resilience</p> <p><b>Support</b> funding bids and opportunities for research and practical action on climate resilience</p>	<p><b>Support</b> efforts to develop climate resilience research and demonstration projects</p> <p><b>Collaborate</b> with partners and stakeholders to share best practice and to overcome barriers</p> <p><b>Work with MCCA and other partners</b> to identify</p>	<p><b>Support</b> efforts to develop climate resilience research and demonstration projects</p> <p><b>Collaborate</b> with partners and stakeholders to share best practice and to overcome barriers</p> <p><b>Work with MCCA and other partners</b> to identify lessons and learning for climate resilience and adaptation</p>	<p><b>Support</b> efforts to develop climate resilience research and demonstration projects</p> <p><b>Collaborate</b> with partners and stakeholders to share best practice and to overcome barriers</p> <p><b>Work with MCCA and other partners</b> to identify</p>	<p><b>Participate</b> in 'citizen science' initiatives to monitor and enhance climate resilience and adaptation</p>

	<p><b>Convene</b> and <b>co-ordinate</b> an Adaptation and Resilience Advisory Group formed of city-wide experts</p>		<p>lessons for climate resilience and adaptation</p>		<p>lessons and learning for climate resilience and adaptation</p>	
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