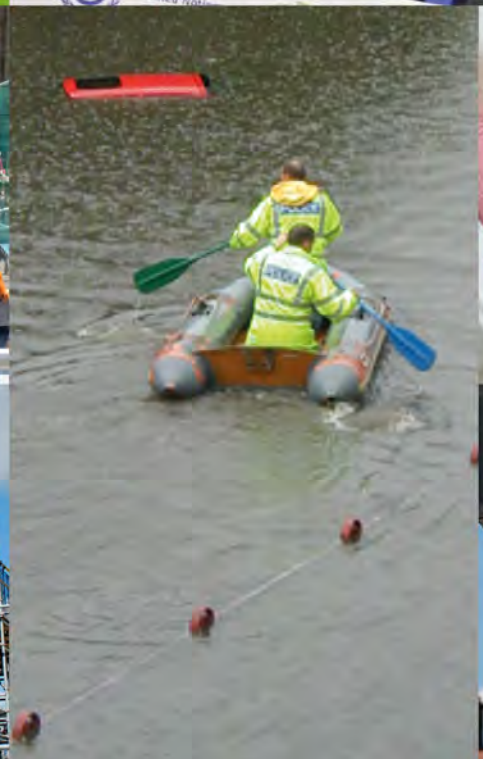
GLASGOW'S CLIMATE ADAPTATION PLAN 2022-2030



Glasgow
CITY COUNCIL

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Foreword

Climate change is already upon us.

In Glasgow and the West of Scotland our weather and climate patterns are already changing, and it is predicted that our climate will continue to change considerably over the coming decades.

We are facing this significant challenge amidst a global pandemic which is magnifying many of the challenges affecting our communities and environment (natural and built).

The **Paris Agreement**, adopted by world nations in 2015, aims to strengthen the global response to the threat of climate change by keeping a global temperature rise well below 2 degrees Celsius (above pre-industrial levels). The Paris agreement also aims to strengthen the ability of countries to deal with the impacts of climate change; through appropriate financial models, a new technology framework and an enhanced capacity building framework.

The **Glasgow Pact**, was agreed by all 197 parties at the 26th UN Conference of Parties (COP 26) held in Glasgow in November 2021. This committed to accelerating action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change; emphasising the role of multilateralism in addressing these impacts.

Glasgow City Council (GCC) and our city partners are strongly committed to climate mitigation action. By setting out our ambition to reduce the city's carbon footprint, we are therefore addressing the causes of climate change, and avoiding further irreversible and catastrophic effects. Our climate mitigation ambition is boldly outlined in the **Glasgow Climate Plan published** in 2020.

The City also acknowledges the urgent need to take action to **ADAPT** to Climate

Closing of COP26 on 13 December 2021
Credit: UNFCCC

Foreword continued

Change, preparing for the inevitable local impacts of our global changing climate, now and in the future. This was reiterated by the commitment under the Climate Plan, action 19, to develop a Climate Adaptation Plan for the city and embedded in city planning policy.

The focus of this plan is therefore **Climate Adaptation.**

Climate Adaptation is defined by the Intergovernmental Panel on Climate Change (IPCC) as: **"Adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities"**.

Glasgow has already established through **"Our Resilient Glasgow"** strategy that climate change involves visible, immediate impacts for our environment (natural and built) and local communities. These are often witnessed as extreme weather events (shocks) but also less visible, indirect, and longer-term impacts (stresses), such as changes in wider food and energy costs.

Climate change can also aggravate other effects such biodiversity loss, soil erosion, landslides, desertification, and flooding. Extreme precipitation events, fast melting of snow or ice, high river flows and increased droughts all influence soil degradation.

Whilst climate change presents risks and added pressures. This also has the potential to exacerbate already existing inequalities, impacting disproportionately on the poorest, very young and elderly in our city.

It is clear that climate and weather events (shocks) do not, in themselves, discriminate, but the long term less visible impacts (stresses) have the potential to disproportionately impact those already most vulnerable in our communities.

Working to enhance citywide climate resilience, therefore, requires action to take account of those less visible impacts on nature, people, our built environment, and infrastructure that emerge over longer timeframes and which impair our capacity to respond to short term shocks.

The City will, therefore, strive to place climate justice at the centre of our adaptation work. We will ensure that our local response to climate change builds the resilience of our communities and businesses to respond to both the short and long-term impacts of a changing climate.

Early climate adaptation action offers many opportunities. The potential to deliver a "triple dividend" by avoiding future biodiversity losses, generating positive economic gains through innovation, and delivering additional social and environmental benefits thus addressing local inequalities.

Timeous and appropriate action can not only reduce our risk, but also enable us to fully realise opportunities for the city, particularly for our natural environment, our people, and communities, not compromising the ability of future generations to further adapt.

Councillor Angus Millar
Convenor for Climate, Green Deal, Transport and City Centre Recovery

1. Background

Climate change represents a critical threat to the planet. The world has already warmed by around 1.2°C above pre-industrial levels due to human activities and is experiencing the related impacts. Every tenth of a degree matters.

At the 2015 United Nations Climate Change Conference (COP21) held in Paris, all governments promised to come to COP26 with more ambitious 2030 commitments to close the emissions gap that was already evident.

In 2018, the IPCC Special Report on 1.5°C reinforced the scientific imperative, and again in 2021, called a climate **"code red."**

The Glasgow Pact, recently agreed at COP26, although a step in the right direction, revealed that there are still significant action and commitment gaps to achieving net zero goals. Even with the new commitment secured through the Glasgow Pact, it is clear that it will be challenging to achieve our global 2030 emissions target. In fact, it is predicted that global emissions will double in 2030 compared to the reductions required to achieve 1.5°C, as evidenced by the Climate Action Tracker.

The IPCC makes it clear that to stay within the globally agreed target of 1.5°C rise in temperature, world nations will require significant and rapid social and technological transformation over a very short timescale. With cities and urban areas at the forefront of this transformative action for both climate mitigation and adaptation.

The latest IPCC report assessing the global impacts of Climate Change, highlights the increasing impacts that are expected as the rise in global temperatures approach 1.5°C. The IPCC report warns that many of the impacts of global warming are now simply **"irreversible"**, with over 40% of the world's population being **"highly vulnerable"** to climate.

In short, Climate Change is already happening and there is unequivocal evidence that this is caused by human activity.

1.1 Climate Mitigation and Climate Adaptation

There are two ways of responding to the climate crisis:

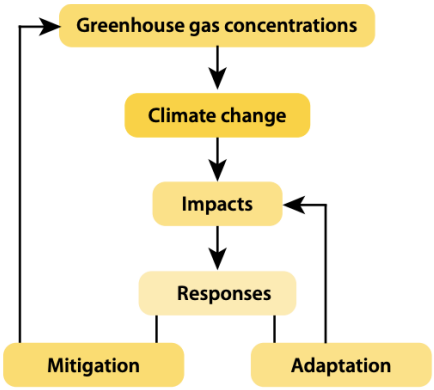


Figure 1. Synergies between Mitigation and Adaptation

Mitigation: This term refers to the action taken to address the causes of climate change, such as reducing greenhouse gas emissions including carbon emissions into the atmosphere.

Glasgow is already committed to addressing carbon emission reduction targets through the Glasgow Climate Plan. In addition, this is being further considered at sectoral level through developing strategies such as the forthcoming Local Heat and Energy Efficiency Strategy (LHEES)

1.1 Climate Mitigation and Climate Adaptation continued

to reduce the city's energy use and carbon emissions across the Built Environment.

The recent publication of Glasgow's Climate Plan is a key step to address the Climate and Ecological Emergency by accelerating climate mitigation action. The Climate Plan sets a new and ambitious target for the city to **"achieve net zero carbon emissions by 2030"**.

Adaptation: This is about building local resilience to the unavoidable consequences of a changing climate. Adaptation action includes identifying climate change impacts, minimising potential negative effects, and responding appropriately.

Adapting to climate change has two aspects:

- **Adapting to present climate and weather.**
- **Making changes based on future projected changes in the climate.**

Adaptation takes account of both risks and opportunities arising from climate change, and the need to plan for them now. Adaptation is an ongoing process. There will be considerable local variations and there is no final 'adapted state'.

This Plan aims to address **Climate Adaptation** action in the city, building our understanding of climate risks and increasing our adaptive capacity, helping to make the city more resilient to current and future climate events such as flooding, and overheating.

Glasgow, together with our strategic partners, is committed to be at the forefront of just and transformative action on climate adaptation. This plan builds on a wealth of work by the city council and partners, these include: Sustainable Glasgow, the Metropolitan Glasgow Strategic Drainage Partnership (MGSDP), and Climate Ready Clyde.

This Plan will sit alongside the Climate Plan to help build capacity of Climate Adaptation and raise the profile of adaptation action in the city.

Climate Adaptation action was highlighted by a recent report produced by the Committee on Climate Change[1] as being the Cinderella of Climate Change, often overlooked, not appropriately funded, or understood.

It is expected that, if the actions proposed under this plan are successful, both responses: Mitigation and Adaptation, will be integrated in the next iteration of the Climate Plan.

1. UK Climate Change Risk Assessment (2021)

2. Introduction

Glasgow is the biggest city in Scotland and the economic engine not only for the region but the whole of Scotland. With almost half of the population of the country living within an hour of the city, the resilience of our institutions, economy, people, and infrastructure is not only of local importance, but will play a crucial role regionally and nationally[2].

It is vital that Glasgow builds its climate resilience by adapting early and effectively to the impacts of climate change on our city, whilst also continuing to address the causes of climate change, by continuing to reduce our greenhouse gas emissions. This Climate Adaptation Plan develops and outlines our approach to adaptation that will sit firmly alongside the ambitious action in the Glasgow Climate Plan.

The Council is mindful of the fact that we are amidst a climate emergency. Our climate has already been significantly impacted and we will continue to face these impacts as we bear out the full consequences of those global carbon emissions that are already locked into the atmosphere.

As figure 2 illustrates, global policy implementation is advancing slowly.

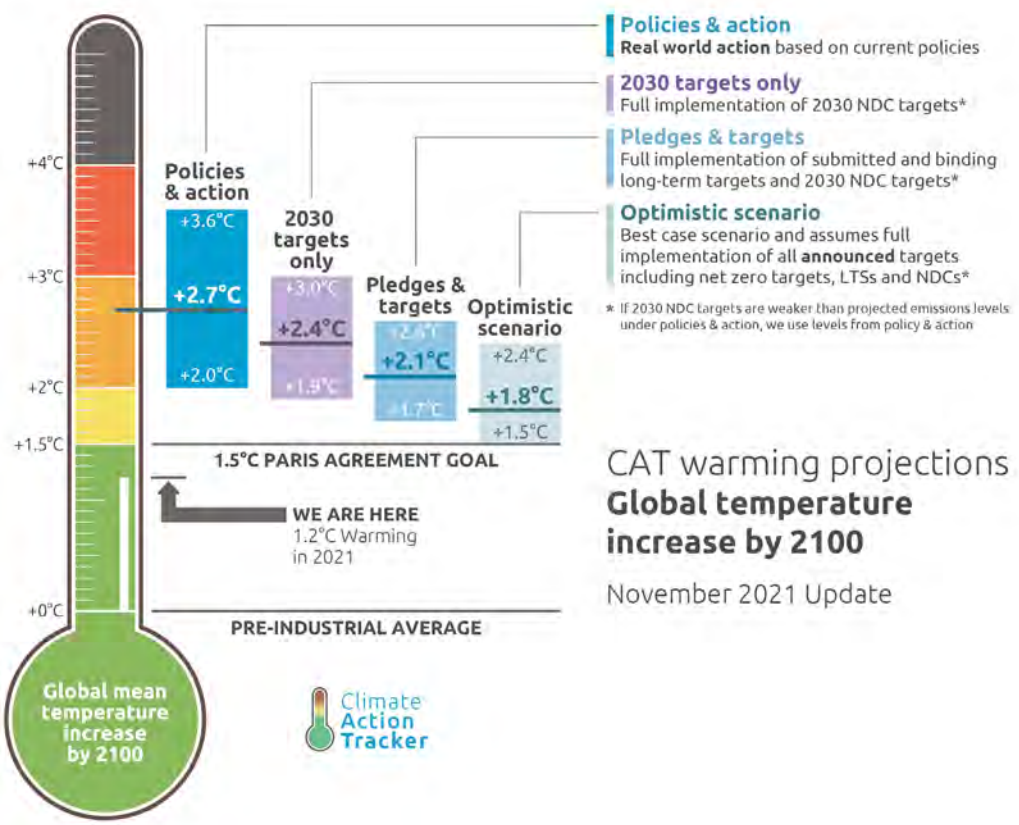


Figure 2. Climate Action Tracker global warming projections by 2100

Under current policies, the **Climate Action Tracker** estimates that by the end of this century warming will be as high as 2.7°C. Whilst this temperature estimate has fallen since their 2020 assessment, there is a need for significant effort across all sectors, in this decade, to decarbonise the world in line with the 1.5°C target.

Furthermore, the **Climate Action Tracker** highlights that the current 2030 targets (without long-term pledges) still puts the world on track for a 2.4°C temperature increase by the end of the century.

2. Our Resilient Glasgow, Glasgow City Council Strategy (2016)

2. Introduction continued

The latest **IPCC Report** states that human actions in heating the climate are causing dangerous and widespread disruption, threatening devastation to the natural world and rendering many areas uninhabitable. It also states that there is a small window of opportunity to act and prevent further irreversible damage. We must take this opportunity to act now.

This plan will specifically focus on the local impacts of global temperature increases, what they mean for the city, and how we plan to address them by adapting ahead of time, ensuring a resilient and climate ready city.

This plan covers the period up to 2030. The associated action plan will be reviewed annually and will be subject to monitoring and evaluation via the council's committee reporting mechanisms.

The development of this plan, has incorporated significant findings from the following sources:

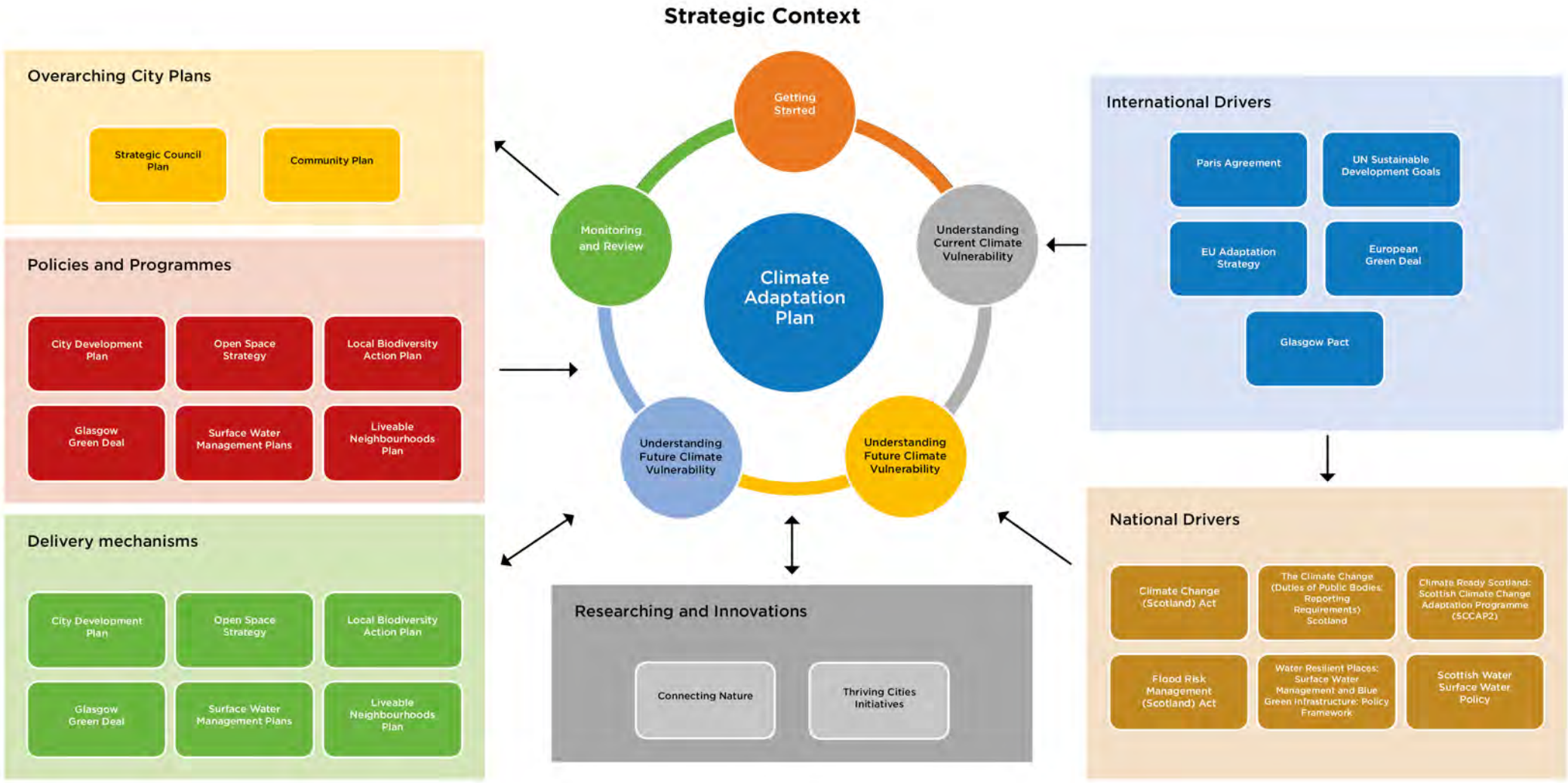
- **Glasgow's Local Climate Impact Profile 2007-2017. Highlighting previous weather incidents that have impacted the city, the council's response and preparedness, and vulnerability to current and projected climate impacts.**
- **Key Climate Risks for Glasgow City Council 2019. High-level risk assessment conducted to assess the council's risk based on the projected climate impacts.**
- **Thematic stakeholder engagement workshops with Glasgow Stakeholders. These workshops considered the granular detail around thematic areas of Society, Natural Environment and Built Environment and Infrastructure. A series of iterative workshops have been held between 2014 and 2021.**
- **National Flood Risk Assessment (2018).**
- **Climate Ready Clyde's Climate Change Risk and Opportunity Assessment for the City Region (2019) detailed further on Page 30 and Appendix B.**
- **Dynamic Coast, SEPA's Underlying susceptibility to coastal erosion as well as flood risk.**
- **Third UK Climate Change Risk Assessment (2021).**
- **Adaptation Capability Framework and Benchmarking Tool - Engagement and outputs detailed further in Appendix D.**
- **Recommendations of the Climate and Ecological Emergency working groups (in 2019 and 2020 respectively), including associated community consultation in 2019 and 2021.**

3. Strategic Context

This Adaptation Plan has been developed with respect to various International, National and Local drivers including policy and legislation. This is a fast paced and evolving area, and the plan will be revisited annually to ensure that its context and strategic direction are still correct.

Some of these key drivers are detailed in the figure below. Each of these drivers are described in more detail in Appendix E.

Figure 3. Strategic Context for Climate Adaptation in Glasgow



3. Strategic Context continued

CASE STUDY 1: EU H2020 CONNECTING NATURE

Connecting Nature is an EU Horizon 2020-funded, five-year project, delivered by a consortium of over 30 partners across 16 European countries, as well as Brazil, China, South Korea, Georgia and Armenia.

Glasgow City Council joins a range of organisations, from local authorities and universities to communities and NGOs, in coming together to development nature-based projects in the urban environment. As a front runner city, Glasgow is leading the way in delivering nature-based solutions to the issues that cities are facing, leading the way for the project's **'fast follower cities'** to emulate these methods.

Connecting Nature is helping Glasgow City Council to understand how we should best use open spaces to deliver the aims of the Open Space Strategy and to deliver projects such as Stalled Spaces and Building with Nature, all of which will contribute to making Glasgow a healthier, greener and climate resilient city.

4. Our Climate Story

To build the city's adaptive capacity, it is essential to understand how the local climate has already changed over the last few decades and how it is projected to change in the future. This informs our understanding of current and projected future impacts and what we need to do now to adapt and prepare.

4.1 The Past: Our Climate Trends

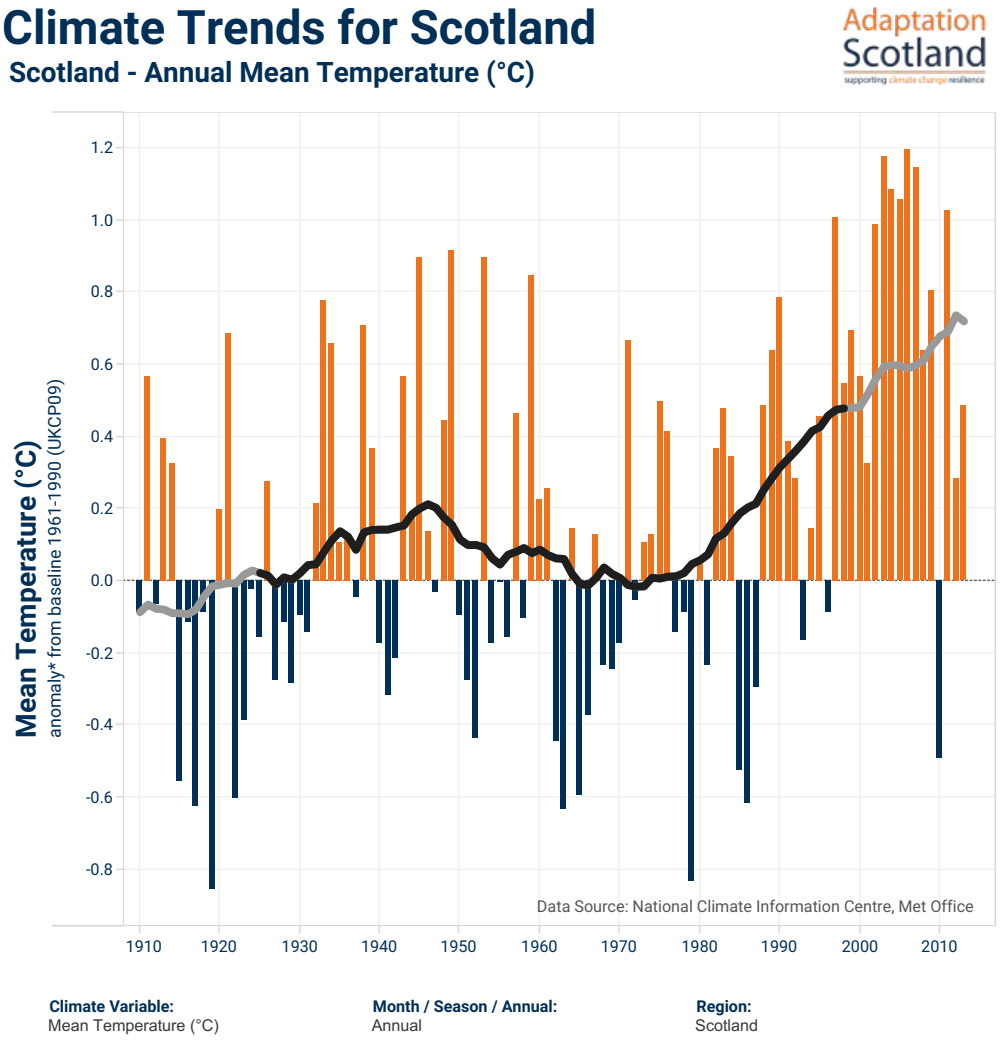
The Met Office **"State of the UK Climate"**[3] reports provide an important context for climate change, allowing us to establish a baseline to compare future changes, validate climate models, and begin to examine impacts already occurring globally and locally.

According to the Met Office, the last century has been a period of rapid climate change across Scotland, including Glasgow and the West of Scotland.

Evidence presented in the latest UK Climate Projections 2018 (UKCP18) shows that over the last few decades: temperatures have increased. The last decade was the warmest on record. Rainfall patterns have changed with increased rainfall and more heavy downpours. Sea-level rise is accelerating. There have also been fewer days with frost and snow cover.

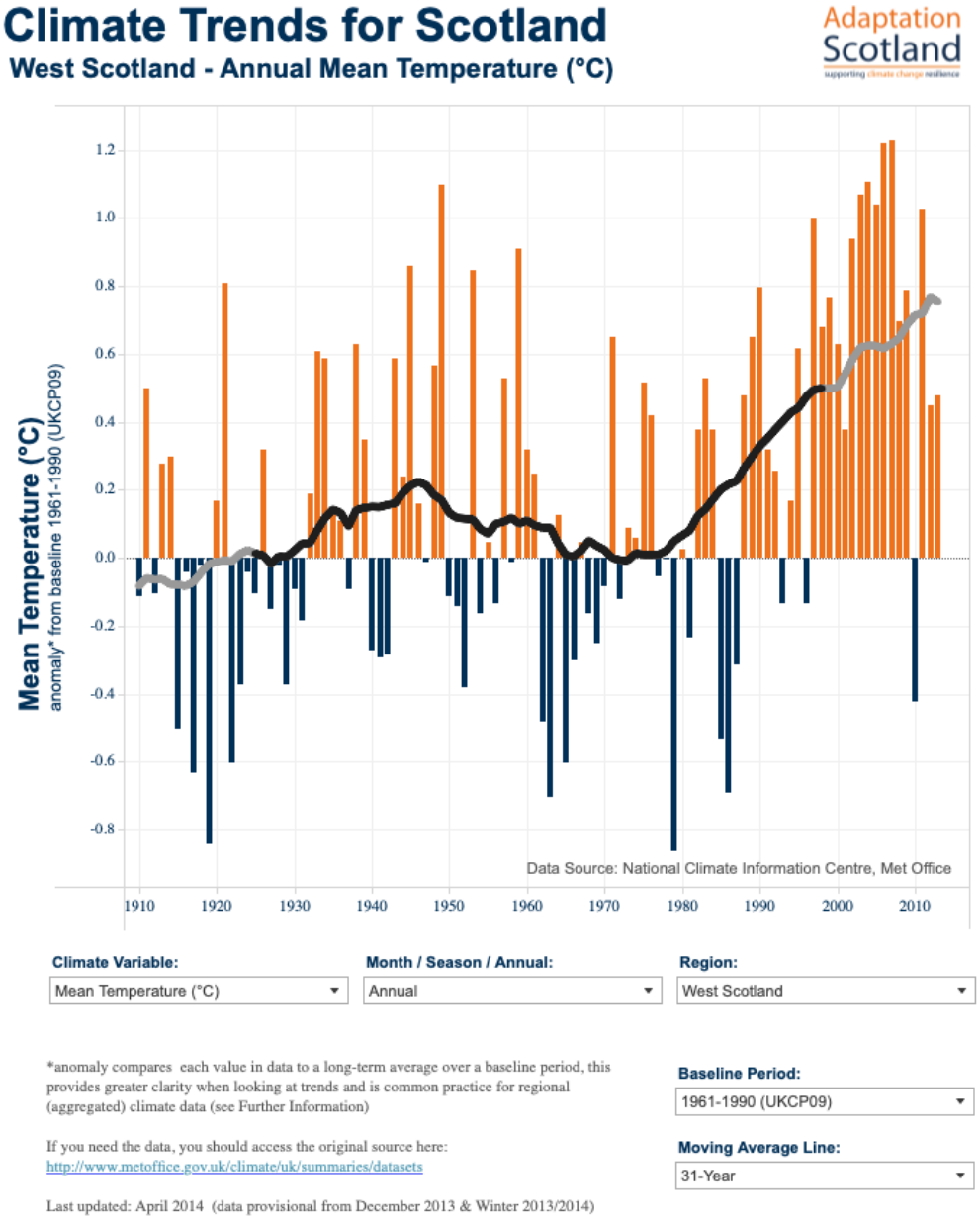
In summary, over the last century, it has become warmer and wetter, with an increase in annual mean temperature, both total rainfall (especially in winter) and the occurrence of heavy rainfall events, as seen in figures 4 and 5.

Figure 4. Trends in Mean Annual Temperature for West of Scotland (1910 – 2010) Source: Adaptation Scotland



3. The State of the UK Climate report is an annual publication which provides an accessible, authoritative, and up-to-date assessment of UK climate trends, variations and extremes based on the latest available climate quality observational datasets. The latest report for 2019 is available here.

4. Our Climate Story continued



4.2 The Future: Climate projections for Glasgow

Projecting Glasgow's future climate (UKCP18)

The UK Climate Projections (UKCP18) provided by the Met Office, is the leading source of climate change information for the UK. This includes modelling of climate impacts in relation to three different greenhouse gas emission scenarios: low, medium, and high[4].

The Met Office uses computer models to simulate climate decades into the future. These models suggest that increasing greenhouse gas concentrations in the atmosphere leads to an increase in global temperature, the basis for climate change.

As we know, the climate is complex and small changes in global temperature can cause large changes to the weather patterns that are experienced locally.

To model and predict future climate it is necessary to make assumptions about the economic, social, and physical changes to our environment that will influence climate change. Representative Concentration Pathways (RCPs) are a method for capturing those assumptions within a set of scenarios. The conditions of each scenario are used in the process of modelling possible future climate evolution.

The scenarios illustrated in the following figures are RCP 6 and RCP 8.5. The four RCPs range from very high (RCP 8.5) through to very low (RCP 2.6) future emissions concentration scenarios. The numerical values of the RCPs (2.6, 4.5, 6.0 and 8.5) refer to the concentrations in the year 2100.

Figure 5. Trends in Mean Annual Rainfall for West of Scotland (1910 - 2010) Source: Adaptation Scotland

4. Adaptation Scotland, 2020

4. Our Climate Story continued

The “RCP 6.0’ scenario uses a high greenhouse gas emission rate. This is a stabilisation scenario where total radiative forcing is stabilised after 2100 by employment of a range of technologies and strategies for reducing greenhouse gas emissions.

The ‘RCP 8.5’ scenario is high-emissions scenario and frequently referred to as **“business as usual”**, suggesting the likely outcome if society does not make a concerted effort to cut greenhouse gas (carbon) emissions.

The predicted general climate trends in UKCP18 for Glasgow indicate that for all emission scenarios, we can expect future changes in climate to be far greater than anything we have seen in the past.

Long-term projected climate change trends for Scotland and Glasgow include:

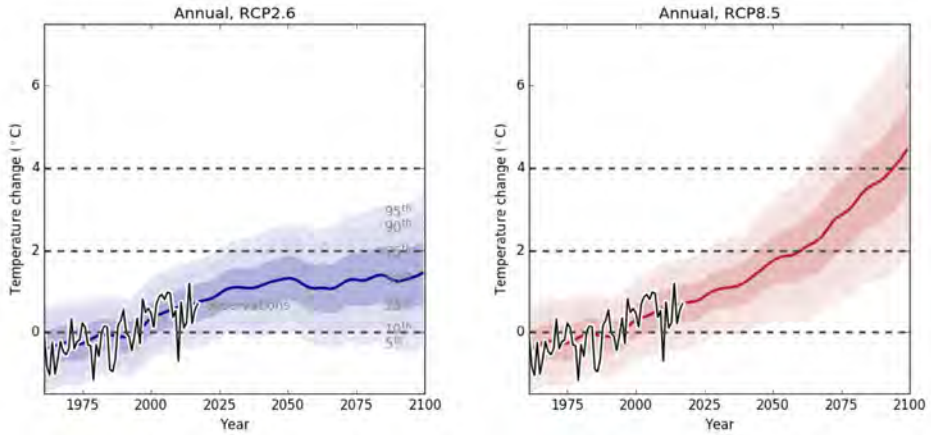
- **Average temperatures will increase across all seasons**
- **Typical summers will be warmer and drier**
- **Typical winters will be milder and wetter**
- **Intense, heavy rainfall events will increase in both winter and summer**
- **Sea levels will continue to rise**
- **Reduced frost and snowfall**
- **Weather will remain variable, and may become more variable**

We can also expect to see the following events:

- **Increase in summer heat waves, extreme temperatures, and drought**
- **Increased frequency and intensity of extreme precipitation events**
- **Increase in growing season**
- **Reduced occurrence of frost and snowfall**

4.3 Seasonal Trends for Scotland

It is important to consider the extent of seasonal variation of these trends upon our local climate:



WINTER Temperature

Winter temperatures in Scotland and Glasgow is projected to increase. These changes do not mean that "cold snaps" and/or severe snowstorms cannot or will not occur in the future. The 'Beast from the East', for example, caused considerable disruption in early 2018, and similar cold/snow events remain a possibility despite the overall warming trend.

Figure 6. Annual Temperature difference from 1981-2000 average (UKCP18) Source: Climate Ready Clyde

WINTER Rainfall

Winters in Scotland and Glasgow is projected to become wetter, in terms of both the total amount of rainfall and the number of wet days. The increase is expected to be greater in Western Scotland compared to the East.

The intensity of rainfall on the wettest days is also expected to increase.

Precipitation difference from 1981-2000 average, Glasgow grid cell

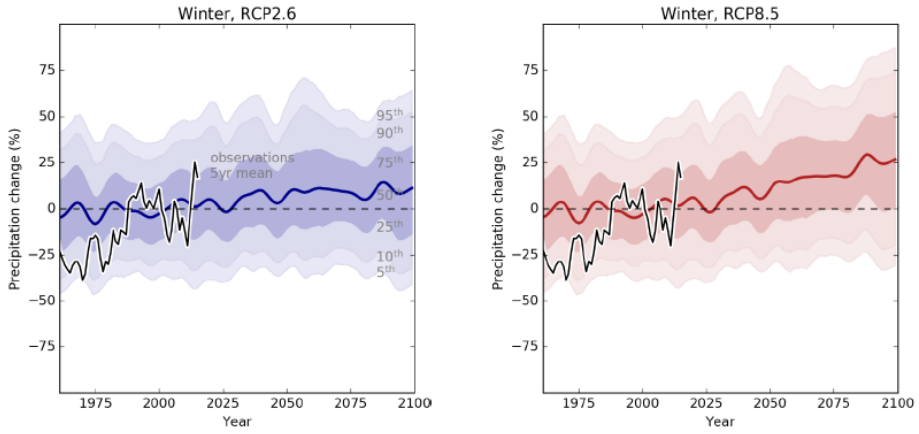


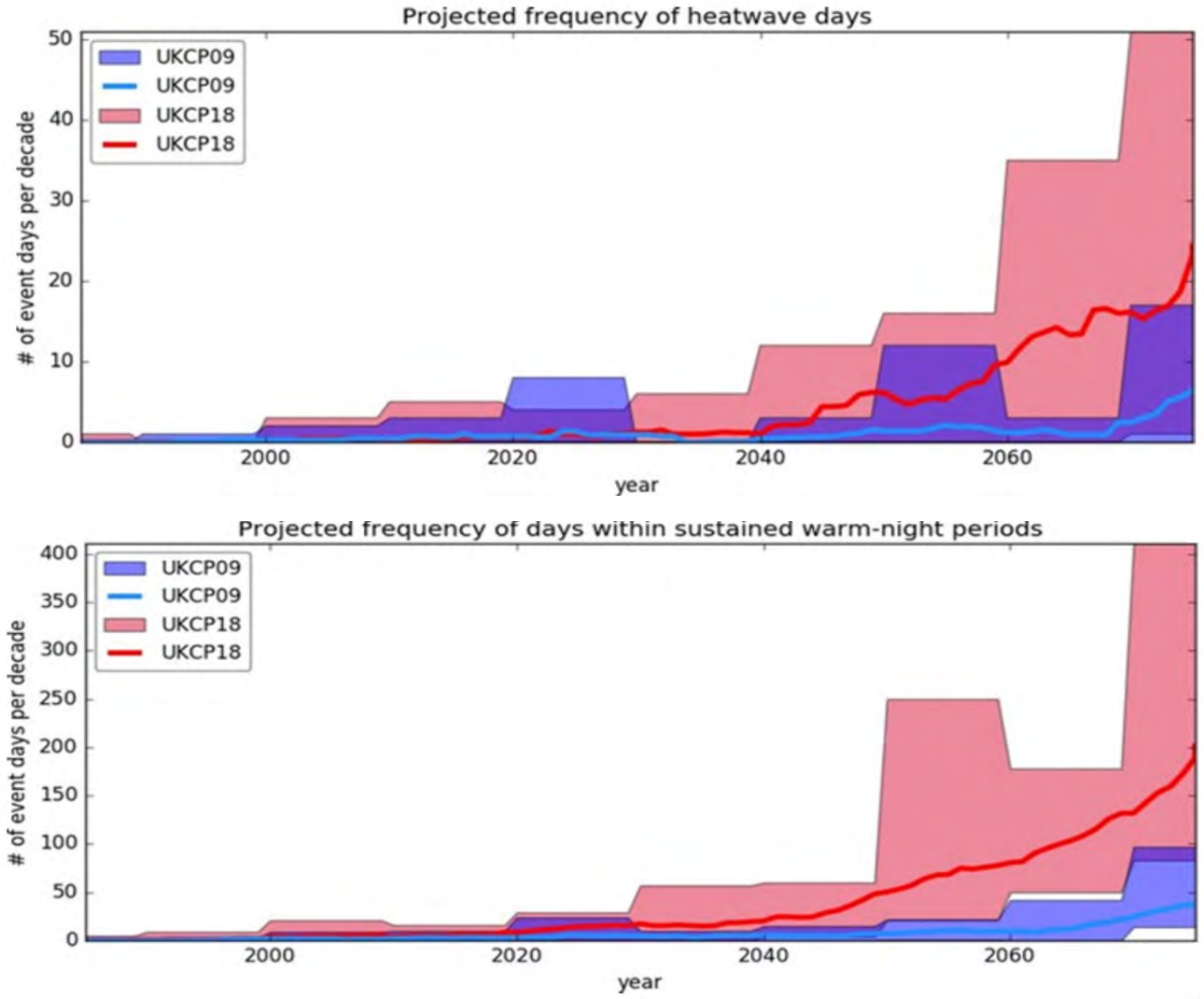
Figure 7. Precipitation difference from 1981-2000 average (UKCP18) Source: Climate Ready Clyde

4. Our Climate Story continued

SUMMER Temperature

Temperatures in Scotland and Glasgow are projected to increase in both summer and winter, but warming is expected to be greatest in summer. Climate change has already increased the chance of seeing a summer as hot as the summer of 2018 to a likelihood of between 12% and 25%. With future warming, hot summers (by mid-century) could become even more common, near to 50% likelihood, as highlighted in figure 8.

Figure 8. Projected Frequency of Heatwave days and days with sustained warm night periods for Glasgow City Region (Source: Climate Ready Clyde)



4. Our Climate Story continued

SUMMER Rainfall

Summer rainfall in Scotland and Glasgow is projected to decrease, although extreme downpours will be heavier despite the overall drying trend.

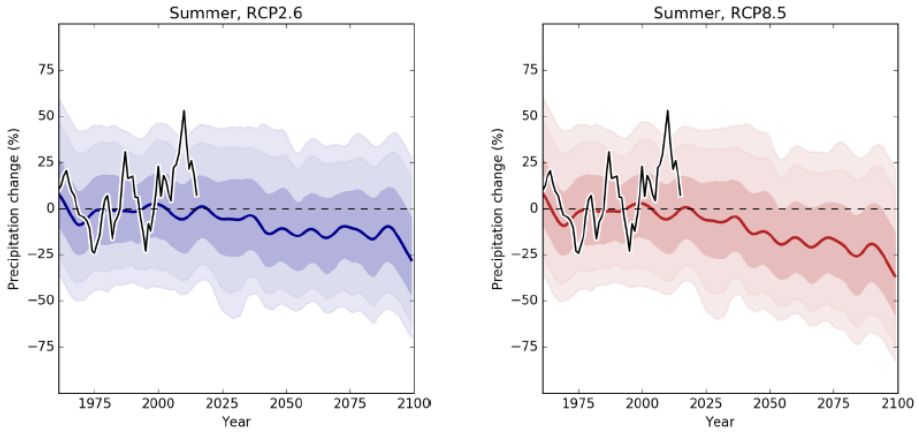


Figure 9. Precipitation difference from 1981 -2000 average. UKCP18. Source: Climate Ready Clyde

Changes in Sea level

Sea levels are predicted to continue to rise as global temperatures increase. The increase in global temperature warms the sea which leads to its expansion and the warmer atmosphere melts glaciers. These two factors combined increase the overall volume of water in the sea and lead to rising sea levels.

SEPA guidance on climate change allowances recommends an allowance of 0.85 metres be applied for the Clyde River Basin Region to 2100, with a further 0.15 metres allowance per decade beyond 2100[5]. See tables shown at the end of section 5.2.

Glasgow has suffered several severe river floods; however coastal flooding has not posed a significant threat to date. In future, coastal flooding could become a problem in Glasgow because of the rising sea levels combined with storm surges and rougher sea conditions.

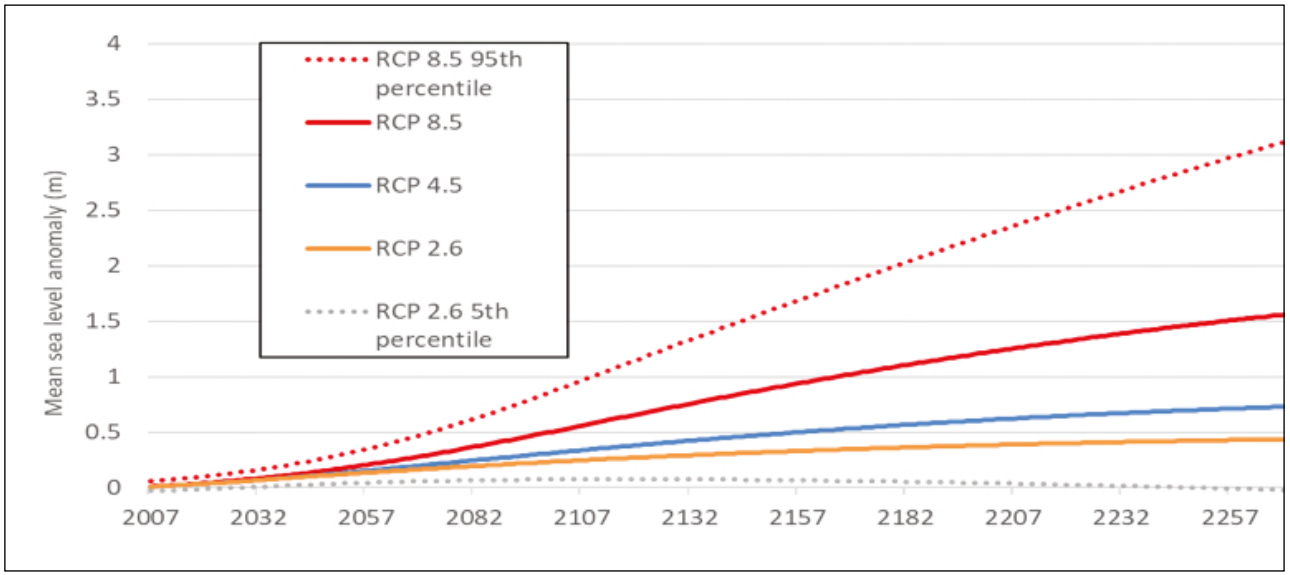


Figure 10. Sea Level Rise Pathway scenarios for Glasgow City Region (Source: Climate Ready Clyde]

The extent to which the climate changes will depend on different emissions scenarios (i.e. the level of greenhouse gas (carbon) emissions released globally). It is predicted that lowering greenhouse gas (carbon) emissions will lead to less effects and changes in the climate. Correspondingly, higher greenhouse gas (carbon) emissions will lead to increased effects and a more volatile climate with periods of intense rain and heat.

This adaptation plan has been based on UKCP18 projections, working on assumption of the **"High Emission Scenario"**, based on the precautionary principle and current global emissions In short, this plan has been based upon projections that Glasgow's climate is set to continue to get warmer and wetter, increasing the risk of storms, flooding, sea level rise and urban heat island effect.

The following sections offer additional detail on the risk of flooding and increased temperatures, as two of the key challenges for Glasgow.

5. Source - link

5. Spotlight on Flooding and Heat

It is important to fully understand projected climate impacts for Glasgow in order to take appropriate and timeous action.

As highlighted above, the main climate impacts for Glasgow will relate to flood risk and overheating, including urban heat island effects. There has been significant work undertaken to understand the risk associated with these impacts and assessment of both current and future scenarios.

5.1. National Flood Maps

The Scottish Environment Protection Agency (SEPA) produced **National flood maps for Scotland**. These show existing flood risk for a High (10% AEP), Medium (0.5% AEP) and Low (0.1% AEP) likelihood of flooding from coastal, surface water (pluvial) and river (fluvial) flood sources.

Future flood risk, to the year 2080, is also shown for Coastal and River flooding sources.

Understanding Return Periods and Cumulative Probability

When considering flood risk, it is best practice to express the likelihood of flooding in any given year as the 'Annual Exceedance Probability' (AEP), rather than refer to a 'return period'. This is because return periods are often misunderstood and can give a false sense of security.

A **"1 in 100-year"** return period does not mean a storm event will only happen once in 100 years. It means that the event has a 1% chance (or AEP) of happening in any given year.

Cumulative probability dictates that over a given number of years, the likelihood of experiencing that given event will increase (accumulate). This is set out in table 1 below:

Table 1 - Return Periods and Cumulative Probability

This shows that over a period of 20 years (the typical duration of a mortgage), the probability of experiencing a 1% AEP (1 in 100 year) storm event is just over 18%[6].

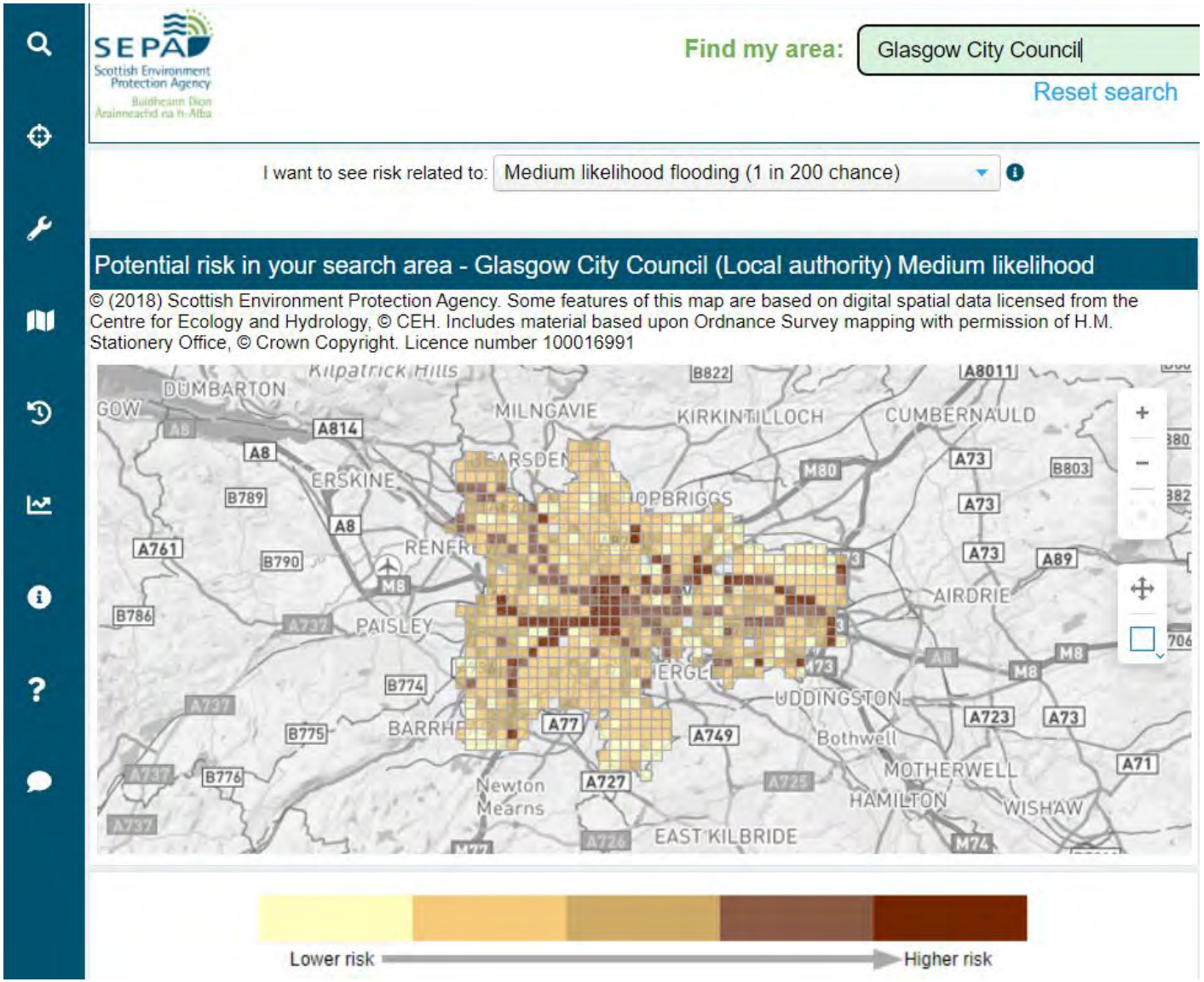
Return Period (1 in X)	Probability (chance) of event over time...			
	Any 1 year	Over 10 years	Over 20 years	Over 30 years
200 year	0.5%	4.89 %	9.54 %	13.96 %
100 year	1 %	9.56 %	18.21 %	26.03 %
50 year	2 %	18.29 %	33.24 %	45.45 %
10 year	10 %	65.13 %	87.84 %	95.76 %

6. Source – SEPA Technical Flood Risk Guidance for Stakeholders - link
Also – Global Facility for Disaster Reduction and Recovery - link

5.2 National Flood Risk Assessment 2018

The National Flood Risk Assessment (NFRA) published by SEPA in 2018, assessed flood risk for existing properties from all sources. This was undertaken for a range of receptors and using a current and future climate change scenario (for the year 2080 based on a UKCP09 High Emission scenario).

Figure 11. SEPA Flood Risk Map



5. Spotlight on Flooding and Heating continued

The National Flood Risk Assessment predicts that:

Nationally for Scotland:

- **Current scenario: For a 0.5% AEP event. This would result in 284,000 properties and businesses at risk of flooding (all sources). With 210,000 properties and businesses at risk of surface water flooding only.**
- **Future scenario (by 2080): For a 0.5% AEP event.**
- **This would result in 394,000 properties and businesses at risk of flooding (all sources).**

Locally for Glasgow:

- **Current scenario: For a 0.5% event.**

  This would result in 45,200 properties and businesses at risk of flooding (all sources). With 41,500 properties and businesses at risk of surface water flooding only.

- **Future Scenario (by 2080): For a 0.5% AEP event.**

  This would result in 57,000 properties and businesses at risk of flooding (all sources).

These figures illustrate the scale of the current and future challenge in terms of flood risk. SEPA provides guidance on recommended climate change uplift allowances to be used in design for **flood risk assessment in land use planning** as shown in the tables.

Table 2. Peak river flows allowance by River Basin Region

River Basin Region	Total change to the year 2100
Argyll	56%
Clyde	44%
Forth	40%
North East	24%
North Highlands	37%
Orkney	41%
Shetland	41%
Solway	44%
Tay	35%
Tweed	33%
Western Isles	56%
West Highlands	56%

Table 3. Sea level rise allowance by River Basin Region

River Basin Region	Cumulative rise (in metres) from 2017 - 2100
Argyll	0.35
Clyde	44%
Forth	40%
North East	24%
North Highlands	37%
Orkney	41%
Shetland	1.32
Solway	44%
Tay	35%
Tweed	33%
Western Isles	56%
West Highlands	56%

Table 4. Peak rainfall intensity

Region	Total period change for 2100
East	35%
West	55%

5.3 Increased Temperatures and Urban Overheating in Glasgow

Scotland's top 10 warmest years have all occurred since 1997 (since records began in 1884). The average temperature in the last decade was 0.68 ˚C warmer than the 1960-1997 average.

Heatwaves were more frequent in Scotland in 2018 and 2021 and Glasgow urban areas were on average 4-6 ˚C warmer due to urban heat island (UHI) effect[7]. By 2050, summer temperatures in Glasgow is expected to increase (UKCP18).

Glasgow's housing infrastructure is largely underprepared for this increasing temperature and many parts of the city will be affected by the **"Urban Heat Island effect"**.

The **Urban Heat Island (UHI)**: Is an urban or metropolitan area that is significantly warmer than its surrounding areas due to human activities.

Overheating of super-insulated buildings is already being witnessed with potential consequential health implications such at heat exhaustion or heat stroke[8].

Heatwaves can result in severe effects, often contributing to premature death and illnesses. Heatwaves have the potential to particularly affect older and younger people and exacerbate existing illnesses such as cardio-vascular and respiratory diseases.

In Scotland, cases of Chronic Obstructive Pulmonary Disease (COPD) as a cause of death and disability have increased by 20% within a decade. It is also of note that COPD, lower respiratory effects, lung cancer, stroke and ischemic heart disease are the top 5 illnesses causing the most deaths and are experiencing increased prevalence[9].

7. Emmanuel R, Begum R, Ananyeva O, Valdez A, Rattanakijanant N. 2021. Climate Proofing Glasgow - Adaptation Strategies for Urban Overheating, ISBN: 978-1-7398476-0-9, link

8. WHO Health and Climate City Profiles - link

9. Glasgow Centre for Population Health – History, politics and vulnerability: explaining excess mortality in Scotland and Glasgow Policy brief - link

5.4 UK Climate Change Risk Assessment

The latest UK Climate Change Risk Assessment (CCRA3) suggests that certain parts of the UK are already vulnerable to increases in average temperature rises and extreme heat.

These increases in temperature can lead to cities and local communities being seriously impacted by extreme temperatures. The impact of increasing temperatures can result in heat-health related issues, especially for more vulnerable groups, for example, the elderly or young people. Extreme heat will also impact infrastructure, and the built and natural environment.

A study published by Climate Ready Clyde[10] in 2019 examines future heatwave days and extreme temperatures projected for Glasgow City Region for 2046-2055 (2050s) and 2066-2075 (2070s) using data from UKCP18.

Key findings from the report include:

- **Maximum summer daytime and night-time temperatures associated with heatwave events that have a 1%, 10% or 20% chance of occurring in any year are projected to increase in the 2050s and 2070s.**
- **The temperature of the "1 in 10 year" hottest summer day increases from about 28°C (1980-2010) to 32°C (2050s). By the 2070s the projection for the "1 in 10 year" hottest summer day will reach 34°C.**
- **The city region is likely to experience an increasing number of heatwave days in the 2050s and 2070s.**
- **The city region is projected to see an increase in the number of heatwave[11] days per decade. From the baseline period (1981-2010) with values of "0 heatwave days" per decade, to "5 to 10 heatwave days" per decade in the 2050s. This increases again to "10 to 50" heatwave days per decade in the 2070s.**

The report explored data on all hot day and hot night cases. Summer nights in the Glasgow City Region are predicted to warm considerably, with minimum temperatures increasing more than maximums, and more frequently. These long-lasting periods of extreme night-time summer temperatures are predicted to increase in the 2050s and 2070s.

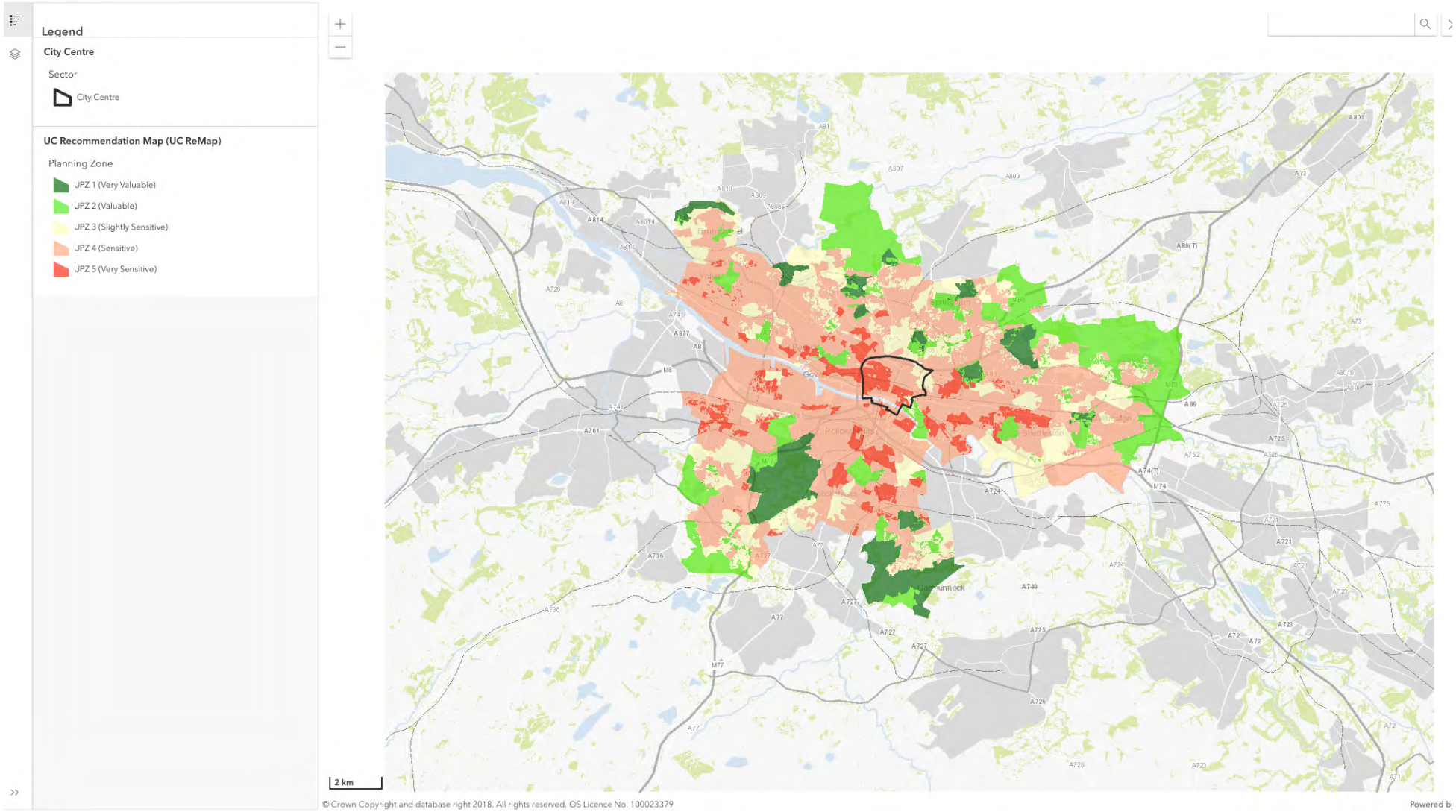
Serious consideration should be given to the impacts that could arise because of the increasing return values and heatwave days for the Glasgow Region and the City, especially as we transition from the 2050s into the 2070s.

10. Source: link

11. Heatwave days are defined as periods of three or more days where maximum temperatures exceed 28°C and minimum temperatures are above 15 °C.

5. Spotlight on Flooding and Heating continued

Figure 12. Heat Risk and Recommendations Map (Source: Climate proofing Glasgow – Adaptation Strategies for Urban Overheating)



6. Understanding our Impacts

To build Glasgow's climate resilience, we need to work together to continue to develop an understanding of how climate change is likely to impact Glasgow and how best to address this.

This work will include:

- **Understanding Impacts and Assessing risks of potential damage via assessment such as the Local Climate Impacts Profile (LCIP).**
- **Quantifying the extent to which appropriate, prompt and long-term action will bring long term savings.**
- **Understanding that climate change impacts are a stress multiplier which may affect certain groups in our community disproportionately, exacerbating exposure of our most vulnerable communities and increasing inequalities.**

The experience of recent years has shown us that global climate change and extreme weather events have already impacted many local aspects of our lives locally, nationally, and globally.

These impacts are considered using a sectoral approach to risks and opportunities of a changing climate at a national, regional and citywide scale.

6.1 Key Consequences and Impacts for Scotland

The Scottish Government's Climate Change Adaptation Programme: Climate Ready Scotland identifies 15 key consequences of climate change, shown in figure 12 below.

The Climate Ready Scotland programme sets out the objectives of Scottish Ministers in relation to climate change adaptation, their proposals, and policies for meeting those objectives.

Figure 13. 15 Key Consequences of Climate Change for Scotland (Source: Adaptation Scotland)

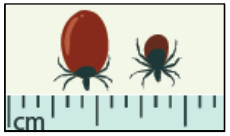
The productivity of our agriculture and forests

The health of our natural environment

The security of our food supply

The increased risk of flooding

The change at our coast



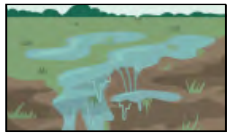
The occurance of pests and disease

The availability and quality of water

The health of our marine environment

The resilience of our businesses

The health and wellbeing of our people



The quality of our soils

Poor cultural heritage and identity

The security and efficiency of our energy supply

The performance of our buildings

Infrastructure - Network Connectivity

Climate change and associated extreme weather events have the potential to disrupt transport, energy, and communication networks in Scotland and around the world. This could impact on markets, affect supply chains, and raise insurance costs.

The most significant opportunities identified for Scotland from climate change appear to be changes in crop, grass and forest productivity and land class leading to potential increases in yields.

The 15 key consequences of Climate Change for Scotland were used as the framework for citywide stakeholder workshops, explained further in section 6.4.

6.2 Key Impacts for the wider Glasgow City Region

We are a member of Climate Ready Clyde. This is a cross-sector initiative funded by fifteen member organisations and supported by the Scottish Government to create a shared vision, strategy and action plan for an adapting Glasgow City Region.

The partnership comprises local authorities and public agencies across the Glasgow City Region. Climate Ready Clyde aims to both assess the regional impacts of climate change and deliver effective, joined up adaptation action.

We value our continued participation in this partnership. Climate Change has no respect for political boundaries and so working together we can both build our understanding of climate impacts and our capacity to address them more effectively. The wider regional risk assessments undertaken by Climate Ready Clyde are key to informing local action and supporting regional adaptation action in the form of Climate Ready Clyde's Adaptation Strategy.

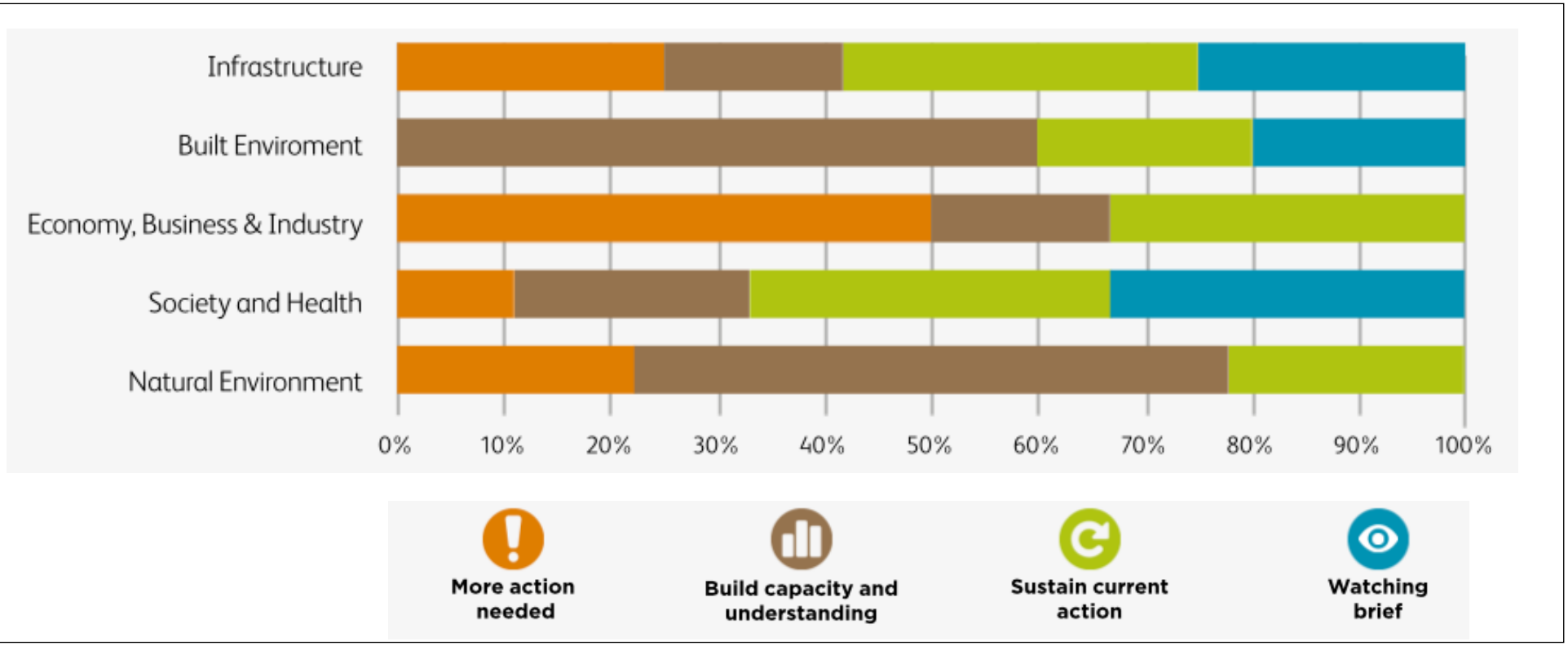
Climate Ready Clyde undertook a Climate Risk and Vulnerability Assessment (RVA) for the city region. This identified 67 climate risks and opportunities through a collaborative process, designed and delivered with over 100 stakeholders from across Glasgow City Region, Scotland and UK. This was also advised by international advisory board of academics, cities, as well as the Committee on Climate Change.

The RVA assumes a 4-degree rise, high emissions scenarios, with other scenarios also considered. The methodology follows an 'urgency scoring' approach to find consensus on risk. It focusses on future level of risk; size, approach to management, and benefits to further action in the short term.

The figure on page 28 illustrates some progress to date but also highlights a need for further, bolder action, particularly in sectors such as **"Economy"**, and **"Infrastructure and Natural Environment"**. The RVA also highlights the need for improved data and understanding of the challenges.

6. Understanding our Impacts continued

Figure 14. Key Climate Risks and Opportunities for Glasgow City Region (Source: Climate Ready Clyde)



More details on the key risks highlighted by the RVA for the City Region can be found here, a summary is also provided in Appendix B.

6.3 Local Climate Impacts Profile (LCLIP)

GCC conducted an initial Local Climate Impacts Assessment (LCLIP) using the Adaptation Scotland toolkit as far back as 2007. The LCLIP was updated in 2017 to cover a 10-year period from 2007-2017 (Murtagh, 2017). This process enabled Glasgow to document and examine past weather events, the impact on services and residents, and identified our responses to such events.

Climate events such as wetter winters, drier summers, increased flooding and extreme weather events have implications to service areas including:

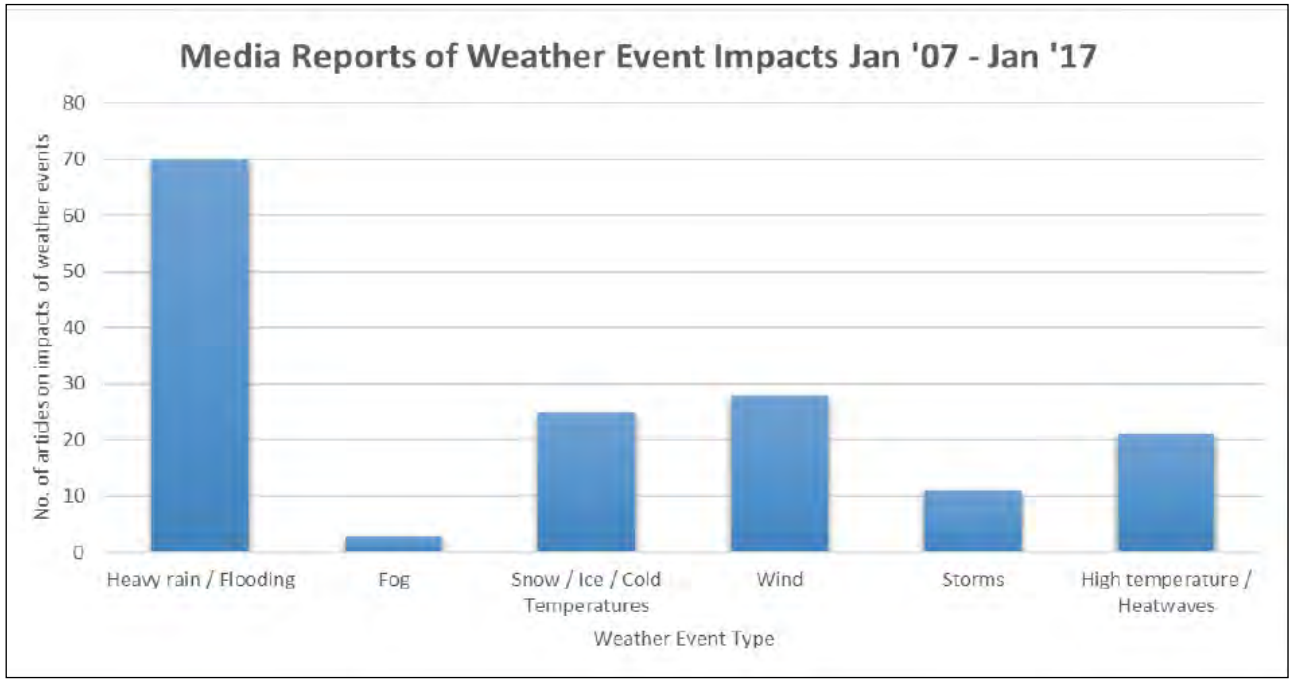
- **Emergency planning**
- **Waste collection and disposal**
- **Land use planning and building control**
- **Council estate management**
- **Management of biodiversity and open space**

As expected for the West of Scotland, due to its proximity to the Atlantic and as one of the more exposed areas of the UK, severe weather events involving high winds, heavy rain or the combination of both were the most frequently reported for Glasgow, as observed in figure 15 below.

Surprisingly, high temperatures (heatwaves) were also identified as having an impact on council's services, particularly parks and open spaces maintenance, as well as the city's economy, with close correlation between warmer weather and retail or consumption behaviours.

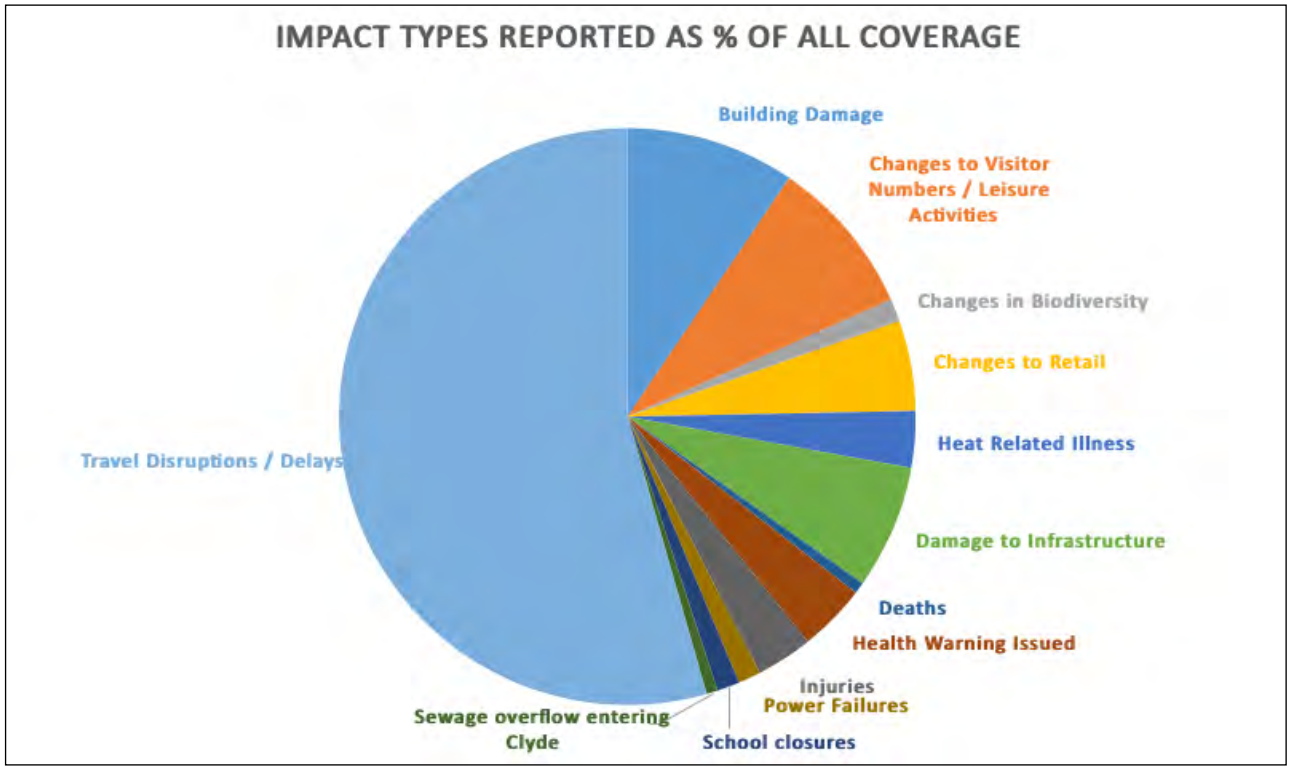
Despite milder weather providing a more temperate environment and supporting a boost to the leisure and tourism industries in Glasgow, it also has the potential to cause problems. Coupled with the urban heat island effect within the city, this may lead to higher energy demands for cooling, pressures on the emergency services to deal with heat related illnesses and increased responses to anti-social behaviour (ASB).

Figure 15. Media reports of weather events in Glasgow (2007-2017) Source: Glasgow LCLIP Murtagh (2017).



The LCLIP for Glasgow identified the impacts of weather events on the council family. As illustrated in figure 15 below, most of these impacts related to travel disruption, damage to buildings, changes in leisure activities and damage to infrastructure.

Figure 16. Reports of weather events in Glasgow (2007-2017) Source: Glasgow LCLIP (Murtagh, 2017)



The LCLIP also highlighted key impacts from increased temperatures and heatwaves in recent years for the council family, these were associated with:

- **Increased budget pressures to retrofit and provide energy to operate cooling equipment.**
- **Loss of workdays, or service, where safe working temperatures cannot be maintained. This was exacerbated especially within the urban heat island area with older education and community establishments which were not designed for higher temperatures.**
- **Increased workload for social services as they respond to heat hospital admissions and subsequent personalised healthcare packages when they are discharged.**
- **In the past anti-social behaviour has increased as the weather has improved, as a local authority, Glasgow City Council will be impacted by the need to respond to public disturbances and ASB to ensure that people and property are safe.**
- **Increased temperatures will increase vegetative growth across the city, requiring increased maintenance and pressure on labour and budgets.**
- **Planning and investment will need to include new guidance on the provision for cooling in new developments. Thus ensuring that housing and infrastructure is future proofed for the predicted warmer climates, using techniques such as green infrastructure and passive cooling measures.**

- **Services providing caring support for the elderly and infirm, will be at the frontline of the impacts. There is a need for them to understand the effects of heat on their clients. This will include the need to spot clients at high risk from heat related illness and have access to a number of solutions to alleviate these pressures, such as rest bite care, increased home care, hospital admissions and home modification services.**

6.4 Glasgow City Council Stakeholder Workshops: Key climate consequences for Glasgow

Specific workshops on the Local Climate Impacts Profile were held between 2017 and 2021, using the key consequences provided in the Climate Ready Scotland document (Section 6.1). These stakeholder workshops included representatives from across Glasgow City Council, the City's universities and arm's length organisations (ALEOs).

Participants were guided through the **"15 Key Consequences for Scotland"** exercise and asked to feedback on those consequences that were most important to the city and city council.

The workshop exercises concluded the following 4 consequences were the most important for Glasgow:

1. **Increased risk of flooding: Flooding already has a devastating effect on those impacted. With climate change likely to alter rainfall patterns and bring more heavy downpours, we expect flood risk to increase in the future.**

   This could impact on properties and infrastructure with serious consequences for our people, heritage, businesses, and communities. The mental and physical health consequences, especially for more vulnerable communities, were cited as key areas for concern.

   Higher river levels can result in bank erosion, collapsing quay walls and loss of path networks all of which affect the city council. The risks to those already most vulnerable was noted, with lack of insurance a distinct possibility.

   Lack of understanding and limited priority given to flood mitigation was cited, noting a perception that both citizens and developers lacked understanding of SuDS, with flood alleviation not treated as a priority by either citizens or developers. Participants highlighted a need for increased support or guidance for residents, including homeowners.

   Other associated challenges noted include urban creep, reduction in permeable paving, limited funding, and lack of national strategy on green infrastructure.

2. **The performance of our buildings: Climate change will have an impact on the design, construction, management and use of our buildings and places. Whether in retrofitting or new builds, it is likely that there will be issues with water management (in flood and drought), weather resistance and overheating.**

   The age of the city's buildings was noted with 100-year-old buildings not designed for heat, high winds or heavy rain. Infrastructure disruption such as staff delays, safety, delays to deliveries were highlighted.

   Health and wellbeing concerns were also highlighted with participants noting that there would be a need to retrofit buildings to clients demand, including ventilation, insulation, and SuDS. Energy security was also noted, including demand to minimize, cost of new technologies/maintenance, and increased energy costs.

3. **Infrastructure - network connectivity and interdependencies: Our energy, transport, water, and ICT network support services are vital to our health and wellbeing and economic prosperity. The effect of climate change on these infrastructure systems will be varied. They are likely to be impacted by an increase in disruptive events such as flooding, landslides, drought, and heatwaves. Our infrastructure is closely inter-linked and failure in any area can lead to wider disruption across these networks.**

   This is likely to lead to impacts such as combined server failures, transport networks failures, river floods, energy supply disrupted and higher demands on energy.

4. **The health and wellbeing of our people: A warming climate may provide more opportunity to be outdoors and enjoy a healthy and active lifestyle, while reducing mortality in winter. However, it could affect patterns of disease and other health issues.**

Climate change and associated extreme weather may disrupt the lives of individuals and communities, limiting access to vital services and impacting on people's physical and mental health.

Some suggested impacts were: the reduction in use of open spaces, increased use of motorized transport, increase in mental health issues including depression and SAD, days lost due to trips and slips and dampness causing respiratory illness.

There were also concerns for health and wellbeing. With the potential increase in the prevalence of pests which will be heightened during warmer spells. This also has the potential to cause an increase of pests around domestic waste and food wastes, Increased littering during increased temps with an associated increased demand on resources to clear this up.

There was also consideration of impacts around the potential varying composition of waste changing due to changes in lifestyle and consumption patterns, staff working in warmer conditions, and ageing population becoming more vulnerable to the impacts of flooding and heat waves, damage to roads network because of flooding or heavy rain events followed by dry spells or higher temperatures.

There were further concerns regarding the potential for traffic disruption and economic implications for maintenance of potholes, deterioration of ageing infrastructure, and the impact of extreme weather events on project delays for example, roads construction and repair.

These key consequences and comments have been used to inform the development of the Adaptation Interventions and supporting actions detailed in the Action Plan (Appendix A).

6.5 Glasgow City Council Risk Assessment

In addition to taking account of national and regional climate trends and projections, risk assessments, and learnings from our Local Climate Impacts Profile; a high-level climate risk assessment was undertaken to support the development of this plan. This Glasgow City Council Risk Assessment highlighted potential risks and impacts for the council and the city.

To develop this assessment, risks were defined based on an initial qualitative assessment by the Sustainable Glasgow team and subsequently validated through internal sectoral workshops and one to one meetings. The exercise follows Glasgow City Council's standard risk assessment method:

I x P = risk.

I = Impact: 5 = catastrophic; 4 = major; 3 = moderate; 2 = minor; 1 = insignificant.

P = Probability: 5 = almost certain (>90%); 4 = likely (>70%); 3 = possible (<50%); 2 = unlikely (<30%); 1 = rare (< 10%).

The risk was defined as the likelihood of the climate impact occurring in the first instance, not the likelihood of the Impact occurring as scored. Attached to each predicted impact are relevant services or organisations and existing or planned policy that may influence our action.

This risk assessment will be further developed during the implementation of the Adaptation plan. The city council and partners will undertake a detailed risk and vulnerability assessment (RVA) for the city, following the approach taken by Climate Ready Clyde (section 6.2).

PROBABILITY							
	Almost certain	5	5	10	15	20	25
	Likely	4	4	8	12	16	20
	Possible	3	3	6	9	12	15
	Unlikely	2	2	4	6	8	10
	Rare	1	1	2	3	4	5
			1	2	3	4	5
			Negligible	Minor	Moderate	Major	Critical

Figure 17. Glasgow City Council Risk Assessment Matrix

The following key climate risks for Glasgow, were identified in the high-level risk assessment. These have been broken down into the following sectors:

- **Built Environment and Infrastructure**
- **Natural Environment, Parks and Open Spaces**
- **Society and Economy**

The full Risk Assessment is provided in Appendix C.

Built Environment and Infrastructure

STRATEGIC DRAINAGE AND FLOOD RISK MANAGEMENT

Our changing climate will influence the location and design of new development as more information becomes available on flood risk and flood disadvantage, now and in the future.

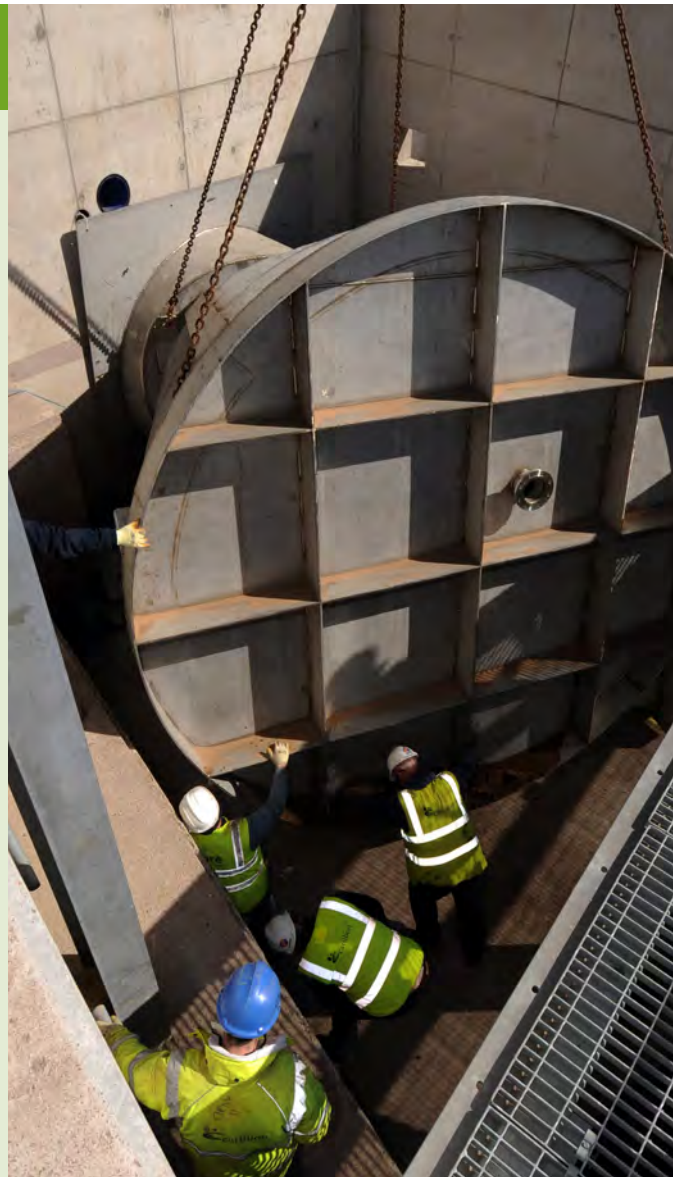
Global Climate Impacts will also affect our interactions with the rest of the world, and include food supply networks, international trade, governance, knowledge exchange, people movement and development.

As our global climate changes, international food supply networks may change, this includes disruption of transport routes and infrastructure due to increases in extreme weather and sea level rise. International food production may be affected as extreme weather and water scarcity reduce the quantity and type of crops grown in different countries.

As Glasgow and Scotland's climate changes, its international food supply networks may change. This includes disruption of transport routes and infrastructure because of increases in extreme weather and sea level rise.

We may also face new challenges associated with food safety and quality. Climate change could impact on imported food quality and safety in a variety of ways. Increased risk of flooding could increase the risk of environmental contamination. There may be additional risks from increased pesticide use in response to new pests and diseases, and transmission of diseases and toxicity through food. There may also be an increased risk of substitution of food in the supply chain if supplies are limited as a result of extreme weather.

Increases in the variability of river flows, intensity of rainfall events, surface water flooding, and seasonality of rainfall, followed by periods of drought may present numerous and complex challenges for the city. Wetter winters and more intense downpours throughout the year may increase the risk of flooding of properties in the city.



Strategic Drainage and Flood Risk Management continued

The predicted increase in intense rainfall will increase the risk of pluvial, fluvial and groundwater flooding and drainage surcharge. Communities and properties located in areas that are at increased risk of flooding or landslips will become increasingly and particularly vulnerable.

SEPAs indicative river, coastal and surface water flood map shows areas of Scotland that are at increased risk of flooding. Development in at-risk locations is likely to become difficult to insure.

Glasgow has a long history of pluvial and fluvial floods, but coastal flooding, whilst a recognised risk, has not occurred to any significant extent to date.

Climate change driven sea level rise and more frequent storm surges is increasing the risk and potential impacts of coastal flooding along the tidal reach of the River Clyde.

Long-term sea level rise impacts on Land Use Planning in that it highlights a need to look at impact of short-term Land Use Planning decisions (including those already agreed) on narrowing or retaining options for how resilient the city can be to Sea Level Rise. It is essential to ensure that land use plans developed today account for risk, erosion and storm surges in 2100-2200.

SEPA's indicative flood map shows significant areas in Glasgow at risk of surface water flooding currently and increasing due to climate change. **Link.**

More frequent and extreme severe weather events may present a risk for older, historic buildings, as well as new developments.

Flooding and severe weather damage to housing could have serious consequences for residents, with the most vulnerable in our communities bearing the brunt of these impacts, and the least equipped to recover.

The Metropolitan Glasgow Strategic Drainage Partnership **(MGSDP)** looks to transform how the city region considers and manages rainfall to prevent uncontrolled flooding and improve water quality. The partnership seeks to upgrade and modernise the Glasgow area's drainage and sewerage network, reducing flooding and improving the quality of our river water.

LAND USE AND PLANNING

The National Planning Framework (NPF) and Scottish Planning Policy state planners and developers should address these issues in their plans and designs as the draft NPF4 embeds adaptation further into national planning policy.

The City Development Plan recognises that new buildings must be designed to withstand the impacts of climate change. This Plan plays a central role in guiding the delivery of a place-based approach to improving personal, community and economic resilience. It has been informed by and aligns with the Strategic Plan objectives and promotes a policy framework that gives priority to achieving successful placemaking.

It is essential that the City Development Plan also takes account of the impacts of Global climate Change on our supply chains and allows for land to be allocated to local food growing and production as proposed by the City Food Plan and Glasgow's Food Growing Strategy.

PROPERTY AND HOUSING

Glasgow's forthcoming LHEES will seek to establish **"opportunity zones"** for decarbonisation of the built environment. This will include consideration of innovative low carbon technologies and also take into consideration flood risk maps as well as impacts of current and future climate.

The risks of overheating of buildings in summer is likely to increase in Scotland. There may be an increase in the number of heat waves similar to the Summer of 2017.

The city must consider the effects of heat on building performance and maintenance over time.

Wetter winters and increased summer temperatures, with an increase in extreme rainfall events, may lead to greater issues with condensation and dampness in buildings. flooding and improving the quality of our river water.

TRANSPORT

The potential for increased flooding, storms and high winds, and rising sea levels may cause damage to Glasgow's transport infrastructure, leading to travel disruption and delays, but also disruption to supply chains impacting the cost and availability of food and essential goods.

Heavy precipitation could result in flooding, which could disrupt traffic or railway services, delay construction activities and weaken or wash out the soil and culverts that support roads, tunnels and bridges.

Severe weather events may make it more difficult for staff to travel to work, resulting in difficulties to deliver essential services to the community, particularly those most vulnerable and disproportionately affected by severe weather.

As average temperatures are projected to increase, disruptions from snow and frost may become less frequent, reducing reliance on resources to deal with cold weather. However higher temperatures are likely to require the provision of air conditioning on public transport. This could adversely affect the purchase and operating costs of vehicles. Importantly, the impact of heat on active travel should also be considered in design of cycling and walking infrastructure to ensure that shelter opportunities are considered and maximised.

KEY CLIMATE RISKS

- Increased flooding, warmer temperatures, changing precipitation patterns and the consequences of these impacts for land use and spatial planning.
- Increased energy consumption in summer months due to increased need for air conditioning/cooling in existing buildings.
- Increased bio productivity promoting growth of problem species, pests' infestations and vermin.
- Increased 'Urban Heat Island' effect.
- Damage to property from wetter winters and severe weather events.
- Increased dampness and mould in buildings.
- Disruption to construction work due to severe weather.
- Increased insurance costs.
- Increased incidence of flood damage.
- Increased vulnerability to storm surges.
- Tourism and recreational demand.
- Change in demands for winter maintenance.
- Failure of essential road infrastructure.
- Road deterioration.
- Failure of drainage infrastructure.
- Disruption to work programmes and operational issues.
- Disruption to public transport, cycling and pedestrian networks due to the increased incidence of localised and widespread flooding
- Increased number of emergency callouts.
- Failure of coastal defences/ quay walls.
- Economic and reputational implications of transport disruption
- Changes in demand for waste collection and Cleansing.

Natural Environment, Parks and Open Spaces

NATURAL ENVIRONMENT

As projected changes in temperature and rainfall become more evident in Glasgow and the West of Scotland some form of intervention or active management may be necessary to maintain the city's current natural habitats and to accommodate new species.

Climate change is already having a direct impact on biodiversity. With some species moving north and new species identification becoming more frequent.

Those species moving North may be 'pest' species, adversely affecting local habitats and species, while some will increase the diversity of species found locally with minimal or possibly beneficial effects.

Climate change could also have implications for the spread of plant diseases, with consequences on Glasgow's existing biodiversity.

There will be physical effects on habitats, including loss of habitat to coastal erosion. Ultimately, the effects of a changing climate and the loss of species diversity could degrade ecosystem function.

Action will be required to secure the ecosystem services that support nature, the economy and contribute to quality of life, as well as to reduce their vulnerability to the impacts to climate change.

Parks and Open spaces also have a crucial in helping the city adapt to the impacts of climate change, they have a role in:

- **Flood risk management for example, Sustainable urban drainage systems; floodplain greenspaces, blue-green infrastructure.**
- **Flood greenspaces can be extended to include dynamic river edges, or erosion zones**
- **Temperature cooling for example, Roadside tree planting, shelterbelts, and green roofs.**
- **Biodiversity provision for example, Conservation of key sites; integrated habitat networks.**
- **Health and wellbeing provision for example, providing shaded and cooler spaces, green networks, pollutant absorption, outdoor activity spaces and increased activity.**
- **Local food growing and production provision for example, providing space for local, sustainable food growing, supporting biodiversity connectivity and resilience to global climate impacts on our food supply chains.**

Natural Environment, Parks and Open Spaces continued

LOCAL BIODIVERSITY

The Scottish Biodiversity Strategy states that biodiversity conservation calls for an ecosystems approach. Highlighting that nature provides us with many ecosystem services, though they're not always evident.

Adopting an ecosystem approach can help to secure these benefits for future generations and support action to address climate risks for habitats and species. People are part of ecosystems, benefiting from the services they provide, from clean water to the health benefits. Ecosystem health is a measure of the status of ecosystems.

Glasgow's Local Biodiversity Action Plan (LBAP) was initially launched in September 2001 with additional habitat and species plans being approved in 2002 and 2005. The aim of the Glasgow's LBAP is to conserve and enhance natural habitats in the city through an ecosystems-based approach, while also addressing the decline in biodiversity with a focus on species of national and local conservation concern.

OPEN SPACE

Glasgow's Open Space Strategy (OSS), adopted in 2020, will deliver a variety of benefits for people and nature in Glasgow in line with the strategy's three outcomes, the need to enhance:

- **The City's Liveability, increasing its attractiveness as a place in which to live, work, move around, study, and invest.**
- **The Health and Wellbeing of the City's human population and of its flora and fauna; and**
- **The long-term Resilience of the City in relation to issues such as climate change.**

CLYDE CLIMATE FOREST

The Clyde Climate Forest was born out of the Green Network Blueprint for the City Region (part of the strategic Habitat Network). The aim is to plant 18 million trees in both urban and rural areas within Glasgow City Region until 2030.

This recognises that trees, woodlands and forests are essential in addressing our climate and ecological crisis by supporting the reduction of greenhouse gas (carbon) emissions, reducing risks associated with flooding and overheating, as well as supporting nature recovery.

As such, the progression of the Clyde Climate Forest will deliver a broad range of climate and ecological benefits to Glasgow City Region.

Natural Environment, Parks and Open Spaces continued

KEY CLIMATE RISKS

- Summer drought.
- Wetter winters.
- Deterioration in river and wetland environments.
- Species and habitat stress.
- Loss of existing habitats and species.
- Introduction of new species/increase in non-native invasive.
- Tree damage and changes in woodland ecosystems.
- Deterioration of public parks (continued/increased usage wear and tear).
- Increased soil erosion and land instability.
- Erosion of coastal habitats.
- Conflict between different uses/users.

Society and Economy

GLASGOW'S HEALTH AND WELLBEING

Weather and climate play a significant role in people's health. Changes in climate affect the average weather conditions that we are accustomed to, with a disproportionate impact on vulnerable groups.

As our global climate changes, international networks may change, Glasgow will be affected by the same issues as the UK and Scotland, this includes disruption of transport routes and infrastructure due to increases in extreme weather and sea level rise. International displacement of people as a direct or indirect result of extreme weather and climate change will place additional pressures on local and national services and infrastructure.

High risk groups include the elderly, individuals with pre-existing illnesses, children and the economically and socially vulnerable. Warmer average temperatures could lead to hotter days and more frequent and longer heat waves, increasing the number of heat related illnesses and deaths.

Rising summer temperatures may lead to a rise in hospital admissions and premature deaths from respiratory problems. Higher temperatures could also increase the spread of disease, cases of food poisoning and affect air quality.

A warming climate threatens to make air quality worse, with the prevalence of harmful photochemical smogs likely to increase throughout longer, hotter summers. This impact on air quality will likely impact upon the health of greater numbers of people, with the potential to see a rise in hospital admissions and a greater risk of incidence of cardiovascular disease.

Climate change may also increase risks to health from buildings overheating and increased vermin and pests.

Hospitals and care homes may be adversely affected by high temperatures during heatwaves. Heavy precipitation and flooding may also adversely affect health care infrastructure.

Increased frequency and/or severity of extreme weather events will increase the risk of flooding, high winds and high temperatures, having the potential to impact on people's health, particularly those communities who are already disadvantaged and or isolated.

Flooding, damage and disruption from severe weather have already had major impacts on communities in the city, damaging property, flooding homes and gardens, and disrupting transport networks.

Extreme weather-related events are likely to worsen mental and physical health, especially when there are already pre-existing conditions, as well as placing unusual strain on Glasgow's health and emergency services. These events could also disrupt local healthcare service delivery, impacting communities and individuals who are already more vulnerable.

GLASGOW'S ECONOMY

Glasgow's Climate Plan recognises the value of a healthy and sustainable economy and how this can build a more resilient city.

Theme Five of the Climate Plan references **'Green Recovery'**. This seeks to support the development of a local wellbeing economy to enable a green recovery from the COVID 19 pandemic while also addressing the global climate and ecological emergencies, specifically supporting:

- **A transition towards a circular economy.**
- **Tree planting and maintenance, peatland restoration, and green infrastructure.**
- **Improved infrastructure for walking, cycling and remote working.**

A key commitment in the Climate Plan, is Glasgow's Green Deal. The Green Deal is guided by three interlinked objectives:

- **Reducing carbon emissions and building resilience to the impacts of climate change.**
- **Creating prosperity, sustainable jobs and high-quality places.**
- **Eliminating poverty and delivering justice through inclusion and equality.**

Glasgow City Council will work with businesses, citizens and Governments to design policy and regulatory measures, innovative and investable projects, and a supporting framework with Governments, the private and public sector and communities.

A healthy and sustainable economy is important to help build Glasgow's resilience to a changing climate. It is also fundamental in securing protection of our natural environment and ensuring a just transition to a more climate resilient future. Climate Change has already impacted on our local economy and have the potential to affect it even further.

While local impacts such as flooding and heatwaves can affect retail and consumer behaviour, as well as potentially causing damage to buildings and travel disruption. Global events also have the potential to disrupt our local economy. The latter may be more difficult to directly influence, but this may be addressed through exploring shorter and more reliable supply chains.

Society and Economy continued

KEY CLIMATE RISKS

- Disruption to essential community services.
- Increased incidence of vector borne diseases.
- More heat stroke, dehydration, and respiratory problems.
- Increase in pest numbers and distribution, and increased demand for pest control services.
- Increased incidence of food poisoning.
- Reduced water quality.
- Mould and fungal illnesses and associated respiratory diseases.
- General increase in public health and safety risks.
- Changes in demand for goods and services.
- Heat stress impact on service provision.
- Closure of water reliant recreational activities.
- Lost workdays.
- Disruption to transport and supplies.
- Disruption to energy supplies/increasing energy costs.
- Increased insurance and repair costs.
- Loss of land and property values.
- Disruption and/or cancellation of events such as concerts.

7. Adaptation Interventions and Actions

In order to deliver a climate resilient city by 2030, a range of collaborative actions will need to be progressed across all sectors in the city.

The impact of a changing climate depends on three key factors: the hazard itself, exposure levels and our local vulnerability.

Adaptation Interventions and actions therefore include the need to empower and engaging communities, support livelihoods, tackle health inequalities, instil long-term and integrated planning around climate change, and require investment in nature-based solutions and flood defence measures.

Thirteen Adaptation Interventions have been identified as essential to address the most significant vulnerabilities identified.

These interventions align with the outcomes of second Scottish Climate Adaptation Plan SCAP2, published by the Scottish Government at the end of 2019.

A full action plan is found in appendix A.

The 13 Adaptation Interventions proposed for the City of Glasgow are:

1. **Governance**
2. **Planning and Housing**
3. **Sustainable Transport**
4. **Natural Environment and Assets**
5. **Health and Wellbeing**
6. **Environment**
7. **Risk Planning**
8. **Economy**
9. **Research and Evaluation**
10. **Climate Justice**
11. **Raising Awareness**
12. **Adaptation Maintenance**
13. **Improved response to Climate Events**

7.1 Adaptation Intervention 1: Governance

Working together, we will identify new ways of working with our services, partners and stakeholders to make the best use of available resources and expertise to build a climate resilient future for Glasgow.

This will include:

a. **Embed the governance of Adaptation measures in the forthcoming Glasgow Climate Board, ensuring visibility and understanding of Adaptation requirements across city operations.**

b. **Facilitating joint working across the city on climate change adaptation issues, policies, and projects, and highlighting best practice, which can be shared throughout the city and the city region, including working with elected members and area partnerships to increase visibility, raise awareness and build capacity around adaptation challenges and solutions.**

c. **Include the impacts of climate change into Glasgow's Risk Register.**

d. **Explore the role sustainable procurement can play in building a more climate resilient city. Create sustainable procurement guidance and estate asset management guidance.**

e. **Investigate and report on how best to gather and share data on the performance of existing SuDS.**

f. **Building on tools developed as part of EU H2020 Connecting Nature and other projects such as the emerging NERC GALLANT, continue to identify potential for nature-based solutions to be implemented across the city enabling the city to build its climate resilience.**

g. **Explore the need for specific rates/ fees for adaptation measures, to incentivise and fund adaptation action aligned with developing the Glasgow Green Deal.**

h. **Investigate and report whether one drainage authority or SuDS approval body to serve the Glasgow/City Region area would be beneficial.**

i. **Continue to support Scottish Water's Surface Water Strategy and hierarchy of options.**

j. **Require all new development/ infrastructure to deliver flood risk net gain (similar to biodiversity net gain principle).**

k. **Better enable strategic delivery to facilitate future development – public sector investment with recovery through developer contributions.**

l. **Develop an adaptation pathway for the tidal River Clyde and wider Glasgow area for flood risk.**

CASE STUDY 2: South East Glasgow Surface Water Management Plan

Enabled by funding from the **Glasgow City Region City Deal**, the South East Glasgow Surface Water Management Plan (SWMP) has been delivered by the Glasgow City Council's Flood Risk Management Team working with colleagues in City Deal, Roads Maintenance, Technical Services, Parks and Education.

The SWMP has delivered a number of retrofit surface water management interventions at Kings Park, Croftfoot Park, Croftpark Avenue and Croftfoot Primary School in the south east of Glasgow to:

- **reduce existing and future flood risk for the local community – by providing more space for water in the form of flood attenuation / storage, to slow down the rate at which water gets into the piped drainage network.**
- **reduce pressure on the combined sewer network – by removing surface water from the sewer and directing it to the watercourse, and by slowing down surface water that continues to be discharged to the combined sewer.**
- **provide watercourse morphology benefits – by opening up (deculverting) a number of sections of watercourse culvert.**
- **provide biodiversity benefits – by retrofitting blue-green infrastructure to existing highways and introducing open water to existing greenspace.**
- **improve accessibility – by proving new footpaths/access to existing greenspace.**
- **increase carbon sequestration and reduce surface water runoff – by planting trees in existing greenspace.**

CASE STUDY 2: South East Glasgow Surface Water Management Plan

At the north end of Kings Park, retrofit swales and a new SuDS basin have been formed to manage surface water runoff from the park and reduce flood risk for communities downstream.

Kings Park North basin

At the south end of Kings Park, work has been done to deculvert, or 'daylight', a section of the Spittal Burn to form a new length of open watercourse along its original route. This provides morphology and biodiversity benefits, as well as providing more space for the water in the form of flood attenuation/storage by re-creating floodplain, which will help to reduce flood risk for communities downstream.

New open-section of Spittal Burn formed along its former route - see map here.

At Croftfoot Park (former Kings Park golf course), an online SuDS basin has been retrofit to the Spittal Burn here to provide morphology and biodiversity benefits, as well as providing more space for the water in the form of flood attenuation capacity, which will help to reduce flood risk for communities downstream. These works compliment the previous phase of works to retrofit a SuDS basin in the park, further to the east.

An attractive woodland walkway has also been created in the park, formed through a programme of tree planting and the construction of new path networks linking Croftpark Avenue with Croftside Avenue.

At Croftpark Avenue, retrofit highway raingardens have been formed to manage surface water runoff from the road, and provide attenuation and treatment, prior to discharge to the Spittal Burn culvert that runs under the road. The raingardens provide a range of benefits including a home for biodiversity, urban cooling, air quality improvements and reducing flood risk for communities downstream. By keeping the surface water out of the combined sewer, the raingardens also help to ease pressure on the sewer network and reduce the risk of combined sewer overflow spills to the water environment.

CASE STUDY 2: South East Glasgow Surface Water Management Plan

Retrofit highway raingardens on Croftpark Avenue

At Croftfoot Primary School, a new swale has been formed to collect runoff from the playground area, and new drainage to gather runoff from roof downpipes, all of whcih is conveyed to below a new multi-use games area (MUGA). The MUGA has a permeable surface and storage below it to attenuate the surface water runoff, prior to discharge to the Spittal Burn culvert on Croftpark Avenue.

An outdoor amphitheatre area has also been formed. This combines an outdoor learning area with additional storage capacity during large storms that exceed the storage under the MUGA. Once the storm event passes, the amphitheatre drains down by gravity over the course of a number of hours.

CASE STUDY 2: South East Glasgow Surface Water Management Plan

New multi-use amphitheatre area to manage exceedance events at Croftfoot Primary School.

This project started on site July 2019 and was completed December 2020.

Further information on this project, and other SWMPs that have been delivered by Glasgow City Council, is available on the **MGSDP website**.

7.2 Adaptation Intervention 2: Planning and Housing

We will undertake a detailed analysis of the risks posed to the city from the impacts of climate change to identify the most vulnerable buildings, locations and neighbourhoods, and specific actions to address these.

This will include:

a. **Working in partnership to analyse fully the risks posed to our built environment from the impacts of climate change.**

b. **The City Development Plan to mandate green roofs for new buildings, or retrofit, over a certain m2 size threshold, for the multiple benefits this could bring in terms of flood risk, biodiversity and urban cooling. Require developers to include adaptation onto development projects, undertake sympathetic retrofitting measures for older buildings, and other measures such as incorporating green roofs, green walls and/or rainwater collectors on buildings where appropriate.**

c. **Control urban creep through requirements for source control for property extensions and reduction of permitted development rights.**

d. **Incentivise (grant fund) property flood resilience (PFR) in line with the CIRIA Code of Practice for PFR (C790).**

e. **Undertake strategic analysis of flood risk and move greenspace to areas of high risk and built development to areas of low risk.**

f. **Engage with Registered Social Landlords and the private developer sector to increase awareness of the need to deliver water resilient places.**

g. **Require property basement conversions to undertake assessment of flood risk and the need for resilient design.**

h. **Ensure that opportunities for efficiencies through collaboration with climate mitigation programmes of work are identified and actioned – for example, home energy retrofit and property flood resilience retrofit.**

7.3 Adaptation Intervention 3: Sustainable Transport

We will continue to monitor the impacts of climate change on our transport infrastructure and use this information to incorporate adaptation into future transport planning and development.

This will include:

a. **Ensuring climate change adaptation is fully incorporated into all city transport strategies, plans and guidance, especially the Liveable Neighbourhoods Plan, forthcoming Glasgow Transport Strategy, and associated Policy Framework. Working with colleagues in City Deal/Avenues project and others to continue to retrofit green infrastructure onto existing streets and public spaces through, for example, the development of rain gardens, and permeable surfaces.**

b. **Consider what role existing and future infrastructure should have in managing extreme weather events to protect property and businesses. Embedding adaptation onto future transport infrastructure development, active travel network, roadworks, and repairs. This would mean reducing the need to travel where possible, but also continuing to design infrastructure with climate resilience in mind, particularly increased incidences of flooding and high temperatures. Building a strong active travel network, with a particular focus on the role of green (for example, open space, country, and local parks) and blue (river and canal networks) infrastructure for cooling and flood risk reduction, prioritising solutions to transport and placemaking that help the city adapt to climate change while also enhancing biodiversity and reducing pollution– including ensuring that future adaptation interventions are not made too difficult/ expensive.**

CASE STUDY 3: City Centre Avenues and Urban Heat Island

The creation of a network of city centre avenues is revitalising key city centre districts by breathing new life into some of Glasgow's most important streets. A catalyst for social, economic and environmental change, it is focused on good street design and high-quality places that work for everyone:

To enable this, spaces are being redesigned in favour of climate ready infrastructure: active travel provision; smart technology; and urban greenery.

What makes this project stand out is the attention that has been given to the adaptation agenda, with a network of green-blue infrastructure contributing to a more resilient environment. As part of the improved ecosystem services offering this brings, the project is yielding effective temperature reduction to counterbalance the clustering effect of urban heat island.

Heat island is one of the many climate related threats to the city centre, which typically experiences temperatures that are 4-6°C warmer than the rest of the city due to its dense urban fabric. Planning for the Avenues has been done in the context of such risk, with Glasgow Caledonian University modelling the scheme against a range of heat island scenarios to inform design and spend. The graph below illustrates the benefits of the Avenues Programme Interventions and proposed improvements.

The project will see the installation of over 200 semi-mature urban trees of mixed species selected to perform well under

a changing climate, which have the highest potential to mitigate heat and thermal sensation. The inclusion of grasses that will be integrated into a cumulative rain garden area of 6,747 square metres, will provide the best solution. Where possible, species with high albedo values are selected to aid lower scale cooling. Similarly, public realm materials that reflect more solar energy such as light granite and buff asphalt are favoured over darker options

CASE STUDY 3: City Centre Avenues and Urban Heat Island

Climate justice is at the heart of this project, with efforts being made to ensure that the deprived communities based in and around the city centre benefit most from the opportunities that the Avenues affords. Currently, deprived areas of the city centre have lower access to climate services, and poor ecosystem health is evident. Not only will the Avenues improve access to green jobs and opportunity, but it will also raise health and wellbeing outcomes for local people, for which overheating has direct implications.

The Avenues project has been funded through the Glasgow City Region City Deal programme – an agreement between the UK Government, the Scottish Government and the eight local authorities that make up the Glasgow city region. Match funding from Sustrans (£21 million) will enable delivery of a further 4 peripheral avenues which will facilitate connections between the city centre and wider communities.

7.4 Adaptation Intervention 4: Natural Environment and Assets

We will ensure collaboration with Parks Management, Biodiversity and the EU H2020 Connecting Nature project. Through collaboration we will review priority species and habitats to identify those at greatest risk from climate change and utilise open space and ecological services to help mitigate and adapt to future impacts.

This will include:

a. **Increase planting of street trees and other blue-green infrastructure for their cooling effect, to reduce flooding through canopy capture and evaporation, and for improvement of solid drainage by their deep root structure. Continuing to work with MGSDP to promote natural flood management in catchment planning both within and outwith Glasgow City Council boundary. Building on knowledge base and tools developed as part of EU H2020 Connecting Nature project to improve natural features in urban environments to assist adaptation, for example through creation of habitat connectivity, reduce heat gain and slow the movement of rainwater drainage into the urban drainage system.**

b. **Management of nature conservation sites to take account of a changing climate, and to consider the placement of these sites in the wider ecological network. Managing species conservation priorities to take account of a changing climate. Reducing pressures on habitats vulnerable to climate change.**

c. **Promoting ecological connectivity to assist in species movement in response to climate change, and as a means of building larger, resilient species populations and habitats.**

d. **Develop a programme to facilitate and incentivise a reduction in existing impermeable surfacing through 'de-pave' activities, taking cognisance of the Open Space Strategy Delivery Plan.**

CASE STUDY 4: Claypits Local Nature Reserve

The Claypits Local Nature Reserve (LNR) is an important part of the three-phase regeneration of North Glasgow. It is an excellent example of how nature-based solutions can help us adapt to the multiple pressures of climate change. The Claypits section changed a 10 hectare derelict site into Glasgow's only inner-city local nature reserve with a barrier free path and boardwalk network, linking communities with the Claypits and across the canal.

Extreme Rain

The LNR is part of the Smart Canal system dealing with the extreme rainfall events that are becoming more frequent. There are two rainwater inflows from the new housing project under development at Hamiltonhill. Both drain into the large basin pictured which will fill during extreme rain, and then drain slowly into the Fort and Clyde Canal. The basin will be colonised by plants, and always have some water at the lowest point making it a good place for watching wildlife.

Urban Cooling, Thermal Comfort and Placemaking

Large urban areas tend to be a few degrees warmer than the surrounding countryside. The difference can be enough to affect health – creating heat stress during the day, disrupting sleep, reducing recovery during the night. The very young and old are most vulnerable.

A network or vegetation and waterways helps reduce these effects in the areas around them by evaporative cooling. Evaporating water out of plants uses the Sun's energy without raising the temperature.

The shade from trees and shrubs reduces the feeling of heat meaning that getting out of the house is more appealing. Active travel becomes more viable and reduces carbon emissions. Attractive and comfortable places near our homes to play and relax reduces also helps reduce travel emissions.

7.5 Adaptation Intervention 5: Health, Wellbeing and Education

We will continue to work with our partners to build a better understanding of climate impacts on communities, health and wellbeing, as well as inequalities associated with those. We will identify actions and continue to develop recommendations to address existing and future health and inequality issues linked to a changing climate.

This will include:

a. **Ensuring climate change adaptation is incorporated into all Glasgow's community planning processes and city organisations work in partnership with communities to ensure climate change impacts are minimised for residents, especially the most vulnerable. Ensuring the engagement of all Glasgow's citizens, including children and young people, in the process. Including through the use of the Co-Impact Tool. Helping communities to identify outcomes they want to deliver and measure.**

b. **Working with Education Services on Learning for Sustainability Curricular entitlement to raise awareness of the benefits of early adaptation action and impacts on health and wellbeing in the city.**

CASE STUDY 5: Wee Forests

A Wee Forest (also known as a Tiny Forest) is made up of densely packed, fast growing native trees in a space the size of a tennis court and has the potential to attract over 500 animal and plant species within the first three years. It also provides rich opportunities for engaging young and old alike with the environment and sustainability and encouraging people to re-connect with nature.

Wee Forests can contribute towards urban cooling, flood risk alleviation, carbon absorption and increasing urban biodiversity and habitat connectivity.

They also provide community spaces and help raise awareness of climate change and how everyone can be actively involved in the solutions. Together Glasgow City Council, Earthwatch Europe, NatureScot, Glasgow Science Centre, Green Action Trust and The Conservation Volunteers (TCV) Scotland have planted eight Wee Forests across the city.

The forests have been supported by BlackRock, Bloomberg LP, OVO Foundation (charity arm of OVO Energy), Scottish Government, the Seven Lochs Project, Vaillant Group and Whyte & Mackay.

The Wee Forests require ongoing maintenance and monitoring. These will be provided by community volunteers including local schools and by undertaking citizen science collecting data on flooding, cooling effects, biodiversity as well as social and health and wellbeing effects.

7.6 Adaptation Intervention 6: Environment

We will work with our partners to develop a fuller understanding of the potential impacts of climate change on air and water quality, pest and disease control, and other environmental health factors, and from this identify actions to address these.

This will include:

a. **Ensuring and evidencing that the Air Quality Action Plan for the city reflects a growing understanding of the interrelationship between climate change and local air quality.**

b. **Ensuring and evidencing that the impacts of climate change are taken into consideration when developing actions to improve water quality.**

c. **Ensuring and evidencing that the threat of a rise in pests and diseases due to climate change is fully realised, and that pest and disease control services are fully prepared to meet potential increased demand for their services. Raising awareness of the potential environmental health risks of climate change and ensuring the engagement of all Glasgow's citizens in this process.**

7.7 Adaptation Intervention 7: Risk Planning

We will ensure more robust risk management strategies that give prominence to climate change issues and aid informed climate resilience planning.

This will include:

a. **A citywide risk assessment to incorporate the recommendation of the latest UK Climate Change Risk Assessment published in 2021.**

b. **Work with key stakeholders, including Scottish Water and SEPA, to improve flood forecasting and warning systems.**

c. **Identify high flood risk areas where planned surface storage of floodwater is linked to a flood warning system to mitigate risk to parked vehicles.**

d. **Increase the conveyance capacity of the drainage system at critical points where blue-green infrastructure is not sufficient to manage flood risk to an acceptable level. This may include the construction of new drainage conduits.**

Case Study 6: Glasgow Science Centre Roof Repair

Due to excessive and prolonged heat build-up at certain times of the year over the last two decades, Glasgow Science Centre's roof saw its waterproof membrane gradually melt away which resulted in black tar staining its titanium shingle roof. This was particularly visible and widely reported in the summer of 2018.

Glasgow Science Centre, funded by Scottish Enterprise, recently began a £5.5 million upgrade to become improve the roof, windows, and overall building management system to make the centre more energy efficient, weatherproof, and more resilient to present and future weather events.

The external works to the roof started in June 2021 and set to be completed by Spring 2022. The works will involve replacing the current shingles with new stainless-steel shingles, new insulation and a more heat resistant waterproof membrane. The roof will retain its iconic look but will be more robust in dealing with the ever-changing Glasgow climate, set to become even more changeable in the future.

Glasgow Science Centre is an iconic landmark for the city. The new roof design and the planned improvements to the windows and building management system will make the building more energy efficient and resilient in the face of our changing climate.

The venue one of Scotland's highest profile visitor centres and a significant educational resource for young people, this is particularly important with the centre's strong focus on the climate change agenda. Glasgow Science Centre will play a key role in demonstrating Scotland's ability to deliver innovative solutions to the climate crisis while also helping to facilitate a green recovery to the COVID19 pandemic.

7.8 Adaptation Intervention 8: Economy

We will work with our partners to raise awareness of climate change impacts among Glasgow's business community and to inform future planning of major events and attractions.

This will include:

a. **Working with a range of local economic development partners to ensure a proactive approach is taken to climate change adaptation. Ensuring businesses are able to take full advantage of the business opportunities offered by a changing local and global climate, including property retrofit and recovering from extreme events. Encouraging local production and markets to try to offset disruptions in global trade due to climate change impacts.**

7.9 Adaptation Intervention 9: Research and Evaluation

We will ensure ongoing monitoring, evaluation, and research to inform our decision-making on climate change adaptation.

This will include:

a. **Ensure ongoing monitoring, evaluation, and research to inform our decision-making on climate change adaptation action. Carrying out further research to enable options appraisal and cost benefit analysis of different adaptation responses. Acknowledging the gaps in our understanding about climate change impacts.**

b. **Collating key sets of evidence (flood risk maps, Urban Heat Island/coastal change info etc) and making these available to inform risk assessments and decision making. Work with SEPA to improve mapping of surface water flood risk.**

c. **Research design guidelines for increased temperatures. Consideration of the thermal comfort impact for people including the measurement of radient temperatures. Support and inform the development of planning policy to help reduce exposure and enhance ability to react (for example, affect building planning guidelines, shading, and density controls).**

7.10 Adaptation Intervention 10: Climate Justice and Just Resilience

We will ensure that the principles of Climate Justice and a Just transition are incorporated throughout our action to ensure we are building a fairer, more climate resilient city.

Climate Justice is an acknowledgment that those who contributed least to climate change, are also those who are now most vulnerable to its impacts.

Climate impacts are not equally distributed in the city. The Climate Risk and Vulnerability Assessment undertaken by Climate Ready Clyde evidenced that certain geographical areas of the city are more vulnerable to flooding and overheating while some of the most deprived areas of the city do not have easy access to good quality open space. This is further evidenced by Open Space maps resulting from an audit of the open spaces within Glasgow between 2007 and 2010, and also the health and social data dashboard, underpinning the Open Space Strategy.

In 2020, The Just Transition Commission published their recommendations for a Just Transition in Scotland. It stated that 'Scotland has an opportunity to use the transition to net-zero as a catalyst for building a fairer, healthier, greener country.'

Working with our community planning partners, Climate Ready Clyde, Sustainable Glasgow, Developing the Young Workforce Glasgow (DYW) and Chamber of Commerce we will aim to mitigate injustices that may arise as a result of climate change. We will also ensure that we capture opportunities to address existing health and economic inequalities, driving positive change that improves wellbeing. Glaswegians need to see and experience the transition to both a low carbon and resilient city as being fair and inclusive.

This will include:

a. **To equip people with the skills and education they need to benefit from action to make the city more climate resilient places. To equip people with knowledge and skills to understand what climate impacts such as flooding and increased temperatures mean for them and what they can do about it. Thus, empowering and invigorating our communities and strengthening local economies.**
To apply the lessons learned from Glasgow's COP 26 Climate Assembly across the development of all policies for tackling climate adaptation and support a green recovery.

b. **Work with community planning partners to deliver a just and green recovery from Covid 19 in collaboration with local communities. Work with Education Services on Learning for Sustainability Curricular entitlement to raise awareness of Climate Justice, its definition and local issues.**

c. **Through the City Development Plan and Liveable neighbourhoods plan, ensure that developers commit to creating communities that help build climate resilience.**

d. **Work with pension funds, including Strathclyde Pension Fund, and Local Credit Unions to support funding of climate adaptation action in the city. Support the delivery of the city's circular economy route map and champion frameworks that prioritise wellbeing over GDP as a measure of success.**

7.11 Adaptation Intervention 11: Raising Awareness

We will work with communities and stakeholders, including children and young people, across the city to improve awareness of climate impacts and solutions. This is essential to highlight and better understand key impacts such as flooding and increased temperatures, as well as ensure capacity building across organisations. This is an important step inclusive.

This will include:

a. **Develop and publish the Clyde and Loch Lomond Local Flood Risk Management Plan by December 2022.**

b. **Undertake a Glasgow City Council communications campaign to raise awareness of climate impacts and adaptation. Including flood risk, adaptation needs and options, as well as responsibilities for flooding.**

c. **Work with Glasgow STEM to highlight flood risk and risk of overheating in the Glasgow area. Working with Education Services on Learning for Sustainability Curricular entitlement to raise awareness.**

d. **Work with Scottish Government, Scottish Water and SEPA to improve guidance on blue-green infrastructure.**

7.12 Adaptation Intervention 12: Adaptation Maintenance

We will work with partners to ensure consideration of adaptation maintenance early on in project design and management processes. Thus ensuring that sufficient funding is **“built into”** projects to support long term adaptation maintenance and successful delivery.

This will include:

a. **Increase and ring-fence funding for maintenance of the drainage system (pipes and open watercourses) and blue-green infrastructure. Training in design and maintenance of blue-green infrastructure (including inspection during construction to reduce future maintenance).**

b. **Invest in ‘smart’ systems to gather data and inform emergency responses and maintenance needs (i.e., CCTV cameras at watercourses, level sensors, data gathering on flood events).**

7.13 Adaptation Intervention 13: Improved Response to Climate Events

A coordinated and strategic response to climate and weather events is essential if the city is to build resilient to current and future climate.

This will include:

a. **Working with key stakeholders – Scottish Water, Fire and Rescue Service, Police, SEPA, Scottish Flood Forum, neighbouring authorities, etc, to improve systems for reporting flooding and coordinating responses.**

8. Collaboration and Partnership working

The city council will continue to build on existing partnerships, strengthening our links and continuing our successful collaboration with the following organisations, programmes and initiatives across the city in order to embed Climate Adaptation across local policy and action.

Some of the key stakeholders involved in this process include:

- **Climate Ready Clyde**
- **Metropolitan Glasgow Strategic Drainage Partnership**
- **The Sustainable Glasgow Partnership**
- **Glasgow and Clyde Valley Green Network**
- **EU H2020 Project Connecting Nature**
- **EU H2020 Project RUGGEDISED**
- **The Glasgow Chamber of Commerce**
- **Glasgow Centre for Population and Health (GCPH)**
- **Glasgow Community Planning Partnership**
- **Clyde Mission**
- **Glasgow City Region City Deal**
- **SEPA**
- **Scottish Water**
- **Scottish Flood Forum**
- **Scottish Government**
- **NHS Greater Glasgow and Clyde**
- **Glasgow Caledonian University**
- **University of Glasgow**
- **University of Strathclyde**
- **Keep Scotland Beautiful**

9. Monitoring and Evaluation

The preparation of this plan is the start of a comprehensive approach towards the delivery of Climate Adaptation action. This will enable us to adapt the city to the impacts of climate change and future proof against projected climate impacts.

9.1 Timetable

The proposed timetable for the Plan includes the following milestones:

- **Approval of the draft plan by March 2022.**
- **Development of indicators for the Action Plan to show active progress towards achieving the below measures of success, including through progressing Adaptation Benchmarking as part of Climate Adaptation Capability Framework.**
- **Annual Action Plan updates to ESCR Committee, starting in 2023.**
- **Two-year review undertaken in 2024 and a full review of the Plan in 2030.**

9.2 Measures of success

The following measures will show how successfully the Plan is being implemented across the city:

- **Levels of technical capacity increase across the city to assess and respond to the risks of climate change.**
- **The extent to which climate change considerations are increasingly incorporated into high level policies, plans and practical programmes in priority impact areas.**
- **Growing evidence that implemented adaptation strategies are increasing citywide resilience to extreme weather events.**
- **The extent to which climate change adaptation strategies continue to reduce stress on vulnerable members of society.**
- **Growing evidence of engagement between the Council and its partners, citywide communities, local communities of interest, identity and place, non-governmental organisations and other levels of government on addressing climate change issues.**
- **The extent to which climate change adaptation is integrated into Glasgow's risk planning agenda and action plan.**
- **Increased level of public, staff and stakeholder awareness about climate change and its impacts, and support for actions to protect against climate change.**

9.3 Adaptation Benchmarking Assessment and Capability Framework

During 2020, the City Council held a series of internal capacity building and benchmarking assessment workshops. This was a collaboration between Sustainable Glasgow and Glasgow City Council Development Plan Teams.

This included an initial desktop exercise to gather baseline information to complete the starter pack templates. This also included an initial benchmarking exercise undertaken by a core internal working group and supported by Adaptation Scotland.

Evidence gathering was followed by a series of Benchmarking workshops, again supported by Adaptation Scotland. Three workshops were undertaken with: The Climate Change Officers Group, The Corporate Management Team and Elected Members. A completed record of the initial benchmarking process and outcomes provided using the toolkit provided by Adaptation Scotland is provided in Appendix D.

This process enabled capacity building across key staff on climate adaptation and climate impacts. This exercise also enabled validation of benchmarking and scoring, as well as a reflection on our current position and potential next steps, roles, and responsibilities.

As a result of the engagement outlined above, Glasgow City Council's current position in terms of maturity level (starting, intermediate, advanced, mature) for each of the four capabilities was agreed and illustrated in table 5 below.

More data is required in order to score each maturity level and prioritise actions supporting each Capability. This exercise will be repeated on an annual basis to reassess progress.

Table 5 - Adaptation Capability Framework

Adaptation Capability	Description	Maturity Level
1. Organisational Culture and Resources.	Resources, leadership, governance and reflection and flexibility	Starting
2. Understanding the Challenge	Knowledge, evidence, research and innovation.	Intermediate
3. Planning and Implementation	Strategic approach, appraisal and prioritisation, take action.	Starting
4. Working Together	Networks, partnership, engagement, and joint action.	Intermediate

APPENDIX A – Glasgow's Adaptation Action Plan

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 1: GOVERNANCE					
1A	Embed the governance of Adaptation measures in the forthcoming Glasgow Climate Board.	Work with elected members, area partnerships and local partners to mainstream adaptation across all policy areas. Help build capacity and understanding of local impacts of global climate change. Raise the profile of Climate Adaptation in the city, ensuring visibility and understanding of Adaptation requirements across city, our strategic priorities and operations.	Climate Adaptation is included as a workstream within the Glasgow Climate Board.	Glasgow City Council, Universities, Climate Ready Clyde, Sustainable Glasgow Partnership.	2022 (ongoing)
1B	Facilitate joint working across the city on climate change adaptation issues, policies, and projects.	Work through the Adaptation Benchmarking and Capability Framework, revisiting progress annually. Benchmarking Workshops to identify and develop adaptation capabilities.	Number of Plans and Policies that acknowledge Climate Adaptation and propose action Number of plans undertaking Climate Impact Assessment	Glasgow City Council, Universities, Climate Ready Clyde, Sustainable Glasgow Partnership.	2024 (ongoing)

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 1: GOVERNANCE					
1B	Facilitate joint working across the city on climate change adaptation issues, policies, and projects.	Develop a methodology to include young people in this process, working with Education improvement service and build on the work of the Children's climate charter Work with elected members, senior management and local partners to mainstream use of Capability framework and build capacity to adapt. Hosting internal and external regular meetings with elected members, officers and key partners, exchanging knowledge, and raising awareness. Highlighting best practice, which can be shared throughout the city and the city region.	Number of Plans and Policies that acknowledge Climate Adaptation and propose action Number of plans undertaking Climate Impact Assessment	Glasgow City Council, Universities, Climate Ready Clyde, Sustainable Glasgow Partnership.	2024 (ongoing)

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 1: GOVERNANCE					
1C	Include the local climate risks and vulnerabilities in Glasgow's Risk Register.	Undertake a Local Climate Risk and Vulnerability Assessment drawing on the existing high level risk assessment for the city council, the latest UKCCRA and Climate Ready Clyde's RVA.	Risk Register prepared including Climate risks and Vulnerabilities for the city council and city.	Glasgow City Council, Universities, Climate Ready Clyde, Sustainable Glasgow Partnership, Community Planning Partnership, Local Communities.	2022
1D	Collaborate with Sustainable Procurement to look at the role sustainable procurement can play in building a more climate resilient city.	Develop sustainable procurement guidance and estate asset management guidance.	Sustainable Procurement Guidance published.	Glasgow City Council, Corporate Procurement, Scotland Excel.	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 1: GOVERNANCE					
1E	Consider how best to gather and share data on the performance of existing SuDS.	Public sector, businesses and academia to consider how best to gather and share data on the performance of existing SuDS. Collate information from businesses and landowners who already have SuDS to provide data on maintenance and feedback in terms of performance. Draw on lessons learnt, and data collected as part of the EU H2020 Connecting Nature project.	Data and Reports published sharing findings and recommendations.	Glasgow City Council, Universities, Public Bodies, Businesses, SEPA, MGSDP, EU H2020 Connecting Nature Project.	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 1: GOVERNANCE					
1F	Building on tools developed as part of participation in the Connecting Nature and other projects such as NERC GALLAN to promote the implementation of nature-based solutions (NBS) across the city enabling climate resilience.	Identify potential funding opportunities for implementation of nature-based solutions (NBS). Gather and share data about ongoing NBS research in the city to help with natural capital accounting. Collate GIS data on NBS to provide better mapping of area wide risks and opportunities in terms of climate change. Delivery of the Open Space Strategy and local context documents.	Place based approaches using NBS for climate adaptive city.	Glasgow City Council, NatureScot, Greenspace Scotland, Universities	2024
1G	Consider the need for specific rates or fees for adaptation measures, to incentivise and fund adaptation action.	Examine existing and identify new and improved ways to incentivise retrofit of surface water management and natural cooling solutions. Identification of effective retrofit incentives.	Guidance to be developed and included City Development Plan.	Glasgow City Council, Scottish Government, Developers, MGSDP	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 1: GOVERNANCE					
1H	Consider whether one drainage authority or SuDS approval body to serve Glasgow and the City Region area would be beneficial.	Work with CaLL, MGSDP and Scottish Government to consider the benefits of establishing a City or Regional authority to better influence place-based action.	Publish report with findings and recommendations, and/or establishment of a regional drainage authority.	Glasgow City Council, Scottish Government, MGSDP, CaLL Universities	2024
1I	Continue to support Scottish Water's Surface Water Strategy and hierarchy of options.	Glasgow City Council to continue to work with MGSDP, CaLL and local communities to deliver Surface Water Management Plans and raise awareness of their purpose.	Surface Water Management Plans.	Glasgow City Council, MGSDP, Scottish Water	Ongoing
1J	Require all development to deliver flood risk net gain (similar to biodiversity net gain principle).	Glasgow City Council to continue Glasgow City Council Planning department to work with MGSDP and Scottish Government to identify the most effective approach and develop methodology. City Development Plan Guidance to include flood risk net gain as part of supporting supplementary guidance.	City Development Plan Guidance.	Glasgow City Council, MGSDP, Scottish Government, Developers	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 1: GOVERNANCE					
1L	Enable strategic delivery of adaptation solutions to facilitate future development (public sector investment with recovery through developer contributions).	Glasgow City Council to work with Climate Ready Clyde and Sustainable Glasgow Partners to identify opportunities to leverage Community Benefit Clauses. Adopting a strategic approach to developer's contributions to invest in climate adaptation solutions and greening the city.	To enable this via Procurement guidance .	Glasgow City Council, Sustainable Glasgow, Developers, NatureScot, Universities, Climate ready Clyde	2026
1M	Develop an adaptation pathway for the tidal River Clyde and wider Glasgow area for flood risk.	Glasgow City Council to work with Clyde Mission, Glasgow City Region and others.	Adaptation pathway developed and defined.	Glasgow City Council, Clyde Mission, Glasgow City Region	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 2: PLANNING AND HOUSING					
2A	Undertake a full analysis of the risks posed to our built environment from the impacts of climate change.	Glasgow City Council to work with Housing Associations, Climate Ready Clyde and Sustainable Glasgow to undertake an assessment of the risks and vulnerabilities climate change poses to the city's existing building stock, building on the Regional findings by Climate Ready Clyde. This will include; Building Condition surveys. Evaluating current building condition and influencing adaptation action across city stakeholders. Encouraging individuals and landlords to adapt their properties. Evaluating the ability of existing building stock to cope with extreme weather events.	Risk and Vulnerability Assessment and proposed action published.	Glasgow City Council, Climate ready Clyde, Universities, Sustainable Glasgow, Housing Associations, Residents, Businesses, City Building.	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 2: PLANNING AND HOUSING					
2B	City Development Plan to mandate green roofs for new or retrofit buildings over a certain m2 size threshold.	Work with Glasgow City Council, City Development Plan colleagues and developers to ensure that all new developments and drainage systems are 'climate ready' for future impacts, this includes flood risk reduction and natural cooling solutions, aligning with NPF4 and the next iteration of the City Development Plan. Require developers to include adaptation onto development projects, undertake sympathetic retrofitting measures for older buildings, and other measures such as incorporating green roofs, green walls and/or rainwater collectors on buildings where appropriate.	City Development Plan Guidance.	Glasgow City Council, MGSDP, NatureScot, Climate Ready Clyde, Sustainable Glasgow, Developers, Scottish Government, Universities.	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 2: PLANNING AND HOUSING					
2C	Implement requirements for property extensions and reduction of permitted development rights to control urban creep.	Glasgow City Council to work with residents to raise awareness and build capacity for reducing permitted development rights and developing policy guidance in relation to property extensions. The City Council and partners to align their approach with the Scottish Government's review of the Town and Country Planning (General Development Procedure) (Scotland) Order 1992.	Number of property extensions approved. Guidance published.	Glasgow City Council, Scottish Government, SEPA, Scottish Water	2024
2D	Incentivise (grant fund) property flood resilience (PFR) (means tested and up to a maximum level) in line with the CIRIA Code of Practice for PFR (C790).	Glasgow City Council to work with planners, residents, businesses, and developers to implement CIRIA Code of practice.	Grant fund established for property flood resilience.	Glasgow City Council, Scottish Government, Developers, Residents, Insurers	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 2: PLANNING AND HOUSING					
2E	Undertake strategic analysis of flood risk to move greenspace to areas of high risk and built development to areas of low risk.	Building on SEPA's flood maps, Open Space Strategy and EU H2020 Connecting Nature GIS mapping, move greenspace to areas of higher vulnerability. Delivery of Open Space Strategy.	Strategic analysis completed.	MGSDP, Glasgow City Council, Universities, Climate Ready Clyde, Greenspace Scotland, GCPH, NatureScot	2024
2F	Engage with Registered Social Landlords and the private developer sector to increase awareness of the need to deliver flood and heat resilient places.	Glasgow City Council to work with Housing Associations, developers and registered social landlords to build capacity and develop guidance to implement flood and heat resilient measures.	Number of landlords and Housing associations engaged.	Glasgow City Council, Housing Associations, Social Landlords, Developers	2024
2G	Require property basement conversions to undertake assessment of flood risk and the need for resilient design.	Development of supplementary guidance as part of CDP and aligned with NPF4. Communication and awareness raising.	Supplementary guidance as part of CDP.	Glasgow City Council, Scottish Government, MGSDP, Developers	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 2: PLANNING AND HOUSING					
2H	Ensure that opportunities for efficiencies through collaboration and trade-offs with climate mitigation programmes of work are identified and actioned – for example, home energy retrofit, and property flood resilience retrofit.	Enhanced multisectoral and multidisciplinary communication and collaboration enabling adaptation and mitigation trade off opportunities to be identified earlier on in the process – at design stage, leading to more efficient and cost-effective action to build adaptive capacity while also reducing carbon emissions, for example as part of LHEES programme and City Deal Projects such as the Metro and Housing retrofitting programme.	Number of adaptation and mitigation programmes acknowledging and addressing trade off opportunities.	Glasgow City Council, Scottish Government, MGSDP, Developers, Sustainable Glasgow, Climate Ready Clyde	Ongoing

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 3: SUSTAINABLE TRANSPORT					
3A	Work with partners across the city, including Liveable Neighbourhoods programme and City Deal/ City Centre Avenues to continue to retrofit green infrastructure onto existing streets and public spaces.	Demonstrate the value of nature-based solutions (NBS) across the city as outlined in the open Space Strategy. Accelerate investment in natural drainage and cooling solutions. (For example, through the development of rain gardens, permeable paving on pavements, paths, and roadways). Invest in the long-term maintenance of nature-based solutions and other climate adaptation interventions.	Number of NBS interventions included in City Deal/Avenues projects and Liveable Neighbourhoods Programme.	Glasgow City Council, Glasgow City Region City Deal, Developers	Ongoing

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 3: SUSTAINABLE TRANSPORT					
3B	Develop Climate Resilient Transport systems.	Glasgow City Council to work with Sustainable Glasgow Partners, SPT and Transport Scotland to understand the role of existing and future infrastructure in managing extreme weather events to protect property and businesses. Resolving barriers to implementing holistic flood risk management solutions including discharge of flood water onto roads and enhanced statutory powers for the Council. Influence public transport strategies, ensuring better connectivity across the city and ensuring climate proofed infrastructure, such as drainage, NBS for water attenuation, shading and cooling. Embedding adaptation solutions such as permeable surfaces, NBS as outlined in the Open Space Strategy, for cooling, shading and water attenuation onto future transport infrastructure development, active travel, roadworks, and repairs (ensuring that future adaptation interventions are not made too difficult.	Number of transport interventions including nature-based solutions.	Glasgow City Council, Sustainable Glasgow, Sustrans, Transport Scotland, SPT	2026

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 4: NATURAL ENVIRONMENT AND ASSETS					
4A	Increase planting of street trees and other blue-green infrastructure for their cooling effect, to reduce flooding through canopy capture and evaporation, and for improvement of solid drainage by their deep root structure.	Continue to work with MGSDP to promote natural flood management in catchment planning both within and outwith GCC boundary. Continue to learn from the tools developed and data gathered as part of the EU H2020 Connecting Nature project to improve natural features in urban environments to assist adaptation (for example, through creation of habitat connectivity, reduce heat gain and slow the movement of rainwater drainage into the urban drainage system). Delivery of Open Space Strategy, associated Play Sufficiency Assessment and Forestry and Woodland Strategy.	Number of NBS interventions in the city.	Glasgow City Council, MGSDP, Climate ready Clyde, Glasgow City Region/City Deal, Sustainable Glasgow, NatureScot, GCVGN, GAT.	Ongoing

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 4: NATURAL ENVIRONMENT AND ASSETS					
4B	Management of nature conservation sites to take account of a changing climate, and to consider the placement of these sites in the wider ecological network.	Managing species conservation priorities to take account of a changing climate. Reducing pressures on habitats vulnerable to climate change.	Number of sites in positive management.	Glasgow City Council, NatureScot, RSPB, GCVGN, GAT	Ongoing
4C	Promoting ecological connectivity to assist in species movement in response to climate change, and as a means of building larger, resilient species populations and habitats.	Accelerate the delivery of the Local Biodiversity Plan and Open Space Strategy.	Quantification of Biodiverse green and blue corridors (square metres)	Glasgow City Council, NatureScot RSPB, GAT, GCVGN	2026
4D	Develop a programme to facilitate and incentivise a reduction in existing impermeable surfacing through ‘de-pave’ activities.	Work with developers and residents to raise awareness of the impact of impermeable surfaces on flood risk management and natural environment. Develop guidance to facilitate de-pave activities in the city. Establish and promote a programme for ‘de-paving’ activities and increasing permeability in the city.	Quantification of the amount of permeable surface in the city (square metres)	MGSDP, NatureScot, Glasgow City Council, Developers, Communities, Area Partnerships	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 5: HEALTH AND WELLBEING					
5A	Ensuring climate change adaptation is incorporated into all Glasgow's community planning processes.	Glasgow City Council and city organisations work in partnership with communities to ensure climate change impacts are minimised for residents, especially the most vulnerable. Ensuring the engagement of all Glasgow's citizens in the process.	Community Action Plan and Local Place Plan includes explicit reference to Climate Adaptation.	Glasgow City Council, Community Planning Partnership, Area Partnerships, MGSDP, Sustainable Glasgow, Climate Ready Clyde	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 6: ENVIRONMENTAL HEALTH					
6A	Ensuring the Air Quality Action Plan reflects a growing understanding of the interrelationship between climate change and local air quality.	Continue to work with Glasgow City Council colleagues on building our collective understanding of the links between climate change and air quality. Continue to implement the city's LEZ and reporting on improvements as well and lessons learnt.	Air Quality Action Plan includes references to Climate adaptation action.	Glasgow City Council, GCPH, Transport Scotland, NHSGG&C, Public Health Scotland	2023
6B	Ensuring the impacts of climate change are taken into consideration when developing actions to improve water quality.	Glasgow City Council to work with SEPA and Scottish Water to understand how increase in river water temperatures, more intense rainfall and flooding can affect the quality of the water locally and use evidence to inform decision making.	Water quality levels.	Glasgow City Council, SEPA, Scottish Water, MGSDP, NatureScot	2030

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 6: ENVIRONMENTAL HEALTH					
6C	Ensuring the threat of a rise in pests and diseases due to climate change is fully understood, and that pest and disease control services are prepared to meet potential increased demand for their services.	Work with Glasgow City Council Environmental health and city organisations to build our collective understanding of the impacts of climate change upon pests and diseases, existing solutions and building capacity to address potential additional pressures. Raise awareness of the potential environmental health risks of climate change and ensuring the engagement of all Glasgow's citizens in this process.	Incidence of pests and disease.	Glasgow City Council, Scottish Government, Public Health Scotland	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 7: RISK PLANNING					
7A	Undertake a citywide climate risk assessment.	Incorporate the recommendations of the latest UK Climate Change Risk Assessment published in 2021 and findings from Climate Ready Clyde's Risk and Vulnerability Assessment for the City Region. Work with local stakeholders and communities to assess and validate key findings and publish findings, revisiting the assessment every 5 years.	City Climate Risk and Opportunity Assessment Published.	Glasgow City Council, Universities, Sustainable Glasgow, Climate Ready Clyde, Community Planning Partnership, Emergency Services, MGSDP	2023
7B	Work with key stakeholders, including Scottish Water and SEPA, to improve flood forecasting and warning systems.	Collaborative analysis of existing forecasting systems and consider alternatives.	New or improved flood warning system.	Glasgow City Council, MGSDP, Scottish Water, SEPA	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 7: RISK PLANNING					
7C	Identify areas of high flood risk where planned surface storage of floodwater is linked to a flood warning system in order to mitigate risk to parked vehicles.	Collaborate with SEPA, Scottish Water, and MGSDP to understand areas of high risk and align with relevant flood warnings. Align action with the Open Space Strategy delivery plan - using open space and Vacant and Derelict Land for flood mitigation.	Ensure flood warning system includes risk to parked vehicles.	Glasgow City Council, MGSDP, Scottish Water, SEPA, Transport Scotland	2026
7D	Increase the conveyance capacity of the drainage system at critical points where blue-green infrastructure is not sufficient to manage flood risk to an acceptable level. This may include the construction of new drainage conduits.	Build on work of the British Geological Survey in relation to surfaced planning and sub surface water storage and geothermal opportunities. Develop and understanding of areas where blue-green infrastructure is not sufficient to manage flood risk and add capacity through the construction of new drainage infrastructure such as conduits.	Capacity of the drainage system.	Glasgow City Council, MGSDP, Scottish Water, SEPA	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 8: ECONOMY					
8A	Work with a range of local economic partners to ensure a proactive approach is taken to climate change adaptation, through Implementation of Glasgow's Green Deal.	Work with city stakeholders to raise awareness of climate change impacts among Glasgow's business community and to inform future planning of major events and attractions. Ensure businesses are able to take full advantage of the opportunities offered by a changing local and global climate. Encouraging local production and markets to offset disruptions in global trade due to climate change impacts.	Number of business adaptation plans.	Glasgow City Council, Glasgow Economic Leadership Board, Glasgow Chamber of Commerce, Glasgow City Marketing Bureau	2025

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 9: RESEARCH, MONITORING AND EVALUATION					
9A	Ensure ongoing monitoring, evaluation, and research to inform our decision-making on climate change adaptation action.	Continue to review climate risk and vulnerability for the city and the council's critical service delivery. Assess progress in relation actions annually. Continue to revisit adaptation benchmarking to develop adaptation capabilities from existing baseline.	Annual progress report.	Glasgow City Council, Sustainable Glasgow, Climate Ready Clyde, Universities	Annual
9B	Ensure ongoing monitoring, evaluation, and research to inform our decision-making on climate change adaptation action.	Acknowledge the gaps in our understanding about climate change impacts. Carry out further research to enable options appraisal and cost benefit analysis of different adaptation responses. Work with SEPA to improve mapping of surface water flood risk. Share data and evidence with policy makers, communities and businesses in the city to mainstream climate adaptation action across the city.	Evidence reports and GIS mapping.	Glasgow City Council, MGSDP, SEPA, Universities, Sustainable Glasgow, Climate Ready Clyde	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 9: RESEARCH, MONITORING AND EVALUATION					
9C	Research design guidelines for increased temperatures.	Guidelines for planners to adapt in built form (form-based guidelines). Consideration of the thermal comfort impact for people including the measurement of radient temperatures. Support and inform the development of planning policy to help reduce exposure and enhance ability to react (for example, affect building planning guidelines, shading, density controls).	Research findings and recommendations published.	Glasgow City Council, Glasgow Caledonian University	2023

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 10: CLIMATE JUSTICE AND JUST RESILIENCE					
10A	Equip people with the skills, knowledge and understanding they need to benefit from and take adaptation action to make the city a more climate resilient place.	Equip people with knowledge and skills to understand the risk associated with climate impacts such as flooding and increased temperatures; what it means for them and what they can do about it. Thus, empowering and invigorating our communities and strengthening local economies. Apply lessons learned from Glasgow's COP 26 Climate Assembly across the development of all policies for supporting climate adaptation and a green recovery.	Level of awareness of local Climate Impacts. Number of stakeholders engaged.	Glasgow City Council, Community Planning Partnership, Education Services, Skills Development Scotland	2025
10B	Work with community planning partners to deliver a just and green recovery from Covid 19 in collaboration with local.	Work with communities to help protect residents' property from damage from climate change impacts through awareness raising and community action.	Level of community engagement. Number of stakeholders engaged.	Glasgow City Council, MGSDP, Climate Ready Clyde, Sustainable Glasgow, Community Planning Partnership	2026

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 10: CLIMATE JUSTICE AND JUST RESILIENCE					
10C	Ensure that developers commit to creating communities that build climate resilience, through the City Development Plan and Liveable neighbourhoods plan.	Work with developers and communities to incentivise the creation of climate resilient communities, including active travel connectivity, proximity to good quality open space and green infrastructure.	Proportion of neighbourhoods at risk of flooding and overheating.	Glasgow City Council, MGSDP, Climate Ready Clyde, Sustainable Glasgow, Universities	2025
10D	Work with Strathclyde Pension Fund and Local Credit Unions to support funding of climate adaptation action in the city.	Work with Credit Unions and Strathclyde Pension Fund to understand how their investments can be localised to fund nature-based solutions and other adaptation programmes which can provide a return on their investment and added benefits in relation to community resilience to climate change and improved health and wellbeing.	Proportion of investments in local adaptation projects.	Glasgow City Council, Glasgow Credit Union, Strathclyde Pension Fund, Glasgow Economic Leadership Board	2028

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 11: RAISING AWARENESS					
11A	Develop and publish the CaLL Local Flood Risk Management Plan (LFRMP).	Continue to work with CaLL partners to develop the LFRMP.	Level of community engagement.	CaLL partners, MGSDP, Scottish Government, SEPA, NatureScot	2022
11B	Undertake a Communications Campaign on flood risk, adaptation needs and options. This must highlight the need for action and responsibilities for flooding – noting that in Scotland it is the owner's responsibility to protect a property from flooding.	Capacity building across the city to ensure wider understanding of the purpose and importance of Climate Adaptation, including understanding of capabilities, risks and solutions. Raise understanding of interventions such as SuDs, Nature Based Solutions, Woodland creation and other climate adaptation measures. Ensuring that designs of built environment account for projected changes in climate and weather patterns.	Level of community engagement.	Glasgow City Council, MGSDP, Climate Ready Clyde, Sustainable Glasgow. Leadership Board	2023

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 11: RAISING AWARENESS					
11C	Develop practical guidelines on individual climate resilience.	To produce practical and positive guidance on how Glaswegians can make their homes more climate ready. Ranging from flood alleviation, to energy efficiency and natural cooling solutions (focussing on the personal, social, and financial benefits of taking action). Produce information on health and economic benefits of adaptation action. Improve Individual and community knowledge and understanding. Encourage and support individual resilience.	Guidelines developed and published.	Glasgow City Council, MGSDP, GCVGNT, CRC, Emergency Services, GSA and Other academic institutions, Housing Associations	2024
11D	Work with Glasgow STEM to highlight flood risk in the Glasgow area.	Work with Education Services and young people in the city to raise awareness and build capacity about the risk of flooding, potential solutions, roles, and responsibilities.	Proportion of schools engaged.	Glasgow City Council, MGSDP, CaLL, STEM, Skills Development Scotland	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 11: RAISING AWARENESS					
11E	Work with Scottish Government, Scottish Water and SEPA to improve guidance on blue-green infrastructure.	Glasgow City Council to engage with Scottish Government, Scottish Water and SEPA as part of NPF4 to develop improved and consistent guidance on blue and green infrastructure. Aligning with a Place Based Approach to Nature Based Solutions.	Guidance developed and published.	Glasgow City Council, Scottish Government, SEPA, Scottish Water, MGSDP.	2025

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 12: ADAPTATION MAINTENANCE					
12A	Funding to support long term adaptation maintenance in citywide projects.	Assessment of life cycle costs for climate adaptation measures including maintenance and securing the necessary capital and revenue funding. Increase in ring-fenced funding for maintenance of drainage systems (pipes and open watercourses) and blue-green infrastructure. Training in design and maintenance of blue-green infrastructure (including inspection duration construction to reduce future maintenance).	Proportion of projects or interventions allocating funding to long term maintenance.	Glasgow City Council, Scottish Government, Sustainable Glasgow, Climate Ready Clyde.	2024
12B	Invest in 'smart' systems to gather data and inform emergency responses and maintenance needs.	Work with partners to identify locations and install CCTV cameras at watercourses, level sensors, data gathering on flood events.	Weather events data recorded.	Glasgow City Council, Scottish Government, Sustainable Glasgow, Climate Ready Clyde, SEPA, Scottish Flood Forum	2024

APPENDIX A – Glasgow's Adaptation Action Plan continued

NO.	ACTION	DESCRIPTION	KEY PERFORMANCE INDICATORS	PARTNERS	TIMESCALE
ADAPTATION INTERVENTION 13: IMPROVE RESPONSE TO CLIMATE EVENTS					
13A	Creation of a coordinated and strategic response to climate and weather events.	Work with key stakeholders: Scottish Water, Fire and Rescue Service, Police, SEPA, Scottish Flood Forum, neighbouring authorities, to improve system for reporting flooding and coordinating responses.	Level of response to weather events	Glasgow City Council, SEPA, Police Scotland, SFRS, Scottish Flood Forum	2024

APPENDIX B – Key climate Risks for the City Region – Climate Ready Clyde

Some of the key risks highlighted by the **Risk and Opportunity Assessment for the City Region** are summarised in the table below. The full Climate Risks and opportunity assessment for Glasgow City Region was published by Climate Ready Clyde in 2019.

SECTOR	KEY RISKS AND OPPORTUNITIES
Infrastructure	Infrastructure interdependencies – risks of cascading and converging failures. Risks to infrastructure from river, coastal and surface water flooding, coastal erosion and storminess – including certain sections of railway on the North Banks of the Clyde, trunk road network and the Erskine bridge. Emerging risks of heat to transport, ICT and energy infrastructure, and risks of wildfires. Increased vegetation growth affecting rail lines, power lines. Risks to water-based trade and travel infrastructure – including ports, canals and harbours from sea level rise, flooding and storms.
Built Environment	An increasing risk to homes as a result of flooding and sea level rise, and new developments could be locking in further risk. More ongoing impacts to our buildings from repairs and maintenance due to storms and high winds. Changes to heating and cooling demands of our buildings – risks of overheating, but also less heating demand in winters. Risks to cultural heritage, with particular risks for Newark Castle and Dumbarton Castle as well as wider buildings at risk, scheduled monuments Increased maintenance requirements for green space from longer growing season and enhanced use. Minor positive elements – rising temperatures will contribute to reduced fuel poverty, ambitions for food growing and renewables viability.

APPENDIX B – Key Climate Risks for the City Region – Climate Ready Clyde continued

SECTOR	KEY RISKS AND OPPORTUNITIES
Economy, Business and Industry	Increasing business disruption due to extreme weather events, flooding, coastal erosion, and sea level rise – to businesses and SEILs. Disrupting wider supply chains and business productivity. Impacting business productivity due to water scarcity. Increasing tourism related opportunities Providing opportunities for developing new products and services to support adaptation
Society and Health	Direct impacts on people's health and wellbeing – through exposure to flooding, heatwaves as well as interaction with air quality, and pests and pathogens. Potential to increase health inequalities – flooding not experienced equally Impacts will change the pattern of demand on NHS services and social services due to morbidity and mortality from extreme weather, and gradual change Affecting the performance of health and social care services – through direct impacts of flooding but also disruption through extreme weather events.

SECTOR	KEY RISKS AND OPPORTUNITIES
Natural Environment	Depleting soil stock and reduced soil function from changes in temperature and water regime. Changing land suitability for forestry and agriculture. . Ocean acidification will make our seas less hospitable for marine life, particularly those with calcium carbonate shells or skeletons. As sea levels rise, coastal habitats and landforms such as beaches, saltmarshes and mudflats will be significantly altered and/or may disappear due to coastal erosion. Rising water temperatures in rivers, lochs and the sea will affect the suitability of the habitat for some species. Altered plant communities and habitats from changing temperature and rainfall patterns Impacts of extreme weather events on industries closely linked to the natural environment. Wildlife will also struggle to adapt to an increasingly erratic and extreme weather system. Potential for new invasive and non-native terrestrial and aquatic species. Risks to nationally and internationally important geo-heritage sites due to flooding and erosion, and coastal, vegetation, freeze-thaw and rainfall change.
International, cross cutting and adaptive capacity issues	Glasgow City Region faces the same set of international risks and opportunities as the rest of the UK, relating to trade, food, and human displacement. Potential to be affected by failure to manage national/UK risks as well. Many actions could offer the potential for addressing wider societal challenges, including health and wellbeing, carbon reduction, and air quality or by working to bring around wider transformation. Social justice implications, requiring explicit acknowledgement and consideration from ethical, legal and practical perspectives. Effective adaptation needs continued strategic leadership and direction, as well as adequate funding for implementation. Threatened by no clear replacement for EU funding for delivery.

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s)

The Table opposite details a climate risk assessment for the city council, and it follows Glasgow City Council's standard risk assessment method: I x P = risk.

These risks were defined based on an initial qualitative assessment by the Sustainable Glasgow team and validated through internal sectoral workshops:

I = impact:
5 = catastrophic; 4 = major; 3 = moderate;
2 = minor; 1 = insignificant.

P = Probability:
5 = almost certain (>90%); 4 = likely (>70%);
3 = possible (<50%); 2 = unlikely (<30%); 1 = rare (< 10%).

This was defined as the probability of the climate impact occurring in the first instance, not the probability of the Impact occurring as scored

Attached to each predicted impact are relevant organisations and existing or planned policy that have the potential to address the risks identified.

PROBABILITY							
	Almost certain	5	5	10	15	20	25
	Likely	4	4	8	12	16	20
	Possible	3	3	6	9	12	15
	Unlikely	2	2	4	6	8	10
	Rare	1	1	2	3	4	5
			1	2	3	4	5
			Negligible	Minor	Moderate	Major	Critical

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
PROPERTY AND HOUSING						
Warmer Slightly Drier Summers	Increase energy consumption for cooling	4	3	12	GCC, SG, Utilities	ECM, LHEES, HS, CDP
	Increase in energy poverty	4	4	16	GCC, Registered Social Landlords,	HS/CDP
	Increased pest infestations and vermin	5	4	15	GCC, Private pest control	Public Health Act
	Overheating of buildings and public realm	4	3	12	GCC, GCVGN, CP, GCU, CBGN	CRC, CP, CDP
	Increased bio productivity promotes growth of problem species for example, buddleia, Himalayan balsam	5	3	12	GCC, NATURESCOT, SEPA	LBAP

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
PROPERTY AND HOUSING						
	Increased water demand	5	2	10	SW, MGSDP – GCC, SEPA, Regional Las, GCVGN	MGSDP, CDP, CP, CRC
	Damage to buildings/ fittings due to subsidence and heave	3	3	9	GCC, SFR, Insurers	Building control
Wetter Warmer Winters (decadal timescale)	Building damage	5	4	20	GCC, SFR, Insurers	Building control
	Dampness/mould issues increase	5	3	15	GCC	
	Increased pest infestations and vermin	4	3	12	GCC	Environmental Health
	Change in end use for energy (reduced for heating but increased for drying)- seasonal	5	2	10	GCC, Utilities	ECM

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
PROPERTY AND HOUSING						
Severe Weather Events: Extreme Rainfall, Wind and Heatwaves	Building damage	5	3	15	GCC, SFR, Insurers	Building control
	Increased vulnerability of key heritage and cultural assets to damage	5	3	15	Historic Environment Scotland, GCC, GL, NTS	CDP, SG9 – Our Historic environment
	Increased insurance costs due to building and infrastructure damage	5	4	20	GCC, Association of British Insurers	
	Increased incidence of inundation and flood damage	5	3	15	GCC	Civil Contingencies Act Flood Risk Management Plan, Local Flood Risk Management Plan, SG08
	Change in end use for energy (reduced for heating but increased for drying) - daily	5	2	10	GCC, Utilities, SG	CDP, ECM, LHEES

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
PROPERTY AND HOUSING						
Sea Level Rise	Damage to tidal weir, quay walls and coastal defence infrastructure.	4	4	16	GCC, MGSDP, RU	MGSDP, CDP, RP, Clyde Marine Planning Partnership
	Flooding/damage to coastal property and possible loss of property value.	2	4	8	GCC - Insurance, Insurers (Private Property)	Check MGSDP
	Increased vulnerability to storm surges.	1	4	4	GCC – Insurance, MGSDP	

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
LAND USE						
Warmer Slightly Drier Summers	Overheating of Buildings	4	3	12	NHS, BREEAM, RES,	CDP, LHS, LHEES, NPF4
	Pressure from increased tourism and recreation demand.	3	2	6	NHS, VS, TS, GMB	CDP, GMB, OSS, FWS
	Lack of Green Network and connectivity threatening habitats and wildlife populations.	4	3	12	NHS, GCC- NRS, GCVGN, CP	CDP, OSS, LBAP, FWS, NPF4
	Enabling policy to increase Green Network and connectivity so that wildlife can better adapt to the changeing climate.	5	5	25	GCC - NRS, GCVGNT, GAT	LBAP, GCVGN Blueprint

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
PLANNING						
Severe Weather Events: Extreme Rainfall, Wind and Heatwave	Guidance to ensure that new developments can withstand, increased rainfall, more intense rain, high winds and flooding from surface water.	5	4	20	NHS, SQHR, BREEAM, RES	CDP
	Strategic planning response to ensure increased rainfall intensity will result in changes and improvements in the fresh and waste water infrastructure system.	5	3	15	MGSDP	MGSDP
	Improvements to flood risk areas such as, improved drainage systems and coastal defences to reduce flood risks.	5	4	20	MGSDP	MGSDP
	Disruption to transport – minimise need to travel.	5	4	20	NHS, NHS – Transport	TS

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
LAND USE PLANNING						
Severe Weather Events: Extreme Rainfall, Wind and Heatwave	Disruption to services – decentralise provision of energy and water supplies.	**5**	**3**	**15**	NHS, CMT, SG, SW, Energy providers	ECM, CDP, ES
	Need to develop more innovative building materials and designs to climate proof buildings and infrastructure.	**5**	**3**	**15**	NHS, CMT, BREEAM, RES	CDP
Sea Level Rise	Need to adapt coastal developments to adapt to flooding.	**5**	**4**	**20**	MGSDP	CDP
	Local Development Plans must reflect the impact of long-term sea-level rise.	**5**	**3**	**15**	NHS, MGSDP	CDP, MGSDP

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
BIODIVERSITY AND OPEN SPACE						
Warmer Slightly Drier Summers	Vegetation damage due to heatwaves, need for additional watering facilities across open and green spaces.	4	2	8	NRS – Parks, SFR, RU, NHS	POSS, CDP, CCP, MGSDP
	Damage to river and wetland ecosystems.	4	3	12	NHS, VS, TS, GMB	CDP, CCS
	Reduced water quality.	4	2	8	SEPA, SW, MGSDP	
	Increased fire risk.	4	3	12	RU, SFR, PS, NHS	
	Longer growing seasons.	5	3	15	NRS – ROADS AND PARKS, AMEY, TS, NR	
	Species and habitat stress.	4	3	12	NRS – BIODIVEHSITY, NATURESCOT, GCVGN	
	Introduction of new species.	4	3	12	NRS – BIODIVERSITY, PARKS, PUB HEALTH, NATURESCOT	
	Damage to tree roots – subsidence and heave.	4	3	12	NRS – PARKS, ROADS, FACILITIES, NHS – BC, CDP	GOSS, TS, MGSDP, CDP

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
BIODIVERSITY AND OPEN SPACE						
Milder Wetter Winters (decadal timescale)	Habitat changes.	4	4	20	NRS-BIODIVERSITY/ PARKS, NATURESCOT, NHS, GCVGN	LBAP, GOSS, CDP, CP
Severe Weather Events; Extreme Rainfall, Wind and Heatwaves	Damage to vegetation and trees.	4	3	12	NRS –PARKS, BIODIVERSITY, TS, SPT, NATURESCOT, GCVGN, SEPA	CP, GCVGN, CDP, NATURESCOT, TS
	Mature trees liable to be blown down during storms, potential to cause injury and infrastructure damage, traffic accidents and road closures.	3	4	12	NRS – PARKS, ROADS, TS, SPT, NATURESCOT, GCVGN, SEPA	
	Deterioration of public parks.	3	4	12	NRS –PARKS, BIODIVERSITY, TS, SPT, NATURESCOT, GCVGN, SEPA	CDP
	Increased soil erosion and land instability resulting in increased risk of landslides and accelerated coastal erosion.	3	3	9	NRS – PARKS/ BIODIVERSITY, SEPA, NATURESCOT, MGSDP	MGSDP, CDP,

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
ENVIRONMENTAL AND COMMUNITY HEALTH AND WELLBEING						
Warmer Slightly Drier Summers	Changes in incidence of vector borne diseases.	4	3	12	GCC –NRS (Env Health and Public Health) NHS, GGC, GCPH	Environmental Health NHS Health Protection Scotland
	Increased risk of heat stroke, dehydration and respiratory problems.	5	4	20	NHS, GCC, GCPH	
	Increased incidence of food poisoning.	5	4	20	GCC, NHS, GGC	
	Reduced water quality – river and standing water.	5	5	25	NHS, BREEAM, RES	CDP, LHS, LHEES, NPF4
	Increase in air particulates leads to worsening air quality.	5	4	20	GCC – Air Quality, SEPA Strathclyde, Glasgow and Caledonian Universities	LAQAP

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
ENVIRONMENTAL AND COMMUNITY HEALTH AND WELLBEING						
Wetter Warmer Winters (decadal timescale)	Increased risk of mould and fungal illness with associated respiratory diseases.	4	4	16	GCC, NHSGCC Strathclyde, Glasgow and Caledonian Universities	
	Higher levels of air pollution when there is no wind.	2	3	6	GCC-AIR QUALITY Strathclyde, Glasgow and Caledonian Universities	LAQAP
Severe Weather Events; Extreme Rainfall, Wind and Heatwaves	Safety and public health risks increase.	4	4	16	Emergency Planning and Emergency responders: GCC, NHSGCC, Police, Fire and Rescue; Community and Safety Services	Community Risk Register and Emergency Plan
	Disruption to essential community services for vulnerable persons.	4	4	16	GCC-Social Services; CORDIA; Community and Safety Services	CPP LOIPS

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
ENVIRONMENTAL AND COMMUNITY HEALTH AND WELLBEING						
Severe Weather Events; Extreme Rainfall, Wind and Heatwaves	Long term and chronic mental health issues as a result of reoccurring property flooding.	**5**	**3**	**15**	GCC - Social Services and NHS GGCGCPH	CPP LOIPSn
	Increase in poverty and homelessness cases.	**4**	**4**	**16**	GCC – Social Services; Housing; Financial Services Quarries etc)	CPP LOIPS
	Increased risk of social exclusion.	**5**	**3**	**15**	GCC – Social Services; Housing; Financial Services; Voluntary Sector (Shelter, Quarriers etc) GCPH	LAQAP
	Exacerbation of existing socio-economic inequalities.	**5**	**3**	**15**	GCC – SW, Housing, Financial Services; LAHs; Voluntary Sector (Shelter, Quarriers etc) GCPH, Economic Development	

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
ENVIRONMENTAL AND COMMUNITY HEALTH AND WELLBEING						
Sea Level Rise	Long term and chronic mental health issues.	3	3	9	GCC - Social Services and NHS GGC, GCPH	CPP LOIPs
	Increase in poverty and homelessness cases.	2	3	6	GCC – Social Services; Housing; Financial Services; Voluntary Sector (Shelter, Quarriers etc)	CPP LOIPs
	Increased risk of social exclusion.	2	3	6	GCC – Social Services; Housing; Financial Services; Voluntary Sector (Shelter, Quarriers etc) GCPH	CPP LOIPs
	Exacerbation of existing socio-economic inequalities.	3	3	9	GCC – SW, Housing, Financial Services; LAH'S; Voluntary Sector (Shelter, Quarriers etc) GCPH, Land Use Planning	

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
CLEANSING AND WASTE SERVICES						
Warmer Slightly Drier Summers	Changes in incidence of vector borne disease.	3	3	9	GCC-NRS and NHSGGC	
	Increased infestations and vermin.	4	3	12	GCC-NRS (Pest Control)	Environmental/ Public Health
	Increase in odour issues and associated public complaints.	5	3	15	GCC-NRS	
	Greater green waste volumes caused by increased bio productivity.	3	4	12	GCC-NRS Private waste collection operators	Recycling Plan Regional/area plans, National targets for Scotland
Wetter Warmer Winters (decadal timescale)	Increase in infestations and vermin.	3	3	9	GCC - NRS	Public Health
	Potential for leachate to escape from landfills and contaminate land.	5	3	15	GCC-NRS (waste services) NRS – Geotechnical	Geotechnical
	Increase in flooding issues with cemeteries and burials.	4	4	16	GCC-NRS	

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
CLEANSING AND WASTE SERVICES						
Severe Weather Events: Extreme Rainfall, Wind and Heatwaves	Loss of workdays.	5	3	15	GCC (all), Chamber of commerce	
	Disruption to transport networks and supplies.	5	4	20	GCC NRS, NRS; SPT; Chamber of commerce	
	Increase in public complaints.	5	3	15	GCC – CBS PR Equivalent in other organisations	
	Increase in reputational risks.	5	3	15	GCC – CBS PR Equivalent in other organisations	

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
CLEANSING AND WASTE SERVICES						
Warmer Slightly Drier Summers	Changes in incidence of vector borne disease.	3	3	9	GCC-NRS and NHSGGC	
	Increased infestations and vermin.	4	3	12	GCC-NRS (Pest Control)	Environmental/ Public Health
	Increase in odour issues and associated public complaints.	5	3	15	GCC-NRS	
	Greater green waste volumes caused by increased bio productivity.	3	4	12	GCC-NRS Private waste collection operators	Recycling Plan Regional/area plans National target for Scotland
Sea Level Rise	Loss of recycled materials.	4	3	12	GCC – NRS; SEPA	
	Increased insurance and repair costs	4	2	8	GCC – Finance/ Claims Insurers	
	Increased vulnerability of landfill sites and risk of contaminated land.	2	2	4	GCC- NRS (Geotechnical services)	

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
ECONOMY						
Warmer Slightly Drier Summers	Higher demand for outdoor events.	5	4	20	GCC LES – Parks, Corporate Resilience unit, Glasgow Life, GCMB, Police, Fire and Rescue, NHS GGC	Parks and Open Spaces Strategy, Community Risk Register
	Increased staff health and safety risks associated with heat.	4	3	12	GCC all NHS GGC	
	Heat stress to service provision.	4	2	8	GCC – Resilience Unit and Risk Managers	
	Closure of water dependent leisure activities and events.	4	3	12	GCC Parks, Education services, Glasgow life, colleges and universities	Parks and Open Space Strategy
	Higher demand for outdoor recreational space.	5	2	10	GCC Parks, Glasgow life, colleges and universities	Parks and Open Space Strategy

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
ECONOMY						
Wetter Warmer Winters (decadal timescale)	Changes in demand for weather related goods or services.	4	2	8	GCC, Chamber of Commerce? Glasgow Economic Partnership?	Glasgow Economic Strategy?
Severe Weather Events: Extreme Rainfall, Wind and Heatwaves	Cancellation or disruption of events.	5	3	15	GCC Parks/ events, Glasgow Life, GCMB	Parks and Open Spaces Strategy
	Loss of workdays.	5	3	15	Glasgow Economic Partnership, Chamber of Commerce, GCC	
	Disruption to transport networks and supply chains.	5	4	20	SPT, GCC, Glasgow Economic Partnership, Chamber of commerce	Transport Strategy

APPENDIX C – Climate Change Impact Assessment for Glasgow City Council (2030s -2050s) continued

CLIMATE HAZARD	CLIMATE IMPACT	LIKELIHOOD	IMPACT	RISK	RELEVANT ORGANISATIONS	RELEVANT POLICIES
ECONOMY						
Warmer Slightly Drier Summers	Higher demand for outdoor events.	5	4	20	GCC LES – Parks, Corporate Resilience unit, Glasgow Life, GCMB, Police, Fire and Rescue, NHS GGC	Parks and Open Spaces Strategy, Community Risk Register
	Increased staff health and safety risks associated with heat.	4	3	12	GCC all NHS GGC	
	Heat stress to service provision.	4	2	8	GCC – Resilience Unit and Risk Managers	
	Higher insurance claims and repair costs.	5	4	15	Insurers, Glasgow economic Partnership, Chamber of commerce	G Economic Strategy, City Centre Strategy
	Loss or damage to land and infrastructure.	5	4	20	GCC, SEPA, Insurers?	LDP/ MGSDP? /Economic Strategy?
Sea Level Rise	Loss or damage to land and infrastructure.	4	3	12	GCC, SEPA, Insurers?	MGSDP; Economic Strategy

Adaptation Risk Assessment Glossary

BREEAM	Building Research Establishment's Environmental Assessment Method https://www.breeam.com
CPP	Community Planning Partnership
GAT	Green Action Trust
GCC	Glasgow City Council https://www.glasgow.gov.uk
GCHSCP	Glasgow City Health and Social Care Partnership https://glasgowcity.hscp.scot
GCPH	Glasgow Centre for Population Health
GCVGN	Glasgow and Clyde Valley (GCV) Green Network https://www.gcvgreennetwork.gov.uk
GL	Glasgow Life https://www.glasgowlife.org.uk
GMB	Glasgow Marketing Bureau
HES	Historic Environment Scotland https://www.historicenvironment.scot
HSCP	Health and Social Care Partnership https://glasgowcity.hscp.scot
LDP	Local Development Plan
MGSDP	Metropolitan Glasgow Strategic Drainage Partnership https://www.mgsdp.org
NATURESCOT	Scotland's Nature Agency https://www.nature.scot
NHS (CMT)	National Health Service (Carbon Management Team)
NHSGCC	National Health Service Greater Glasgow & Clyde https://www.nhsggc.org.uk
NTS	National Trust for Scotland
Regional LAs	Regional Local Authorities
RES	Resource Efficient Scotland https://directory.resourceefficientscotland.com/
SEPA	Scottish Environment and Protection Agency https://www.nature.scot
SFR	Scottish Fire and Rescue https://www.firescotland.gov.uk
SG	Scottish Government https://www.gov.scot
SPT	Strathclyde Partnership for Transport
SW	Scottish Water https://www.scottishwater.co.uk
TS	Transport Scotland
VS	Visit Scotland

Adaptation Risk Assessment Glossary continued

Plans and Policies

ECMP	Energy and Carbon Masterplan
LHEES	Local Heat and Energy Efficiency Strategy
CDP - SG	City Development Plan Supplementary Guidance
CP	Community Plan
CAP	Community Action Plan
FWS	Forestry and Woodland Strategy
LBAP	Local Biodiversity Action Plan
OSS	Open Space Strategy
LOIPS	Local Outcome Improvement Plans
NPF4	National Performance Framework 4
SWMP	Surface Water Management Plan

Appendix D - Adaptation Benchmarking Exercise

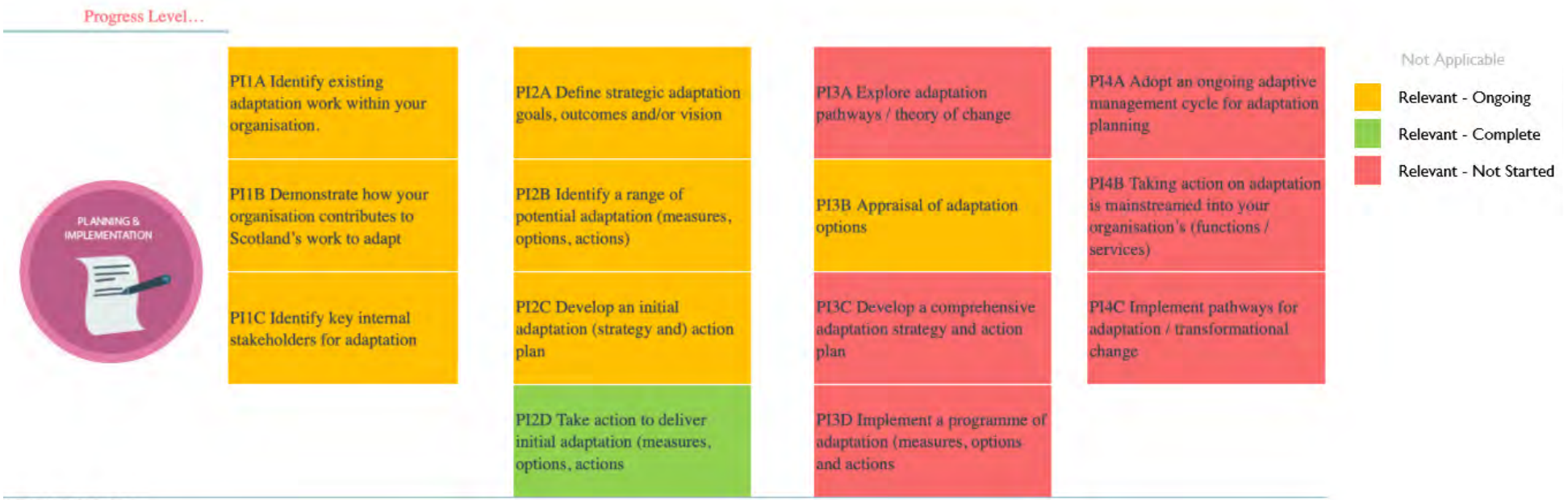
	1. Starting	2. Intermediate	3. Advanced	4. Mature
Organisational Culture & Assets				
Progress Level…				
	OC1A Examine the Structure & Priorities of your Organisation	OC2A Secure resources to plan and deliver adaptation	OC3A Identify opportunities to include adaptation in plans, policies and procedures	OC4A Mainstream adaptation into your organisation's plans, policies and procedures
	OC1B Identify resources available for adaptation	OC2B Engage with colleagues to identify adaptation opportunities and potential 'champions'	OC3B Motivate 'champions' and actively promote adaptation across the organisation	OC4B Develop a network of recognised adaptation 'champions'
		OC2C Establish governance arrangements for adaptation	OC3C Put governance arrangements for adaptation into operation	OC4C Review and update governance arrangements for adaptation
Understanding the Challenge				
Progress Level…				
	UC1A Learn about climate trends and projections	UC2A Develop understanding of climate risk and vulnerability	UC3A Develop (scenarios, storylines, narratives) for future climate change impacts and vulnerabilities	UC4A Mainstreaming of climate change risk assessment
	UC1B Learn about climate impacts affecting Scotland	UC2B Consider how your organisation's (decisions / functions) might be affected by climate change	UC3B Undertake strategic climate change risk assessment	UC4B Accessible climate adaptation knowledge that is integrated into internal systems and procedures
		UC2C Explore the impact of recent weather events on your organisation	UC3C Undertake project-level risk assessment	UC4C Actively engaged in sharing, learning, research and innovation
			UC3D Identify knowledge gaps, seek expertise and foster links with research and innovation	

Not Applicable
Relevant - Ongoing
Relevant - Complete
Relevant - Not Started

Not Applicable
Relevant - Ongoing
Relevant - Complete
Relevant - Not Started

APPENDIX D – Adaptation Benchmarking Exercise continued

Planning & Implementation



Working Together

Appendix E - Strategic Context and Policy Drivers

This Adaptation Plan has been developed with respect to various national and local drivers including legislation and policy detailed below. This is a fast paced and evolving area, and the plan will be revisited annually to ensure that its context and strategic direction are still correct.

GLOBAL, NATIONAL, REGIONAL AND LOCAL POLICY DRIVERS
INTERNATIONAL
UN FRAMEWORK CONVENTION ON CLIMATE CHANGE
Climate change is affecting every country on every continent. It is disrupting national economies and affecting lives. Weather patterns are changing, sea levels are rising, and weather events are becoming more extreme. Saving lives and livelihoods requires urgent action to address both the pandemic and the climate emergency. The Paris Agreement, adopted in 2015, aims to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels. The agreement also aims to strengthen the ability of countries to deal with the impacts of climate change, through appropriate financial flows, a new technology framework and an enhanced capacity building framework. COP26 and the Glasgow agreement committed parties to accelerating action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change.

EU ADAPTATION STRATEGY

The new EU Adaptation Strategy links directly to global agreements, such as the Paris Agreement, the Sendai Framework for Disaster Risk Reduction and the 2030 Agenda as well as the EU implementation of the UN sustainable Development Goals. It also aligns with key EU initiatives such as the Mission for a Climate resilient Europe and the Union's sustainable finance agenda. The Strategy was part of the EU Green Deal action plan. The Strategy outlines a long-term vision for the EU to become a climate-resilient society, fully adapted to the unavoidable impacts of climate change by 2050. This strategy aims to reinforce the adaptive capacity of the EU and the world and minimise vulnerability to the impacts of climate change, in line with the Paris Agreement and the proposal for a European Climate Law.

The Strategy aims to build a climate resilient society by improving knowledge of climate impacts and adaptation solutions; by stepping up adaptation planning and climate risk assessments; by accelerating adaptation action; and by helping to strengthen climate resilience globally.

THE EUROPEAN GREEN DEAL

This presents the Commission's plan for a sustainable green transition. At the heart of the Green Deal, the first European Climate Law proposal establishes the framework for achieving climate neutrality by 2050. The proposal recognises adaptation as a key component of the long-term global response to climate change and requires Member States and the Union to enhance their adaptive capacity, strengthen resilience and reduce vulnerability to climate change. It also introduces a requirement for the implementation of national strategies.

NATIONAL

THE CLIMATE CHANGE (SCOTLAND) ACT (2009)

The Act places a statutory climate change duty on public bodies. A public body must, in exercising its functions, act in a way:

- best calculated to contribute to delivery of the Act's emissions reduction targets.
- best calculated to deliver any statutory adaptation programme; and
- that it considers most sustainable.

THE CLIMATE CHANGE (DUTIES OF PUBLIC BODIES: REPORTING REQUIREMENTS) (SCOTLAND) ORDER 2015

This now states that all Public Sector Bodies are 'major players' and requires them to report to Scottish Government through Public Bodies Climate Change Duties (PBCCD) Reporting on an annual basis. This reporting includes details of mitigation as well as adaptation action undertaken by each organisation..

CLIMATE READY SCOTLAND: SCOTTISH CLIMATE CHANGE ADAPTATION PROGRAMME (SCCAP2) (2019-2024)

The second Scottish Climate Change Adaptation Programme (SCCAP2) was launched in September 2019. This outlines how Scotland is preparing for the impacts of climate change until 2024. The SCCAP responds to the risks set out in the UK Climate Change Risk Assessment (UK CCRA) 2017, published under section 56 of the UK Climate Change Act 2008. It follows an outcomes-based approach, informed by the UN Sustainable Development Goals and Scotland's National Performance Framework.

The next SCCAP, will respond to the priority risks identified for Scotland in the 2022 Risk Assessment, will be prepared for publication in 2024.

FLOOD RISK MANAGEMENT (SCOTLAND) ACT 2009

The Flood Risk Management (Scotland) Act 2009 (FRMAct) places a duty on Scottish Ministers, SEPA and responsible authorities (which includes local authorities) to adopt an integrated approach in exercising their flood risk related functions with a view to reducing overall flood risk.

WATER RESILIENT PLACES: SURFACE WATER MANAGEMENT AND BLUE-GREEN INFRASTRUCTURE: POLICY FRAMEWORK

This paper outlines how surface water is currently managed in Scotland, sets out a vision for the future and describes the components that should be brought together to form a coherent framework that will support delivery of water resilient places.

SCOTTISH WATER SURFACE WATER POLICY

For sustainability and to reduce risk of flooding from the sewer network, Scottish Water we will not normally accept any surface water connections into the combined sewer system.

This Surface Water Policy reflects Scottish Water's Surface Water Management strategy, which can be summarised as:

- no new surface water draining into the combined sewer networks.
- work with developers and regulatory bodies to removing surface water from the existing combined sewer network; and
- undertake the above whilst supporting economic growth.

REGIONAL

CLIMATE READY CLYDE (CRC)

CRC is a unique multi-sector partnership aimed at ensuring the collaboration of organisations across Glasgow and the Clyde Valley region to address adaptation. This partnership ensures multiple benefits by urging organisations to work together to understand and respond jointly to the challenges and opportunities that the region faces as a result of climate change.

THE METROPOLITAN GLASGOW STRATEGIC DRAINAGE PARTNERSHIP (MGSDP)

This collaborative partnership includes organisations involved with the operation of the sewerage and drainage network within the metropolitan Glasgow regional area.

The MGSDP is referenced in the draft of NPF4 laid before the Scottish Parliament on 10 November 2021.

The partnership has a key role in helping to reduce flood risk in the city and city region. Acknowledging that if no action is taken to adapt to our changing climate, the number and severity of flood events in the city and region will increase, and that the window of opportunity to adapt to climate change must be grasped to deliver water resilient places.

Delivery of the MGSDP Vision and Objectives in line with the Guiding Principles, which include making the city 'Climate Change Ready' will help to sustainably drain the Glasgow city region, better service existing communities, unlock potential development sites and build greater resilience to long-term climate change.

CLYDE AND LOCH LOMOND FLOOD RISK MANAGEMENT PLAN

Flood risk management plans are Scotland's route map for reducing the effects of flooding on our communities. This is key to Scotland's health, wellbeing and economic success, with an estimated 284,000 homes, businesses and services identified as at risk of flooding. The plans are also an important response to the climate emergency, as the number of homes businesses and services at risk of flooding are projected to increase by an estimated 110,000 by the 2080s.

Flood risk management plans for Scotland have been developed to ensure all efforts to reduce flood risk are coordinated. The plans outline the long term ambition by setting objectives and identifying actions. There are multiple organisations responsible for flood risk management and the plans focus their efforts to where the risk of flooding and benefits of actions are greatest.

Scotland has been divided into 14 Local Plan Districts (LPDs) for flood risk management purposes, and a plan has been prepared for each LPD. These districts are based on river catchments and coastal areas which cross administrative and institutional boundaries. Flooding demands a collaborative and coordinated response from the organisations and individuals.

Glasgow City Council is the Lead Local Authority for the Clyde and Loch Lomond (CaLL) LPD. The FRM Plans Strategies for all LPDs for the period 2022-2028 may be access **here**.

CLYDE AND LOCH LOMOND LOCAL FLOOD RISK MANAGEMENT PLAN

For each LPD, the FRM Plan describes the agreed ambition for managing flooding and the priority of actions to be taken forward to deliver this. A Local Flood Risk Management Plan (LFRMP) has been prepared for each LPD to provide additional detail on the local responsibility, funding and coordination of actions identified in the FRM Strategy. Taken together, these documents are the single point of reference for the public in describing the response and commitment of public bodies to address flooding. The CaLL LFRMP for the period 2016-2022 is here.

The CaLL LFRMP for the period 2022-2028 will be published by Glasgow City Council, as Lead Local Authority, by December 2022 to provide additional detail on the delivery of the actions identified in the CaLL FRM Plan 2022-2028.

GLASGOW CITY REGION CITY DEAL

Glasgow City Region City Deal funding is helping to deliver two projects to increase resilience and adapt to a changing climate, including: **Glasgow City Council Avenues Programme** and Glasgow City Council MGSDP **Programme**.

CLYDE MISSION

Clyde Mission is a project set to transform a riverside corridor running from Glasgow city centre to the sea, spanning an area of 1,000 hectares, drawing together ambitious initiatives for green transport, renewable energy, freeing up large tracts of land in key locations for development and addressing the impacts of our changing climate such as sea level rise, flooding and increased temperatures.

Glasgow City Region is working in partnership with the Scottish Government on plans for Clyde Mission which could support a green recovery for the Region and be a driver for a genuine economic recovery in the rest of Scotland.

Climate change and rising sea levels increase the risk of flooding along sections of the banks, then project will look at potential solutions contributing to making the Clyde more usable and developable.

LOCAL

GLASGOW CITY STRATEGIC PLAN (2017-2022)

This plan sets out the priority themes and commitments that will be delivered by the council, its services and arm's length organisations. In particular this focus on priorities for the city including the need to:

- Promote human rights and reduce inequalities across Glasgow.
- Improve the life chances and choices for all our citizens
- Embed social justice in our policy making.
- Empower our citizens, giving them a stake, and a say, in what happens in their local communities and communities of interest.

Making Glasgow 'A Sustainable and Low Carbon City' and a 'Healthier City' are two of those key themes. This adaptation plan looks to contribute towards achieving the outcomes for both.

GLASGOW'S CLIMATE PLAN

This plan is the City's response to the global Climate and Ecological Emergency, this sets a new target for the City to achieve net zero carbon by 2030. This includes a detailed action plan to address and mitigate carbon emissions, promote behaviour change and support sustainable business practices. This plan refers to adaptation action, which is detailed further in this document.

To achieve Glasgow's vision of becoming a just, net zero carbon and climate resilient city by 2030 it is essential that we work in collaboration with our communities, our institutions, and our people to promote effective co-design, co-development, transparent delivery and monitoring of sustainability decision making and climate action.