



Glasgow City Region Climate Risks and Adaptation: Evidence Summary

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1. Introduction

This evidence summary has been prepared by Climate Ready Clyde to support the eight planning authorities within Glasgow City Region¹ with the evidence gathering stage of the local development plan process. It provides an overview of regional sources of information on climate risks and climate adaptation developed by Climate Ready Clyde, as well as signposting to other relevant information that may be included in the Evidence Report.

[Climate Ready Clyde](#) is a cross-sector initiative funded by 13 member organisations and supported by the Scottish Government to create a shared vision, strategy and action plan for an adapting Glasgow City Region. Climate Ready Clyde members include all eight local authorities in the City Region as well as SEPA, SPT, University of Glasgow, University of Strathclyde and NHS Greater Glasgow and Clyde. The secretariat is provided by the sustainability charity [Sniffer](#).

Climate Ready Clyde has published a [climate risk and opportunity assessment](#) for Glasgow City Region, which informed the City Region's first Climate Adaptation Strategy and Action Plan. Spatial planning is identified as a key lever of change in the Strategy and Action Plan, which calls for a "revolution in planning" to rethink how we use land and space, and where and what we build, to prioritise climate resilience. The evidence provided in this document aims to support planning authorities in contributing towards this goal through the preparation of their Local Development Plans.

2. National Planning Framework 4 context

This evidence summary is particularly relevant to supporting delivery of National Planning Policy 2 of the [National Planning Framework 4 \(NPF4\)](#) - Climate mitigation and adaptation. In relation to climate *adaptation*, the intent of this policy is to "encourage, promote and facilitate development that...adapts to the current and future impacts of climate change", supporting the outcome that "our places are more resilient to climate change impacts". However, as this policy is connected to all other national planning policies, the information in this document will also be useful in informing the Evidence Report more broadly.

The Scottish Government's [Local development planning guidance](#) recommends that the evidence required to enable Local Development Plans to take account of NPF4 policy on climate adaptation includes details of climate risks likely to affect the plan area, incorporating the likelihood and severity of these risks, both currently and in the future.

¹ East Dunbartonshire, East Renfrewshire, Glasgow, Inverclyde, North Lanarkshire, Renfrewshire, South Lanarkshire, West Dunbartonshire.

The guidance also recommends that planning authorities may wish to review local and regional adaptation partnerships, plans and strategies for their spatial implications. This includes taking into account unevenly felt effects and inequalities that may increase the climate vulnerability of different groups of people, both as a result of physical location and societal factors.

This document provides a summary of the evidence on climate risks, and relevant plans and strategies at the regional scale for Glasgow City Region, including their spatial implications. This will need to be supplemented by additional local evidence held by local authorities and others.

3. Relevant regional evidence on climate risks and adaptation

Relevant evidence produced by Climate Ready Clyde is summarised in the table below, with more detail provided in the following sections. The links between this evidence and other NPF4 policies are summarised in Appendix 1.

Summary of relevant regional evidence for National Planning Policy 2: Climate Mitigation and Adaptation			
	Evidence source	Description	Link
NPF4 policy advice – information likely required in taking account of NPF4 policy			
Details of climate risks likely to affect the plan area	Adaptation Scotland Climate Trends and Projections	Summary of current and future climate trends for Scotland, and broken down by region	https://www.adaptationscotland.org.uk/why-adapt/climate-trends-and-projections
	Climate Ready Clyde Glasgow City Region Risk and Opportunity Assessment	A comprehensive assessment of the strategic climate risks and opportunities of most importance for Glasgow City Region	https://www.crc-assessment.org.uk/
	Climate Ready Clyde Glasgow City Region Climate Vulnerability Map	Postcode areas within Glasgow City Region most vulnerable to the impacts of climate change (heat and flood risk)	https://climatereadyclyde.org.uk/climate-vulnerability-map/
Other information planning authorities may wish to: prepare, or review for spatial implications			
Local/regional adaptation partnerships, plans and strategies	Glasgow City Region Climate Adaptation Strategy and Action Plan	A strategic framework for adaptation in and by the Glasgow City Region that fits alongside and supports key plans, policies and activities to enable delivery.	https://climatereadyclyde.org.uk/adaptation-strategy-and-action-plan/

4. Climate impacts and risks

i. Climate change trends

The Adaptation Scotland programme has published a [Climate Change Projections for Scotland Summary](#) (2021). The summary uses the 2018 UK Climate Projections, produced by the Met Office Hadley Centre, to provide up-to-date information about the potential future climate in Scotland based on four greenhouse gas emissions pathways.

The key long-term climate trends for Glasgow City Region are:

- Increasing extreme weather
- Heavier winter rainfall and reduced summer rainfall
- Higher average temperatures, with more frequent and extreme heatwaves
- Sea level risk and coastal erosion
- Increased likelihood of flooding.

More detailed climate trends for West Scotland, including mean, maximum and minimum temperatures, rainfall, rain days, hours of sunshine and days of air frost are available through [Adaptation Scotland](#), where they can be downloaded in different formats, and summarised in the [Glasgow City Region Climate Adaptation Strategy and Action Plan](#).

ii. Climate risks

The key climate risks affecting Glasgow City Region are presented in the comprehensive [Glasgow City Region Climate Risk and Opportunity Assessment](#) (2018). The assessment identified 67 risks and opportunities that are of strategic importance to Glasgow City Region across six themes:

- Infrastructure
- Built environment
- Society and health
- Natural environment
- Economy, business and industry
- International, cross cutting and adaptive capacity

32 of the 67 risks have been classified as requiring further action to ensure that the City Region can manage these risks effectively over the period to 2100.

The highest priority risks, where more action is urgently needed, are:

- Infrastructure: risk to infrastructure services from coastal flooding and erosion
- Infrastructure: risks to energy, transport and ICT infrastructure from storms and high waves
- Infrastructure: risks to energy, transport and ICT infrastructure from extreme heat
- Society and human health: risks to NHS estates due to flooding and overheating
- Natural environment: risks to soil stock from changes in temperature and water regime
- Natural environment: risk to crops and livestock from extremes in temperature and water regime
- Natural environment: risks to freshwater biodiversity from pests, invasive species and disease

- Economy, business and industry: risk to new and existing business sites from river, surface water and coastal flooding
- Economy, business and industry: risks to business from disruption to supply chains and distribution networks

Detailed risk descriptions for all 67 strategic risks, including spatial priorities, and further supporting evidence, can be found in the [Technical Report](#) for the Climate Risk and Opportunity Assessment. A summary of all the risks, sorted by urgency score, is outlined in Appendix 2 below.

iii. Climate vulnerability: spatial considerations

The Glasgow City Region Climate Adaptation Strategy and Action Plan sets a target to increase the resilience of over 140,000 people in the region who are most vulnerable to the impacts of climate change. This target is informed by spatial data on climate vulnerability – identifying locations where exposure to climate risks intersects with socio-economic factors that can limit communities’ capacity to respond and adapt.

In support of this target, the Climate Ready Clyde [Climate Vulnerability Map](#) identifies the postcode areas within the City Region that are most vulnerable to the impacts of climate change. The map highlights locations that are within the top 20% of deprivation according to the Scottish Index of Multiple Deprivation (SIMD), and that are exposed to either flood risk, heat risk or both.

The Climate Vulnerability Map uses the following key data sources:

- Deprivation data from the [Scottish Index of Multiple Deprivation \(SIMD\)](#). The priority postcode areas are those within the 20% most deprived.
- Flood risk data from [SEPA Flood Risk Maps](#). Priority postcode areas highlighted for flood risk are those that contain locations subject to 1 in 200 year flood risk (plus climate change) from one or more sources (rivers, coastal, surface water).
- Heat risk data from the [4EI Heat Hazard Index](#). Priority postcode areas for heat risk are those that are within the top two heat risk bands (4 and 5).

The map also includes further contextual data on Vacant and Derelict Land, and urban tree canopy cover percentage.

The underlying data, and GIS files, can be made available to local planning authorities on request. Please contact grant.mcfarlane@clydeplan-sdpa.gov.uk.

5. Glasgow City Region Climate Adaptation Strategy and Action Plan

The [Glasgow City Region Climate Adaptation Strategy and Action Plan](#) aims to ensure that the City Region’s economy, society and environment is not only prepared for, but continues to flourish in the face of the impacts arising from the climate crisis. It is informed by, and responds to, the risk and opportunity assessment.

The Strategy provides a strategic framework for adaptation in and by the Glasgow City Region that fits alongside and supports key plans, policies and activities to enable delivery. It is supported by an Action Plan that contains the concrete actions being taken in the City Region between 2020 and 2025 that will move us the vision of flourishing in a future climate.

The Strategy and Action Plan has a focus on transformational adaptation – going beyond incremental actions towards systems change - and delivering ‘just resilience’, where the benefits of adaptation are equitably shared, and address underlying socio-economic inequalities. The Strategy is informed by Scotland’s Place Principle, and aligned with the objectives of National Planning Framework 4.

Strategic Intervention 8.4. of the Glasgow City Region Climate Adaptation Strategy and Action Plan identifies the need for:

Strengthening of adaptation requirements in the planning system supported by Scottish Government, Clydeplan and local planning authorities through the National Planning Framework 4, the Regional Spatial Strategy and local development plans and building standards.

i. Place-based priorities

The Adaptation Strategy identifies several place-based priority areas that are regionally and nationally significant for adaptation. **Please note that these place-based priorities reflect the Clydeplan Strategic Development Plan 2, and National Planning Framework 3 (NPF3), and will be subject to review following the development of the new Regional Spatial Strategy, in line with NPF4.**

The Adaptation Strategy defines place-based priorities as areas that meet one or more of the following conditions:

- Current and future climate hazards are most acute
- Potential to disproportionately affect vulnerable communities
- Significant concentrations of economic assets
- Significant regional decisions are being taken in relation to new development

Further information about these place-based priorities can be found in Section 2.4. (p.61) of the [Adaptation Strategy and Action Plan](#).

ii. Strategic Interventions and Flagship Actions: Spatial Implications

The Glasgow City Region Adaptation Strategy and Action Plan outlines 11 interventions that set a strategic direction until 2030, and 16 flagship actions that provide the priorities up until 2025. Several of these interventions and flagship actions have spatial implications, as outlined below.

- Intervention 6: Adapt the Clyde Corridor for the twenty-second century²
 - This intervention aligns with **NPF4 National Development 13: Clyde Mission** which recognises the need to adapt the area to the impacts of climate change, particularly through nature-based solutions.
- Intervention 8: Ensure everyone’s homes, offices, buildings and infrastructure are resilient to future climate change
- Intervention 9: Deliver nature-based solutions for resilient blue-green ecosystems, landscapes and neighbourhoods

² An initial options analysis and scoping report for tidal flooding on the Clyde has been published by ClimateXChange (2022): <https://www.climatexchange.org.uk/research/projects/tidal-flooding-on-the-clyde-options-analysis-and-scoping-of-adaptation-pathways/>

- This intervention aligns with **NPF4 National Development 5: Urban Sustainable, Blue and Green Surface Water Management Solutions**, and **National Development 7: Central Scotland Green Network**.

Further details of these interventions can be found in Section 2.5. of the [Adaptation Strategy and Action Plan](#)

- Flagship Action 2: Communities shaping climate-ready places
- Flagship Action 4: Clyde Climate Forest
- Flagship Action 11: Clyde Adaptation Mission
- Flagship Action 14: Climate resilience embedded into the Regional Economic Strategy and Regional Spatial Strategy

Further details of these flagship actions can be found in Section 3.2. of the [Adaptation Strategy and Action Plan](#).

Appendix 1: Evidence relevant to other NPF4 policies

Summary of relevant regional evidence for other policies in NPF4				
	Evidence source	Description	Link	Other relevant NPF4 Policies
<i>NPF4 policy advice – information likely required in taking account of NPF4 policy</i>				
Details of climate risks likely to affect the plan area	Adaptation Scotland Climate Trends and Projections	Summary of current and future climate trends for Scotland, and broken down by region	https://www.adaptationscotland.org.uk/why-adapt/climate-trends-and-projections	Policy 1 Twin crises Policy 5 Soils Policy 10 Coastal development Policy 19 Heating and cooling Policy 20 Blue Green Infrastructure Policy 22 Flood risk and water management <i>Policy 13 Sustainable transport Policy 14 Design Policy 15 Local living</i>
	Climate Ready Clyde Glasgow City Region Risk and Opportunity Assessment	A comprehensive assessment of the strategic climate risks and opportunities of most importance for Glasgow City Region	https://www.crc-assessment.org.uk/	Policy 1 Twin Crises Policy 3 Biodiversity Policy 4 Natural places Policy 5 Soils Policy 6 Forestry Policy 10 Coastal development Policy 11 Energy Policy 13 Sustainable transport Policy 14 Design Policy 15 Local living Policy 19 Heating and cooling Policy 22 Flood risk and water management <i>Policy 7 Historic Assets Policy 18 Infrastructure first Policy 26 Business Policy 30 Tourism Policy 31 Culture</i>
	Climate Ready Clyde Glasgow City Region Climate Vulnerability Map	Postcode areas within Glasgow City Region most vulnerable to the impacts of climate change (heat and flood risk)	https://climate-readyclyde.org.uk/climate-vulnerability-map/	Policy 1 Twin Crises Policy 19 Heating and cooling Policy 20 Blue Green Infrastructure Policy 22 Flood risk and water management <i>Policy 3 Biodiversity Policy 4 Natural places Policy 6 Forestry Policy 9 Brownfields and VDL</i>

Summary of relevant regional evidence for other policies in NPF4				
	<i>Evidence source</i>	<i>Description</i>	<i>Link</i>	<i>Other relevant NPF4 Policies</i>
<i>Other information planning authorities may wish to: prepare, or review for spatial implications</i>				
Local/regional adaptation partnerships, plans and strategies	Glasgow City Region Climate Adaptation Strategy and Action Plan	A strategic framework for adaptation in and by the Glasgow City Region that fits alongside and supports key plans, policies and activities to enable delivery.	https://climate-ready-clyde.org.uk/adaptation-strategy-and-action-plan/	Policy 1 Twin Crises Policy 6 Forestry Policy 13 Sustainable transport Policy 14 Design Policy 15 Local living Policy 19 Heating and cooling Policy 20 Blue Green Infrastructure Policy 22 Flood risk and water management Policy 25 Community wealth building

Appendix 2: Glasgow City Region Climate Risk and Opportunity Assessment: key risks by theme

Key: More action needed Build capacity and understanding Sustain current action Watching brief

THEME 1 INFRASTRUCTURE		THEME 2 BUILT ENVIRONMENT		THEME 3 SOCIETY AND HUMAN HEALTH		THEME 4 NATURAL ENVIRONMENT		THEME 5 ECONOMY, BUSINESS AND INDUSTRY		THEME 6 – INTERNATIONAL RISKS AND CROSS CUTTING AND ADAPTIVE CAPACITY ISSUES	
RISK / OPPORTUNITY	SCORE	RISK / OPPORTUNITY	SCORE	RISK / OPPORTUNITY	SCORE	RISK / OPPORTUNITY	SCORE	RISK / OPPORTUNITY	SCORE	RISK / OPPORTUNITY	SCORE
IN3: Risk to infrastructure services from coastal flooding and erosion		BE2: Risks to building fabric from moisture, wind, storms and driving rain		SH5: Risks to NHS estates due to flooding and overheating		NE1: Risks to soil stock from changes in temperature and water regime		BI1: Risk to new and existing business sites from river, surface water and coastal flooding.		IT1: Risks from weather-related shocks to international food production and trade	✘
IN7: Risks to energy, transport and ICT infrastructure from storms and high waves		BE4: Risks to traditional and historic buildings from moisture, wind and driving rain		SH1: Risks to people and communities from flooding and flood disadvantage		NE5: Risk to crops and livestock from extremes in temperature and water regime		BI4: Risks to business from disruption to supply chains and distribution networks		IT2: Imported food safety risks	✘
IN8: Risks to energy, transport and ICT infrastructure from extreme heat		BE5: Increased maintenance of green space due to rising temperatures and severe weather		SH2: Increase in summer temperatures and heatwaves leading to increased morbidity and mortality		NE17: Risks to freshwater biodiversity from pests, invasive species and disease		BI5: Opportunities for products and services to support adaptation to climate change		IT3: Risks and opportunities from long-term, climate-related changes in global food production	✘
IN1: Risks of cascading failures from interdependent infrastructure networks		BE7: Risk of overheating of buildings from increased energy efficiency/insulation		SH3: Risks to health from changes in air quality		NE3: Risks to soils from pests, pathogens and invasive species		BI3: Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working environments		IT4: Risks to the UK from climate-related international human displacements	✘
IN11: Risks to water-based transport and trade infrastructure from sea level rise, floods and storms		BE10: Increased viability of electricity and heat from renewable energy sources		SH6: Risks to business continuity of health and social care from extreme weather		NE6: Risks to agriculture from pests and disease		BI2: Risks to business operations from water scarcity		IT5: Risks to the UK from international violent conflict	✘
IN2: Risk to infrastructure services from river and surface water flooding		BE1: Risks to homes from flooding and sea level rise		SH7: Increased patient demand on NHS services from extreme weather		NE8: Risks to forestry and woodlands from extreme weather events		BI6: Increased tourism revenue from increased temperatures		IT6: Risks to international law and governance	✘
IN4: Risk of sewer flooding due to heavy rainfall		BE3: Risks to cultural heritage from landslides, flooding or coastal erosion		SH4: Risks to health from vector-borne pathogens		NE9: Risks to forestry and woodlands from pests, invasive species, and diseases				IT7: Opportunities from changes in international trade routes	✘
IN5: Risks to bridges and pipelines from high river flows and bank erosion		BE6: Increased cooling demand in buildings as a result of rising temperatures		SH8: Potential benefits to health and wellbeing from reduced cold		NE10: Risk and opportunities for biodiversity from changes in habitat suitability				CC1: Indirect impacts from Scottish, UK and international climate change risks	✘
IN9: Risks to infrastructure from increase in vegetation growth		BE8: Opportunities for local food growing from warmer temperatures and increased growing season		SH9: Improved physical and mental health from increased use of parks and green space due to warmer weather		NE11: Risks to coastal habitats and industries from sea level rise				CC2: Potential for co-benefits and transformation in adaptation responses	✘
IN6: Risks to transport networks from slope and embankment failure		BE9: Reduced heating demand for buildings due to rising temperatures				NE12: Risks to marine biodiversity from increases in sea temperature				CC3: Risks and Opportunities to social justice and inequalities from climate change and adaptation responses	✘
IN10: Risks to infrastructure from wildfires						NE13: Risks to marine biodiversity from ocean acidification				AC1: Failure to position adaptation as a strategic economic and social issue, leading to inadequate adaptation responses	✘
IN12: Potential benefits to water, transport, digital and energy infrastructure from reduced extreme cold events						NE15: Risks to freshwater biodiversity from changes in water regimes				AC2: Reduced access to project development and implementation funding from leaving the European Union	✘
						NE2: Risks to soil carbon storage from temperature rises and changes in precipitation					
						NE7: Risks and opportunities to forestry and woodlands from changes in land suitability and productivity					
						NE14: Risks to marine biodiversity from pests and invasive species					
						NE18: Risks to nationally and internationally significant geoheritage sites from flooding and erosion, and coastal, vegetation, freeze-thaw and rainfall change					

✘ N/A (Not scored)

