

South Gloucestershire Council Adaptation: ARP4 report



Executive Summary

Human-caused carbon dioxide emissions and other greenhouse gases are the primary drivers of climate change and reducing emissions continues to be essential. However, our climate is beginning to change and will continue to do so. How we can adapt and be resilient as an organisation is important to enable us to continue to deliver our services in an effective way.

This year the Department for Food and Rural Affairs (Defra) invited local authorities to be part of the 4th round of adaptation reporting as a pilot group. The objectives of the fourth round of adaptation reporting are to support the integration of climate change risk management into the work of reporting organisations and to build understanding of the level of preparedness of key sectors to climate change and inform other parts of the government's statutory cycle for climate adaptation.

To understand our climate risk we need to look at the drivers of our climate (such as temperature, rainfall and sea level rise), and look at how these impact us now, including extreme weather events, and how they will impact us in the future.

To model and predict future climate risk, climate scenarios in the form of potential pathways are produced. Guidance is to prepare for a 2 °C rise in global temperature whilst assessing the risks for a 4 °C rise. As the climate changes we can expect higher summer and winter temperatures with wetter winters and drier summers. There will be more frequent and intense extreme weather events such as storms and heatwaves, and sea level rise.

Flooding, including tidal flood risk, and extreme heat are hazards we already experience. Their impacts will increase with a changing climate and they are considered significant risks for South Gloucestershire. There are also a wide range of other risks, including interacting and cascading risks. Using information from national and local climate modelling data sets, and in consultation, we will need to look at where we are best placed to provide leadership and enable adaptation and resilience within our wider area as we develop a Climate Adaptation and Resilience Framework next year.

Council Risk Assessment

Assessing the impact of a changing climate on how we deliver our council functions will enable us to become more resilient as an organisation. We held initial discussions on service level hazard and risk with Public Health; Property; and Education and skills.

Service Area	Key risks as highlighted from facilitated discussion
Public Health	Travel disruption; Impact on health of extreme heat; Worsening of inequality; Worsening of health conditions; Worsening of air quality indoor and outdoor; Flooding impacting school access
Property	Risk from flooding including water ingress (buildings and hard surfaces/vegetation); Risk from heat (building and hard surfaces/vegetation); Risk to building fabric- (including pests); Travel disruption
Education and skills	Heat and heat stress (buildings, learning and behaviour, use of outdoors; place planning); Risk on outdoor activities- importance of play; Flooding (to schools and travel; place planning); Cascading impact of school closures; Cascading impact of building stock issues/changes; Risk to mental health- climate anxiety; Increase in health-related employment issues; Impact on how training is delivered

The discussions also raised many points in relation to adverse weather events, adaptation actions, blockers and ways to take adaptation forward, which need further consideration. These discussions have also helped shape our action plan.

Adaptation and resilience actions

The Climate and Nature Emergency Action Plan will remain the main place for our actions and updates (and can be found on our [climate and nature emergency webpages](#)). This ARP4 report highlights some of these projects and five strategic actions;

- Action One: Continue to embed resilience in our governance structure
- Action Two: Continue to review and develop climate change data and processes
- Action Three: Continue assessing risk, and building resilience amongst council services
- Action Four: Develop an area wide Climate Adaptation and Resilience Framework and further targeted actions
- Action Five: Continue to implement the Green Infrastructure and Nature Recovery Action Plan to 2030

We are committed to working alongside Government to support the delivery of the National Adaptation Programme, bringing to life the challenges facing our region and working together to unlock the support we need. Collaborative working with local and regional partners, and utilising local intelligence, will be essential to undertaking this. We will also need additional funding from central government to help us deliver this change, including the significant investment and behavioural change that will be required to build climate resilience across a broad range of partners, sectors, and stakeholders and help us prepare for the consequences of a rapidly changing climate.

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1.Introduction

Human-caused carbon dioxide emissions and other greenhouse gases are the primary drivers of climate change. Reducing emissions continues to be essential to reduce the future impact of a changing climate. However, the impacts of greenhouse gases mean that our climate is beginning to change, and will continue to do so, and therefore we also need to adapt and build resilience. Compared to 1990 we can expect higher summer and winter temperatures with wetter winters and drier summers. There will be more frequent and intense extreme weather events such as storms and heatwaves, and sea level rise.

Although there is broad agreement on the direction of change in climatic conditions, there is significant uncertainty in the extent and timing of changes, especially post 2050, with the magnitude and severity of the longer-term impacts being dependant on how well we reduce emissions now.

We will need to deliver our council functions within this changing climate so considering how we can adapt and become more resilient as an organisation is important to enable us to continue to deliver our services in an effective way.

a. 4th round adaptation reporting

The Climate Change Act 2008 [1] set a framework for action on climate adaptation in the UK. The Act requires:

- A UK-wide climate change risk assessment (CCRA) to be undertaken every five years, (the UK's third Climate Change Risk Assessment (CCRA3) was published in June 2021 [2]);
- A national adaptation programme (NAP) to be put in place and reviewed every five years, setting out the Government's objectives, proposals and policies for responding to the risks identified in the CCRA (The Third National Adaptation Programme (NAP3) was published in July 2023 [3]);
- The Adaptation Sub-Committee of the Climate Change Committee to advise on the preparation of the UK CCRA and to report to Parliament on Government's progress with the implementation of the NAP

The Climate Change Act also introduced 'Adaptation Reporting Powers' which enable the Secretary of State to direct 'reporting authorities' (organisations with functions of a public nature and statutory undertakers) to prepare climate change adaptation reports.

This year the Department for food and rural affairs (Defra) invited local authorities to be part of the 4th round of adaptation reporting, as a pilot group.

The objectives of the fourth round of adaptation reporting are to:

- support the integration of climate change risk management into the work of reporting organisations
- build understanding of the level of preparedness of key sectors to climate change, at a sectoral and national level, and inform other parts of the government’s statutory cycle for climate adaptation, including CCRA and NAPs

Guidance has been set out via Defra on how we may undertake an ARP4 report and we have been part of a pilot of local authorities to share information and approaches to inform our report. The reports will feed into the fourth round of adaptation planning.

b. Structure of this report

As well as the guidance from Defra there are a range of other sources of information on how to undertake a climate adaptation report and risk assessment. Local Partnerships have developed an adaptation report guide, and a toolkit, to assess risk in local authorities based on a five-step process, and this guidance and toolkit has been integral in informing our process [24].

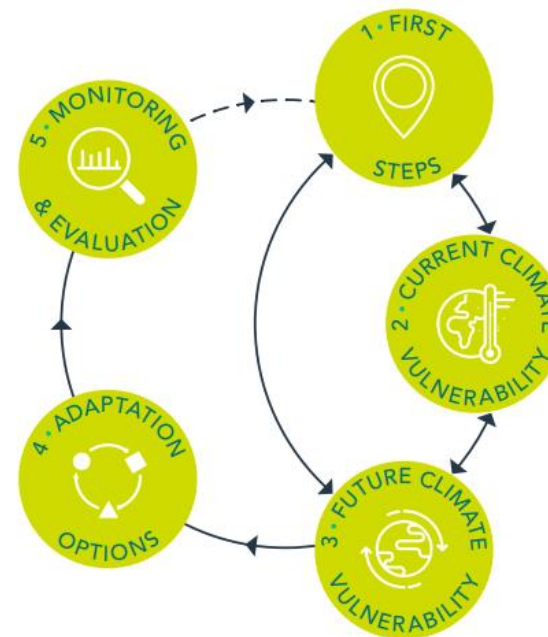


Figure 1- Adaptation report diagram, Local Partnerships, 2024 [24]

2. Our area

South Gloucestershire sits in the south-west of England and covers an area of 536.5 km². We are largely rural though the majority of our population lives within the fringe of Bristol and large towns in our rural areas. Over 40% of South Gloucestershire is covered by the green belt (green space) which surrounds and separates Bristol and Bath.

Our population has increased by 10.5% over the past decade and is expected to grow by a further 20% by 2043. Since 2011 there has been a 22% increase of people aged 65 years and over [4].

a. South Gloucestershire Unitary Council

As a council we deliver hundreds of vital services to our residents every day. We declared a Climate Emergency in 2019 and pledged to provide the leadership to enable South Gloucestershire to become carbon neutral by 2030 [5]. We have a Climate Emergency Strategy, and we undertake a wide range of projects to tackle the climate and nature emergency. These can be found within our Climate and Nature Emergency Action Plan on our climate and nature emergency webpage [6].

We set out our priorities in our council plan [7], which is our key corporate strategy. Driving a green transition and responding to the climate and nature emergency is one of the plans aims, along with helping to reduce inequalities, supporting children and young people and supporting wellbeing and independence.

In relation to risk management, we have an organisational risk register, and risk from a changing climate is one of the themes within this. We also have a statutory duty to respond to emergencies when they arise and further information on emergency planning can be found on our webpages [8].

b. West of England Mayoral Combined Authority-synergy between local and regional plans

The West of England Mayoral Combined Authority (MCA) [9] region covers the geographical area of South Gloucestershire as well as Bath & North East Somerset, and Bristol City. The MCA is working to create a greener West of England, that is equal, fair, and inclusive and to make the region more prosperous across workstreams on transport, skills, jobs, and support for businesses.

The West of England Climate and Ecological Strategy and Action Plan (CESAP) sets out dedicated action to tackle the climate and ecological emergencies. With 2030 goals across net zero, nature recovery and climate resilience, the strategic objective for the MCA is

working with the three constituent unitary authorities, and neighbouring North Somerset, and other regional partners to accelerate adaptation action and build the region's resilience. The MCA is also reporting under the ARP4 process.

The CESAP will be updated in 2025 to reflect the MCA's five climate resilience workstreams all of which will have direct benefits for supporting local delivery in the region.

- **Workstream 1 - strategic planning for building resilience and adapting to climate change impacts** including: co-development of an adaptation strategy and action plan; and producing accessible, online resources summarising MCA ARP4 report
- **Workstream 2 - evaluating regional activity, ongoing impacts and preparedness levels** including: a stocktake of action building resilience to major climate hazards; and gathering regional stories on extreme weather and adaptation action through engagement with residents and businesses.
- **Workstream 3 - developing regional data, metrics and mapping resources** including: reviewing resources describing regional exposure to climate hazards, and developing a regional mapping tool exploring climate risks
- **Workstream 4 - building climate resilience into the region's fabric** including: progressing action across priority MCA areas including strategy development, transport projects, support for major flood schemes, local nature recovery and showcasing best practice within the region.
- **Workstream 5 - developing regional partnerships to accelerate progress** including: supporting regional funding bids and working with regional universities to align research opportunities with major climate resilience challenges and supporting local councils in delivering climate resilience and building the business case for local action.

Our aim is to ensure our climate resilience work programmes complement each other. We already work together through many partnerships, working groups (including climate and green infrastructure) and projects (including accessing MCA funding), and will continue to do so, helping the region adapt to climate change impacts and build regional resilience.

c. Climate change- inequality of exposure and impact

It is important to note that whilst everyone will be exposed to the impacts of climate change not everyone will be affected equally. For example, in the UK risks from heat and cold vary across the population, with older populations, those with multiple severe health conditions and those residing in care homes more likely to be severely impacted [10]. In our work on adaptation and resilience we need to ensure we are looking to reduce these inequalities in line with the UK sustainable development goal 'to leave no one behind'

We have undertaken work that looks at climate hazards and inequality, for example a pilot project with UK Health Security Agency to map population vulnerability and then overlay with heat and flood risk (see case studies section for more information).

d. Climate change-the importance of living eco-systems

It is also important to note that as well as human impacts and outcomes, that nature, our environment and wildlife are being adversely impacted by a changing climate. These systems are crucial in their own right and also for meeting our fundamental needs, including food production. We need to do everything possible to protect these living ecosystems that support us and support all life on earth.

3. Assessing Climate Risks

To understand our climate risk, we need to look at the drivers of our climate (such as temperature, rainfall and sea level rise), and look at how these drivers impact us now, including extreme weather events, and how they will impact us in the future. As human emissions change the climate, there will be changes in both long-term climate trends (such as increased temperate or increased rainfall in the winter) and extreme climate events (such as heatwaves or extreme rainfall and flooding). These changes will lead to other hazards such as the increased spread or introduction of new vector borne diseases. How these hazards will affect us, and the resulting risk, will depend on our vulnerability to them and our exposure. The diagram below shows the overlap between hazard, vulnerability and exposure and how this leads to risk. The Intergovernmental Panel on Climate Change (IPCC) also has a useful diagram explaining climate risk which can be accessed here [Climate Risk Diagram: SPM1](#) (IPCC) [11].

Figure 2: Diagram explaining Climate Risk from Met Office Local Authority Climate Explorer [12]

Climate risk

Understanding the risks that climate change poses to your community, organisation or business is the first step to taking action. The **RISKS** from a changing climate and the potential for resultant impacts, depend on three factors:

HAZARD: weather and climate events which may have adverse effects. Their occurrence, duration and intensity may change due to climate change.

EXPOSURE: the location of people, property and other resources, relative to a hazard.

VULNERABILITY: the likelihood of the exposed people, property or resources suffering adverse effects from the hazard. Vulnerability is reduced by the capacity of people and places to adapt or respond to the hazard.



4. Current climate vulnerability, exposure and risk

An understanding of our existing exposure and vulnerability to extreme weather events is important. It can highlight which hazards are impacting our local area; and our local authority responsibilities, services and work, the most. If we are experiencing more extreme events than we expect, this may indicate we are beginning to be impacted by a changing climate.

Understanding how climate risk is currently integrated into our risk management processes within the council is also important

a. Rainfall and Flooding

The Environment agency produce rainfall data for the South Gloucestershire area. Recent rainfall data show that:

- February 2024 was the second wettest February since records began in 1871, and the wettest in the last 101 years. There was not a single day in February without rain somewhere in the Wessex area.
- March was also a wet month with an average of 127mm across Wessex which is 171% of the long-term average.
- Analysis of long-term rainfall data also shows it was the wettest 21-month period on record.

As may be expected, with the high level of rainfall described above, there have been flooding events within South Gloucestershire within 2024.

- In January 2024 Fluvial flooding from the River Avon affected properties in Swineford, Hanham and Hanham Mills.
- Surface water flooding affected several properties across the county although these were isolated incidents.
- The Council's Highway Maintenance Team were placed under significant pressure as a result of the wet weather as they received considerably more reports of blocked gullies and flooding to the highway.

South Gloucestershire's Local Flood Risk Management Strategy (2022 – 2027) [13] sets out how South Gloucestershire Council addresses the management of local flood risk¹ and contains a range of maps and data in relation to flood risk. The Environment Agency

¹ Local flood risk is defined as flood risk from surface run-off; groundwater and ordinary watercourses (with more detailed explanation provided in the strategy). Our Local Flood Risk Management Strategy sets out our flood risk management responsibilities that are a statutory requirement of the Flood and Water Management Act 2010

are responsible for managing main river fluvial flooding. They area also responsible for tidal flood risk, which has been a significant risk with South Gloucestershire.

Figure 3: Example flood risk maps from the Local Flood Risk Management Strategy [13]

Figure 9 – Flood risk from surface water, based on the Risk of Flooding from Surface Water dataset

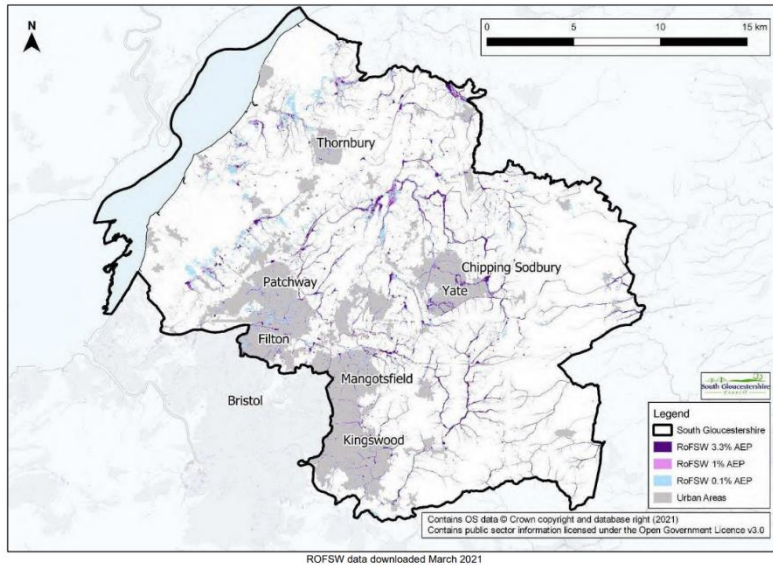
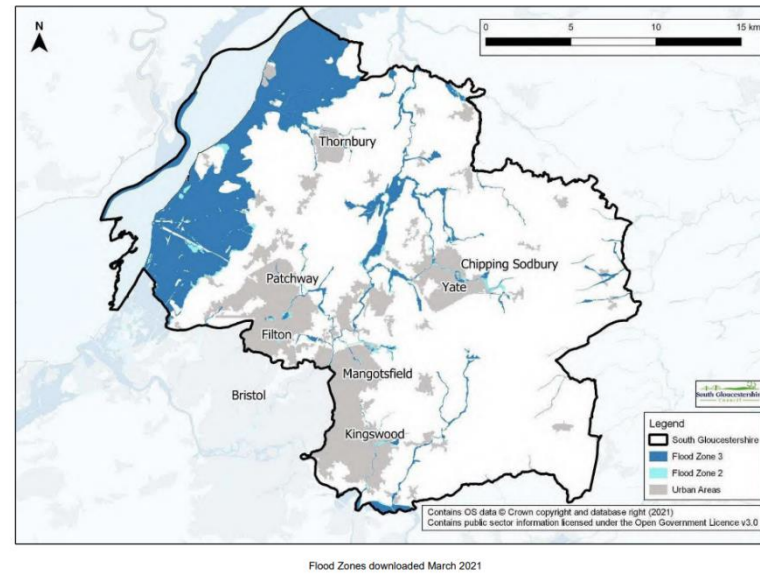


Figure 11 – Flood risk from rivers and sea, based on the Environment Agency Flood Zones



Tidal flood risk

A major flood event in 1981 led to the building of flood defences in the Severnside area. Flood defences have recently been improved by the Avonmouth Severnside Enterprise Area (ASEA) Ecology Mitigation and Flood defence project [14]. The scheme aims to reduce flood risk and protect communities along a 17 kilometre stretch of coastline. Flood risk will be reduced for at least 60 years.

Tidal flood risk is managed differently for different parts (segments) of the shoreline as set out in the shoreline management plan [15]. To the north of the ASEA defences the overall intention for the Littleton Warth to Aust Ferry segment is for a natural shoreline, so the management approach is no active intervention.

The Severn Estuary is internationally important and designated for wildlife [16], and the ASEA scheme is creating natural habitat including high tide roost sites for wild fowl and wading birds to deliver ecological mitigation [14]

b. Extreme heat and cold events

The summer of 2022 was the first time nationally where temperatures in the UK exceeded 40 degrees in some locations. On 18 and 19 July 2022, a Met Office Red Extreme Heat Weather Warning and a UK Health Security Agency (UKHSA) Level 4 Heat Health Alert were in force, both for the first time since their introduction in 2020 and 2004, respectively. When we receive heatwave alerts these are cascaded from emergency planning to our relevant departments. In the last two summers we have sent out cold packs to more vulnerable residents to help them deal with the heat. This has been a project in association with partners and we have worked together to widely publicise their availability.

Cold is still a considerable risk in terms of temperature extremes, and we have needed to enact responses to the cold, such as providing warm packs [17]. We have community welcome spaces [18] to help build community resilience in relation to any extreme weather that may be experienced, and some of these also provide information on personal measures that can be undertaken to increase resilience.

c. National and local risk registers

Dealing with temperature extremes and flooding are two risks from a changing climate that we currently respond to and will need to continue to do so with a changing climate. As discussed in the next sections there are many risks from a changing climate that we need to consider going forward that we do not currently experience such as wildfire risk.

These risks are beginning to be factored more strongly in our existing business risk considerations. We utilise the national security risk register [19] to inform our emergency planning and business continuity responses. The need to consider a changing climate is more prominent in the latest edition of the national security risk register. The national risk register also informs the Community Risk Register [20] produced by the Local Resilience Forum (LRF), which we are a part of.

d. Wider groups, networks and forums

From our discussions with colleagues to gather information for this report, we are aware that there are also a range of existing forums where community and organisational resilience is being discussed and actioned. We need to ensure we utilise their local intelligence and work with them as we develop our adaption and resilience work, including our Climate Adaptation and Resilience Framework next year.

5.Future climate vulnerability, exposure and risk

a. Climate pathways

To model and predict future climate risk, climate scenarios in the form of potential pathways are produced. The most recent scenarios make assumptions about economic and social, as well as physical changes, to our environment and how these are likely to change our climate. These scenarios are called Representative Concentration Pathway (RCP) warming levels and are explained more in the table below.

Figure 4: RCP Pathways [21]

RCP	Change in temperature (°C) by 2081-2100 ²	Representative Concentration Pathway (RCP) warming levels
RCP 2.6	1.6 (0.9-2.3)	Represents a pathway where greenhouse gas emissions are strongly reduced.
RCP 4.5	2.4 (1.7-3.2)	Two medium stabilisation pathways, with varying levels of mitigation.
RCP 6.0	2.8 (2.0-3.7)	
RCP 8.5	4.3 (3.2-5.4)	Pathway where greenhouse gas emissions continue to grow unmitigated

UKCP18 is the latest set of national climate projections and provides projected climate data for all the above scenarios. They have also produced projections at a more local scale (for the RCP8.5 scenario).

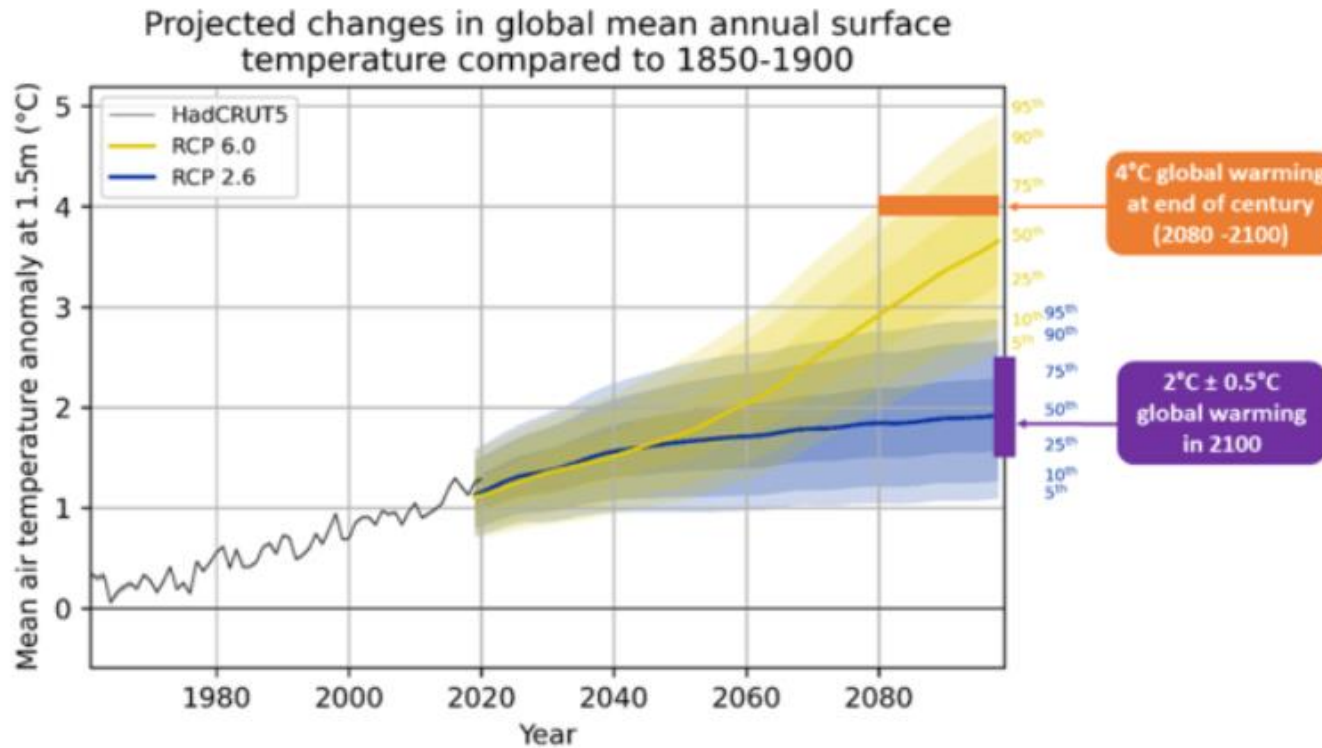
b. Key messages on our changing climate

Independent guidance, adopted by the UK government for climate change risk assessment is to prepare for a 2 °C rise in global temperature whilst assessing the risks for a 4 °C rise.

² The increase in global mean surface temperature averaged over 2018-2100 compared to the pre-industrial period (average between 1850-1900) for the RCP pathways (best estimate, 5-95% range)

The latest national climate change risk assessment, CCRA3 [2] brings together and reviews a large range of evidence, including the UKCP18 data, to look at the potential changes that could occur from a warming climate. Two global warming pathways based approximately on RCP 2.6 and RCP 6.0 were chosen to assess against 61 risks. CCRA3 also highlighted 8 risks that were considered a priority for action within the next 2 years. Both of these can be found in Appendix One.

Figure 5: Graph showing future global warming pathways (Met Office [22].)



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The key messages from CCRA3 show that:

Changes to our existing climate based on climate change are already apparent:

- Temperature and sea level rise are the clearest signals of a changing climate for the UK.
- UK's annual temperature has warmed by nearly 0.3 °C per decade. Heatwaves are more common and intense and cold extremes significantly less likely
- Sea levels are over 5 cm higher than in 1990 and continue to rise.
- New UK weather and climate records are being set more frequently

Future warming will lead to a changing climate with:

- Future summers projected to be hotter and drier.
- Future winters projected to become warmer and wetter overall.
- Sea levels will continue to rise

Many climate risks are driven by changes in weather extremes (e.g. flash flooding is driven by the intensity of rainfall over the period of a few hours). As well as the average rises to the general climate described above, we will get more weather extremes including:

- More frequent and more severe extreme daily high temperatures (heat waves)
- Despite overall summer drying, with wet days projected to become less frequent, projections show the daily rainfall will be more intense, raising the risks of flash flooding
- Future winter weather is projected to be dominated by more mobile, cyclonic weather systems. This will affect the western parts of the UK, in particular. Winter extreme rainfall is projected to be more intense with related flooding, as well as a higher incidence of strong winds and waves.
- New high-resolution projections (2.2km) within CCRA3 allows convection (vertical movement of air) to be taken into account and show:
 - Increases in winter rainfall are significantly larger than in low resolution models (can be nearly twice as large)
 - Larger increase in intense summer rainfall than in low resolution models- raises the potential for flash flooding
 - More intense temperature extremes- more likely to exceed 40°C due to improved representation of the urban heat island effect
- Individual years could still see conditions opposing the long-term average trend.

In relation to the different emissions pathways:

- Until 2050 changes to the UK climate are predicted to largely follow the same path
- In the second half of the century a wide range of future UK climates remains possible. Future changes in UK weather and climate depend on both the amount of future global greenhouse gas (GHG) emissions and on how the climate responds to these emissions
 - Higher emissions scenarios are projected to lead to greater increases in extreme weather and sea level both at UK and global scales, including the severity of extremes
 - Warming reaching 4°C by 2100: Much warmer and wetter winters, much drier and hotter summers with frequent and intense heatwaves. Over 50% of days could have ‘very high’ fire risk in the peak months of the summer.

Low likelihood, high impact events and tipping points

There are some events that are considered low likelihood but high impact, for example significant shifts in the North Atlantic Jet Stream by 2100. These major events, often known as tipping points, could have an extreme impact on climate change. As set out in CCRA3 it is therefore vital that these processes are monitored and reviewed and CCRA3 has identified evidence on these where available.

c. Localised data based on our changing climate








There are two locally available data sets that give local nuances to the national pictures (Figure 6). The first is a set of data from the Met Office Local Authority Climate Explorer³ [12] and second of these comes from the Local Climate Adaptation Tool (LCAT) [23]. The Met Office data also gives some useful general guidance on how our South-west of England location might impact future climate change (Figure 7). They also provide projections for how the climate is predicted to alter in a range of future global warming levels (GWLs) (1.5 °C, 2 °C and 4 °C). This data predicts for example the change in the amount of hot summer days. The Met Office data is currently being run as a beta service to local authorities to allow discussion and feedback.

Both sets of data show there is a significant difference if we reach the higher scenarios (4°C of GWL or RCP 8.5) than if we have a future where we have a lower degree of warming (2 °C or RCP 6.0).

LCAT data uses RCP 6.0 and RCP 8.5. The Met Office data is for RCP 8.5- this scenario allows a single set of projections to represent a wide range of global warming pathways.

Figure 6: Local Climate data tables

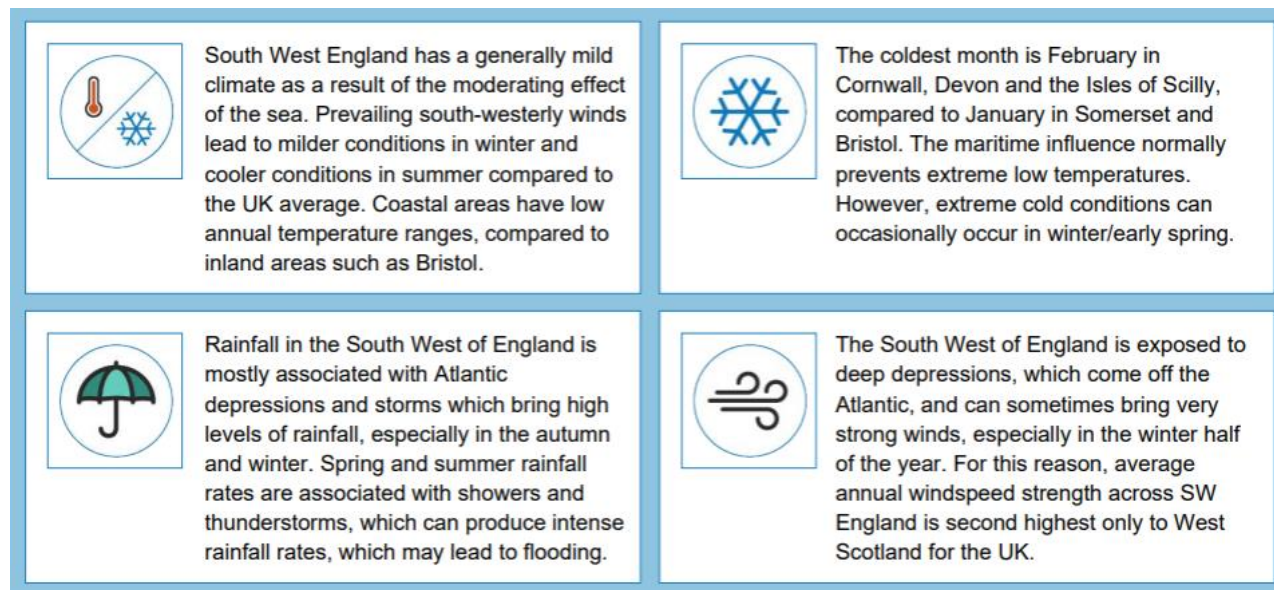
Met Office Local Authority climate explorer [12]- Data for South Gloucestershire

		0.6°C GWL Baseline 1981- 2000	1.0°C GWL Recent Past 2001-2020	1.5°C GWL Paris Agreement	2°C GWL Guidance: Prepare	4°C GWL Guidance: Assess risks
	TEMPERATURE	°C	°C	°C change	°C change	°C change
	Summer Maximum Temperature	29.1 28.9 to 29.4	31.1 30.2 to 32.3	+3.1 +0.6 to +3.5	+3.4 +1.9 to +4.9	+7.0 +6.0 to +9.5
	Summer Average Temperature	16.1 16.0 to 16.1	17.2 16.7 to 17.6	+1.3 +1.0 to +2.1	+2.1 +1.5 to +2.6	+4.3 +3.7 to +5.3
	Winter Average Temperature	4.7 4.7 to 4.7	5.4 5.0 to 5.7	+1.0 +0.6 to +1.2	+1.3 +0.7 to +1.6	+2.7 +1.8 to +3.3
	Winter Minimum Temperature	-7.1 -7.7 to -6.9	-6.1 -7.1 to -3.5	+1.9 +0.9 to +3.1	+1.8 +1.2 to +3.9	+4.1 +3.4 to +5.1
	Annual Average Temperature	10.1 10.1 to 10.1	10.9 10.8 to 11.1	+1.1 +1.0 to +1.3	+1.6 +1.2 to +1.8	+3.3 +2.9 to +3.8
	PRECIPITATION	mm/day	mm/day	% change	% change	% change
	Summer Precipitation Rate	1.91 1.91 to 1.91	1.87 1.56 to 2.02	-6 -18 to -1	-16 -24 to -4	-31 -49 to -26
	Winter Precipitation Rate	2.59 2.57 to 2.60	2.70 2.57 to 3.14	+7 -3 to +19	+9 +4 to +18	+21 +14 to +34

Local Climate Adaptation Tool (LCAT)- Data for South Gloucestershire [23]

	2070	
	RCP 6.0	RCP 8.5
Summer average air temperature	+2.81°C	+ 5.6 °C
Summer average rainfall	-0.06 9mm/day	+ 0.9mm/day
Summer cloudiness	-19.47 Watts/m2	- 48.51 Watts/m2
Summer windiness	-0.12 m/sec	-0.22 m/sec
Winter average air temperature	+ 3.4 °C	+ 3.4 °C
Winter average rainfall	+ 0.25 mm/day	+ 0.56 mm/day
Winter cloudiness	-4.32 watts/m2	-4.07 watts/m2
Winter windiness	-0.01m/sec	+0.20m/sec

Figure 7: Types of Weather that South West England experiences across the year [12]



d. Climate hazards and their potential risk within South Gloucestershire

The changes to our climate in South Gloucestershire, in terms of the climate drivers and associated climate hazards, will follow that of the national picture with some local refinements (where hazards and associated risks are likely to impact us to a greater or lesser degree than the national picture). We also need to consider any specifics of the area that might make us more vulnerable or exposed and therefore increase our risk from certain impacts.

Sea level rise, flooding, and extreme temperatures, including heat and cold, are climate hazards which, as set out in the previous section, we already know are significant risks to South Gloucestershire. Their impact is considered below.

Flooding

CCRA3 sets out that *the risk of flooding to people, communities and buildings is one of the most severe risks from climate hazards for the UK population – both now and in the future* [2].

The Met Office location data suggest that our location within the southwest of England means we are likely to be more at risk than the national average for increased rainfall and strong winds going forward. The climate change scenarios show that the likelihood of flooding, including flash flood events from increased rainfall in both summer and winter will be more likely, and is likely to increase our populations exposure to flood risk.

As discussed in section 4, a considerable amount of work that has been undertaken to review and manage flood risk at both a national and local level and this helps to build our resilience.

Sea level rise

Sea levels are rising and will continue to rise, and there is a certain locked in element to this regardless of the future emissions scenario (due to the time lag between emissions and sea level rise occurring). Higher future emissions scenarios could lead to significantly higher levels of sea level rise, in particular if we were to be impacted by low likelihood high impact events such as ice sheet melting. In South Gloucestershire our coastal Severnside area is a significant economic centre for the authority with locally and regionally important infrastructure, (as well as residential development) and these factors increase our exposure and vulnerability to any coastal flooding.

The risk of flooding from sea level rise may also be compounded by issues such as tidal locking⁴ or storm surges and further information is needed on this.

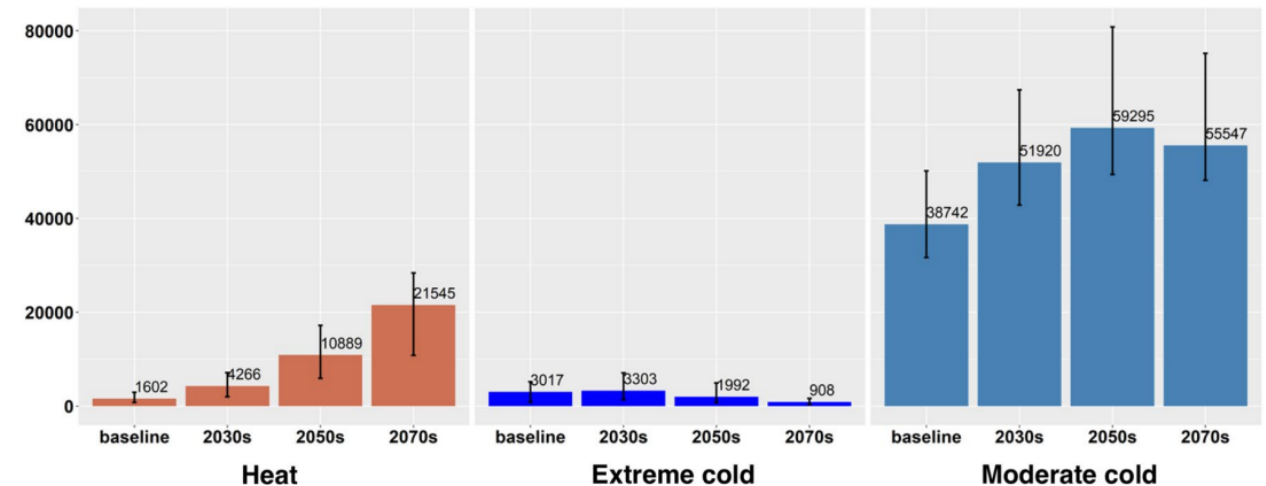
As discussed in section 4, coastline management, including sea defences and ecological flood mitigation, help us build resilience, however we need to be aware of the longer-term impacts of sea level rise and keep our ability be resilient under review.

Extreme heat and heat stress

As the underlying temperature gets hotter this will alter our general climate in terms of the average daily temperature increasing and it will also lead to more extreme heat events (heatwaves) that last for longer periods of time. The Met Office local data [12] shows that the amount of summer days (over 25 degrees) has increased since 1981 and is predicted to increase in all future scenarios. However, a 4 °C future has double the amount of summer days predicted for South Gloucestershire compared to that of 2 °C s, with hot and extreme days predicted to triple.

Extreme heat is a hazard that already causes direct deaths, and this is expected to increase with a changing climate (with a greater impact from higher climate scenarios) as shown below in this chart from the Health Effects of Climate Change in the UK [10].

Figure 8: Annual Temperate related deaths (UK all ages), Health Effects of Climate Change in the UK [10].



⁴ Tidal locking describes the impact of tides on the ability of rivers to drain out to the sea. In very low-lying areas such as the Somerset Levels, the fall on the rivers may be so small that only during the lowest parts of the tidal cycle is the river able to drain to the sea. This was a major factor in the Somerset floods during the 2013/14 winter. This tidal locking will increase as mean sea level rises [34]

Different groups of the population are also more vulnerable to rising temperatures and extreme heat. This may be related to factors such as age (with older people more at risk of from extreme heat) or because of other factors for example living within an urban area and being subject to the urban heat island effect. Our demographics show that will have a growing older population in future years that would be more a risk from extreme heat which will further exacerbate our exposure and vulnerability as climate change impacts increase [4].

Increasing temperatures, including extreme heat events, are hazards that we have had less exposure too historically as a country and as such we less adapted and resilient to the impacts of them. We do not for example build resilience to future hot temperatures into buildings as standard. All of these factors mean that we consider extreme heat to be a key hazard for South Gloucestershire. Extreme heat events can also lead to a higher risk of related other hazards such as wildfires.

We are also aware that we need to better understand our exposure and vulnerability to heat at a local level and need to continue to build on previous work undertaken in relation to this.

Extreme and moderate cold

Increasing winter temperatures meant that deaths from moderate and extreme cold are projected to decline due to climate change but the total burden from moderate cold will still exceed that from heat well into the 2070s (as shown in Figure 8). Despite rising temperatures in future, cold related impact will increase to the mid 2050's, largely driven by changes in the UK population in terms of population growth and ageing. Therefore, cold is still considered a key hazard going forward.

Other direct and indirect climate hazards and risks

There are a wide variety of other climate hazards and risks to consider. The Local Climate Adaptation Tool (LCAT) [24] provides information alongside the local data set to assist with consideration of climate hazard risks, including links to data sources (or highlighting where there are gaps). The tool also provides information on how those more vulnerable may be impacted.

As well as data on temperature and rainfall, the Met Office Local Authority Climate Explorer [12] has projected changes in eight climate indicators for South Gloucestershire for a number of Global Warming Levels (GWLs) (1.5 °C, 2 °C and 4 °C). For example, data is provided on the change in cooling degree days (which is an indicator of energy demand for cooling) and this data could be used in planning adaptation actions. It will be important to understand whether the temperature extremes of the recent few years, such as the summer extremes of 2022, alter where we consider we are on the trajectory provided (which uses recent past of 2001 to 2020) and therefore the projections.

CCRA3 looks at the impact from the changing climate in relation to five areas- Natural environment and Assets; Health, Communities and the Built Environment; Business and Industry; Infrastructure; and International dimensions and they set out 61 risks (Appendix One). As

well as assessing the risks CCRA3 looks at the plans we have in place at a national level to adapt to these risks and our likely adaptation gaps. All this information is then utilised to give a score in relation to high, medium or low. CCRA3 also set out the eight highest priorities for adaptation for the two years following publication in 2021 and these are set out in Appendix One.

Using information from all these data sets, including the CCRA3 and the eight priority risks, local intelligence from existing groups and in consultation with partner organisations, colleagues and the wider community, we will need to look at where we are best placed to provide leadership and enable adaptation and resilience within our wider area as we develop a Climate Adaptation and Resilience Framework next year.

Some examples of the wider climate risks:

- Wildfires - Climate change increases the risk of wildfires through a combination of factors including, low humidity and low rainfall making it drier, higher temperatures and higher windspeeds. Human factors are also considered likely to increase risk as more people are likely to access outdoors as temperatures rise. We need to better understand our vulnerability and risk to wildfires at a local level.
- Drought and water scarcity - A reduction in rainfall and an increase in heat leads to an increased risk of drought. A prolonged drought is considered a high impact, low likelihood scenario, but with increasing probability in future years and with higher temperatures and would have widespread impacts including on food production. The climate scenarios in CCCRA3 show water deficit becoming an issue, particularly in higher temperature scenarios and in later years across the UK. Data from CCRA3 in relation to South Gloucestershire (and other parts of our area in the south-west) show we are likely be far less impacted by water scarcity than other regions of the UK though will still be in water deficit by 2100.
- Wind-storms - Wind storms are among the most damaging extreme events in the UK, however their shift due to climate change is uncertain. Our location on the southwest coast means we may be more exposed to wind-storms and this requires consideration.
- The introduction and spread of vector borne⁵ diseases - Vector borne diseases have already been impacted by hotter summers and are predicted to spread further due to temperature rise. There are actions being undertaken to review this, such as monitoring at ports. Our location within the south of England means it is likely we will experience this earlier than more northern areas of the country.

⁵ Vectors are living organisms that can transmit infectious pathogens between humans, or from animals to humans

- Risks to crops, livestock and commercial trees from multiple climate hazards - Productive agriculture and forestry sectors are essential for future domestic food security. Climate change poses a direct risk to crops, livestock and commercial trees through increased exposure to heat stress, drought risk, waterlogging, flooding, fire, and pests, diseases and invasive non-native species.
- Risk to soils from changing climatic conditions, including seasonal aridity and wetness- There is increasing evidence of the negative impacts of climate change on soil resources. This includes those due to heavier rainfall events (erosion and compaction risks), and increased soil moisture deficits in summer (loss of biota and organic matter etc). Soil health is crucial for the natural environment as it provides multiple ecosystem services, notably for agricultural and forestry production, as well as for maintaining biodiversity.

Interacting and cascading risks

As well as individual risks, risks can interact. Interacting risks pose one of the biggest challenges when assessing climate risks as they can have significant, far-reaching consequences. CCRA 3 identified risks to people and the economy from climate-related failure of the power system as one of the top priorities for Government, given the potentially far-reaching consequences of a power failure across society and the growing importance of electricity in the whole infrastructure system in the transition to a Net Zero economy.

Natural environment and nature-based solutions

The natural environment plays an important role in moderating many climate change risks and nature-based solutions are therefore key to climate change resilience and central to many adaptation measures. We also need to ensure that we acknowledge that the natural capital [25] value of natural assets (our green infrastructure) can only be sustained if effectively maintained; and to take this into account across our decision making, plans and work. Nature is also being adversely impacted by our changing climate (CCRA3 see Appendix 1) and these risks and impacts and the role of nature-based solutions need to be considered and included in adaptation plans to both protect nature and manage potential interacting and cascading risks for people, place and communities.

We are already undertaking projects to build resilience and restore nature utilising nature-based solutions, with some examples set out in section 7, and this will continue in our next year actions.

6. Risk Assessment for South Gloucestershire Council-targeted services

Assessing the impact of a changing climate on how we deliver our council functions will enable us to become more resilient as an organisation. It is also a key aim of the ARP4 reporting process.

Our organisation risk register sets out what we consider to be the key risks to the council. The risk from a changing climate is one of the themes within this. We also have a statutory duty to respond to emergencies and we undertake emergency and business continuity planning. Whilst we will always need a clear and planned emergency response, we want to ensure we are also forward planning and building adaptation and resilience to climate events into service delivery.

We reviewed our functions and prioritised those to hold initial discussions on service level hazard and risk with, and a presentation was held to Senior Managers.

a. Service prioritisation

The areas prioritised were:

- Public Health
- Property
- Education (and skills)

We have already undertaken projects with public health, due to the link between health and a changing climate, and the importance of minimising the widening of inequality. Property is an area where there is the potential for decisions being made now to lock-in⁶ impacts. Property is also strongly related to the risk from climate to health. Supporting children and young people is one of the priorities in the council plan. Other immediate areas to target going forward are Information Technology (IT), due to the reliance on IT infrastructure for council employees to undertake work. Nature- community spaces, due to the importance of nature- based solutions in relation to both

⁶ Early actions or decisions that involve long lifetimes or path dependency, which will potentially increase future risk or vulnerability and that are difficult or costly to reverse later (irreversibility). This can be from a 'business-as-usual' action or decision, from a lack of an action or decision, or from a maladaptive action or decision. Source: CCRA3 Technical Team [2]

continuing to build adaptation and resilience and of supporting our fundamental eco-systems. Environmental health, as food security is also another of our fundamental needs.

b. Facilitated discussions

We held three facilitated discussions with the following aims and outcomes:

- To understand whether existing changes to the climate or extreme weather events have already impacted service delivery
- The key hazards and risks to each service
- Potential adaptation actions being undertaken
- How can climate adaptation and mitigation be integrated into service delivery

The Local Partnerships risk assessment matrix [24], which is based on the 61 climate risks from CCRA3 but with filters for authority type and some service functions, was utilised to refine hazards and risks more specifically for each service.

c. Key outcomes

Figure 9: Overall risks highlighted by attendees

Service Area	Key risks as highlighted from facilitated discussion
Public Health	Travel disruption; Impact on health of extreme heat; Worsening of inequality; Worsening of health conditions; Worsening of air quality indoor and outdoor; Flooding impacting school access
Property	Risk from flooding including water ingress (buildings and hard surfaces/vegetation); Risk from heat (building and hard surfaces/vegetation); Risk to building fabric- (including pests); Travel disruption
Education and skills	Heat and heat stress (buildings, learning and behaviour, use of outdoors; place planning); Risk on outdoor activities- importance of play; Flooding (to schools and travel; place planning); Cascading impact of school closures; Cascading impact of building stock issues/changes; Risk to mental health- climate anxiety; Increase in health related employment issues; Impact on how training is delivered

I. Public Health facilitated discussion

Figure 10: Risk matrix for public health.

Risk ID	Risk / Opportunity	Urgency (CCRA defined)	Service Area
CCRA risk r	CCRA risk		Council service area
H01	Risks to health and wellbeing from high temperatures	HIGH More action needed	Public Health
H02	Opportunities for health and wellbeing from higher temperatures	MED Further investigation	Public Health
H07	Risks to health and wellbeing from changes in air quality	MED Further investigation	Public Health
H08	Risks to health from vector-borne disease	HIGH More action needed	Public Health
H09	Risks to food safety and food security	MED Further investigation	Public Health
I08	Risks to public water supplies from reduced water availability	HIGH More action needed	Public Health
ID02	Opportunities for UK food availability and exports from climate impacts overseas	LOW Sustain Current Action	Public Health
ID09	Risk to UK public health from climate change overseas	HIGH More action needed	Public Health

Learning from the facilitated discussion with Public Health

The main aim of the session was to discuss key risks and any adaptation actions and blockers to building resilience to a changing climate. The discuss showed widening inequalities and worsening health as important risks to consider from those attending, alongside travel disruption. Whilst a few risks in the CCRA3 public health risk matrix were briefly discussed several were not.

It was found in the discussion on current weather events that a changing climate was not yet significantly impacting the service delivery of those public health team members in attendance at the event. It is likely this contributes to the discussion on risk. When to build

adaptation and resilience to the risks from a changing climate into different parts of the service delivery is therefore a key consideration. We need to ensure we avoid making decisions in relation to climate risk that might be irreversible or costly to revert later, but also avoid discussing issues prior to actions being necessary.

Learning from how we currently manage extreme weather events, such as extreme cold, was highlighted as important for dealing with future extreme event risk.

Rapid adaptation pathways assessments

South Gloucestershire Council have been part of a pilot on rapid adaptation assessment pathways (RAPAs). RAPAs look at different pathways to adapt and build resilience to climate change and the thresholds for when we need to take action. This approach may be appropriate for considering climate risk with public health colleagues (e.g. when and how do we focus more on heat, and how this may be different across the service depending on the role).

As public health covers a wide range of services and areas, including significant work with other stakeholders and the community; and the impacts of a changing climate are projected to have a considerable impact on health, including the potential to widen inequalities, we continue to have a specific action to continue to work with public health colleagues within our Climate and Nature Emergency action plan [6].

II. Property Facilitated discussion

Figure 11: Risk matrix for property.

CCRA risk ref	CCRA risk		Council service area
H01	Risks to health and wellbeing from high temperatures	HIGH More action needed	Property
H03	Risks to people, communities and buildings from flooding	HIGH More action needed	Property
H05	Risks to building fabric	MED Further investigation	Property
H06	Risks and opportunities from summer and winter household energy demand	HIGH More action needed	Property
B01	Risks to businesses from flooding	HIGH More action needed	Property
B02	Risks to businesses and infrastructure from coastal change from erosion, flooding and extreme weather events	HIGH More action needed	Property
B06	Risks to business from disruption to supply chains and distribution networks	HIGH More action needed	Property

Learning from the facilitated discussion with Property

The climate risk assessment based on the CCRA3 61 risks, emphasised six main potential risks in relation to property (as well as one opportunity). The discussion highlighted the property team were aware of these risks, and the adaptation actions that could assist with them. However, they highlighted challenges to undertaking these actions (for example in terms of funding).

Figure 12: Adaptation actions, blockers and integration going forward- Property

Adaptation actions	Air source heat pumps; improved building standards; decarbonisation project commencement; Estates Strategy; PV project: green energy options-onshore wind/battery/solar/storage
Blockers to adaptation actions	Funding; leases; competing needs for land ownership; lack of appropriate land; capturing land needs to support climate change
Ways to integrate adaptation and resilience into service delivery	Put the climate friendly option in (e.g. put in the options at the decision stage (1) normal school (2) Passivhaus); business resilience and business continuity; bringing together costs; bring together key people across teams; provide a trajectory: be clear on the problem we are trying to solve: need to know what people need (in terms of property assets)

III. Education and Skills Facilitated Discussion

Figure 13: Risk matrix for Education and Skills.

Risk ID	Risk / Opportunity	Urgency (CCRA defined)	Service Area
CCRA risk <input type="text"/>	CCRA risk <input type="text"/>	<input type="text"/>	Council service area <input type="text"/>
B02	Risks to businesses and infrastructure from coastal change from erosion, flooding and extreme weather events	HIGH More action needed	Education and Skills
B05	Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working environments	MED Further investigation	Education and Skills
H13	Risks to education and prison services (Heat and flood as key for education)	HIGH More action needed	Education and Skills

Learning from the facilitated discussion with Education and Skills

The discussion covered the topics in the risk matrix above but also wider concerns. Alongside concern in relation to physical buildings and heat, there was discussion in relation to how heat could impact behaviour and learning, both during heat wave events but also before with general higher temperatures. Play and opportunity for engagement in outdoor physical activity was discussed as being essential to the development, health and well-being of children and young people and therefore extreme heat, and the impact on the ability to utilise outdoor space, was a concern. Heat impact in schools was highlighted as an issue that has already been experienced in the adverse weather events discussion.

Of concern is also the impact of hearing about the risks and dangers associated with climate change on the mental health and wellbeing of children and young people and that some children and young people are experiencing increasing levels of anxiety. This should be considered when planning communications via early years settings, schools and colleges about the impact of climate change.

School transport and adult community learning are also in the scope of this service and impacts on these were discussed. How physical buildings are adapted was raised in relation to flooding and heat and this needs further discussion with property colleagues. As set out below a range of different ways to integrate adaptation and resilience into service delivery were discussed.

Figure 14: Adaptation actions and blockers going forward- Education and skills

Building resilience	
Adaptation actions (currently undertaking and could undertake in the future)	New schools being built to passive regs; Reduced travel through online meetings; Providing training online to reduce travel; Adult community learning courses on how to adapt to increased heat; Offset increased use of IT impact on energy consumption; Advice to schools regarding adapting to heat; A lot of work with mental health generally but further work hearing their concerns in this area; Learning from existing extreme weather events (snow). Audit school building risk flood: audit of our schools in terms of how resilient they will be to hot or cold extremes.

Blockers to adaptation actions	Transport risks to consider in here- people can choose at moment high transport distance (high carbon) school choices
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d. Going forward- including challenges

As well as the specific points raised in the sections above, which need further consideration, the discussions undertaken have inputted into our action plan for adaptation and resilience in the following section.

As highlighted in the discussions there will be challenges to integrating adaptation and resilience into our council functions, even when we are aware of the opportunities and options. For example, in relation to funding for adaptation and resilience measures in property.

7. Adaptation and Resilience Actions

Each year since South Gloucestershire Council declared a Climate and Nature Emergency we have developed and reported on a Climate and Nature Emergency Action Plan [6] with eight themes, one of which is adaptation and resilience.

This section highlights some existing adaptation and resilience projects and strategic actions from the action plan. It also sets out some strategic actions evolved from this report. The Climate and Nature Emergency Action Plan will remain the main place for our action planning and can be found on our [Climate and nature emergency webpages](#). [6] Activity being progressed by the West of England Mayoral Authority, through their climate resilience programme, will support the delivery of our ongoing work in this area, including the opportunity to share and learn from others within the region.

Adaptation and resilience will also be a co-benefit within many of the projects in the other seven sections of our action plan. For example, we have a variety of projects in relation to home retrofit and energy efficiency. These focus on reducing emissions and co benefits such as reducing fuel poverty. Warm and Well provides home energy advice for Gloucestershire and South Gloucestershire [26]. Retrofit West is a regional project and gives advice to householders on their retrofit journey [27]

a. Strategic actions

Action 1. Continue to embed resilience in our governance structure

- Short- and long-term action

Adaptation and resilience has been built into the new council plan 2024-2028 [7]. It is one of the segments on our Climate and nature emergency decision wheel, which has been used since April 2023 to make sure better social and environmental outcomes are considered when we make decisions about projects, especially those that needs £100,000 of more of external funding [6]. As a part of our business as usual working we will continue to look to embed resilience into our governance structure and the facilitated discussions have brought out ideas for further consideration.

Action 2. Continue to review and develop climate change data and processes

- Short- and long-term action

New sources of data have provided additional information for assessing hazards and risks, however, there are still data gaps, in particular at a local level. We also need to consider how we as a council collate our data on climate risk. We need to continue to work with partners, including the MCA, to look at where, and at which level, to best obtain this data, and we will continue to do this a part of our business-as-usual working.

Action 3: Continue assessing risk, and building resilience amongst council services

- Medium term action for initial assessments

We will need to deliver our council functions within a changing climate. Considering how we can adapt and become more resilient as an organisation is important to enable us to continue to deliver our services in an effective way. This process has been started this year (2024) with targeted departments and we aim to continue to do this going forward. It will be an on-going process to embed adaptation and resilience, including review.

Action 4. Develop an area wide Climate Adaptation and Resilience Framework and further targeted actions

- Short term action 2025-2026

We will need to continue to enable climate resilience across the South Gloucestershire area. The data and information collected on national and local climate risk, can be utilised to help us to review and continue conversations as to where we are best to target and prioritise as a local authority to help build resilience in the wider community. We will need to take into account local intelligence from existing networks and forums, our existing projects, some of which are outlined in the next section, as well as other work streams, such as the MCAs CESAP, so that we complement our priorities. We will also need to look at how best to engage and consult with our residents, communities, business and wider area on determining the priorities.

Action 5. Continue to implement the Green Infrastructure and Nature Recovery Action Plan to 2030

- Short- and long-term actions- to 2030

Nature based solutions have a critical role in adaptation and resilience. Our natural ecosystems are also important in their own right as they underpin our ability to function. The Green Infrastructure and Nature Recovery Action Plan to 2030, shows how we will take action to achieve the outcomes of our Green Infrastructure Strategy 2021: Greener Places. It contains 77 projects, many of which will build a greater resilience to the changing climate. Several of the actions from this plan are included in more detail in the project-based actions and case studies below.

b. Adaptation and resilience projects for 2025-2026

As highlighted above the full list of climate adaptation and resilience projects, as well as our climate mitigation work, can be found in our action plan on our website [6]. Some of the key projects in relation to delivering adaptation and resilience actions in 2025-2026 are highlighted below.

Linking the levels	
<p>Linking the Levels is a landscape scale partnership project working for restored, connected, thriving and resilient nature across the Lower Severn Vale, Levels and Shore of South Gloucestershire. With Green Recovery funding from the West of England Mayoral Combined Authority, project partners are surveying the area and engaging with landowners and communities to identify opportunities to develop and deliver nature-based solutions to improve biodiversity and flood and drought resilience. For example, one of the project themes includes surveying water courses and catchments to identify where water can be held back to increase flood resilience. Find out more at Funding secured to help restore nature along the Severn Estuary Newsroom (southglos.gov.uk) [28]</p>	<p>2024-2026 initial phase</p>
Towards a sustainable food place	
<p>The aim of this project is to develop a cross-sector food partnership and strengthen the food system across South Gloucestershire. We will build on work undertaken this year building the partnership and we are looking to develop and begin to deliver an action plan in consultation with all the partners. We are also undertaking a food systems analysis to look at where our food comes from [6].</p>	<p>Continues from previous year</p>
Investing in Climate and Nature Scheme (ICaN)	
<p>The South Gloucestershire Investing in Climate and Nature (ICaN) Scheme is a new scheme which manages a portfolio and pipeline of 'investment ready' projects that deliver nature recovery, climate adaptation and social value improvements to council assets including public open spaces. These improvements are designed to increase natural capital value to ensure that these spaces</p>	<p>Continues from previous year</p>

work better for nature and deliver increased ‘ecosystem services’ such as flood and drought resilience, air quality improvement, temperature moderation and carbon sequestration. They’re also designed to ensure that local communities have better access to high functioning green spaces and associated health, well-being and social value benefits. The scheme enables funding from a range of sources to be secured to deliver and sustain improvements for nature, adaptation, resilience and communities. Contact: ICaN@southglos.gov.uk [6]	
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Heating and Cooling from mines	
South Gloucestershire has an extensive mining heritage with significant local disused and abandoned coal mines. The old mines are filled with floodwater which is naturally heated by underground geological activity. This could be utilised via heat pumps for heating and cooling. Further work to investigate this potential will continue next year [6].	Continues from previous year

Adaptation and Resilience Local Plan Policy	
The new local plan will be going in its fourth round of consultation and contains a draft Adaptation and resilience policy that aims to increase our resilience to climate change impacts and threats and avoid lock-in to future impacts such as heat [29].	Continues from previous year

c. Going forward- including asks for Government

South Gloucestershire Council is committed to working alongside Government to support the delivery of the National Adaptation Programme, bringing to life the challenges facing our region and working together to unlock the support we need. Collaborative working with the West of England Mayoral Combined Authority and other partners, and utilising local intelligence, will be essential to undertaking this. Collaborative cross departmental working at a national level would also be beneficial.

We will need additional funding from central government to help us deliver this work and to support the changes needed, including the significant investment and behavioural change that will be required to build climate resilience across a broad range of partners, sectors, and stakeholders and help us prepare for the consequences of a rapidly changing climate.

8. Case Studies

Summer cooling video

To support our residents to consider preparing for the local impacts of a changing climate we have developed an information page on our website as well as a short video exploring how to keep a home cooler during the summer which was developed in partnership with our energy advice provider Severn Wye Energy Agency. The link to the web page can be found here:

<https://beta.southglos.gov.uk/preparing-for-local-climate-change/>

Health Standards Agency Heat mapping work

We have completed a pilot project to look at local heat and flooding vulnerability working with the UKHSA on a dedicated mapping tool and use cases across the authority. The results of this pilot project are due to be issued shortly.

Rapid Adaptation Pathways Assessment

Rapid Adaptation Pathways Assessments (RAPAs) are 'high-level' adaptation pathways developed in workshop settings. They use the expert judgement of participating stakeholders to identify thresholds and actions, using maps and clearly defined data

This year, in conjunction with the MCA, we have been one of three local authority areas using this technique, in a pilot project run by the Association of Directors of Environment, Economy, Planning & Transport (ADEPT) and the Environment Agency (EA). We held a workshop that brought together stakeholders from business, industry, infrastructure, councils, and community representatives to look at rising sea level and coastal flood risk in the ASEA Severnside area of South Gloucestershire and explored issues such as tipping points and insurability.

The adaptation pathway approach allows decision makers to act even under climate uncertainty, identifying what actions can be taken now and to plan and adapt for climate hazards and changes in the future. Further technical information on adaptation pathways can be found at [Adaptation Pathways | ADEPT \(adeptnet.org.uk\)](https://adeptnet.org.uk) [30].

Resilient Frome Partnership

In 2021, the Resilient Frome programme was granted £6m through a successful bid to the [Defra Flood and Coastal resilience innovation programme](#) [31]. The programme aims to improve flood resilience in both rural and urban areas delivering multiple benefits across the

Bristol Frome catchment using nature-based solutions. We are working with Bristol City Council, Environment Agency and Wessex Water.

The Resilient Frome is working with local farmers and landowners to develop a range of Natural Flood Management (NFM) measures which include more natural management of land and water. Modelling has shown that on the Bristol Frome, good soil management is a one of the best ways we can manage surface water run-off. Good soil management helps increase the sponginess of the soil improving water infiltration also reducing nutrient and sediment loss to watercourses. Therefore, we have supported farmers through the provision of advice on how best to manage soil, their most valuable asset. This also helps farmers by producing healthier soils benefitting crop productivity.

Where fields are less productive or regularly flooded in areas we have bunded off sections to allow corner storage areas which collect run-off before it reaches the field ditch network and onto the rivers. Within the rivers we have installed multiple leaky dams which hold water back and encourage water to spill out onto the floodplain in areas where there is space. These measures together help slow down the transfer of water from the fields to the rivers locally reducing flood risk. These methods are cost effective and a sustainable way to support flood management, as well as creating important habitat for wildlife and improving water quality. See short video <https://youtu.be/cX-IDs0B-7g> [32].

We are also working towards addressing surface water run-off in more urban areas by piloting the retrofit of Sustainable Urban Drainage solutions (SuDS) in a range of settings including schools, public spaces, industrial sites, across Frome. Once installed we intend to engage, inspire and train other organisations to take similar action to reduce surface water flows in their own localities. As more SuDS are installed this will reduce surface water flooding locally whilst enhancing biodiversity and local amenity.

In the lower sections of the river in Bristol the project is also designing a river improvement scheme around Riverside Park which will invest in improvements in the Frome corridor there. We have also installed hydrometry and telemetry equipment monitoring rainfall, water levels and water flows to help inform operational management of the Frome and Avon.

Over the remaining 3 years the Resilient Frome is aiming to:

- Deliver more NFM within the Frome headwaters.
- Retrofit pilot SuDS within schools, industrial sites and highways across the Frome.
- Deliver a river enhancement scheme in Bristol and
- Develop an Innovative Funding Mechanism or link with existing mechanism to engage with private sector funding.

Further information can be found [Resilient Frome | Engage Environment Agency \(engagementhq.com\)](#) [33]

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Appendix One: Climate Change Risk Assessment 3rd round

CCRA3 61 risks and opportunities [2]

N1 Risks to terrestrial species and habitats	N2 Risks to terrestrial species and habitats from pests, pathogens and INNS	N4 Risk to soils from changing conditions, including seasonal aridity and wetness	N5 Risks to natural carbon stores and sequestration from changing conditions	N6 Risks to and opportunities for agricultural and forestry productivity
N7 Risks to agriculture from pests, pathogens and INNS	N8 Risks to forestry from pests, pathogens and INNS	N11 Risks to freshwater species and habitats	N12 Risks to freshwater species and habitats from pests, pathogens and INNS	N14 Risks to marine species, habitats and fisheries
N16 Risks to marine species and habitats from pests, pathogens and INNS	N17 Risks and opportunities to coastal species and habitats	I1 Risks to infrastructure networks from cascading failures	I2 Risks to infrastructure services from river and surface water flooding	I5 Risks to transport networks from slope and embankment failure
18 Risks to public water supplies from reduced water availability	I12 Risks to transport from high and low temperatures, high winds, lightning	H1 Risks to health and wellbeing from high temperatures	H3 Risks to people, communities and buildings from flooding	H4 Risks to people, communities and buildings from sea level rise
H6 Risks and opportunities from summer and winter household energy demand	H8 Risks to health from vector-borne diseases	H11 Risks to cultural heritage	H12 Risks to health and social care delivery	H13 Risks to education and prison services
B1 Risks to business sites from flooding	B2 Risks to business locations and infrastructure from coastal change	B6 Risks to business from disruption to supply chains and distribution networks	ID1 Risks to UK food availability, safety, and quality from climate change overseas	ID5 Risks to international law and governance from climate change overseas that will impact the UK
ID4 Risks to the UK from international violent conflict resulting from climate change	ID9 Risk to UK public health from climate change overseas	ID7 Risks from climate change on international trade routes	ID10 Risk multiplication from the interactions and cascades of named risks across systems and geographies	N3 Opportunities from new species colonisations in terrestrial habitats

N9 Opportunities for agricultural and forestry productivity from new species	N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	N15 Opportunities for marine species, habitats and fisheries	N18 Risks and opportunities from climate change to landscape character	I3 - Risks to infrastructure services from coastal flooding and erosion
I4 Risks to bridges and pipelines from flooding and erosion	I6 Risks to hydroelectric generation from low or high river flows	I7 Risks to subterranean and surface infrastructure from subsidence	I9 Risks to energy generation from reduced water availability	I10 Risks to energy from high and low temperatures, high winds, lightning
I13 Risks to digital from high and low temperatures, high winds, lightning	H2 Opportunities for health and wellbeing from higher temperatures	H5 Risks to building fabric	H7 Risks to health and wellbeing from changes in air quality	H9 Risks to food safety and food security
H10 Risks to health from poor water quality and household water supply interruptions	B3 Risks to businesses from water scarcity	B5 Risks to business from reduced employee productivity – infrastructure disruption and higher temperatures	B7 Opportunities for business - changing demand for goods and services	N13 Opportunities to marine species, habitats and fisheries
I11 Risks to offshore infrastructure from storms and high waves	B4 Risks to finance, investment, insurance, access to capital	ID8 Risk to the UK finance sector from climate change overseas	ID2 Opportunities for UK food availability and exports	ID3 Risks to the UK from climate-related international human mobility
ID6 Opportunities (including Arctic ice melt) on international trade routes				

 More Action Needed
  Further Investigation
  Sustain Current Action, Watching Brief

CCRA3 eight priority risks

<p>1</p> <p>Risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards</p>	<p>2</p> <p>Risks to soil health from increased flooding and drought</p>
<p>3</p> <p>Risks to natural carbon stores and sequestration from multiple hazards, leading to increased emissions</p>	<p>4</p> <p>Risks to crops, livestock and commercial trees from multiple climate hazards</p>
<p>5</p> <p>Risks to supply of food, goods and vital services due to climate-related collapse of supply chains and distribution networks</p>	<p>6</p> <p>Risks to people and the economy from climate-related failure of the power system</p>
<p>7</p> <p>Risks to human health, wellbeing and productivity from increased exposure to heat in homes and other buildings</p>	<p>8</p> <p>Multiple risks to the UK from climate change impacts overseas</p>