



South Gloucestershire

Climate Change Strategy

Part 2: Climate Adaptation Plan

February 2015

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Executive Summary

There have always been natural fluctuations in the climate but records show that we are seeing rates of change far greater than those experienced in recent history. In the UK we are expecting hotter drier summers and warmer wetter winters, alongside more extreme weather events with floods, storms and heat waves of greater severity and frequency, and sea level rise.

This Climate Adaptation Plan aims to provide a framework for managing the impacts of climate change to make sure that South Gloucestershire remains a safe, secure and healthy place to live and do business. Our priorities for action are set out below.

We will

- Ensure flood risk management takes account of the impacts of climate change on flood risk
- Improve resilience of council assets and the natural environment to climate change
- Take predicted changes in climate into account in the allocation of sites for new development and encourage consideration of climate change in design
- Seek to protect people from the adverse impacts of extreme weather and take steps to enable healthy lifestyles as the climate changes
- Seek to manage strategic economic risks and enable economic opportunities from a changing climate through West of England Local Enterprise Partnership projects

In order to deliver these priorities we will

- Coordinate action across administrative boundaries to manage climate-related risks that operate at a city-region scale and beyond
- Signpost information on climate adaptation and actions that individuals, communities and businesses can take to increase their own resilience

- Embed consideration of climate change in Council decision making and procurement of products and services
- Improve recording and understanding of the local effects and costs of severe weather events as well as incremental changes in the weather and climate in order to help plan for the future

Introduction and Policy Context

There have always been natural fluctuations in climate but observational records show that we are seeing rates of change far greater than those experienced in recent history¹. Increases in global temperatures are causing sea level to rise and increasing the frequency and intensity of extreme weather events. Even if we stopped all greenhouse gas emissions today, those already released into the atmosphere will continue to cause changes to the climate for the next 30-40 years.

Severe weather is already affecting services provided by public bodies, with operational, reputational, financial and legal consequences. This is likely to increase in future (in terms of frequency and severity), and the impacts of climate change will interact with and potentially compound other long term challenges such as rising energy prices, resource scarcity, ageing population, and social and economic inequalities.

This Climate Adaptation Plan aims to provide a framework for managing the impacts of climate change to make sure that South Gloucestershire remains a safe, secure and healthy place to live and do business.

The Climate Change Act 2008 sets 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;
- 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 Adaptation Sub-Committee of the Committee on Climate Change 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 introduces '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 reports².

The first UK CCRA was published in 2012 and sets out key risks and opportunities for the UK under five themes: Natural Environment; Buildings & Infrastructure; Health and Wellbeing; Business and Services; and Agriculture and Forestry³.

¹ National Adaptation Programme (2013)

²The first round of reporting required major infrastructure providers from the energy, transport and water sectors to produce adaptation reports. The Government has now published its '2013 Strategy for exercising the Adaptation Reporting Power and list of priority reporting authorities' which sets out proposals for the second reporting round. This Strategy states that "Given the government's localism agenda and in particular the establishment of the LGA's Climate Local initiative, local councils will not be invited to report under the ARP to avoid duplication with sector-led voluntary reporting arrangements."

³https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69487/pb13698-climate-risk-assessment.pdf

The first UK NAP was published in 2013. It responds to the risks and opportunities identified in the CCRA, setting out objectives, policies and actions at a national level to help adapt to future weather conditions. The Programme is structured into chapters as follows:

- Built Environment
- Infrastructure
- Healthy and Resilient Communities
- Agriculture and Forestry
- Natural Environment
- Business
- Local Government

Local Government is identified as having a central role to play in *“leading and supporting local places to become more resilient to a range of future risks and to be prepared for the opportunities from a changing climate”*. In particular to:

- *“build resilience into decisions on buildings, roads, businesses, parks and other public spaces*
- *build resilience into key services such as social care, emergency planning and public health*
- *make the best use of land, assets, investments and maintenance spending to manage risk better*
- *plan for the long term by reflecting climate risks and sustainable development in Local Plans*
- *increase organisational resilience to extreme weather by building climate change risks into corporate risk registers*
- *support retrofitting, green-build and the design and management of green spaces*
- *encourage local businesses to be climate ready to ensure they are resilient and competitive”*

Risks from a Changing Climate

Climate Projections

Both extreme weather events and long-term gradual climate change could have wide-ranging implications. In the UK we are expecting hotter drier summers and warmer wetter winters, alongside more extreme weather events with floods, storms and heat waves of greater severity and frequency, 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. The UK Climate Projections published in June 2009 ('UKCP09') are the first to attach probabilities to different levels of future climate change. For each climate projection, the level of uncertainty is reflected by a data range with high and low estimates, as well as a central estimate. The data can be used to understand the likely and possible range of change in climatic variables that we can expect and should aim to plan for.

Pre-prepared key findings for South West England have been published using information from UKCP09, with projections for the 2020s, 2050s and 2080s based on low, medium and high greenhouse gas emission scenarios. These are set out in Annex 1 for five different climatic variables, along with information about projected sea level rise for the Severn⁴.

Changes in the climate elsewhere in the world will also impact upon the UK. There is a significant risk of declining crop yields globally, and rising sea levels will mean that the homes of tens to hundreds of millions of people are likely to be affected by coastal flooding. The consequences of impacts such as these will be transmitted through global trade, resource flows, migration and political networks⁵.

Local Issues and Risks

The UK CCRA provides a summary of key risks and opportunities from a changing climate and many of these are relevant to South Gloucestershire. However as acknowledged in the NAP, *“the impacts of extreme weather and climate change will vary from location to location. The risks and opportunities highlighted in the CCRA will therefore, in many cases, need to be managed locally...”* This section provides a summary of relevant local issues to help set the context for the action plans.

Flood Risk

Tidal Flood Risk

The Severn Estuary forms the western boundary of South Gloucestershire and the area is therefore directly affected by changes in sea level. Tidal flood risk is already a major constraint to the significant economic development opportunity in the Severnside area, although in the short term (the next ~10 years), flood risk to the Severnside development sites is predominantly from fluvial sources (from the system of rhines that discharge to the Severn).

Existing development in the Severn Beach area is also at risk of tidal flooding from wave splash over the flood defences. The risk of overtopping or breach of tidal flood defences will increase in future given the projected impacts of climate change.

The Avonmouth and Severnside Flood Defence Working Group has already completed a Stage 1 study of flood risk (including an assessment of the impacts of climate change) and options to improve flood protection for Avonmouth and Severnside. The Working Group published their Stage 1 report in December 2013 and consulted on the outcomes including a preferred option to upgrade Avonmouth and Severnside tidal flood defences to a height of 10.7 metres above ordnance datum at an estimated cost of between £31m and £70m.

⁴ Further information is available from <http://ukclimateprojections.defra.gov.uk/>.

⁵ Intergovernmental Panel on Climate Change (2007)

420 acres (170 hectares) of land at Shepperdine adjacent to the former nuclear power station at Oldbury has been included on the Government's list of sites deemed potentially suitable for new nuclear development. The site is in an area which is vulnerable to flood risk from the River Severn (and from the ability of surface water to discharge to the Severn Estuary, particularly at high tide), and climate change is expected to exacerbate this. There is a requirement to protect new nuclear sites from a flood event with a probability of up to 1 in 10,000 years, taking account of the possible implications of climate change. Horizon Nuclear Power states that *“Proposals for ensuring this level of protection are being developed with the Environment Agency (EA) and the Office for Nuclear Regulation (ONR) and are likely to consist of a combination of site-raising alongside improvements to the area's existing flood protection measures. Whatever scheme is finally proposed, we will have to demonstrate that our flood protection measures do not increase the risk of flooding elsewhere in the locality”* (<http://www.horizonnuclearpower.com/oldbury-faq>).

The River Frome Catchment

The Bristol Frome rises in the Cotswold Hills and flows through Chipping Sodbury, Yate, Frampton Cotterell, Hambrook and Frenchay, then over the boundary into the Bristol City Council area where it continues through Stapleton and Eastville. From Eastville it flows mainly via culvert under the city into the Floating Harbour in central Bristol. At times of flood, the Northern Storm Water Interceptor sewer (NSWI) is operated to convey excess flood water from the River Frome at Eastville under the city to a tidal outfall on the River Avon at the disused Blackrocks Pumping Station.

A number of settlements within South Gloucestershire have properties which are already at risk of flooding from the River Frome and its tributaries (particularly Yate, Chipping Sodbury, Frampton Cotterell and Winterbourne), and this flood risk will increase as a result of climate change. There is also the potential for flooding in Bristol should peak flows exceed the combined capacity of the River Frome culvert and the NSWI downstream of Eastville (or in the event of significant culvert blockage or failure).

Various studies have sought to model the capacity of the Bristol River Frome catchment to cope with flood events now and in the future, taking into account the effects of climate change. The need and potential options for increasing storage capacity within the catchment have also been broadly reported. According to the South Gloucestershire Strategic Flood Risk Assessment Level 2 report, the extreme 1 in 100 year flood event can be conveyed through the River Frome and NSWI culvert system but there is very limited additional capacity under the current conditions, and there may be a need for additional river flow strategic storage provision upstream within South Gloucestershire to cope with impacts of climate change on peak flows. Bristol's Central Area Flood Risk Assessment also shows that flooding could be experienced downstream of the NSWI with climate change.

Other earlier studies have concluded there is adequate capacity in the river system (at Eastville and downstream) to cope with the 1 in 100 year event for the next 50 years and beyond.

According to studies published to-date, the most effective location for increasing flood water storage to reduce peak flows in Bristol (at Frenchay and downstream) is on the Bradley Brook, west of Winterbourne. Other strategic storage options (such as increasing the capacity of the Tubbs Bottom Iron Acton detention reservoir and increasing flow storage capacity on the Ladden Brook) have the potential to reduce peak flows through settlements in South Gloucestershire.

Sewer Flooding

Sewer flooding occurs when the capacity of combined sewers (which carry both sewage and storm water) is exceeded. Climate change is likely to increase the risk of sewer flooding with changes in rainfall intensity/frequency and tidal/coastal conditions. Wessex Water is responsible for maintaining the sewerage network in South Gloucestershire. An example of a recent improvement scheme completed by Wessex Water in South Gloucestershire is at Cog Mill, Iron Acton, where a sewage screening scheme with a new sewage pumping station was completed in 2012 to prevent overflow of solid sewage waste into the River Frome following heavy rainfall.

Asset Management

Council Assets

Buildings, transport infrastructure, open spaces and rights of way in South Gloucestershire are already vulnerable to extreme weather. Examples of impacts of severe weather and changing weather patterns on asset management in South Gloucestershire that have already been observed include:

- Increase in blockages in the highway drainage network including trash screens as a result of more intense rainfall events carrying rubbish into the system
- Damage to the highway network e.g. separation of highway layers and washout of materials results in voids and increased incidence of pot holes
- Deformation and melting of roads during hot weather with increased need for sanding, stripping and surface dressing
- Increased scour around structures resulting in need for increased inspections
- Shorter and less predictable seasonal window for certain works (e.g. surfacing, lining, concrete- based construction, painting)
- Shorter life expectancy of assets (e.g. carriageways and outdoor wooden furniture)
- Changes in drainage design to account for climate change (in accordance with national standards) have resulted in increased costs for drainage schemes and more structures to adopt e.g. attenuation tanks
- Loss of vegetation during heatwaves
- Higher winds in summer have resulted in more damage to trees (which catch the wind more when in leaf), and flooding weakens trees and makes them more prone to blowing over. Tree damage and tree fall increases maintenance requirements and associated costs, as well as causing disruption and danger to the public.

Natural Environment

Habitats and species in South Gloucestershire (as elsewhere) are vulnerable to the impacts of climate change. Both changing seasonal averages and extreme weather events such as storms, floods and drought could have significant implications. Interactions between weather and climate and biodiversity are complex and difficult to predict, but are likely to include some loss and fragmentation of vulnerable habitats and species and a possible increase in invasive species and pests / diseases.

The Severn Estuary European designated Special Protection Area / Ramsar Site falls partially within South Gloucestershire. Climate change is likely to affect the ecological interest of the site through changes to a range of physical characteristics (including sea level, precipitation, salinity and temperature) with implications for water levels and habitats (eg loss of intertidal areas and saltmarsh). Potential sites identified through the Severnside & Avonmouth Wetland Habitat Project (the 'Cresswell Report', 2011) to provide compensatory habitat to offset the impacts of new development in the enterprise area could also assist in mitigating the potential adverse impacts of climate change on the ecological interest of the Severn Estuary. In addition, the Heritage Lottery funded Lower Severn Vale Levels Forgotten Landscape project includes a programme of activity ('Coming Home to Roost') to improve and create roost sites to create a safe refuge for waterbirds at times when intertidal sites are not available.

Water Resources

Climate change poses potential challenges for management of water resources. Increased rainfall in winter alongside decreased rainfall in summer is likely to lead to more marked seasonality in river flows and potential deterioration in water quality. Heavier rainfall results in more rapid runoff and tends to be more difficult to capture and store, with less groundwater and reservoir recharge. Increased temperatures will also result in increased evaporation from surface water stores and demand for water may increase during hot summers – both for domestic and non-domestic (eg agricultural) use. There is also the possibility of extreme weather (including flooding) or sea level rise affecting water supply infrastructure such as reservoirs and treatment works.

Bristol Water is the public water supply company in South Gloucestershire, responsible for collecting and storing water from a variety of sources (85% from rivers and reservoirs, the remainder from groundwater), treating it to potable standards, and distributing it to customers. Bristol Water has no resources infrastructure located in South Gloucestershire.

Bristol Water's Water Resource Management Plan (2014) states "*The impact of the median emissions scenario for climate change on the supply/demand balance is relatively minor. At 2030, the loss of resource yield is approximately 3% of the current deployable output. Climate change induced consumption accounts for an additional increase in demand of approximately 1% overall... This is a relatively small contribution compared to the impacts caused by growth in demand for water due to rising population.*" Although relatively small, the impact of climate change is reflected in

Bristol Waters' business planning both at a strategic level and in terms of contingency planning as set out in detail in the Water Resources Management Plan and the Bristol Water Climate Adaptation Plan (2011).

New Development

The South Gloucestershire Core Strategy makes provision to accommodate 28,550 new houses during the Plan period 2006-2027. Given the extent of new development planned in South Gloucestershire, it is important that it is located and buildings, infrastructure and outdoor spaces are designed with resilience to future climate in mind. This includes protection of South Gloucestershire's best and most versatile agricultural land and ensuring new development is not at risk of flooding (and does not exacerbate flood risk elsewhere).

In accordance with national guidance, new development (including transport infrastructure) should be designed with drainage adequate to contain run-off during storm events now and in the future. Currently, drainage systems are required to contain the 1 in 100 year flood event plus a 20% allowance for climate change.

The South Gloucestershire Strategic Flood Risk Assessment Level 2 Report (SFRA) considered the susceptibility of Core Strategy major development sites to fluvial and surface water flooding, and the impact of the development of Core Strategy major development sites on flooding elsewhere in South Gloucestershire (taking into account climate change). The SFRA finds that although all the sites are subject to surface water and fluvial flood risk, *"by influencing the design and layout of the development sites and the land uses proposed, it is feasible to mitigate flood risk on these sites."*

Regarding the impact of development on flood risk elsewhere, the SFRA states *"It is observed that the most significant change to flows [in the river Frome] at Frenchay and Eastville are as a consequence of climate change effects. Compared to this the impact of the proposed developments is minimal. It is anticipated that there will be a need to consider the provision of a strategic measures to address the effects of climate change on the River Frome."* However, it was agreed that contributions to a strategic off-site solution would not be sought through the development sites in the Core Strategy due to proportionality and complexity / timescales for implementation of an off-site storage solution.

Health and Wellbeing

Extreme weather events can have direct implications for public safety (e.g. danger of drowning during flooding, or dehydration during heat waves) as well as less direct health and safety implications, for example as a result of interruption to power or water supply, telecommunications, contamination of property and land, or closure of transport routes.

A number of arrangements and networks are already in place locally to ensure that service users continue to have access to the support they need during extreme

weather events. The Avon and Somerset Local Resilience Forum is responsible for publishing and updating the Community Risk Register which assesses risks to public safety in the Avon and Somerset area, including risks from severe weather.

The Council's Emergency Planning Unit has undertaken planning for severe weather events including flooding and heat waves, and collaborated with Local Resilience Forum partners and other agencies to develop and coordinate emergency response plans. The Emergency Planning Unit also works in the community to increase awareness of risks and to disseminate information on how to increase preparedness for emergencies. Existing response plans include the NHS England Heatwave Plan and the South Gloucestershire Council Strategic Flood Plan and Operational Response Plan.

Climate change has the potential to change the incidence of health conditions / infections / diseases. This is difficult to predict and plan for since it is driven by a complex interaction of climatic variables with human response and behaviour. The Council's Environmental Health team has a role in monitoring the incidence of infections / disease locally.

Economy

South Gloucestershire has a buoyant economy driven by a diverse range of high value as well as volume sectors. Business and employment opportunities are provided in a number of Strategic Employment Areas (including the Bristol North Fringe, the Bristol East Fringe, Severnside, Yate, and Thornbury), as well as a number of retail centres (including the regionally significant Mall at Cribbs Causeway) and smaller office parks and industrial estates within urban and rural areas.

South Gloucestershire's ~10,500 businesses could be affected by changing climate and weather in a variety of ways – including risks to premises, processes, supply chains, and the health and safety of employees. A number of organisations provide support and tools to enable businesses to identify risks to their operations from a changing climate and actions that can be taken to improve resilience.

The Council works with partners across the West of England and the Local Enterprise Partnership (LEP) to deliver infrastructure to support economic development. The Severnside Strategic Employment Area is a potential major employment location (with extant planning permissions granted in 1957/58 covering approximately 650 hectares). Planning policy continues to support its development, while recognising the significant constraints that affect the area which include flood risk. As previously described, climate change will increase flood risk to the Severnside area and the Council is participating on the Avonmouth and Severnside Flood Defence Working Group to enable the flood risk issues to be resolved in order to unlock the development potential.

Managing risks and opportunities locally

South Gloucestershire Council signed up to the Climate Local initiative in 2013. This commits us to setting and publishing commitments and actions to manage climate risks (as well as reducing carbon emissions). In so doing (during the preparation of this Adaptation Plan), we have had regard to:

- The risks and opportunities set out in the first UK CCRA, and their relevance to South Gloucestershire
- The first UK NAP and its vision for Local Government
- An earlier assessment of possible risks to South Gloucestershire from a changing climate (undertaken by the Council with the South Gloucestershire Partnership and other stakeholders in 2009-10)
- An assessment of current local priorities and issues
- Extent of local control and influence
- Extent of Council control and influence
- Outcomes of consultation on the draft Climate Adaptation Plan
- Availability of Resources

Action plans have been developed to address:

- Flood Risk Management
- Asset Management (includes assets managed by the Council and the natural environment)
- New development
- Health and Wellbeing
- Economy

Relevant risks and opportunities being addressed by each action are included in the action plans.

The Action Plans provide a summary of existing and proposed activities over a short term (two year) period. In some cases, further research is required to determine what longer term action is required 'on the ground' to increase resilience to climate change. Many of the actions therefore relate to further investigation. Specific solutions will be developed as our knowledge increases and will be included in later iterations of the Adaptation Plan.

Actions in the plans are predominantly within the sphere of influence of the Council, where the Council is either the lead or a partner. Some additional relevant local partner actions have also been signposted where these activities already take place.

Our aim and priorities are set out below.

Our aim

To increase resilience to and preparedness for a changing climate so that South Gloucestershire remains a safe, secure and healthy place to live and do business.

Our priorities for action

We will

- Ensure flood risk management takes account of the impacts of climate change on flood risk
- Improve resilience of council assets and the natural environment to climate change
- Take predicted changes in climate into account in the allocation of sites for new development and encourage consideration of climate change in design
- Seek to protect people from the adverse impacts of extreme weather and take steps to enable healthy lifestyles as the climate changes
- Seek to manage strategic economic risks and enable economic opportunities from a changing climate through West of England Local Enterprise Partnership projects

In order to deliver these priorities we will

- Coordinate action across administrative boundaries to manage climate-related risks that operate at a city-region scale and beyond
- Signpost information on climate adaptation and actions that individuals, communities and businesses can take to increase their own resilience
- Embed consideration of climate change in Council decision making and procurement of products and services
- Improve recording and understanding of the local effects and costs of severe weather events as well as incremental changes in the weather and climate in order to help plan for the future

Management, implementation and monitoring arrangements

South Gloucestershire Council and the South Gloucestershire Strategic Partnership are responsible for leading, driving and monitoring action on Climate Change in South Gloucestershire.

Within South Gloucestershire Council the Policy and Resources Committee has overall responsibility for the Climate Change Strategy and the lead committee for co-ordination, monitoring and management is the Planning Transportation and Strategic Environment Committee.

All members, managers and staff are responsible for implementing the strategy and ensuring that Council policies, decisions, projects and procurement are delivered in line with the priorities in the Strategy.

South Gloucestershire Council provides the resource for co-ordinating the Strategy. The lead officer for co-ordination and management of the Strategy is the Director of Environment and Community Services supported by the Strategic Environment and Climate Change team.

We are not proposing outcome based targets for the Adaptation Plan but will report on progress with delivery of actions through the Council's Performance Management System which includes scrutiny by the PTSE Committee. The Strategic framework will be reviewed and updated to coincide with the 5 year cycle for the UK Climate Change Strategy. The Action Plans will comprise an operational document to be updated annually as part of the annual service planning process. New risks, issues and problems with delivery will be reported to PTSE Committee for consideration and referral to Policy and Resources Committee if required.

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
agreed actions in future revisions of the Climate Adaptation Plan				
Routine maintenance (including dredging) of the main rhines that discharge to the Severn		Lower Severn Internal Drainage Board	Ongoing	
<p>Bristol River Frome Commission work to assess the impacts of climate change on the Frome catchment both in South Gloucestershire and Bristol, with identification and assessment of strategic options for improving the standard of protection if needed.</p> <p>Work with partners to review outcomes; seek funding for implementation of recommendations (if needed), and include agreed actions in future revisions of the Climate Adaptation Plan. Ensure links are made with West of England Local Nature Partnership catchment improvement project.</p>	<p>Study commissioned</p> <p>Study completed</p>	<ul style="list-style-type: none"> Environment Agency SGC Streetcare Bristol City Council 	<p>2016</p> <p>2016</p> <p>TBC</p>	Future peak flows in the Bristol River Frome catchment exceed the capacity of the river system and cause flooding of land and properties
<p>Local Flood Risk Management Strategy Complete the development of the Local Flood Risk Management Strategy and implement agreed measures</p>	Strategy adopted	<ul style="list-style-type: none"> SGC Streetcare 	2015	Flooding of properties, transport infrastructure and utilities causing damage, disruption, and risks to health

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
	Actions implemented in accordance with adopted Strategy		Ongoing	
<p>Sustainable Drainage Developer Guide Agree and publish local SuDS standards and guidance (including requirement that surface water attenuation will be designed to control surface water runoff during the lifetime of the development, including an allowance for climate change in accordance with national guidance)</p>	Local standards and procedures published	<ul style="list-style-type: none"> SGC Streetcare with other West of England authorities and Somerset County Council 	2015	New development resulting in increased risk of surface water flooding on and/or off-site
<p>Land Owners Provide information for land owners on their responsibilities for managing land drainage to minimise the need for enforcement action</p> <p>Work with landowners through the Severn Estuary Nature Improvement Area project to encourage appropriate management of rhines and ditches</p>	<p>Improve information on the website</p> <p>Information on ownership of ordinary watercourses Recorded in a centralised database</p>	<ul style="list-style-type: none"> SGC Streetcare West of England Local Nature Partnership 	<p>2014-15</p> <p>2015-2016</p> <p>2015-2016</p>	Flood risk from inadequate management of watercourses / land drainage by private land owners

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Catchment-Based Improvement Works Review opportunities for catchment-based improvement works e.g. tree planting in upper catchments to reduce runoff and therefore flooding in the lower catchments</p> <p>Any identified opportunities to be taken into account in planning new tree planting with partners (see also – Asset Management action plan) and agreed actions included in future revisions of the Climate Adaptation Plan</p>	Review completed	<ul style="list-style-type: none"> • West of England Local Nature Partnership with partners including: • SGC Streetcare • Environment Agency • Bristol Avon Catchment Group • Avon Frome Partnership • Bristol Avon River Trust 	2015	Rapid runoff in upper catchments contributing to flood risk downstream
<p>Sewer Flooding Ensure design standards for new sewers take climate change into account</p> <p>Cooperate with Wessex Water to enable implementation of improvement schemes to mitigate the risk of flooding of existing systems</p>		<ul style="list-style-type: none"> • Wessex Water • SGC 		Increased risk of water contamination from sewer flooding

Asset Management

Priority: *Improve resilience of council assets and the natural environment to climate change*

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
Council Asset Management				
Streetcare Resilient Assets Project Identify actions to improve resilience to climate change for individual asset groups for inclusion in the Streetcare Asset and Infrastructure Asset Management Strategy	Highways and Rights of Way risk assessment and action plans completed Open spaces risk assessment and action plans completed Actions embedded in Asset and Infrastructure Asset Management Strategy	<ul style="list-style-type: none"> SGC Streetcare 	2015 2016 2016	Highways, rights of way and open spaces maintained by the Council are adversely affected by climate change resulting in risk, inconvenience and cost for users
Council Owned Open Space Review Include identification and implementation of site-specific opportunities to increase resilience to future climate in council owned open space review. For example, protection and enhancement of	Review completed Projects delivered Funding secured to deliver actions eg	<ul style="list-style-type: none"> SGC Streetcare with partners 	Review completed by end 2014	Flora and fauna adversely affected by changing seasonal patterns and extreme weather events

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
shading; opportunities for growing food; improving biodiversity (e.g. less frequent mowing, less use of herbicide, take into account the Natural England 'Biodiversity Climate Change Vulnerability Model'; selection of appropriate species e.g. considering water demand / drought resistance)	S106/CIL public open space contributions			Increase in sunburn, heat stroke and skin cancer due to greater exposure to sun Deterioration in nutrition from reduced availability of food (locally or internationally)
Monitoring Severe Weather Events Improve monitoring of the impacts of severe weather events on management of highways and open spaces Review the recorded implications and costs of severe weather events in future operational planning	Method for recording information on severe weather events and implications agreed and being implemented	<ul style="list-style-type: none"> • SGC Streetcare 	2015	Implications of severe weather events are not taken into account in future planning and decision making
Council Properties Take climate-related risks (including risk of flooding and overheating) into account in decisions about the management of Council properties including buildings	Shade in school grounds audited as part of the Healthy Schools Work Programme	<ul style="list-style-type: none"> • SGC Property Services • SGC Strategic Environment and Climate Change • SGC Health and Wellbeing 	Ongoing	Council owned properties are vulnerable to extreme weather with potential health risks for users, implications for business continuity, damage to building fabric, and costs

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
Regional Road Network Resilience Develop a resilient road network model which over time provides a core network of increased resilience in the South West Region	Completion of Stages 1 & 2 – identification of the core network and risks to the network from climate change; and assessment of the investment required to reach a level of resilience	<ul style="list-style-type: none"> SGC Streetcare with highway authority partners in the South West 	2015	Piecemeal approach to prioritisation of improvements to network resilience
Council Procurement & Decision Making Implement the Council's sustainable procurement guidance and use the environmental assessment template to ensure that resilience to future climate is taken into account in decision making including purchasing	Staff briefings	<ul style="list-style-type: none"> SGC Strategic Environment and Climate Change 	Staff briefings 2015	Climate change is not taken into account in Council decision making and procurement
Natural Environment				
Trees Protect and manage existing trees and increase tree cover in South Gloucestershire	Priority areas for new tree planting on Council land identified (eg play areas and schools with limited existing shade, and highway land) Opportunities for new tree planting in upper catchments identified	<ul style="list-style-type: none"> SGC Streetcare West of England Local Nature Partnership with partners 	2016 2015 (TBC)	The potential to adapt to climate change through the use of existing and new trees is not realised Trees are susceptible to climate-related risks eg storm damage, drought, increase or changes to pests / diseases

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
	<p>(see also – Flood Risk Management action plan)</p> <p>Work with community groups to protect existing trees and increase tree planting</p> <p>Council Tree Strategy adopted</p> <p>Inclusion of Tree Policy in adopted Policies Sites and Places Plan</p>	<ul style="list-style-type: none"> • Partners including Forest of Avon Trust and Woodland Trust • SGC Streetcare • SGC Planning Policy 	<p>Ongoing</p> <p>2015</p> <p>2015</p>	
<p>Biodiversity Work through the Local Nature Partnership to secure funding for and deliver projects that provide benefits for wildlife and the natural environment</p>	<p>Implement projects including:</p> <ul style="list-style-type: none"> • Nature Improvement Area to identify areas for restoration and ways to improve the landscape along the Severn Estuary coastal strip • Catchment-Based Improvement Works in the Bristol Avon catchment • 'State of the environment' maps 	<ul style="list-style-type: none"> • West of England Local Nature Partnership 	<p>2015-2016</p>	<p>Threats to flora and fauna from changing seasonal patterns and extreme weather events</p>

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Implement the Lower Severn Vale Levels Forgotten Landscape Project including the 'Coming Home to Roost' work stream to improve high tide roosts for waterbirds</p> <p>Seek funding and develop options to implement the Avonmouth/ Severnside Wetland Offsetting Project to provide at least 80.5ha of new wetland habitat in the Avonmouth/Severnside coastal floodplain (required under Habitat Regulations 2010 to offset the impact of developing the Avonmouth/Severnside Enterprise Area development sites)</p>	<p>highlighting preferred locations to enhance ecosystem services</p> <ul style="list-style-type: none"> • Funding approved (via Economic Development Fund created through the West of England City Deal process, and other funding stream(s) TBC) • Establish the 'biodiversity off-setting' scheme to secure financial contributions from developers in the Avonmouth /Severnside Enterprise Area towards the creation of the wetland reserves 	<ul style="list-style-type: none"> • Forgotten Landscape Project Partnership • Avonmouth/Severnside Enterprise Area ecology sub-group • SGC Economic Development • SGC Development Management • Bristol City Council • Natural England 	<p>2014-2018</p> <p>Funding approval 2015</p> <p>Commence survey work winter 2015/16</p>	

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Work with Magnox to encourage restoration of settling tank at Oldbury as wetland habitat</p> <p>Continue to protect and actively manage sites and species designated for their biodiversity value</p> <p>Protection and enhancement of biodiversity on Council owned sites (see also – Council Asset Management)</p> <p>Projects delivered by local partners (eg Avon Wildlife Trust Living Landscape Project which aims to build resilient networks of connected ‘green’ corridors to enable wildlife to move)</p>	<ul style="list-style-type: none"> Improved local biodiversity – active management of local sites (Core Strategy Indicator) 	<ul style="list-style-type: none"> SGC Development Management SGC Development Management SGC Streetcare 	<p>TBC</p> <p>Ongoing</p>	
Water Resources				
<p>Climate change is taken into account in Bristol Water’s Water Resource Management Plan</p> <p>Continue to monitor the quality of private water supplies</p> <p>Encourage water conservation in design of new development and</p>		<ul style="list-style-type: none"> Bristol Water SGC Environmental Health SGC Development Management 		<p>Reduction in availability of water resources alongside increased demand for water</p> <p>Deterioration in water quality with reduced flows in summer</p>

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
through Building Regulations (see New Development Action Plan)				
Historic Environment				
<p>Historic Environment Continue to advise property owners on appropriate preventative maintenance, repairs and where appropriate adaptation of traditional buildings in line with relevant legislation and policy</p> <p>Continue to promote understanding of traditional building methods and repairs via the Council's endorsed Technical Advice Notes (alongside relevant national guidance)</p> <p>Continue to provide advice and guidance on exposure of and damage to archaeological sites and landscapes due to periods of severe weather, and signpost land and property owners to the relevant national and local guidance and specialists.</p>		<ul style="list-style-type: none"> SGC Strategic Planning Policy & Specialist Advice Team 	Ongoing	Damage to historic assets including Listed Buildings, archaeological sites and landscapes from extreme weather.

New Development

Priority: *Take predicted changes in climate into account in the allocation of sites for new development and encourage consideration of climate change in design*

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
Agricultural Land Protect the best and most versatile agricultural land (grades 3a and higher) in accordance with Core Strategy Policy CS9	Amount of best and most versatile agricultural land lost to built development (Core Strategy Indicator)	<ul style="list-style-type: none"> SGC Development management 	Triggered by site allocations and by individual applications Monitoring to be undertaken from April 2015	Reduced ability to produce food locally with agricultural land being lost to development, in context of climate-related risks to global food supply chains
Flood Risk Management Implement Strategic Flood Risk Assessment recommendations, Core Strategy Policies and Policies Sites and Places Development Plan Document (DPD) to ensure that new development is not at risk of flooding and does not exacerbate flood risk elsewhere or preclude the solution to future flooding problems	Number of planning permissions granted contrary to Environment Agency advice on flooding or water quality grounds (Core Strategy Indicator)	<ul style="list-style-type: none"> SGC Streetcare SGC Development Management 	Triggered by site allocations and by individual applications	New development is susceptible to flooding and/or results in increased flood risk elsewhere

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>New Frome Hydraulic Model Improve understanding of the combined impact of major development allocations on the Frome catchment using the new Frome hydraulic model</p>	<p>Combined flood risk assessment undertaken using new Frome hydraulic model</p> <p>Take outcomes into account in Core Strategy Review</p>	<ul style="list-style-type: none"> SGC Streetcare Environment Agency 	<p>2015</p> <p>2018</p>	<p>Flood risk assessment and mitigation for the cumulative effect of planned major developments does not take account of the best available hydraulic information</p>
<p>Trees Protect existing trees and encourage new tree planting as part of new development</p> <p>See also – Asset Management Action Plan</p>	<p>Inclusion of Tree Policy in Policies Sites and Places DPD</p> <p>Explore opportunities for collaboration with Forest of Avon Trust to deliver off-site tree planting</p> <p>Number of TPOs</p>	<ul style="list-style-type: none"> SGC Planning Policy SGC Development Management SGC Planning Enforcement SGC Streetcare 	<p>Policies Sites and Places DPD scheduled for adoption in 2015</p>	<p>The potential to adapt to climate change through the use of existing and new trees is not realised</p>
<p>Climate Adaptation in Design Encourage developers to demonstrate how their proposed approach to layout, design and construction will:</p> <ul style="list-style-type: none"> ensure comfortable internal and external temperatures are maintained during hotter summers (CS1, CS2) 	<p>Climate adaptation embedded in Developer Guide</p>	<ul style="list-style-type: none"> SGC Development Management SGC Highway Development management SGC Building Control SGC Planning Enforcement 	<p>Triggered by individual planning applications</p> <p>Developer Guide drafted 2015</p>	<p>New developments are not resilient to climate change</p>

Health and Wellbeing

Priority: *Seek to protect people from the adverse impacts of extreme weather and take steps to enable healthy lifestyles as the climate changes*

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Risk Assessment and Emergency Planning</p> <p>Keep the Community Risk Register up-to-date and respond to evolving risks (as determined by central Government) including risks from severe weather</p> <p>Keep the South Gloucestershire Council Strategic Flood Plan and Operational Response Plan (which clarifies arrangements for inter-Council coordination) up-to-date and implement as required</p> <p>Keep the NHS England Heatwave Plan up-to-date and implement as required</p>	<p>Updates in line with Government updates to the national risk register</p> <p>Annual updates</p>	<ul style="list-style-type: none"> Avon and Somerset Local Resilience Forum SGC Emergency Planning Unit SGC Streetcare NHS England 	<p>Currently bi-annually</p> <p>Annual</p> <p>Updates as needed</p>	<p>Risks to health (including mental health) and wellbeing from severe weather events</p> <p>Inadequate response to severe weather events</p>

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Implement the Avon and Somerset Local Health Resilience Partnership Incident Response Concept of Operations which provides scalable arrangements for the health community response to an incident or emergency, and has been trained against.</p>		<ul style="list-style-type: none"> • Avon and Somerset Local Health Resilience Partnership 	Ongoing	
<p>Encourage Parishes to develop emergency plans (to include consideration of the response to extreme weather events)</p>	<p>Completion of pilot Parish Emergency Plan with Pucklechurch Parish Council</p>	<ul style="list-style-type: none"> • SGC Emergency Planning Unit 	2015	
<p>Continue to publish information on preparing and responding to emergencies on the Council's Website</p>	<p>Publication and dissemination of Parish Emergency Plan template</p>	<ul style="list-style-type: none"> • SGC Emergency Planning Unit 	Ongoing	
<p>Review Council Risk Registers and embed climate-related risks where appropriate</p>		<ul style="list-style-type: none"> • SGC Strategic Environment and Climate Change • SGC Risk Managers 	2015	
<p>Implement health and social care sector contingency planning / business continuity planning to deal with emergencies including severe weather events</p>		<ul style="list-style-type: none"> • Health and Social Care Sector 		

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Overheating Buildings Support and review recommendations of the Zero Carbon Hub project – ‘Tackling Overheating in Homes’</p> <p>Encourage developers to demonstrate how their proposed approach to layout, design and construction will ensure comfortable internal and external temperatures are maintained during hotter summers (see New Development Action Plan)</p> <p>Make information available to businesses in South Gloucestershire about risks from a changing climate (including overheating); actions to improve resilience and tools available to support adaptation (see Economy Action Plan)</p>		<ul style="list-style-type: none"> • Strategic Environment and Climate Change • Zero Carbon Hub 	<p>Support Zero Carbon Hub project – 2015</p> <p>Review project findings - 2016</p>	<p>Overheating buildings causing discomfort or ill health for residents / employees</p>
<p>Infection / Disease Monitoring and Response Framework Continue to monitor trends in incidence of infections / diseases locally and respond to incidents, with significant incidents being</p>		<ul style="list-style-type: none"> • SGC Environmental Health • South Gloucestershire 	<p>Ongoing</p>	<p>Increased health risk from water, vector and food borne diseases as a result of increased temperatures and changing rainfall patterns</p>

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>escalated and the response coordinated through the Public Health England system</p> <p>Maintain and implement the Public Health England / Avon and Somerset Local Health Resilience Partnership Communicable Disease Incident and Outbreak Response Framework</p>		<p>Health Protection Assurance Group</p> <ul style="list-style-type: none"> • Public Health England • Avon and Somerset Local Health Resilience Partnership 		
<p>JSNA& JHWS</p> <p>Continue to ensure that the health and wellbeing impacts of climate change are included in the South Gloucestershire Joint Strategic Needs Assessment and the Joint Health and Wellbeing Strategy</p>		<ul style="list-style-type: none"> • SGC Public Health Team 	Ongoing	The impacts of climate change are not considered in local health and social care commissioning plans
<p>Service Providers</p> <p>Make information available to health and social care service providers on climate-related risks and opportunities to increase resilience</p> <p>Implement sustainable procurement policy to ensure climate resilience is considered in commissioning health and social care services</p>		<ul style="list-style-type: none"> • SGC Strategic Environment and Climate Change • SGC Public Health Team • SGC Adult Social Care • SGC Housing Enabling Team • SGC Partners eg Avon Care Forum and CVS South Gloucestershire 	Ongoing	Health and social care premises, operations or supply chains are vulnerable to extreme weather with potential health and wellbeing risks for users, implications for business continuity, damage to building fabric, and costs

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Trees and Shading Protect and manage existing trees and increase tree cover in South Gloucestershire (see also – Asset Management and New Development action plans)</p> <p>Identify opportunities to increase shading on Council owned land (including open spaces, play areas, and schools) (see also – Asset Management)</p>	See Asset Management and New Development Action Plans			Increase in sunburn, sun stroke and skin cancer from increased exposure to sun
<p>Air Quality Management Areas Continue to monitor local air quality and designate Air Quality Management Areas as required with Action Plans to improve local air quality in the Action Areas</p>	Air Quality Management Plans in place for designated Air Quality Management Areas	<ul style="list-style-type: none"> • SGC Environmental Health • SGC Strategic Transport Policy 	Annual review	Risk of increased particulate air pollution and ground-level ozone from increased temperature and other weather variables
<p>Outdoor Activities Public open spaces, public rights of way and sports assets in South Gloucestershire will continue to be proactively managed and improved, and outdoor exercise eg walking and running on public open spaces and rights of way will continue to be promoted.</p>		<ul style="list-style-type: none"> • SGC Streetcare • SGC Community Cultural Services • SGC Health and Wellbeing 	Ongoing	Increased opportunity for outdoor activities such as walking and cycling in warmer weather
<p>Food and Health Strategy Develop Food and Health Strategy with the aim of making healthy and</p>	Develop Strategy	<ul style="list-style-type: none"> • SGC Health and Wellbeing 	2015	Deterioration in nutrition as a result of reduced availability of food (locally or internationally)

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>sustainable food accessible to all. It is proposed that the Strategy will include promotion of community involvement in local food growing, and consumption of locally produced food.</p> <p>See also - New Development, Asset Management and Economy Action Plans</p>				

Economy

Priority: *Seek to manage strategic economic risks and enable economic opportunities from a changing climate through West of England Local Enterprise Partnership projects*

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Managing Strategic Risks Work through the Local Enterprise Partnership to manage strategic risks and realise opportunities across the West of England</p> <ul style="list-style-type: none"> Commission detailed identification of works required to improve standard of tidal and fluvial flood protection to Avonmouth and Severnside area (subject to funding approval) Seek funding and develop options to implement the Avonmouth/Severnside Wetland Offsetting Project to provide at least 80.5ha of new wetland habitat in the Avonmouth/Severnside coastal floodplain (required under Habitat Regulations 2010 to offset the impact of developing the Avonmouth/ 	<ul style="list-style-type: none"> Stage 2 Study Commissioned Funding approved (via Economic Development Fund created through the West of England City Deal process, and other funding stream(s) TBC) Establish the 'biodiversity off-setting' scheme to secure 	<ul style="list-style-type: none"> West of England Local Enterprise Partnership SGC Economic Development Avonmouth and Severnside Flood Defence Working Group Avonmouth/Severnside Enterprise Area ecology sub-group SGC Economic Development SGC Development Management Bristol City Council Natural England 	<p>2015</p> <p>Funding approval 2015</p> <p>Commence survey work winter 2015/16</p>	<p>Risk of flood/storm damage or overheating of business premises</p> <p>Climate-related risks to business operations or supply chains</p> <p>Risk of economic development potential not being realised in the Severnside area due to flood risk</p> <p>Risk of flooding of agricultural land</p> <p>Some increased business opportunities eg infrastructure and building solutions to climate-related risks</p>

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>Severnside Enterprise Area development sites)</p> <p>Encouraging Business Resilience Make information available to businesses in South Gloucestershire about risks from a changing climate, actions that can be taken to improve resilience and tools available to support business adaptation</p>	<p>financial contributions from developers in the Avonmouth /Severnside Enterprise Area towards the creation of the wetland reserves</p>	<ul style="list-style-type: none"> • SGC Strategic Environment and Climate Change and partners including: • SGC Emergency Planning Unit • Climate UK • Climate SW • Environment Agency 	<p>Ongoing</p>	
<p>Enabling the Local Food Sector Protect the best and most versatile agricultural land (see New Development Action Plan)</p> <p>Work through the LEP to secure funding from the Rural Development Programme for England for projects that strengthen the local food sector including commercial and community enterprises</p>	<p>West of England LEADER Group bid submitted to Defra</p>	<ul style="list-style-type: none"> • Local Enterprise Partnership • West of England Rural Network 	<p>Bid submitted September 2014</p>	<p>Risks to the agricultural economy from changing climate (eg decreased soil quality/quantity; need for increased irrigation in summer; reduced die-off of pests and diseases due to warmer winters; heat stress to livestock and poultry; fewer pollinators) and risks to</p>

Action	Milestones / Measures	Who	Timescale	Risk(s) being addressed
<p>There are a number of National and regional initiatives to support climate adaptation in the agricultural sector. Measures available under the Rural Development Programme for England include the Farming Advice Service introduced in 2012 to offer a one-stop-shop to farmers on a number of subjects, including adapting to climate change. Other initiatives include 'Farming Futures', and the Cotswolds Conservation Board Climate Change Advice Service.</p>		<ul style="list-style-type: none"> • Defra • National Farmers Union • Country Land and Business Association • Cotswold Conservation Board • Agricultural Industries Confederation 		<p>wellbeing from disruption to food supply chains</p> <p>Some increased agricultural opportunities eg warming temperatures could increase crop yields with reduced frost damage and a longer growing season</p>

Annex 1 Climate Projections

Projected climate change for the South West Region and projected sea level rise for the Severn

1 Introduction

The UK Climate Projections (UKCP09, published June 2009) provide projections of climate change for the UK. These give greater spatial and temporal detail and more information on uncertainty than previous UK climate scenarios.

Projected climatic changes are influenced by different greenhouse gas emissions scenarios. All climate projections are differentiated according to high, medium and low future emissions scenarios.

UKCP09 is the first set of projections to attach probabilities to different levels of future climate change. For each climate projection, the level of uncertainty is reflected by a data range with high and low estimates⁷, as well with a central estimate.

UKCP09 gives projections of changes for a number of climate variables and time periods at 25 km resolution and for administrative regions including South West England. South Gloucestershire falls within four of the 25km grid squares. The UKCP09 data is complex and it is misleading to present a small number of 'headline messages' for South Gloucestershire. The projections vary markedly depending on the future emissions scenario and the time period. Nonetheless the information gives an indication of the magnitude of potential change.

Pre-prepared key findings for South West England have been published, with projections for the 2020s, 2050s and 2080s based on low, medium and high emissions scenarios. These are set out below. For each emissions scenario and time period, all three probability levels (the 'central' estimate and the low ('very unlikely to be lower') and high ('very unlikely to be higher') estimates are given.

Information about projected sea level rise for the Severn has also been extracted from the UKCP09 data, and is set out in Section 3.

Further information is available from <http://ukclimateprojections.defra.gov.uk/>.

⁷ Low estimates correspond with 10% probability level: 'very unlikely to be less than'
High estimates correspond with 90% probability level: 'very unlikely to be more than'

Key Findings for South West England

Increase in Winter Mean Temperature

Emissions scenario:	2020s			2050s			2080s		
	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than
Low	0.5°C	1.2°C	2°C	0.8°C	1.8°C	2.9°C	1.4°C	2.4°C	2.7°C
Medium	0.6°C	1.3°C	2°C	1.1°C	2.1°C	3.2°C	1.6°C	2.8°C	4.3°C
High	0.5°C	1.2°C	2°C	1.3°C	2.3°C	3.5°C	2.1°C	3.4°C	5.1°C

Increase in Summer Mean Temperature

Emissions scenario:	2020s			2050s			2080s		
	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than
Low	0.7°C	1.6°C	2.7°C	1.1°C	2.5°C	4.1°C	1.3°C	2.9°C	5°C
Medium	0.5°C	1.6°C	2.7°C	1.3°C	2.7°C	4.6°C	2.1°C	3.9°C	6.4°C
High	0.5°C	1.5°C	2.6°C	1.4°C	3.1°C	5.1°C	2.7°C	5°C	7.9°C

Increase in Summer Mean Daily Maximum Temperature

Emissions scenario:	2020s			2050s			2080s		
	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than
Low	0.7°C	2.2°C	4°C	1.2°C	3.4°C	6.2°C	1.3°C	4.1°C	7.6°C
Medium	0.5°C	2.1°C	4°C	1.4°C	3.8°C	6.8°C	2.2°C	5.4°C	9.6°C
High	0.6°C	2.1°C	3.8°C	1.7°C	4.3°C	7.6°C	3°C	6.9°C	11.9°C

Change in Winter Mean Precipitation

Emissions scenario:	2020s			2050s			2080s		
	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than
Low	-2%	6%	18%	0%	12%	30%	5%	19%	42%
Medium	-1%	7%	20%	4%	17%	38%	6%	23%	54%
High	-1%	7%	18%	3%	18%	41%	8%	31%	73%

Change in Summer Mean Precipitation

Emissions scenario:	2020s			2050s			2080s		
	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than	Very unlikely to be less than	Central estimate	Very unlikely to be more than
Low	-24%	-6%	13%	-38%	-13%	16%	-39%	-15%	13%
Medium	-26%	-7%	14%	-41%	-19%	7%	-49%	-23%	6%
High	-23%	-4%	18%	-43%	-19%	8%	-57%	-29%	4%

Relative Sea Level Increase for the Severn

The sea level data extracted from the UKCP09 projections relates to the area around the second Severn crossing (English side), stretching (approximately) from Oldbury-on-Severn southwards towards Severn Beach and the Severnside Industrial area.

The figures below give both the central estimate and a 'full range' (i.e. very unlikely to be lower or higher) estimate.

Low emissions scenario:	2050: 17-20cm rise (central estimate) 8-25cm (full range estimate)
	2100: 35-40cm rise (central estimate) 15-55cm rise (full range estimate)
Medium emissions scenario:	2050: 20cm rise (central estimate) 10-35cm (full range estimate)
	2100: 40cm rise (central estimate) 18-70cm (full range estimate)
High emissions scenario:	2050: 25cm rise (central estimate) 12-40cm (full range estimate)
	2100: 50cm rise (central estimate) 25-85cm (full range estimate)

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