This National Adaptation Programme covers 2013 to 2018.
A NAP covering 2018 to 2023 has been published on GOV.UK

The National Adaptation Programme

Making the country resilient to a changing climate

July 2013

www.gov.uk/defra

HM Government

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Presented to Parliament pursuant to Section 58 of the Climate Change Act 2008

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Ministerial Foreword

Britain has a long history of overcoming the challenges that our famously changeable weather poses and harnessing our natural resources to support growth.

New investments and innovation in both the private and public sectors continue this tradition today. To help manage our water, consumers can now buy bathroom products knowing how water efficient they are, informed by the water label, protecting this valuable resource both now and for the future. In contrast, when there is too much water our flood management investments, expected to total £2.3 billion over the 4 years to 2015, protect homes and families and free up otherwise blighted land that can be put to good use. In our rural economy, our agriculture continues to innovate, using advanced breeding techniques to produce new crops that can thrive even when the weather seems to be against us. Looking ahead, Genetic Modification has the potential to make further crop improvements. Managing our natural resources in innovative ways, is backed by the kind of world class science, and engineering skills that we can be proud equip the UK to succeed in the global race.

However, recent extreme weather in Britain, such as the flooding in the winter of 2012, has brought into sharp relief just how important anticipating and managing weather extremes can be. In the case of flooding, the costs of rebuilding can run to hundreds of millions of pounds. Essential public services such as schools and hospitals can be heavily disrupted and business – particularly small, hardworking businesses – can be hit severely. Even when extreme weather hits abroad we feel the effects at home. For example, harvest failures abroad push up food prices here – a worrying prospect for hard-pressed families.

As the world's climate changes, Britain's expertise in areas such as weather forecasting, flood modelling, infrastructure and insurance are already coming to the fore to prepare us for the kinds of events we might see more often. Indeed, the UK is already one of the global leaders in this industry of the future and this market is expected to grow by 5% or more year on year, supporting skilled jobs and the weather-resilience that saves money in the long term. Economists have estimated that, across Europe, every £1 spent on increasing resilience now could yield £4 in damages avoided.

This report shows what the government is doing to support this. In many cases, some simple planning now comes at little additional cost to existing investments. For example, the prospect of changes in rainfall intensity, as well as the growth of London, is built in to the design of the Thames Tideway Tunnel 'Supersewer' so it can keep the Thames cleaner long into the future.

However, the government cannot act alone. That's why I'm delighted that we have worked so closely with experts from outside government – from industry, from local government and from civil society – who know what works best in their own sectors. These preparations, based on the best evidence and a spirit of partnership, will help avoid costs and damage and so support the growth of a stronger and more balanced economy.

The Rt Hon Owen Paterson MP
Secretary of State for Environment
Food and Rural Affairs

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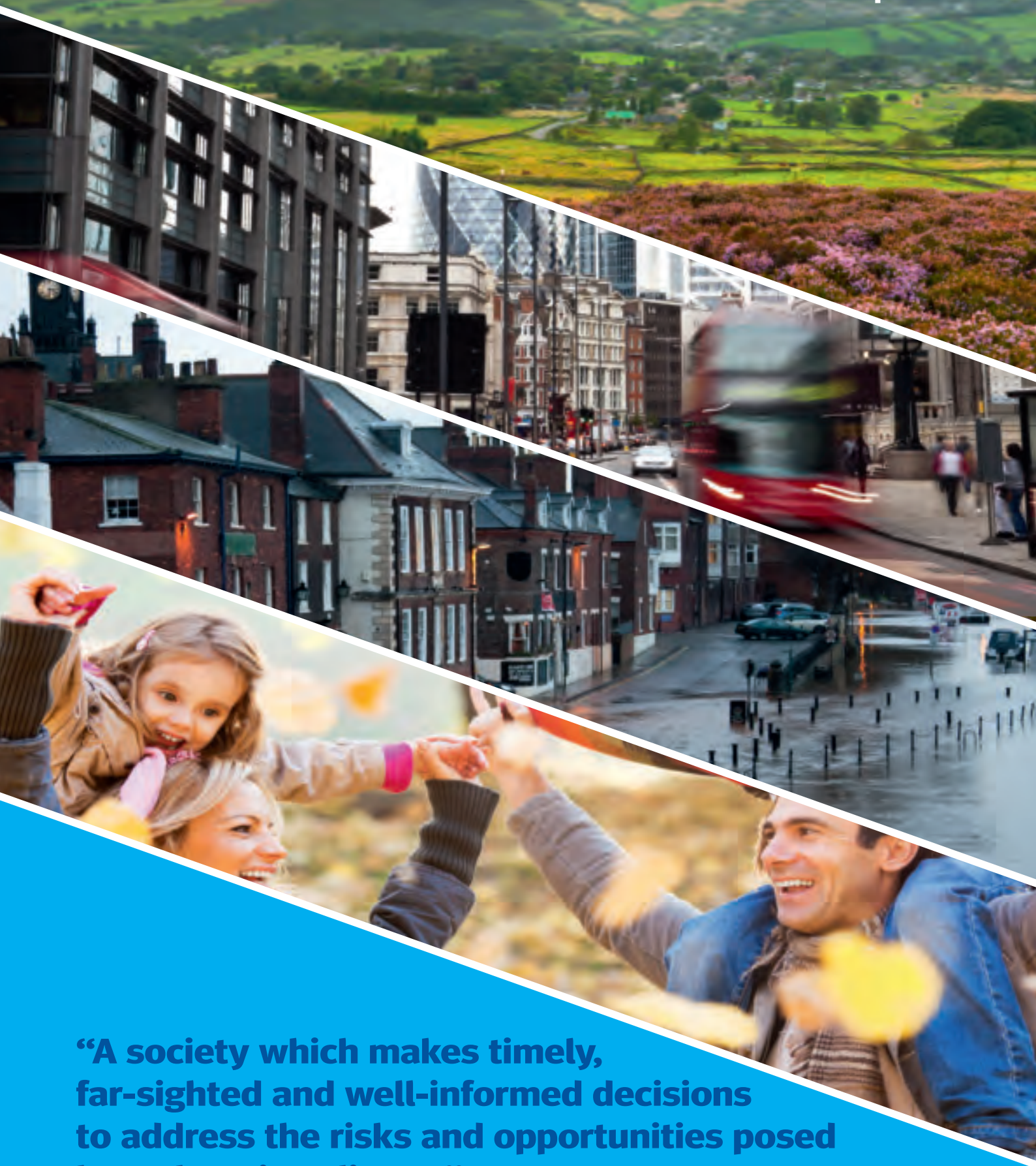
Chapter 1



"A society which makes timely, far-sighted and well-informed decisions to address the risks and opportunities posed by a changing climate"

Building the UK's resilience to climate change is an economic, social and environmental challenge that cuts across every sector of society.

Chapter 1

1. Our climate is changing and the impacts from it are likely to affect most of us in some way during our lifetimes. 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 history. Precise satellite measurements show that the global mean sea level is rising by an average of over 3 millimetres per year and accelerating, average annual sea surface temperature is rising, with each of the last 11 years among the 12 warmest on record and Arctic sea-ice retreated to its smallest ever observed extent in September last year.[1]

2. The government has assessed the risks posed by the changing climate.[2] Extreme events, such as the flooding which occurred throughout the country in late 2012, or the drought of early 2012, are likely to become more frequent and more severe in the coming decades, bringing potential disruption to the economy. However, the government has also found that there are opportunities for some businesses who do take action.

3. This Programme has been drawn up by the government, industry and other non government organisations working together. It contains a mix of policies and actions to help us to adapt successfully to future weather conditions, by dealing with the risks and making the most of the opportunities.

Adaptation supports growth

4. Changes to our climate will affect different parts of the economy in different ways. For example, there may be direct economic impacts on agricultural yields or crop choice. There may also be less obvious indirect effects. For example, power outages from storms could affect businesses, households and public services alike, causing widespread disruption.

5. Reacting to current climate or extreme weather events is often expensive. As an illustration of how costly this can be, the UK floods in 2007 were estimated to have cost businesses £740 million. This is on average around £100,000 per affected business, with some taking about 27 weeks to return to normal operating capacity. Some did not survive at all.[3]

6. However, future climate and economic circumstances are uncertain, and with uncertainty comes risk that needs to be accounted for. Through good risk management, organisations can become more resilient and potentially gain economic benefit. It has been estimated that, in the wider European context, every £1 spent on adaptation represents 4 times its value in potential damages avoided.[4]

1 **http://www.arctic.noaa.gov/reportcard/sea_ice.html**
2 **https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report**
https://www.gov.uk/government/publications/adapting-to-climate-change-uk-climate-projections-2009
3 Defra, 2012 CCRA, Evidence report **https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report**
4 Calculation based on the ratio between the cost of adaptation and the difference between gross and residual damage for Europe from table 3 page 24 in de Bruin, K.C., Dellink, R.B. and Agrawala, S. (2009) 'Economic Aspects of Adaptation to Climate Change: Integrated Assessment Modelling of Adaptation Costs and Benefits' *OECD Environment Working Papers* No.6, OECD Publishing.

7. Some measures, called 'low-regret actions', make economic sense because they deliver benefits now and are feasible under virtually any future climate scenario. Examples include having in place better water efficiency measures, a business continuity plan, checking insurance policies and gaining a better understanding of supply-chain risks. Many other measures are similarly low cost and therefore benefits over time need only be modest to ensure they are cost-effective.

8. Measures which are designed to be beneficial over the longer term need to be flexible enough so that organisations can respond to the changing nature of climate risks. Failure to do so could result in companies making long-term investments which bear sunk costs and which cannot be adapted to deal with climate change. Similarly, incorporating flexibility in investment decisions is likely to be cost-effective when considering the full range of possible climate scenarios.

9. Appraisal methods, such as real options analysis, help decision makers weigh up long-term investment options under deep uncertainty and avoid this kind of potentially expensive lock-in.[5]

10. Proactive adaptation planning can stimulate enterprise in a global market for adaptation goods and services.[6] In 2010-11, these goods and services were worth £2.1 billion, with over 21,000 employees in the UK. In the same period, global activities were worth an estimated £65.8 billion. This is an emerging market with a domestic growth rate of 3.9% for 2011-12 and a forecasted UK growth rate of 7.1% by 2017-18.[7]

11. If adapting to climate change is in the private interests of an individual and an organisation then it should occur naturally and without the government's intervention (except in areas of the government's responsibility). This is already happening in some cases. However, barriers to adaptation do exist. To take advantage of the economic and social benefits of adaptation we need to overcome these barriers. Recent research identifies these barriers and the role of the government.[8] The National Adaptation Programme (NAP) demonstrates how the government is beginning to do this.

5 For an informative discussion on decision making under uncertainty in the context of adaptation see Ranger et al (2010) available online at **http://www.cccep.ac.uk/Publications/Policy/docs/PB-adaptationUK-ranger.pdf**

6 It is not possible to conclude from current evidence if adaptation can go beyond protecting economic growth and actually increase it. Further discussion can be found in the Economics of the National Adaptation Programme Annex of this report.

7 K-Matrix (2012) 'Adaptation and resilience (climate change)' report available online at **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31721/12-p144-adaptation-and-resilience-climate-change-2010-11.pdf.** K-matrix will soon be publishing updated figures for adaptation and resilience goods and services for the year 2011-12.

8 The Economics of Climate Resilience can be found online at: **http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18016** and see also the Economics of the NAP for a full discussion of the barriers to adaptation.

The Climate Change Risk Assessment and the National Adaptation Programme

12. The Climate Change Risk Assessment 2012 (CCRA) for the UK brought together the best available evidence, using a consistent framework to identify the risks and opportunities related to climate change. The assessment distilled approximately 700 potential risks down to more than 100 for detailed review.

13. The government's response to the CCRA, which meets the requirements laid down in the Climate Change Act 2008, is the first NAP. In developing the NAP for England, we have taken the highest order risks from the CCRA and working in partnership with businesses, local government and other organisations, have developed objectives, policies and proposals to address them. This report sets out the progress we have achieved through the Programme and describes what the government considers to be the most urgent areas for action.

Working together

14. Some of the policies and proposals highlighted in this document are the responsibility of the government. However, other policies and proposals cover areas of joint responsibility where we need to develop shared solutions. Local government, industry, communities and civil society all have important roles to play. In developing the Programme we have started to gain a collective understanding of the most urgent climate risks as well as widespread commitment to action.

15. This report therefore describes not only the government's policies and actions, but also those which have been developed by those outside the government. The Environment Agency's (EA) Climate Ready Support Service has been a major provider of tools and knowledge to those organisations who are developing their own responses (see below).

Environment Agency's Climate Ready Support Service

In October 2011 the EA took on a new role to provide advice and support to businesses, the public sector and other organisations on adapting to a changing climate. The service is based on customer needs and feedback and aims to help organisations build their own capacity to adapt, incorporating climate risk management into their business decision making.

The Climate Ready Support Service provides direct support and online information to help organisations assess their sensitivity to a changing climate and take steps to manage their climate risks. Through the Service the EA is working with partners in priority sectors to provide tailored tools, guidance and training to enable them to understand and respond to the challenges of a changing climate. Established partnerships are with the Met Office, the Local Government Association, Climate UK and the Climate Change Partnerships. In addition, the EA's network of staff across England helps to engage customers directly by providing information on the advice available through the online services and work with partners.

16. Organisations depend, to some extent, on the actions of others in managing their own risks. The Climate Change Act enables the Secretary of State to direct certain organisations, for example those with responsibilities for critical national infrastructure, to prepare reports on the steps they are taking and will take to deal with the risks from a changing climate. This is the so-called Adaptation Reporting Power (ARP). Alongside this report, the government is publishing a report on its strategy for exercising this power over the next 5 years. The Secretary of State does not intend to direct organisations to report. Rather, in line with the collaborative approach the government has taken to the NAP as a whole, he will invite progress updates from organisations which have previously reported and new reports from a number of priority organisations.

17. The government is also supporting the building of networks of organisations that may share common risks, for example the Infrastructure Operators Adaptation Forum.

This report on the National Adaptation Programme

18. A climate-ready society will understand where and when to take the necessary action to minimise climate impacts and the effects of extreme weather events. Buildings and infrastructure, health and emergency services, the natural environment, businesses and the agriculture and forestry sectors will be resilient to the risks and ready to maximise the opportunities. This vision has guided our approach to developing the Programme.

> ***Vision**: "A society which makes timely, far-sighted and well-informed decisions to address the risks and opportunities posed by a changing climate."*

19. Each chapter sets out a particular vision of what is needed to ensure that the sector on which it focuses is adequately prepared. The chapters broadly follow the structure of the CCRA, with the addition of a chapter on the role of local government in delivering effective adaptation across all sectors of society.

20. Each chapter describes which risks highlighted by the CCRA and in subsequent consultation with Defra partners require urgent attention. In selecting the areas on which to focus, we were guided by the magnitude, confidence and urgency scores assigned during the analysis underpinning the CCRA. This placed the spotlight on those risks needing urgent attention due to confident expectation of high magnitude impacts or long planning horizons, for example, large infrastructure projects.

21. Some CCRA risks are considered 'urgent' even though the state of knowledge of the risk is relatively low compared with its potential magnitude. The Urban Heat Island (UHI) effect, ocean acidification and the health impacts of increased exposure to UV/sunlight are examples of areas requiring a stronger evidence base, to allow a more robust re-assessment of risk. Risks covered in minimal detail by the CCRA but later identified by practitioners as requiring further attention, such as potential impacts on Information and Communications Technology (ICT) infrastructure, were also added to this category.

22. Objectives have been developed to address the greatest risks and opportunities. These objectives cover 4 main areas across the programme:
    - Increasing awareness
    - Increasing resilience to current extremes
    - Taking timely action for long-lead time measures
    - Addressing major evidence gaps.

23. Each chapter has its own set of objectives to reflect its specific priorities, as agreed with those organisations that were most interested in the area. The chapters then describe the most significant actions for the government and for other organisations that will help to meet these objectives. There are a number of cross-cutting issues and to understand the full picture the chapters need to be considered as part of the whole Programme. However, two cross-cutting risks clearly dominate the list of highest priorities and are recognised as important to every chapter. These are flooding and pressure on water resources. Objectives and actions to address these risks are found in a number of chapters.

24. The Programme will inevitably evolve as knowledge grows, allowing re-evaluation of policy based on the underlying evidence.

The Devolved Administrations

25. The NAP is primarily for England but also covers reserved, excepted and non-devolved matters. The individual Devolved Administrations are developing their own programmes and the government is working with them to share areas of common interest, to ensure a consistent approach in the shape and focus of all the programmes.

    Scotland: A Scottish Adaptation Programme will address the risks identified for Scotland in the UK Climate Change Risk Assessment and will be published in 2013 after a period of consultation. It will replace the existing Adaptation Framework which already contributes to building resilience and capacity to adapt to climate change.

    Wales: The Climate Change Strategy for Wales sets out an adaptation framework to present a national, co-ordinated approach to ensure that Wales understands the risks and opportunities that climate change presents and is well placed to adapt in a sustainable way. The Welsh Government is developing Sectoral Adaptation Plans across 5 important sectors and putting in place programmes for embedding resilience measures against extreme weather events and climate change into all it delivers.[9] These Plans will form part of the next Annual Progress Report (due to be published in Autumn 2013).

9 Natural Environment, Infrastructure, Health, Communities and Business and Tourism.

Northern Ireland: A cross-departmental Northern Ireland Adaptation Programme is due to be published later in 2013. Progress on climate change adaptation is reported annually to the Northern Ireland Executive by the Cross-Departmental Working Group on Climate Change.

Risks related to impacts in other countries

26. This NAP has focused on the risks to impacts in England as well as covering reserved, excepted and non-devolved matters. However, we are also likely to feel the effects from impacts in the rest of the UK and abroad. Understanding the nature of these indirect impacts is highly complex because of the number of variables involved.

27. Development and economic progress will, in many cases, be the most effective way of helping countries to adapt, as well as helping to create stability. A Met Office Hadley Centre project has assessed the impacts from climate change on 24 countries to provide a better understanding of what the global effects may be.[10] In addition, the government continues to support programmes helping the poorest and most vulnerable people in climate change 'hot-spots', as well as identifying and refining tools which are cost-effective and sustainable. The UK is an active participant in the Hyogo Framework for Action (HFA), the global comprehensive agreement on disaster risk reduction. In 2012, the UK was the first country to undergo a peer review to assess its progress in implementing the HFA. The report of the peer review commented that "The National Adaptation Programme, based on the Climate Change Risk Assessment, is an efficient tool to mainstream adaptation to climate change throughout the country, from national to local level. It helps to influence planning to reduce risks accordingly, especially with respect to the risk of flooding, the number one natural risk in the UK."[11]

28. Our prosperity and national security depend heavily on global stability. The impacts of climate change may threaten this stability by affecting the availability and accessibility of food, water, land and energy, as well as the stability of critical infrastructure. We have already seen evidence of acute effects from these impacts in low income and weakly governed countries. However, we have also seen the effects in some emerging economies and in the developed world.

29. Many of the big global risks are being considered as part of the work of the inter-departmental Resources and Risks Working Group. However, Defra has also commissioned research by Price Waterhouse Coopers (PWC) on the international threats and opportunities to the UK.[12] Some of the main findings are set out below.

10 **http://www.metoffice.gov.uk/media/pdf/i/e/MO_COP_brochure_72dpi_1_.pdf**
11 **http://www.unisdr.org/we/inform/publications/32996**
12 **http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18348**

PWC Report on International Threats and Opportunities from Climate Change

- The threats associated with climate change internationally can be an "order of magnitude" larger than domestic threats for some thematic areas, in particular business (trade and investment) and food (imports)
- Certain foodstuffs and energy are concentrated in relatively few countries. Climate change is highly likely to exacerbate volatility of import prices and cause disruptions of supply, over the short-term (to 2020s). Over the longer term (2050s to 2080s) the increasing impacts of climate change could lead to more pervasive systemic changes to trade in food and other physical commodities, with knock-on effects in other areas such as health, conflict and global governance
- The UK has its strongest links with industrialised countries, generally considered to be less vulnerable to climate change. However recent climatic events in such countries, for example drought in the American south-west, show that our exposure to these costs can be high.

Role of the EU

30. The EU can play an important role in supplementing national action by identifying the most important issues related to climate change for Europe, both at global and regional level, and by creating a strong common understanding of the opportunities and risks at the European level.

31. The EU Adaptation Strategy was published in April 2013. It encourages all Member States to adopt comprehensive adaptation strategies and the European Commission will be providing guidelines for formulating them. Member States will not be legally required to meet the guidelines as they are designed to help EU countries to develop, implement and review adaptation policies according to their national circumstances. However, the government expects that the NAP will broadly be in line with the future guidelines.

32. Another important aspect of the EU strategy is that it aims to ensure that climate change adaptation is embedded within existing EU policies and instruments in ways consistent with better regulation, subsidiarity and value for money. In addition it also focuses on helping to fill evidence gaps and on strengthening the sharing of knowledge, data and best practice between Member States through Climate-ADAPT.

Monitoring and evaluation

33. The CCRA provided a basis for monitoring preparedness for climate change in the UK. However, it focused on risk magnitude over the longer term and gave little consideration to the effectiveness of existing adaptive capacity. We now need a framework that will help us to identify whether the actions and policies contained in this Programme are making a difference to our vulnerability in the near-term. The government has a role to play in helping to provide a hub for the monitoring of data, which could enable adaptation outcomes to be tracked on the ground over the long-term and usefully inform future climate change risk assessments.

34. The following types of indicators will help provide a picture of progress and will also serve as evidence for the next CCRA:

- process-based markers, such as whether planned policies have been implemented. These can give an idea of direction of travel
- quantitative data, such as statistics on trends in factors that influence risks from flooding and water scarcity, as collated by the EA; these provide a strong foundation for assessing overall adaptation in relevant areas.

35. Discussions about the most appropriate framework are continuing. However, our preferred approach asks the EA to monitor, through compiling relevant quantitative data on trends in factors that are likely either to increase or decrease our vulnerability to climate risks. Following this approach, the Adaptation Sub-Committee (ASC) of the Committee on Climate Change would carry out its statutory duty under the Climate Change Act to assess progress towards implementation of objectives, proposals and policies highlighted in this report and the Register of Actions, with assessments published in 2015 and every two years hence.[13]

Next steps

36. The government is considering how to approach the next CCRA, due in 2017. The next risk assessment will need to take account of new evidence on the nature of climate risks and the impacts of climate change for the UK. It will also need to reflect on the extent to which the risks have changed as a result of actions undertaken in this Programme and beyond.

13 **http://www.theccc.org.uk/adaptation**

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Chapter 2

Photograph of Dragonfly House © Natural England/Kay Goodridge

Chapter 2: Built Environment

***Vision**: "Buildings and places and the people who live and work in them are resilient to a changing climate and extreme weather and organisations in the built environment sector have an increased capacity to address the risks and take the opportunities from climate change."*

37. Most of the highest order risks for the built environment highlighted in the CCRA are associated with the impacts of flooding, which is expected to become more common throughout the twenty-first century. The cost of expected annual damage to residential properties alone from tidal and river flooding in England and Wales is projected to increase from £640 million at present to over £1.1 billion by the 2020s under the CCRA mid range climate change scenario. This does not account for potential population increases.

38. Non-residential buildings are also at risk. The numbers of English and Welsh hospitals and schools in areas exposed to a significant risk of river and tidal flooding are projected to rise from around 53 hospitals and 927 schools currently to between 59 and 89 hospitals and 1,000 to 1,700 schools by the 2050s.[14]

39. In addition to the major damage that floods can cause, repair costs and rising insurance premiums can have a longer-term impact. Flooding can also cause significant distress to people affected. The impacts on health are explored in Chapter 4.

40. Temperatures, particularly in the summer, are projected to rise, posing risks to health and wellbeing and increasing the demand for energy for summer cooling. The Urban Heat Island (UHI) effect, caused when heat is absorbed and then slowly released by hard surfaces, is already observed around the country and is predicted to push urban temperatures even higher.

41. Increasing pressure on water resources is the third important risk in this sector. Buildings will need to become increasingly water efficient as changes in water availability, particularly reductions in the summer, may lead to a less reliable supply. By the 2050s, the number of people in the UK living in areas affected by water supply-demand deficits could be between 27 million and 59 million.

42. These risks affect other sectors too, so an approach is needed that recognises the breadth of climate impacts and avoids maladaptation, both nationally and locally.

14 Based on the range from a low to a high climate change scenario (CCRA Evidence Report, p.206).

CCRA Risk	Description
FL7a/6a	Non-residential and residential properties at significant risk of flooding
FL6b/7b	Expected Annual Damage (EAD) to residential and non-residential property due to flooding
FL12a/b	Hospitals and schools at significant risk of flooding
FL13	Ability to obtain flood insurance for residential properties
BE1	Urban Heat Island
BE3	Overheating of buildings
EN2	Energy demand for cooling
WA3	Reduction in water available for public supply
WA5	Public water supply-demand deficits
FL2	Vulnerable people at risk

Focus area 1: Flood and coastal erosion risk management

Objective 1: To work with individuals, communities and organisations to reduce the threat of flooding and coastal erosion, including that resulting from climate change, by understanding the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and making sure that other plans take account of them.

43. This first objective is shared with the National Flood and Coastal Erosion Risk Management (FCERM) Strategy for England.[15] The Strategy provides a framework for communities to develop local partnerships and solutions to the flood and coastal erosion risks they face and it underpins the partnership approach to funding flood and coastal resilience projects. The Strategy includes long-term planning, avoidance of inappropriate development in high risk areas, improved flood management infrastructure, increased public awareness and improved flood detection/warning.

The National Flood Forum

Flooding can have a devastating impact on people's lives and more people are at increasing risk due to changes in the weather, population growth, increased suburbanisation and pressure on the drainage system. The National Flood Forum is a charity that supports and represents people and communities at risk of flooding by:

- working with people to understand and reduce their risks of flooding
- helping them to prepare for flooding and to reduce its impact should it occur
- helping people to recover their lives if they have experienced flooding
- working with the government and agencies to ensure that community perspectives on flood risk are effectively built into policy and operational delivery

15 **http://www.environment-agency.gov.uk/research/policy/130073.aspx**

44. The government plans to spend £2.3 billion on flood and coastal erosion risk management over the 4 years to March 2015. The funding will enable 165,000 households to benefit from new and improved defences by 2015, targeted at those most at risk and living in deprived areas. In addition to government funding, private and local council funding is now coming forward to pay for flood defences, with £148 million expected over the same period.

Investing in flood risk management

In 2012, the government announced an additional £120 million of funding included in the £2.3 billion above to speed up the delivery of flood defences aimed at protecting up to 60,000 homes in England. Up to half of this investment is being focused on areas where flood alleviation will unlock growth and regeneration, potentially delivering up to £1 billion of economic benefits. The additional funding is being phased in: £35 million in 2013-2014 and £85 million in 2014-2015.

45. Managing flood risk includes effectively responding to incidents.[16] By taking an integrated approach to flood detection and forecasting, warnings can be issued in good time to minimise potential loss of life and damage. The EA and Met Office will continue to work together to develop and improve the national flood detection and forecasting services provided by the Flood Forecasting Centre, including for surface water. This will include:
    - more accurate forecasts of flooding from all sources
    - warnings and flood information that are as geographically specific as possible
    - longer lead times for flood forecasts and warnings
    - more innovative ways of sharing locally specific information

46. All risk management partners need to find better ways to support recovery from incidents. Local flood risk management strategies should support communities and individuals and Defra, the EA and local councils will work together to help develop a single information portal to share consistent high-level information on flooding.

47. In the UK, cover for flooding is included as a standard part of most buildings and contents insurance policies. Insurance therefore plays an important role in helping households manage the potential financial consequences of their property being flooded. To date, flood insurance has been widely available mainly due to agreements between government and insurers. Premiums have also been kept affordable because customers at risk have not been differentiated from those not at risk, as information on flood risk has been poor. With recent advances in flood mapping, insurers are increasingly able to set premiums more reflective of risk. The government is committed to ensuring the continued availability and affordability of flood insurance to high risk households and the Water Bill is the obvious vehicle to achieve this.

16 Mechanisms for preparing for floods and other civil emergencies are set out in the Civil Contingencies Act (2004)(24).

48. Lead Local Flood Authorities manage the risks of flooding from surface water, minor water courses and groundwater across their areas and take measures to address these.[17] How flooding from rivers, the sea and sewers interacts with these risks may also be considered. Lead Local Flood Authorities have to develop, maintain, apply and monitor their Local Flood Risk Management Strategies. As part of the delivery of the Flood Risk Regulations 2009 an improved understanding of surface water flood risk is being developed. The CCRA was unable to undertake a detailed analysis of the spatial variation of surface water flood risk. This is therefore a priority area for further risk assessment and action.

Management of surface water flood risk in London

Drain London is a £3.2 million multi-year programme to manage surface water flood risk in London. It is managed by the Greater London Authority on behalf of the boroughs and aims to:

- understand where surface water flooding may present a risk to people and property
- build the capacity of boroughs to manage surface water flood risk
- create pilot projects that demonstrate the financial and quality of life benefits from proactive flood risk management
- create a pipeline of projects to secure significant investment in London to understand the 'gap' between the level of rainfall that London's drainage systems can cope with today and the level that London may need to cope with in the future

Actions to address priority risks

Implement FCERM Strategy for England	Defra/EA
Secure, with industry, new arrangements for flood insurance beyond 2013	Government/industry
Develop Local Flood Risk Management strategies that set out the approach to managing local flood risk and consider the effect of future climate change and the increasing severity of weather events	Lead Local Flood Authorities/EA

17 In 2012, the Flood and Water Management Act gave responsibility for local flood risk management to Local Authorities.

Focus area 2: Spatial planning

Objective 2: To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development, including infrastructure that minimises vulnerability and provides resilience to the impacts of climate change.

49. The planning system is important for promoting sustainable development. The National Planning Policy Framework 2012 (NPPF) is clear that local planning authorities, working closely with their communities, should proactively plan to mitigate and adapt to climate change. They should take full account of flood risk, coastal change and water supply and demand considerations. There is also a statutory duty requiring local authorities to include policies in their local plans which help them adapt to climate change.[18]

50. Every local authority area should have a clear local plan, which sets out how local people want their community to develop. These should be consistent with the NPPF and will be used to judge planning applications and appeals. In preparing their local plans, local planning authorities are under a duty to cooperate with neighbouring authorities and other public bodies on planning issues that cross administrative boundaries, like flooding.

51. Under the NPPF, local planning authorities' local plans and decisions should steer development away from areas of flood risk where possible, taking into account the impacts of climate change. Where there are no suitable and reasonably available sites in areas with a lower probability of flooding, new development should only be permitted if it will be safe and resilient to flooding. New developments should not increase flood risk elsewhere and where possible, overall flood risk should be reduced. Local plans should be supported by a Strategic Flood Risk Assessment, which also takes into account the impacts of climate change.

52. Before local plans can be adopted, they are examined at a public inquiry conducted by an independent planning inspector, to decide whether the plan is 'sound'. To be sound, a local plan must be consistent with national policy (including on climate change) and based on proportionate evidence. Local planning authorities are also required to undertake both a sustainability appraisal to appraise the social, environmental and economic effects of a plan and a Strategic Flood Risk Assessment to assess the risks and impacts to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change. Local planning authorities must also publish monitoring reports on progress implementing their local plans.

53. The NPPF is supported by planning practice guidance to help secure effective local implementation. However, the large amount of current planning practice guidance can make it difficult for residents and businesses to work effectively with the planning system. A government review in 2012, led by Lord Taylor, recommended that planning practice guidance on climate change and flood risk should be a priority for re-issue in an updated and streamlined form, helping to make the planning system swifter and more accessible. The government responded positively to this recommendation in its overall response to Lord Taylor's report, published in May 2013.

18 Section 19 (1A) Planning and Compulsory Purchase Act 2004.

54. The NPPF also supports the use of green infrastructure. The work of the sector-led Green Infrastructure Partnership will increase understanding of how green infrastructure can mitigate the effects of the UHI as well as delivering other benefits. The CCRA noted the uncertainty around this. In addition, the Local Government Association (LGA) has recently issued topic-based reference guides and resources to help local authorities plan for and provide green infrastructure in developing their local environment, to reduce and manage climate change impacts in urban areas.[19]

Green and Blue Space adaptation for urban areas and eco towns (GRaBS)

The GRaBS project, led by the Town and Country Planning Association, was one of the first projects to recognise the crucial role of green and blue space infrastructure adaptation to help create more resilient urban areas. The major outputs included Adaptation Action Plan Guidance and methodology, 7 Expert Papers, an international database of good practice and a Risk and Vulnerabilities Assessment tool. 14 organisations formed a pan-European partnership representing responses to diverse challenges of extreme weather. **www.grabs-eu.org**

Actions to address priority risks

Implement the NPPF	Local Planning Authorities
Update Planning Practice Guidance to support the implementation of the NPPF	DCLG
Climate Ready will support the LGA's Climate Local initiative as a means to signpost advice, tools and examples that can help councils take action to improve the resilience of the local built environment	EA
Implement Green Infrastructure Partnership (GIP) work on adaptation	GIP

Focus area 3: Increasing adaptive capacity in the sector

Objective 3: To help businesses and industries in the sector to access skills, training, knowledge and tools to understand and manage climate change risks.

Objective 4: To ensure that investors and developers have the financial and appraisal decision tools they need to support and promote adaptation to climate change.

55. Businesses and professions in the built environment sector are responsible for the development, design and construction of the homes, workplaces, public and leisure buildings that the country needs. Investors and developers will be instrumental in making these buildings resilient, but they need to know how to do this.

19 **http://www.local.gov.uk/web/guest/your-council-and-climate-change**

56. The Economics of Climate Resilience Project made a number of recommendations around adaptive capacity including:

- increasing the design skills and knowledge of organisations in the supply chain
- developing the supply chain for retrofits so builders and architects have access to equipment and information that allows them to advise on effective adaptation and residents have access to advice on how to adapt houses effectively
- addressing information failures by ensuring that targeted and engaging information is accessible
- building residents' ability to adapt through the provision of targeted education and information on behaviour change and passive measures

57. An EA Climate Ready project aims to establish where there are adaptation skills gaps in the built environment sector. It will promote training materials and programmes more effectively in partnership with the most relevant organisations. There is a growing evidence base available to the sector, much of which is promoted through the ARCCC Network.[20] The Network promotes partner-led, co-ordinated research on adaptation in the built environment and infrastructure sectors and involves people from policy, practitioner and research communities in the development and dissemination of targeted evidence.

Design for Future Climate

In 2010 the Technology Strategy Board launched the 'Design for Future Climate Competition' which invested £5 million in two competitions to fund the development of strategies to adapt UK buildings. This innovative partnership with industry has demonstrated how to improve climate resilience as part of a broader focus on sustainability in buildings and the move towards a low carbon future. The competition involved more than 240 companies and organisations and influenced 50 projects with a capital value of over £4.2 billion.

The construction industry is experienced in making buildings more energy efficient but is less experienced in good adaptation practice. The 'Design for Future Climate' projects provide good examples of how to achieve a more climate resilient built environment. There is a market opportunity for design teams to develop climate adaptation services. The programme is due to conclude in Autumn 2013 – for more information see **https://connect.innovateuk.org/web/design-for-future-climate/overview**

58. The built environment sector has recognised the particular need to develop industry-led guidance to address the risks of overheating. Two relevant pieces of work have recently been completed. First, the Chartered Institute of Building Service Engineers (CIBSE) will produce guidance on 'The limits of thermal comfort: avoiding overheating in European buildings', a design guidance document that will include new overheating criteria and assessment methodology. Second, the National House Building Council (NHBC) Foundation has undertaken a review of the evidence of overheating in new homes and issued guidance for house builders and designers on how to avoid the problem.

20 Adaptation and Resilience to a Changing Climate Co-ordination (ARCCC) Network was established by the Engineering and Physical Sciences Research Council (EPSRC) in 2009.

NHBC Foundation

Historically, the overheating of homes has not been identified as much of a problem. Older homes may not be as energy efficient as newer ones but they commonly have draughts to keep them cool during the summer. To address concerns that new homes are more at risk of overheating due to higher standards of air-tightness and increased thermal insulation, NHBC Foundation has launched a new guide **'Understanding overheating: where to start – an introduction for house builders and designers'.**

59. Climate resilience in buildings does not yet appear to be a marketable asset that can be reflected in sale or rental prices. This means that the costs of adaptation may be incurred by one party, while the benefits accrue to another. In the built environment sector, this presents a significant barrier to achieving more well adapted buildings. The lack of a properly articulated economic case for encouraging developers and construction companies to build climate resilient buildings has also been a barrier to action. To address this, Defra, EA and the Modern Built Environment Knowledge Transfer Network (MBE KTN) have begun a project to develop the business case for taking action to adapt the built environment.

Building Research Establishment Environmental Assessment Method (BREEAM)

BREEAM has an on-going commitment to provide a holistic and relevant assessment method to encourage sustainable design, construction and management. As part of this, it is undertaking a comprehensive review of the BREEAM New Construction 2011 technical criteria to assess whether there is any need to strengthen the detailed content or coverage of BREEAM in relation to adaptation to climate change. A number of BREEAM areas already promote adaptation in the built environment. However, early analysis indicates there may be scope to enhance coverage.

Where appropriate, the BREEAM technical criteria will be amended to take greater account of a building's capacity to adapt to climate change. Any changes identified will be reflected in the next version of the BREEAM New Construction scheme, likely to be released in 2014.

Actions to address priority risks

Implement priority actions to increase the level of skills and training in the sector	EA
Disseminate learning from the Technology Strategy Board's Design for Future Climate competition	Royal Institute OF British Architects (RIBA)/ CIBSE/MBE KTN
Develop guidance on making a business case for climate change adaptation	EA

Focus area 4: Making homes and communities more resilient

Objective 5: To increase the resilience of homes and buildings by helping people and communities to understand what a changing climate could mean for them and to take action to become resilient to climate risks.

60. People should continue to take action to prepare for the impacts of climate change in their homes and workplaces, where they are at risk. This includes greater flood protection at the property level, using water efficiently and acting to reduce risk from overheating.

Water efficiency

61. The Water Resources Planning Guidelines say that reducing demand for water is a key priority for water companies in the next round of Water Resource Management Plans. Increasing efficiency in water use will also help to cut emissions. Defra has contributed funding towards the Energy Savings Trust and Waterwise Green Deal guidance. This encourages water companies and Green Deal providers to work in partnership on joint energy and water efficiency projects.

62. Water companies have a statutory duty to promote the efficient use of water by customers.[21] This has resulted in a range of activities such as tips for saving water, retrofit programmes, school education programmes and the offer of subsidised water butts.

Water Label

The Water Label **http://www.water-efficiencylabel.org.uk/** is important in helping people to make informed purchasing decisions and increasing the uptake of water efficient products. Its visibility on bathroom fittings is likely to rise.

Love Every Drop

Anglian Water launched its 'Love Every Drop' campaign in 2010 to raise awareness about the value of water and to change fundamentally how we all work with it and use it. It has set 10 ambitious business goals to help achieve its vision of putting water at the heart of a whole new way of living. The goals involve working with businesses and customers, valuing the environment and encouraging communities to take steps towards a sustainable future. The latest campaign, 'Drop 20', is encouraging everyone to save 20 litres of water per day. Anglian Water offers advice and tips to save water and is working with DIY retailers, schools and the Royal Horticultural Society to spread the messages.

21 Section 93A of the Water Industry Act 1991.

Community and property level flood protection and sustainable drainage

63. Funding for local schemes, which take steps to reduce the likelihood of flood water entering people's homes, is now available to local authorities through the Flood Defence Grant in Aid. The awards are made under the partnership funding approach and a local contribution may be necessary for a scheme to proceed. A Flood Risk Report template is also available to record the change in the level of risk.[22] The report was designed by the government and the insurance industry and provides a standard approach for presenting the flood risk to a property. Insurers may take the information into account when assessing the terms they offer.

64. Sustainable Drainage Systems (SuDS) help reduce the risk of flooding by replicating natural drainage systems to slow the rate that water drains, thereby reducing the amount of surface runoff entering into sewers. SuDS can have significant benefits for managing water resources, improving water quality through the removal of pollutants and reducing the UHI effect.

65. The Flood and Water Management Act 2010 provides for increased uptake of SuDS in new developments. The government plans to implement Schedule 3 by April 2014, subject to parliamentary approval. Once implemented, Schedule 3 will establish a SuDS Approving Body (SAB) in county or unitary authorities. Subject to stipulated exemptions and also subject to affordability, SABs will approve drainage systems before construction begins according to new National SuDS Standards. They will also adopt and maintain SuDS which serve more than one property and are constructed to the National SuDS Standards.

Managing risks from overheating

66. The CCRA reported that the risk of buildings becoming too hot and uncomfortable is highly likely to increase. In some cases, overheating may lead to illness or death and may also affect economic productivity. The CCRA also found that some types of buildings, such as those that are highly insulated, lightweight or have heavily glazed facades, are already vulnerable to summer overheating.

67. The government's policy for Building Regulations and the planning system in England influences the design and construction of buildings. In response to the CCRA, the Department for Communities and Local Government (DCLG) published a detailed literature review and gap analysis about overheating in homes. This work found important gaps in the understanding of overheating and in the development of effective responses. It has also helped inform the continuing joint built environment sector/government response to overheating (see NHBC Foundation box above).

22 **http://www.environment-agency.gov.uk/research/planning/129526.aspx**

68. Building Regulations (which govern the construction of new buildings and the renovation of existing ones) are likely to continue to evolve in response to emerging risks and issues, to ensure buildings meet standards for health, safety, welfare, convenience and sustainability. Rules are already in place to ensure homes and non-domestic buildings are constructed to withstand the impacts of wind and rain, subsidence and consider water scarcity. Requirements already exist on the insulation of hot water pipes to address heat loss. Proposed changes to Part L of the Building Regulations would strengthen the associated guidance on this. Measures to address heat loss in common parts of flats would also address many cases of observed overheating.

69. Overheating is being considered alongside a range of other climate related issues as part of the ongoing review of planning practice guidance. The government has also recently commissioned a review of the Building Regulations framework, including a simplification of local housing standards. In line with the NPPF, the aim of the review is to ensure that new housing is built to appropriate sustainability standards, while reducing costs and burdens on house-builders and supporting economic growth.

70. To support the mitigation of overheating risks, Defra has commissioned the Zero Carbon Hub to increase industry awareness of future overheating in new homes.

Overheating in new homes and role of Zero Carbon Hub

The Zero Carbon Hub has undertaken a programme of work with the house building industry to facilitate access to information and tools that will help the industry to consider the potential impact of overheating in new homes. This includes the production of guidance which summarises the definitions of overheating, the context of future climate change, the main causes of overheating in homes and advice on reducing the risk of overheating, including links to design guidance and further information.

The Zero Carbon Hub continues to work closely with the Technology Strategy Board to collate the learning arising from the Building Performance Evaluation research and to disseminate accordingly. The Hub will also continue to work with a number of universities including University College London, Oxford Brookes and Surrey University to gather further data and disseminate learning.

71. The government has also funded recent research into future energy demand for cooling. The research predicted energy demand for domestic cooling could triple between 2010 and 2050 and called for more research to develop a better understanding of effective approaches to tackling overheating at the building and neighbourhood scale.[23] The potential for such an increase in energy consumption for cooling is likely to require the government to consider how best to minimise the environmental impact. The Department of Energy and Climate Change (DECC) intends to review how overheating is considered and assessed as a part of the next SAP review in 2014-15.

23 Significant research in this area has been undertaken through the Adaptation and Resilience to a Changing Climate programme, for example in the Suburban Neighbourhood Adaptation to a Changing Climate (SNACC) and Community Resilience to Extreme Weather (CREW) projects.

72. The government's flagship energy efficiency scheme, the Green Deal, is taking account of potential overheating risk in existing homes. Using the latest evidence, the UK Climate Impacts Programme (UK CIP) is co-ordinating the production of guidance for the Green Deal supply chain, which is intended to raise awareness about the types of homes that could be vulnerable to overheating risk in the future and how to reduce potential risk from installing energy efficiency measures. There are also measures available under the Green Deal for non domestic buildings to help reduce overheating risks, like blinds, shutters and shading devices.

London Heat Thresholds Project

Extreme hot weather is a significant risk for London. This project attempts to establish a generic, flexible pathway that identifies thresholds for London and its urban systems. In the first phase, the London Climate Change Partnership (LCCP) has produced recommendations to improve policy and practice relating to hot weather planning and heat risk management. This has focused on the social housing and care home sector, with 3 target audiences:

- decision makers in the social housing and care home sectors
- decision makers within London's urban systems
- national level decision makers who are responsible for policy, legislation and guidance relevant to heat risk management in the UK

The final report is available at **http://climatelondon.org.uk/publications/overheating-thresholds-report/.** The LCCP will be working on the second phase of the project this year.

73. Retrofit programmes can combine measures which increase energy efficiency and reduce emissions. A good example is the RE:NEW home energy efficiency programme run by the Greater London Authority. Local authorities also have specific energy efficiency requirements, including to improve efficiency in homes.

74. There are opportunities for promoting new products and services to help consumers adapt their homes, and the EA is looking to work with the DIY supply chain to do this.

Influencing consumers

B&Q has identified 3 opportunities to influence customers to buy and install products in their homes that promote water efficiency, resilience to flooding and overheating:

- products: B&Q already stocks a range of water saving products such as water butts, bark mulch, water saving toilets and eco click taps; overheating, cooling and flooding product packages are also under development
- partnership working with Southern Water: this is delivering discounts on water saving products to customers having a water meter installed
- customer information: making customers aware of products that promote lower water usage has been a major activity using leaflets in partnership with water companies.

Actions to address priority risks

Continue to deliver water efficiency campaigns to households and businesses	Water companies
Continue to encourage the uptake of Property Level Protection to reduce the impacts of floods on people and property	Defra / EA / Lead Local Flood Authorities
Disseminate guidance on overheating risk	UK CIP/ Good Homes Alliance/ NHBC
Review of SAP in relation to overheating	DECC
Review of the framework of Building Regulations and local housing standards	DCLG

Focus area 5: Longer term implications

Objective 6: To explore and build understanding of the long term implications of climate change for the location and resilience of population centres.

75. The CCRA does not contain detailed information about the implications of coastal erosion this century. There has however been work in this area which has helped to inform action to date and this work is ongoing. It is thought that about 270 residential and 470 non-residential properties may be lost to coastal erosion by 2030 in England and a grant is available to councils to help with the demolition costs of properties at risk.

76. The £11 million Coastal Change Pathfinder programme provided ideas and evidence on how policy on supporting community adaptation to coastal change could be developed in future. Shoreline Management Plans provide a large-scale assessment of the physical risks associated with coastal processes. They also present a long term policy framework to reduce these risks to people and the developed, historic and natural environments in a sustainable manner. In addition, the National Coastal Erosion Risk Mapping project (led by the EA) has developed a best practice method for calculating erosion risk in a consistent way across the country, based on evidence including data from the latest climate change projections. The data is publicly available.

77. The EA's Long Term Investment Strategy presents the national evidence base for long term flood and coastal risks and for the costs of managing those risks. The Strategy is being updated and will contain advice for the government on the long term outlook for flooding and erosion. It will also help to create an understanding of the implications of a range of policy options. There will be a greater role for local decision making in the future, adding a local perspective to long-term investment planning.

Actions to address priority risks

Ongoing National Coastal Erosion Risk Mapping work	EA
Review of the Long-Term Investment Strategy	EA

Chapter 3

Chapter 3: Infrastructure

***Vision**: "An infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate."*

78. The National Infrastructure Plan makes clear that infrastructure networks form the backbone of a modern economy and are a major determinant of growth and productivity.[24] Weather-related damage to infrastructure can be extremely costly and can cause significant disruption to large numbers of people and many sectors of the economy. This may be exacerbated by climate change and therefore the government has given attention to increasing the resilience of infrastructure to risks from the changing climate.[25]

79. The highest order risks to infrastructure identified in the CCRA are associated with flooding. While the CCRA assumes that adaptation measures are not yet in place, it is important to note that in reality many of these risks are already being addressed to some extent. This is evident in the reports produced under the Adaptation Reporting Power (ARP) by 91 organisations, including a large number of infrastructure operators and regulators.[26] Of course, it is important to assess how far these existing activities are sufficient to address the risks and to encourage further action.

80. The CCRA highlights power generation, energy supply, strategic transport networks and sewers as being at significant risk of increased flooding. Loss or disruption of any of these services would have consequences for the effective functioning of organisations right across the country. For example, loss of power could also cause many other effects, including loss of telecommunications and difficulties with fuel supplies.

81. Another major risk identified in the CCRA is a significant potential decrease in the water available for public supply. This could affect the majority of the population.

82. Alongside the evidence from the CCRA, the government's 'Climate Resilient Infrastructure' report outlines the main issues for the transport, energy, water and Information and Communications Technology (ICT) sectors, and covers 3 main areas:
    - embedding climate risks in regulatory frameworks
    - improving understanding of the risk of cascade failures
    - promoting the strength of existing links between the National Adaptation Programme and work to improve the resilience of the UK's most important infrastructure to current natural hazards, such as Sector Resilience Plans (SRPs), so as to encourage proportionate levels of investment in the UK's infrastructure.[27]

24 The National Infrastructure Plan (2011) **http://cdn.hm-treasury.gov.uk/national_infrastructure_plan291111.pdf**
25 Climate Resilient Infrastructure – Preparing for a Changing Climate (2011). **https://www.gov.uk/government/publications/climate-resilient-infrastructure-preparing-for-a-changing-climate**
26 Reports from the first round of the Adaptation Reporting Power focused on the infrastructure sector, showing progress in considering adaptation by utilities and infrastructure operators and catalysing others to consider climate risks to their business.
27 'Keeping the Country Running' (2012). **https://www.gov.uk/government/publications/keeping-the-country-running-natural-hazards-and-infrastructure**

83. Sector Resilience Plans set out the resilience of the UK's important infrastructure to the relevant risks identified in the National Risk Assessment.[28] Produced annually, they include a programme of measures to improve resilience where needed. Individual plans are classified, but the Cabinet Office produces a summary Sector Resilience Plan for Critical Infrastructure. The 2010 SRPs focused on the resilience of the UK's Critical National Infrastructure to flooding. The 2011 SRPs extended the scope to allow assessment of other natural hazards and/or less critical assets. The 2012 SRPs extended the scope to allow assessment of the resilience of the sectors' most important infrastructure to all risks (threats and hazards).

84. As recommended in the Climate Resilient Infrastructure Report, the Adaptation Sub Committee of the Committee of Climate Change is looking at preparedness for climate change in the water, transport and energy sectors between 2012 and 2014.

85. This chapter brings together action to address the risks in the 3 sectors analysed by the CCRA: water, transport and energy. Resilient ICT infrastructure is pivotal to the operation of these sectors to best manage any ICT disruptions that could impact on the productivity and effectiveness of these sectors. Further consideration needs to be given to such disruption, along with further evidence to better understand the issues.

86. In December 2012, the government published an update to the 2011 National Infrastructure Plan's detailed pipeline of infrastructure investment. It identified over 550 new projects valued at over £310 billion to 2015 and beyond. This is an increase of over £45 billion in real terms, compared to the value estimated in 2011.[29] Ensuring that infrastructure is resilient to climate change impacts will support this growth and support competitiveness over the longer term. The actions in this programme contribute towards that effort.

CCRA Risk	Description
EN1	Energy infrastructure at significant risk of flooding
FL11a and FL11b	Power stations and substations at significant risk of flooding
WA3	Reduction in water available for public supply
FL8a and FL8b	Roads and railways at significant risk of flooding
WA5	Public water supply-demand deficits
MA2	Decline in marine water quality due to sewer overflows
WA10	Combined sewer overflow (CSO) spill frequency
TR1	Disruption of traffic due to flooding

28 **https://www.gov.uk/government/publications/sector-resilience-plans 18/04/2013**
29 **https://www.gov.uk/government/publications/national-infrastructure-plan-update-december-2012**

Focus area 1: Infrastructure asset management

Objective 7: To ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events.

87. The decisions infrastructure owners and operators, regulators and the government make over the next few years must be informed by an understanding of climate risks. If they are not, the country may be locked into infrastructure development pathways that do not provide adequate protection against future climate impacts and which are detrimental to the economy. There are economic benefits to be gained by adapting infrastructure to a changing climate, as long as decisions are taken at the right time.

Energy

88. The energy sector is well aware of the risks of flooding and has already taken action in response to the Pitt Review recommendations.[30] In addition, energy operators are already addressing other major risks such as heat related damage or disruption, losses to energy transmission efficiency capacity and possible restrictions in water abstraction for energy generation. Action is underway to share best practice and illustrate effective adaptation amongst network providers and energy generators, including applicants for development consent.

89. For transmitters and distributors, the Energy Networks Association led a working group to oversee the response to the Pitt Review's recommendations to improve sub-station resilience. The group has recently re-formed to update important industry guidance around surface water flooding and dam inundation.[31]

90. For energy generators, reports produced under the ARP set out work that is underway to ensure that generating plants are resilient. Typical preparatory actions include flood modelling and monitoring and local resilience planning to manage extreme weather events. Flood risk, in particular, is assessed during project planning and factored into the design of new installations as power station assets are retired and replaced. Energy generators mitigate hazards arising from extreme weather through established corporate risk management procedures. The sector's resilience is also increased by the combination of headroom in generating plant capacity, geographical diversity of plant and diversity in generating technology.

30 **http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/thepittreview.html**
31 Energy Networks Association (ENA), the representative body for energy network providers produced: 'ENA Engineering Technical Report 138 (ETR138) – Resilience to Flooding of Grid and Primary Substations' (October 2009).

91. Those applying for consent to develop energy infrastructure are required to take the need to adapt into account, in line with the principles set out in the Energy National Policy Statements, designated by the Secretary of State for Energy and Climate Change in July 2011.[32] The National Policy Statements (NPSs) set out the framework for consenting applications for major energy infrastructure under the Planning Act 2008.

Energy National Policy Statements

Government will review whether the Energy NPSs accurately reflect emerging climate adaptation policy. This will be part of future reviews to ensure that climate resilience is being accounted for in applications for new infrastructure and in determining applications for new energy infrastructure.

92. Over the coming decades, the UK's energy system faces a number of challenges including the need to decarbonise, the fact that around a fifth of our 2011 generating capacity has to close over this decade and declining domestic fossil fuel production in the context of rising energy demand.

93. The government's Electricity Market Reform programme (EMR) will ensure that electricity supplies are secure and low carbon. One of the main elements of EMR is the implementation of a Capacity Market. If initiated, it would help adapt the overall energy system to both intermittent sources of generation and future weather conditions, for example when demand is high and wind generation is low. If initiated, both generation and non-generation providers of capacity would receive a predictable revenue stream for providing reliable capacity and would face financial penalties if they failed to do so.

94. If the Capacity Market is initiated, the decision on the amount of capacity put in place will not only need to take into account the decarbonisation of the system, but also the changing nature of demand brought about by the changing climate. The CCRA found that milder winters may lead to reduced energy demand for domestic heating with potentially very large economic and social benefits. Higher summer temperatures may result in a rise in energy demand for cooling.

32 Development consent for electricity generating stations of 50MW onshore capacity or greater, electric lines of 132kV capacity or greater and gas infrastructure above specified capacity in England and Wales is required under the Planning Act 2008. In Scotland the infrastructure is consented under the Electricity Act 1989, the Pipe-Lines Act 1962 and the Gas Act 1965.

Actions to address priority risks

The government to consider the impacts of climate change when implementing the Energy Security Strategy	DECC
New energy infrastructure will take account of climate change in line with NPSs. DECC will review the adequacy of this policy to deal with the changing climate	DECC
Capacity Market could, if initiated, help adapt the energy system to both intermittent sources of generation and future weather conditions. The changing climate will be factored into capacity market demand projections	DECC
Organisations in the energy sector implementing the actions set out in their reports under the Adaptation Reporting Power	Energy sector

Transport

95. The Department for Transport (DfT) is working with industry to increase climate resilience in the planning and design of transport infrastructure. DfT will continue to build adaptation into its major plans and strategies, thereby ensuring that project management and appraisals take the need to adapt into account, to ensure sustainable economic growth. Particular examples include:
    - Road Strategies due for publication in 2013
    - Ports NPSs (2012) and future Aviation and National Networks NPSs
    - 2013 Aviation Policy Framework which balances the costs and benefits of aviation, including the need for climate change adaptation
    - Network Rail Strategic Business Plan for 2014-19 (published January 2013) which includes the need to future proof critical infrastructure against the impacts of changing weather

Network Rail

Network Rail has recognised the importance of embedding climate change adaptation into its operations and management:

- allocating funds to protecting tracks and bridges against floods and heat waves
- delivering analysis of impacts from projected climate change, both internally and within the Rail Safety and Standards Board (RSSB) funded Tomorrow's Railway and Climate Change Adaptation (TRaCCA) research programme
- increasing adaptive capacity to provide a strong and informed base for effective climate change adaptation decision making
- supporting the new phase of the TRaCCA research programme to deliver step changes in the knowledge of railway asset vulnerabilities and system inter-dependencies by 2015
- developing decision support tools to drive an increase in climate change resilience of the GB railway industry

High Speed 2

DfT is the sponsor for the High Speed 2 (HS2) rail route and has required HS2 Ltd to incorporate consideration of climate change implications in its design and Environmental Impact Assessment processes.

96. The Highways Agency's (HA) programme of activities future proofs designs and embeds the cost of resilience so that it is not a significant burden in relation to the asset value of around £108 billion. This programme for resilience and integrity of assets and services will bring benefits to users and help avoid the economic costs associated with weather and climate impacts.

Highways Agency

The HA is using its Climate Change Adaptation Strategy and Framework to incorporate climate change into its business through 6 major activities:

- maintaining a safe and serviceable network
- monitoring the rate of climate change and subsequent effects on particular assets
- updating operating procedures
- developing future proof designs
- undertaking contingency planning
- applying retro fit solutions

Actions to address priority risks

DfT to ensure climate resilience is embedded in its Transport and Roads Strategies as well as ensuring that climate change is a part of the Aviation Policy Framework	DfT
HS2 to incorporate consideration of climate change implications in its design and environmental assessment processes	HS2 Ltd and DfT
Network Rail to continue implementing a significant programme of climate resilience research and activity	Network Rail
Organisations that produced adaptation reports under the Adaptation Reporting Power to implement actions set out in their reports	Transport Reporting Authorities

Water

97. The CCRA identified water shortages, water supply-demand deficits and combined sewer overflow spill frequency as the most urgent risks from climate change. Changing rainfall patterns need to be considered alongside ageing water supply and waste water infrastructure assets, drivers of change in water demand such as population growth and increased water use.

98. The government has published a Strategic Policy Statement and Social and Environmental Guidance to Ofwat. These documents will inform the price review process and reflect the government's policy objectives as set out in the Natural Environment White Paper and the Water White Paper. The Water White Paper sets out more detail about the government's expectations of how water companies should consider climate risks. In addition, recent Water Resource Management Plan (WRMP) guidance provides advice about how water companies can make practical use of the latest climate projections. Water Companies will deliver their next WRMPs in 2014.

99. The industry is proactive and Water UK has a Climate Change Network that shares industry approaches to dealing with climate change and raises the profile of issues within the UK and throughout Europe. The group organises vital activity to support the NAP and ensures that future business and investment plans address climate resilience.

Water companies

The reports produced by water companies in the first round of the Adaptation Reporting Power (ARP) show that the industry is implementing climate change adaptation plans and undertaking wider activity such as drought planning and management through the Asset Management Plan process:

- Severn Trent and Anglian Water are using the UKCP09 Weather Generator tool with Anglian Water also using the UKCP09 Threshold Detector tool to assess climate change risks
- Wessex Water is reviewing design standards for sewerage to account for future increases in peak flows using UKCP09

100. In relation to water quality, the CCRA highlighted that an increase in winter precipitation could lead to potential increases in Combined Sewer Outflow (CSO) spill frequency and volumes. Without intervention, this could lead to adverse effects on water quality.

101. Water companies are addressing this risk by gaining a better understanding of drainage and sewerage network performance, so that climate vulnerabilities can be identified and action taken to manage the risks. Monitoring the level of spills helps to better understand how drainage systems are working and to identify any deterioration in performance, before it has an impact on the environment. This also provides greater transparency to customers and communities about the performance of these systems. Early cost-effective measures can then be put in place to reduce spills or remedy the impacts. In addition, a number of water companies are already encouraging customers to play their part in preventing sewer misuse to help improve sewerage and drainage performance.

102. One of the benefits of surface water management is the relief of pressure on existing sub-surface drainage networks. The Flood and Water Management Act 2010 includes a duty to co-operate and ahead of the next price review, water companies are partnering with Lead Local Flood Authorities to produce area drainage plans. LLFAs that have identified areas of significant flood risk are required to produce a set of surface water flood maps by the end of 2013 in collaboration with water companies.

Actions to address priority risks

Strategic Policy Statement and Social and Environment Guidance setting direction on consideration of climate risks in the price review process	Defra
Organisations in the water sector implementing actions set out in their reports under the ARP	Water companies Ofwat
Companies and LLFAs joint working on area drainage plans and surface water flood maps	Water companies LLFAs

Focus area 2: The regulatory framework

Objective 8: To develop regulatory frameworks to support and promote a resilient and adaptive infrastructure sector.

103. The government is looking at how best to include the need to adapt to climate change in established regulatory frameworks in order to promote consistent and proportionate action for developing resilient and economically sustainable infrastructure.

Energy

104. Ofgem incorporates the need to build climate resilience into its current transmission and distribution price control review guidance for network companies. In addition, Ofgem is reviewing its guidance on impact assessment to ensure climate resilience (alongside other considerations) is reflected in its decision making.

105. Statutory Social and Environmental Guidance sets out areas of social and environmental policy, including climate change, which the government expects Ofgem to consider in undertaking its regulatory functions. The government is taking powers to replace this with a new Strategy and Policy Statement (SPS) in the second session Energy Bill. There will be the opportunity to consider how climate resilience should be reinforced during consultation on the draft SPS.

Transport

106. The regulatory framework for transport is already taking into account the need to consider climate risks.

107. Rail safety and rail economics are regulated by the Office of Rail Regulation (ORR). The ORR supports the industry in taking action to adapt, monitoring progress through a combination of short and long term sustainability obligations. DfT will ensure ongoing action by incorporating adaptation into its funding control periods and High Level Output Specifications.[33]

108. Aviation is regulated by the Civil Aviation Authority (CAA) which considers climate impacts in its business continuity planning and risk management. To encourage greater emphasis on adaptation, DfT will work with the CAA to incorporate consideration of climate change in future legislative changes.

Water

109. Ofwat and the EA have jointly commissioned a Drainage Strategy Framework and a supporting good practice guide. This aims to help water companies, working with other Defra partners and interested parties, to develop strategies to manage future drainage risks including those resulting from climate change. Ofwat is also working with the EA and industry to embed resilience planning principles.

110. Defra's Strategic Policy Statement and Social and Environmental Guidance to Ofwat sets out the principles for adaptation in the regulatory framework and how regulatory policies are helping to remove barriers to action. The Price Review (PR14) for the water and sewerage industry will provide the framework within which water companies will invest in the infrastructure measures (both operational and capital) needed to continue to address supply-demand deficits. Ofwat has also published a consultation document on the methodology for the next price review. The methodology encourages a more outcome-focused approach for capital and operational expenditure and targeted incentives for water trading and sustainable abstraction.

33 High Level Output Specifications describe the outputs that Network Rail must deliver.

111. Water companies are using the Cabinet Office publication, 'Keeping the Country Running: Natural Hazards and Infrastructure', to identify investment priorities to build the resilience of their infrastructure to major risks, including climate risks.

Actions to address priority risks

The government will consider promoting climate resilience through the Strategy and Policy Statement for Ofgem that will replace existing Social and Environmental Guidance, subject to passage of the second session Energy Bill.	DECC
Ofgem will ensure adaptation principles are inherent in its undertaking of its price review process and impact assessment and decision making guidance.	Ofgem
DfT, CAA and ORR will collaborate to incorporate consideration of climate change in future legislative changes	CAA/ORR/DfT
Ofwat and EA to provide guidance on the principles for resilience planning and the Water Resource Management Planning Guide. This will continue to set direction on climate resilience in the regulated water sector	Ofwat/EA

Focus area 3: Local infrastructure

Objective 9: To better understand the particular vulnerabilities facing local infrastructure from extreme weather and long term climate change to determine actions to address the risks.

112. Local transport infrastructure includes local road and rail networks, trams and underground rail. Local roads comprise 98% of England's highways, providing vital transport connections with other transport modes. However, they were not part of the analysis in the CCRA so it is important to address this gap and develop an understanding of the potential climate risks to local roads.

113. There are potential economic consequences from local transport failure with knock-on implications for other sectors. To maintain operations and thereby reduce costs and disruption, adaptation at this level is essential. Climate change is already highlighted in the UK Roads Liaison Group's (UK RLG) 'Code of Practice for Well Maintained Highways'.[34] Future updates of other codes for management of highway assets will include more detailed references to climate change adaptation and mitigation.

34 **http://www.ukroadsliaisongroup.org/en/utilities/document-summary.cfm?docid=C7214A5B-66E1-4994-AA7FBAC360DC5CC7**

114. The Association of Directors of Environment, Economy, Planning and Transport (ADEPT) is addressing this knowledge gap. It is working with DfT, local road organisations such as the UK Roads Liaison Group, Highways Maintenance Efficiency Programme (HMEP) and climate groups like Climate UK, through a programme of:
    - communications to enhance knowledge sharing and best practice
    - reviews and updates to guidance like the HMEP asset management toolkits
    - building capacity of relevant local council groups and major Defra partners/interested parties

115. The LGA's Climate Local initiative offers councils with responsibility for highways a framework under which they can identify how their local transport infrastructure will be vulnerable to a changing climate. It sets out options to help them address risks along with supporting resources.

Transport for London (TfL)

TfL is working to improve its resilience to extreme weather and climate change. New infrastructure project plans (eg Northern Line extension) will include adaptation and requirements to address extreme weather are incorporated in major standards and asset management plans. London Underground reviews flood risk and contingency plans, amending standards and processes as necessary. In addition, TfL has identified stations that are subject to current flooding with low frequency or consequence and have plans to reinstate services promptly and to have required safety standards following a flood.

Actions to address priority risks

DfT, UK RLG, ADEPT and Climate UK to work together to build capacity and knowledge on local transport climate resilience	DfT ADEPT, Climate UK, UK RLG
EA Climate Ready to support the LGA's Climate Local initiative to signpost advice, tools and examples that help councils improve the resilience of local transport infrastructure	EA
Amongst a range of climate resilience activity, TfL plans to carry out an extensive flood risk review for the London Underground network, taking into account predicted changes to rainfall patterns	TfL

Focus area 4: Infrastructure interdependencies and climate risk

Objective 10: To develop understanding and promote expertise in managing interconnected and interdependent services, to minimise the risks of cascade failures which could be exacerbated by climate change and identify how systems thinking can support this objective.

116. The CCRA focused on specific infrastructure sectors in isolation and did not take into account the interdependencies between them. We need to develop our understanding of the interplay of impacts between different sectors. The development of skills in systems thinking is likely to be crucial to the delivery of this objective.

117. Cascade failure impacts occur when failure in one area of infrastructure leads to failures in a number of other areas. For example, in 2009 extreme flooding caused the Northside highway bridge collapse in Workington, leading to communities losing power and services.

118. To ensure that vulnerabilities in one sector do not threaten the resilience of others, it is important for organisations to share data and collaborate across networks. Priority areas for the NAP are:
    - the interdependencies between the water and energy sectors
    - understanding climate risks to ICT service delivery and thereby their interdependencies with other sectors
    - ensuring that infrastructure design and planning addresses environmental impacts in a changing climate, through processes such as Environmental Impact Assessment.

119. A number of pieces of work are underway to help improve understanding of interdependencies. Infrastructure UK (IUK) is sponsoring research by the University of Bristol and UCL to develop an 'Interdependencies Planning and Management Framework'. This will help the identification and understanding of cross sectoral interdependencies in new infrastructure projects so that risks can be managed and opportunities identified. IUK, in conjunction with Engineering the Future, is also preparing an update on its 'Infrastructure Policy Timelines' document which aims to identify interdependencies at a policy level.

Energy interdependencies

The Economics of Climate Resilience Project made specific recommendations around energy interdependencies. They include:

- building adaptive capacity by enhancing knowledge and understanding of interdependencies of the sector and adjacent sectors
- encouraging system-wide modelling and assessment to explore different climate risk and adaptation scenarios
- assessing the degree to which resilience is affected as technology develops in other sectors like ICT

Infrastructure Transitions Research Consortium

The Infrastructure Transitions Research Consortium (ITRC), which is funded by a £4.7 million grant from the Engineering and Physical Sciences Research Council (EPSRC), is developing evidence that will help infrastructure operators and policy makers to address interdependent infrastructure failure risks by:

- developing a national risk model to assess the impacts of climate-related infrastructure network failures on people and the economy
- using the framework to identify vulnerabilities under different scenarios and to prioritise strategies to enhance network resilience

Actions to address priority risks

Joint project looking at the risk of dependency of the energy sector on water resources	EA, Energy UK
EA Climate Ready guided activity including Infrastructure Operators Adaptation Forum knowledge sharing and understanding ICT related interdependencies	EA (sponsors)
Activities by IUK and ITRC to enhance systems thinking around interdependencies and how associated climate change risks can be managed	IUK and ITRC

Chapter 4

This National Adaptation Programme covers 2013 to 2018.
A NAP covering 2018 to 2023 has been published on GOV.UK

Chapter 4: Healthy and Resilient Communities

***Vision**: "A health service, a public health and social care system which are resilient and adapted to a changing climate."*

***Vision**: "Communities and individuals, including the most vulnerable, are better prepared to cope with severe weather events and other impacts of climate change."*

***Vision**: "Emergency services and local resilience capability take account of and are resilient to, a changing climate."*

120. The health sector, generally speaking, sees climate change as one of the biggest global public health threats this century.[35] There are risks to the health of the UK population, particularly to the most vulnerable, as well as to the effective delivery of public health, the National Health Service (NHS) and social care services.[36] There may be some welcome benefits, such as warmer winters resulting in fewer winter deaths but these are likely to be outweighed by a range of negative effects. Climate change is also likely to have implications for the emergency services and there is an important role for local responders and communities to play in preparing for and building resilience to potential impacts.

121. The CCRA identified the health risks from increased summer temperatures and overheating in buildings as the most significant, along with the health impacts from floods. Flooding can affect mental health and wellbeing, have an impact on healthcare facilities including hospitals and put vulnerable people at significant risk. The CCRA also identified an urgent need to better understand the potential risk from increased exposure to sunlight and ultra-violet radiation (UV). Our understanding of the severity of these risks has been reinforced through discussions with the health and social care sector and by the publication of the Department of Health (DH)/Health Protection Agency (HPA) Report 'Health Effects of Climate Change in the UK 2012'.[37]

122. Extreme weather events such as droughts, wildfires and the continued occurrence of sudden cold weather snaps can also pose a risk to people's health. So can the increased exposure to ground-level ozone and other air pollutants, including the areas below. Actions to address these issues are included in the Register of Actions at the end of this Report:
    - aeroallergens such as pollen, marine and freshwater pathogens
    - food and vector-borne diseases
    - chemical and biological contamination in the indoor environment (such as mould)
    - food quality and security

35 Costello A, Abbas M, Allen A, Ball S, Bell S, Bellamy R et al., 2009. 'Managing the health effects of climate change'. London: *The Lancet*, Vol 373, no. 9676, pp.1693—733

36 **http://randd.defra.gov.uk/Document.aspx?Document=10067_CCRAEvidenceReport16July2012.pdf** and also **http://www.jrf.org.uk/work/workarea/climate-change-and-social-justice**

37 **http://www.hpa.org.uk/hecc2012**

123. The impacts from extreme weather and climate change will vary by location and place burdens on different parts of society, potentially exacerbating existing inequalities. One example is that older people are more vulnerable to extreme heat and cold. Another example of variability is that urban areas are likely to be particularly affected by high temperatures due to the UHI effect (see Chapter 2).

124. Responsibility for addressing many of the health risks rests with the local health and social care system and there are significant opportunities to ensure that a joined-up approach is taken for the short and long-term by a wide range of local partners. National policy is driven by DH, working across the government along with partners such as NHS England, Public Health England (PHE) and the Sustainable Development Unit for the NHS, public health and social care system (SDU). The co-ordinated actions of emergency services and communities will also play an important role in preparing for, responding to and recovering from extreme weather events as they are expected to increase in severity as a result of climate change.

125. Many of the solutions, particularly for the long-term, will require action beyond the health sector. This chapter should therefore be read in conjunction with Chapter 2 (action to prevent overheating and flooding in the built environment, role of spatial planning, availability of flood insurance), Chapter 3 (interdependencies of health facilities with other critical infrastructure such as water and energy) and Chapter 6 (on green infrastructure).

126. Action to adapt to and mitigate climate change can often deliver wider benefits for health and wellbeing and also cut costs. However it is important to note that some interventions may have inadvertent negative health impacts. These should be considered when taking action. Examples include flood risk management creating habitats for disease vectors and increasingly air-tight buildings causing mould growth and the accumulation of harmful gases.

CCRA Risk	Description
FL12a/b	Hospitals and schools at significant risk of flooding
HE10	Effects of floods/storms on mental health
HE1	Summer mortality due to higher temperatures
HE2	Summer morbidity due to higher temperatures
FL2	Vulnerable people at significant risk of flooding
HE9	Sunlight/UV exposure

Focus area 1: Climate resilience in the health and social care system

Objective 11: To reduce the risk of death and illness associated with severe weather events and climate change and increase preparedness and resilience to the impacts on public health.

Objective 12: To promote climate resilience within the NHS, public health and social care system to ensure continuity of services and resilient assets/estates including the ability to deal with the increased demand for services associated with severe weather events.

National and local frameworks for managing public health risks

127. An important framework for managing health risks to the local population is defined by the Health and Social Care Act 2012, which places an important focus on local planning and decision-making, led by Directors of Public Health. The mechanisms provided for setting and delivering local health priorities, in particular the Joint Strategic Needs Assessments (JSNAs) and subsequent strategies produced by health and wellbeing boards, offer a route to address climate risks and extreme weather events. The boards should consider these risks and possible impacts to inform their jointly-agreed local priorities. Both JSNAs and Health and Wellbeing Strategies will inform commissioning across the local health and care system.

128. The Public Health Outcomes Framework also includes the consideration of climate resilience within the Sustainable Development Management Plans (SDMPs) indicator, supported by PHE and the SDU.[38] Dedicated SDU Adaptation Guidance is available to support adaptation work within health sector organisations and the SDU will continue to promote adaptation action across the NHS as part of Board level SDMPs.[39] A health adaptation tool is being piloted and tested by the EA's Climate Ready support service. A range of other tools are available, for example, to support adapted buildings for older people.[40] The SDU with support from NHS England and PHE will report to the government on progress under the Adaptation Reporting Power.

38 **https://www.gov.uk/government/news/public-health-outcomes-framework-sets-out-desired-outcomes**
39 **http://www.sdu.nhs.uk/documents/publications/Adaptation_Guidance_Final.pdf**
40 BIOPICCC online toolkit supporting local strategic planning to adapt Built Infrastructure for Older People's Care in Conditions of Climate Change: **https://www.dur.ac.uk/geography/research/researchprojects/biopiccc/**

A climate resilient NHS, public health and social care service

129. The Health and Social Care Act 2012 and the Civil Contingencies Act 2004 require the NHS and NHS-funded care providers to ensure that they manage risks to the continuity of health and social care service provision, including from severe weather events and the associated increased demand.[41]

130. Local Health Resilience Partnerships (LHRPs) have been established across England to provide a strategic forum for joint planning and preparedness for emergencies for the health system. They support the health sector's contribution (including the private and voluntary sector where appropriate) to multi-agency planning and preparation for response through Local Resilience Forums (LRFs).

131. DH will work with NHS England and partners such as PHE, SDU and the EA to plan and maintain healthcare facilities that are resilient to flooding and extreme temperatures. They will also explore the potential of the Strategic Health Asset Planning Evaluation toolkit in achieving this. DH will work with the Information Centre for Health and Social Care and NHS Emergency Preparedness, Resilience and Response (EPRR) and business continuity teams to develop climate resilience reporting in national NHS estates and business continuity information frameworks.

Extreme temperatures

132. Research indicates that the 2003 European summer heatwave could become a normal event by the 2040s.[42] Heat-related deaths are projected to increase significantly in future decades, with older people, particularly those over 75, most vulnerable to extreme heat. Cold-related deaths are projected to decline, but cold-snaps will still occur, with associated health impacts.

133. DH/PHE have in place Heatwave and Cold Weather Plans for England, both of which are reviewed annually. These will be further reviewed to ensure they reach beyond the immediate health sector and help safeguard the most vulnerable people. This approach reflects the findings of the 'Economics of Climate Resilience' (ECR) report. That report found that alert systems, preparedness, communication, coordination across the health and social care service, and targeted support to the most vulnerable communities are likely to be the most effective actions to address heat risks to public health. PHE will explore the relevance of these plans to other extreme weather events using the so-called 'all hazards approach' where the same tried and tested system is used to respond to all types of hazard. DH will also keep under review its national best practice guidance for the design, engineering and operation of healthcare facilities, particularly in relation to the extreme temperature and flood resilience of NHS estates and assets.

41 **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/156099/EPRR-Summary-of-the-principal-roles-of-health-sector-organisations.pdf**

42 Stott, P. A., Stone, D. A. and Allen, M. R., 2004. Human contribution to the European heatwave of 2003. *Nature* 432, 610-614. **http://www.nature.com/nature/journal/v432/n7017/abs/nature03089.html**

Heatwave Plan for England

Around 2,000 premature deaths across the UK were attributed to the 2003 heatwave. The Heatwave Plan for England has been in operation since 2004. By 2014 the Plan will have an improved reach to local authorities and include advice on action *beyond* the health sector, for example, on the role of blue and green infrastructure, housing design and transport in reducing health risks associated with overheating and air pollution during heatwaves. Individuals, groups and communities most susceptible to heat impacts will also be actively targeted.
https://www.gov.uk/government/publications/heatwave-plan-for-england-2013

Flooding

134. More than 5 million properties are at risk of flooding in England representing almost 1 in 6 homes. Flood events can have a direct effect on our health through injuries caused by falling into fast-flowing water, from hidden dangers under the water, such as missing manhole covers, or at worst drowning. Indirect effects from flooding include electrocution, carbon monoxide poisoning from the use of generators and other fuel-powered equipment brought indoors to dry out buildings, damage to health infrastructure, water and electrical supplies and the displacement of people and disruption to their lives.

135. Health impacts often continue beyond the immediate flood event, during the recovery and clean up stages and may persist for months or years. The impact on a person's mental health and wellbeing can be particularly significant. This makes the availability of psychosocial support through formal and informal networks especially important, an area explored further in Focus Area 3 of this chapter. The ECR report also highlighted particularly effective actions as being the provision of social support (such as communities, voluntary groups, shared learning), information and practical support for residents to return to their homes.

136. Some important ways to manage the impacts from flooding on people's health include:

- 'NHS Emergency Planning Guidance' (2005) and 'NHS Emergency Planning Guidance on planning the psychosocial and mental health care of people affected by major accidents and disasters (2009)'. These documents set out the role of the NHS in addressing health risks from flooding including risks to mental wellbeing
- PHE's information and guidance notes on the health impacts of flooding (including mental health and wellbeing) for health practitioners, responders and the public[43]
- Directors of Public Health play an important role in determining and overseeing actions to address the health risks of flooding according to local need
- Defra's National Flood Emergency Framework for England will integrate the health impacts from flooding by end 2013
- DH work with the EA, PHE and the NHS to map flood risk to health and social care infrastructure

43 **http://www.hpa.org.uk/flooding**

Actions to address priority risks for climate resilience in the health and social care system

A. To reduce the risk of death and illness associated with severe weather events and climate change and increase preparedness and resilience to the impacts on public health.	
Understanding and considering factors that impact on the health and wellbeing of the local community, and the local health and social care system, in strategic planning process (such as through JSNAs and JHWSs); this could include consideration of climate change and extreme weather events	Health and wellbeing boards
Promotion of climate/extreme weather preparedness and resilience within the local health and social care system	Directors of Public Health, PHE
Putting in place SDMPs and associated Adaptation Guidance	SDU/NHS England/ DH/PHE
Extend the reach of the Heatwave Plan for England beyond the health sector and ensure acts to safeguard most vulnerable; include advice on avoiding over-exposure to UV; explore the relevance of these plans to other extreme weather events using an all-hazards approach	DH/PHE
Promote and implement the Cold Weather Plan for England	DH/PHE
Health impacts integrated within the National Flood Emergency Framework and role of Local Multi-Agency Flood Plans, Local Recovery Groups and Local Health Resilience Partnerships	Defra/DH/PHE/EA/ LAs/Directors of Public Health and partners
Promote and disseminate PHE information and guidance notes on the health impacts of flooding	PHE with involvement from DH/EA/Defra/ LAs/Directors of Public Health and partners
Piloting and testing of Health Adaptation Tool	EA
EA Climate Ready supports the LGA's Climate Local initiative to signpost advice, tools and examples that help councils address health risks	EA/PHE
Maintain and where possible expand real time UV monitoring that is available to the public for their own protection	PHE with partners

B. To promote climate resilience within the NHS, public health and social care system to ensure continuity of services and resilient assets/estates, including the ability to deal with the increased demand for services associated with severe weather related events.	
Promote and implement NHS Emergency Planning Guidance 2005; NHS Emergency Planning Guidance on planning the psychosocial and mental health care of people affected by major accidents and disasters (2009)	DH/NHS
NHS Premises Assurance Model, supporting NHS Trusts to assure flood and extreme temperature resilience of NHS assets/estates	DH/NHS
Health impacts integrated within the National Flood Emergency Framework	Defra/DH/PHE/EA
Strategic Health Asset Planning & Evaluation toolkit (SHAPE), mapping flood risk to health and social care infrastructure and developing its potential	DH/NHS/EA/PHE
Review national best practice guidance on the design, engineering and operation of healthcare facilities for flood risk and extreme temperature resilience	DH/NHS/PHE/SDU
Resilience reporting in national NHS estates and business continuity information frameworks	DH/NHS/NHS Information Centre

Focus area 2: Vulnerable groups

Objective 13: To minimise the impacts of climate change on vulnerable groups in society by strengthening their resilience to better prepare for, respond to and recover from future climate risk.

137. There is a growing appreciation of how the impacts from climate change and extreme weather events could disproportionately affect the most vulnerable in society, such as older people, low income groups and those with multiple health problems.[44] The particular effects will be highly dependent on local circumstances. Effective solutions on how to support vulnerable groups should therefore be found and led by the local community or local council, with voluntary groups playing an important role. (See also the ECR report).

138. Identifying, assessing and addressing vulnerability within sub-sections of society is likely to present complex and difficult situations for local responders, particularly in responding to emergencies where they need to focus on people with the greatest needs. The Cabinet Office's Civil Contingencies Secretariat has produced guidance for emergency planners and responders.[45] Its primary focus is on identifying and building relationships with organisations that know about or are responsible for vulnerable people, so that appropriate response

44 For example through the work of the Joseph Rowntree Foundation: Climate change and Social Justice
45 **www.gov.uk/government/publications/identifying-people-who-are-vulnerable-in-a-crisis-guidance-for-emergency-planners-and-responders**

mechanisms can be agreed before an emergency arises. DH also seeks to ensure equity within its health policies with PHE having a role in providing technical support, guidance and materials and public health intelligence.

139. There will continue to be a need for relevant partners to help vulnerable groups to prepare for and recover from events in the short and long term. Examples of projects aiming to achieve this include the Big Lottery Fund's 'Communities Living Sustainably Initiative' that supports community-level responses to climate change and the Joseph Rowntree Foundation/EA 'ClimateJust' project.

ClimateJust

ClimateJust is a joint initiative of the EA and the Joseph Rowntree Foundation to develop a set of web-based resources for practitioners to assist them in delivering socially just responses to climate change. It will help practitioners to develop adaptation responses that take account of social vulnerability and disadvantage caused by climate impacts. It will support a range of organisations with a role in responding to the potential health and wellbeing impacts of climate change including local authorities, health and social care providers, housing organisations, voluntary and community organisations.

140. The EA's Climate Ready programme will continue to support the LGA's Climate Local initiative, in particular looking at how to understand how best to target vulnerable groups. The Climate Ready programme will also provide adaptation advice and signpost tools and information to a wide range of civil society organisations such as charities and other voluntary groups, working closely with the National Council for Voluntary Organisations (NCVO) to build on its 'Vulnerable people and climate change' programme.

Actions to address priority risks

EA Climate Ready will support the LGA's Climate Local portal to signpost a selection of important tools which help councils take action	EA
EA Climate Ready will continue to share information and promote understanding of the risks to different vulnerable groups, specifically including: • supporting local councils through the dissemination of tools and guidance on how to map vulnerable groups and best work with communities • supporting and disseminating learning about the gaps and barriers which exist for effective working with voluntary organisations on climate resilience, using networks through the NCVO	EA NCVO

Focus area 3: Emergency services, local responders and community resilience

Objective 14: To promote and strengthen community resilience to severe weather related events linked to climate change (preparation, response and recovery), and the climate resilience of the emergency services and other Category 1 and 2 Responders of the Local Resilience Forums (LRFs).

141. At the national level, community and corporate resilience is a workstream within the UK National Resilience Capabilities Programme. The Civil Contingencies Secretariat in the Cabinet Office works in partnership across the government, particularly with DCLG to support community resilience including the provision of resources, community toolkits and advice.[46] Various initiatives are in place to co-ordinate preparedness for severe weather events including 'Get Ready for Winter' and the Natural Hazards Partnership.[47, 48]

Community resilience and the impacts of climate change

In December 2012 Defra awarded grants to 9 Local Resilience Forums to fund projects that will build and strengthen community resilience to the potential impacts of climate change. The following applicants were successful on behalf of their LRF: Blackburn with Darwen Borough Council; Devon and Cornwall Police; Greater London Authority; Hampshire Fire and Rescue Service; Lake District National Park Authority; Lincolnshire County Council; Liverpool City Council; Norfolk Constabulary; and North Somerset District Council.

Projects included:

- A series of children's books which raise awareness about community resilience and the impacts of climate change; these are available to read online and have been distributed to all Hampshire schools and libraries
- New dedicated Community Resilience web portals and a common framework to help communities prepare for the impacts of climate change
- A new model for climate change adaptation and community resilience planning in a rural setting

The outcomes and best practice identified during the projects have been shared at regional LRF workshops and through the wider LRF network.

Relevant links are as follows:

http://www3.hants.gov.uk/susiethechildminder.htm
www.communityresilience-ns.org.uk
https://services.devon.gov.uk/web/lrf/a-clear-plan
http://www.norfolkprepared.gov.uk/Preparing-your-Community/index.htm
www.cumbriaaction.org.uk

46 **www.gov.uk/government/publications/community-resilience-resources-and-tools**
47 **http://www.metoffice.gov.uk/learning/get-ready-for-winter**
48 **https://www.gov.uk/government/policies/improving-the-uks-ability-to-absorb-respond-to-and-recover-from-emergencies**

142. The government will continue to promote community resilience to both current and future severe weather events, working through a Cabinet Office-chaired cross-government Community Resilience Working Group. Its purpose is to promote collaborative, co-ordinated approaches that support communities and local responders. Cabinet Office has also established a Community Resilience Knowledge Hub hosted by the Emergency Planning College, where individuals and communities can post their own experiences. This is supplemented by learning materials to support local community action, along with advice on potential sources of funding and signposting to other information.

Emergency services

143. At the national level, the government has an ongoing programme of training and exercises involving the emergency services and other local responders, to ensure and improve capability to respond to and recover from emergencies. These roles were tested during Exercise Watermark in 2011. This exercise set out to rigorously test arrangements across England to respond to severe, wide area flooding, including a tidal surge along the East Coast of England. Many of the lessons learnt from Watermark emphasised the importance of a planned and organised response from individuals and communities. This was further demonstrated during the flood events of 2012.

144. Individual emergency services are looking carefully at the risks and setting out their local responses. The Chief Fire Officers' Association (CFOA) have agreed to produce a voluntary report under the Adaptation Reporting Power setting out the risks from future weather conditions to their members' operations across England as well as how they will respond to them. The Association of Ambulance Chief Executives (AACE) is collating information on the extent of adaptation coverage within those SDMPs undertaken by the NHS Ambulance Trusts across England.

Local resilience and recovery

145. Planning the recovery of communities following any major emergency is the responsibility of the relevant council. They will be supported by other local partners through the 38 Local Resilience Forums (LRFs) across England. The LRFs play a crucial role in supporting local communities and businesses in managing local risks. Duties set out under the Civil Contingencies Act 2004, including the requirement to maintain and publish a Community Risk Register, already provide a mechanism to drive co-ordinated action in response to the risk of severe weather events, both now and for events that are likely to increase over time.

146. Many LRFs and councils have also identified that local needs can be met most effectively by working with their communities to increase their resilience against a range of natural emergencies. From flood and snow wardens to broader community champions, there are many examples of the commitment of local people investing their time and knowledge to make themselves and their communities more resilient.

147. The recovery phase following a severe weather event is particularly important for minimising some of the significant health risks identified earlier in this chapter such as the mental health and wellbeing impacts associated with flooding. Recovery is best achieved when the process starts from the moment the emergency begins, running in tandem with the response. Following an emergency, councils will usually co-ordinate the multi-agency recovery process. They will chair and provide the secretariat for the Recovery Co-ordinating Group, with support from the full range of multi-agency partners including the private and voluntary sectors and the wider community, all of whom play crucial roles.[49] In undertaking this, councils are responsible for providing a wide range of support.[50] This includes evacuation and shelter and humanitarian assistance.[51] The Civil Contingencies Secretariat provides advice and guidance to support councils through the National Recovery Guidance.[52]

Communities

148. Communities and individuals can help to build their own resilience to severe weather events. LRFs, by developing their own resilience plans, encourage communities to get involved in work in line with the local risk profile.

149. The voluntary sector provides an extensive and diverse range of operational and support skills and services to statutory responders. This may take the form of supporting the emergency services during severe weather events with private off-road vehicles and boats, helping with recovery, providing financial advice and psycho-social support (such as comforting, befriending, listening, help-lines, support networks, drop-in centres, advice, counselling, spiritual support and group therapy).

150. Further examples include the establishment of various local flood groups around the country, many of which work under the umbrella of the National Flood Forum. In response to local needs, they work closely with the emergency services, LRFs, councils and bodies such as the EA.

49 **www.gov.uk/government/publications/emergency-response-and-recovery**
50 **www.gov.uk/government/publications/humanitarian-assistance-in-emergencies**
51 **www.gov.uk/government/publications/evacuation-and-shelter-guidance**
52 **www.gov.uk/national-recovery-guidance**

Flood Resilience Community Pathfinder scheme

Defra launched a grant scheme to support community-led projects to improve resilience to flooding in December 2012. Following a competition, schemes are being funded in: Blackburn; Buckinghamshire; Calderdale; Cornwall; Devon; Liverpool; Northamptonshire; Rochdale; Slough; Southampton; Swindon; Warwickshire; and West Sussex. Defra has invested over £4 million and councils are contributing approximately £1.2 million, up to 2015.

The aim of the scheme is to fund projects that would enable local communities to develop local solutions that:

- enhance flood risk management and preparedness to improve the community's overall resilience
- demonstrably improve the community's financial resilience in relation to flooding
- deliver sustained improvements which have the potential to be applied in other areas

Good evidence exists on what action can be taken both at an individual property-level (eg property-level protection, resilient repairs) and at a larger scheme level (eg building and maintaining flood defences). The intention of the scheme is to learn lessons about what action at a community level really works for local people on the ground, thereby providing inspiration, tools and evidence for other communities that want to take action to better manage their own risks. To capture all the learning from the work of the projects Defra is appointing a scheme level evaluator to work alongside the funded projects.

Wildfires

151. The CCRA identified an increase in the incidence of wildfires as an emerging risk associated with climate change. Severe wildfire has recently been included in the National Risk Assessment (NRA12). It is anticipated that Local Resilience Forums (LRFs) will review and consider the severe wildfire risk, as will the Fire and Rescue Service through their Integrated Risk Management Plan process. The Forestry Commission is publishing guidance for land managers to increase the resilience of woodland to wildfire through forest design planning (including forest structure and species). The United Kingdom Forestry Standard includes the requirement for contingency planning as part of good forestry practice.[53]

53 **www.forestry.gov.uk/theukforestrystandard**

Preparation for impact of climate change on wildfires

The England and Wales Wildfire Forum (EWWF) plays a vital role in preparing for the impact of climate change on wildfires. It provides a focus for public, private and third sector organisations to work together to reduce the effect of wildfire occurrences. As part of the National Adaptation Programme EWWF:

- has issued guidance to land managers to reduce the risk of wildfire occurrence and promote preparation of an effective response and recovery when wildfires do occur
- is assisting in promoting more appropriate land use and habitats management practice to build wildfire resilience for the future
- is beginning to address some major gaps in wildfire knowledge and research

Actions to address priority risks

Support community resilience through the government Community Resilience Programme including cross-Whitehall co-ordination	Cabinet Office/ government depts/ agencies and other public bodies
Action by local responders and LRFs to promote and build community resilience to the impacts of extreme weather events and climate change	LRFs, local responders, communities and partners
Communities and civil society groups taking action to build resilience to extreme weather events and impacts of climate change	Communities, civil society and voluntary groups
Maintain Community Resilience Knowledge hub, which is hosted by Emergency Planning College and signpost important materials for communities and LRFs to draw on	Emergency Planning College, Cabinet Office, EA
Chief Fire Officers' Association (CFOA) to report on a voluntary basis under the Adaptation Reporting Power to promote climate resilience and adaptation within the Fire and Rescue Service	CFOA
Promote climate resilience and adaptation within the Ambulance Service. AACE will collate information on the extent of adaptation coverage within SDMPs promoted across NHS Ambulance Trusts	AACE, Ambulance Service
The Fire and Rescue Service is reviewing the risk of and their capability to deal with a severe wildfire through its Integrated Risk Management Plan process	Fire and Rescue Service, DCLG

This National Adaptation Programme covers 2013 to 2018.
A NAP covering 2018 to 2023 has been published on GOV.UK

Chapter 5

Chapter 5: Agriculture and Forestry

***Vision**: "Profitable and productive agriculture and forestry sectors that take the opportunities from climate change, are resilient to its threats and contribute to the resilience of the natural environment by helping to maintain ecosystem services and protect and enhance biodiversity."*

152. Our farming and forestry sectors are used to managing their businesses in the context of changing weather conditions. They are adept at matching planting, cropping and management patterns and balancing good years with bad. In some years the economic impact from extreme weather conditions is greater than others. However, the CCRA indicates that extreme weather events, such as very high or very low temperatures and changes in precipitation, are likely to become more frequent throughout this century. These changes pose a threat to future productivity and farming and forestry business incomes. In addition, the cumulative effects from soil erosion and disease may affect businesses over many years.

153. This highlights the need to increase the resilience of the agriculture and forestry sectors. Some national measures will need to be put in place. However, businesses will also need to decide what action to take on an individual basis. The type of measures which are most suitable will vary greatly and be dependent on the locality, the particular crops grown, the types of livestock production systems and the species make-up of forest planting and restocking.

154. The need to adapt effectively should be considered in the context of two other the government priorities: i) the sustainable intensification of agriculture and ii) reducing greenhouse gas emissions. It will be important to find a way of integrating our approach to these important areas.

155. The CCRA identified a range of direct impacts on the natural and human environment that could present opportunities for these sectors, for example, increases in average temperature and atmospheric carbon dioxide concentrations, increased yields, opportunities to grow new varieties and the provision of ecosystem based adaptation services. Businesses should take note of these opportunities and look at how to take advantage of the economic benefits they may offer.

156. The agriculture and forestry chapter focuses on 4 priority areas: effective water management in agriculture, resilience in the forestry sector, effective management of pests, disease and invasive non-native species and innovation and evidence.

CCRA Risk	Description
FO1a	Forest extent affected by red band needle blight[54]
WA7	Insufficient summer river flows to meet environmental targets
FL4a/b	Agricultural land at risk of flooding/regular flooding
FO4a	Decline in potential yield of beech trees in England
AG5	Increases in water demand for irrigation of crops
FO1b	Forest extent affected by green spruce aphid
FO2	Loss of forest productivity due to drought

54 The CCRA selected red band needle blight as an indicative risk of wider forestry pest and disease impacts.

Focus area 1: Building resilience in agriculture through effective water management

Objective 15: To increase the resilience of agriculture by effectively managing the impact of volatility in the occurrence and severity of rainfall events on water availability, flooding, soil erosion and pollution due to runoff.

157. Agricultural businesses already have to manage water resources carefully, especially during periods of unusually high or low rainfall. The frequency and severity of these extreme periods are projected to increase as the climate changes, affecting productivity and constraining the potential for higher crop yields. Farming businesses will therefore need to adopt effective strategies for year-round water management in order to sustainably increase productivity, in addition to ensuring watercourses are protected from diffuse agricultural pollution.

158. The Water Bill, which was announced in the Queen's speech in May 2013, will introduce reforms that will enable farmers and other potential suppliers to enter the competitive water supply market. The Bill will also provide ministers with powers to introduce regulations to make it easier for farmers and landowners to sell excess water from on-farm reservoirs and other water storage facilities direct to water companies.

159. In order to protect future water supplies and to encourage abstractors, such as farmers, to use water more effectively, the government intends to reform the abstraction regulation system. The new system will give clearer signals on water availability to allow abstractors to plan effectively and invest for the future. Defra will consult on reform proposals in late 2013 and look to introduce legislation early in the next Parliament. The new system would be piloted and then implemented as soon as possible. Following decisions on the direction of reform for the abstraction regulation system, Defra will review the available guidance and support for farmers to manage their water availability.

160. Agricultural land needs to be effectively drained to support viable arable and livestock businesses. However, the drainage of some types of land, particularly wetlands, can have negative impacts on biodiversity, cause degradation of peat and increase carbon dioxide (CO_2) emissions.

161. Internal Drainage Boards (IDBs) manage a network of drainage ditches and pumping stations that protect 9.7% of England. Half of this is grade 1 agriculture land and this drainage system also protects over half of our energy generation capacity and important transport infrastructure from regular flooding.[55] During Spring 2012, in anticipation of drought, several IDBs kept winter water levels higher than usual to help farmers fill reservoirs and prevent their land and wildlife reserves from drying out. The government will work with the Association of Drainage Authorities (ADAs) and other interested parties to explore further the possible contribution of IDBs to integrated water resource management within catchment areas.

162. Localised water-logging is also an issue in areas where drainage boards do not exist. Defra is reviewing the status of the UK's aging drainage infrastructure to inform future action that supports environmental protection and sustainable intensification.

55 56 major power stations are within IDB districts. This represents 53% of installed capacity in terms of maximum potential output.

163. Good quality soils are essential for agricultural productivity, healthy ecosystems, and the delivery of critical services for society, such as the provision of clean water and the reduction of flood risk. Healthy soils are also naturally more resilient to erosion so it is important to maintain and where possible, enhance them. The Natural Environment White Paper (NEWP) sets out the government's ambition for all soils to be managed sustainably, including successfully tackling degradation threats, by 2030. The Soil Protection Review which forms part of the cross-compliance regime under the Common Agricultural Policy aims to provide a broad level of protection for agricultural soils.

164. Climate change may also increase the environmental impact of diffuse agricultural water pollution. The government's Catchment Sensitive Farming (CSF) initiative already delivers practical and targeted support to enable farmers and land managers to take voluntary action to reduce diffuse water pollution from agriculture. Defra has invested in a network of catchment-scale research sites, called Demonstration Test Catchments, to better understand the causes of diffuse pollution and the effectiveness of approaches to mitigate it.

Implementation of Catchment Sensitive Farming techniques

Amberley Court Farm is a typical example of where CSF techniques have been implemented to reduce soil erosion and run-off and improve water efficiency. These measures, implemented at little or no cost, have resulted in £9,273 of financial savings whilst reducing erosion risk and local water course pollution, which may become more prevalent in extreme weather conditions.

165. The EA Climate Ready Support Service in partnership with industry will explore how to establish a network of on-farm demonstration sites to showcase measures to adapt. This network will inform work to encourage best practice and innovation in sustainable intensification. In particular an industry-led partnership of Agriculture and Horticulture Development Board (AHDB), National Farmers Union (NFU), Royal Agricultural Society of England (RASE), Land Based Colleges Aspiring To Excellence (LANDEX) and others will work to co-ordinate and promote existing on-farm demonstration activities through developing an online database that will be searchable by region, topic and sector. Defra will also look to embed adaptation within the knowledge transfer elements of the UK Agri-Tech Strategy, the Sustainable Intensification Platform and the Rural Development Programme for England (RDPE) 2014-2020.

166. Agricultural and forestry businesses are likely to need some help with developing the right skills and knowledge to increase the resilience of their businesses. The EA's Climate Ready Support Service will work with the sector to develop and promote adaptation good practice, by signposting tools and guidance and integrating climate resilience into advisory services such as the Farming Advice Service (FAS).

Campaign for the Farmed Environment

Through the next phase of the agriculture industry's Campaign for the Farmed Environment (CFE), the NFU, working with AHDBs and other interested parties, will aim to build national awareness of the priorities for climate change adaptation. They will disseminate the customised practices considered to be most relevant and best suited to the circumstances of farming enterprises in each local area.

167. The government will consider how to further encourage the uptake of climate resilience measures and skills development though the RDPE. The government will look at the opportunities to mainstream adaptation across the programme, supporting skills development and knowledge exchange and ensuring RDPE investments offer good value for money. Alongside this, Defra is looking at new 'payment for ecosystem services' approaches, which reward farmers for delivering important services, including adaptation measures that benefit wider society (see Chapter 6).

Farm Resilience Plans

Natural England (NE) has worked with the Scottish Agricultural College to test Farm Resilience Plans. These plans provide farmers with a way of identifying the potential impacts of climate change on their farms. FRPs should combine adaptation of farming practices with good management to help the natural environment adapt to changing conditions in a pragmatic way. The pilot exercise has tested this approach on 10 farms in the north-west of England, using existing work on adaptation in that region. The results of the pilot will be used to inform development of agri-environment and advice programmes in the next RDPE.

Actions to address priority risks

Build national awareness of the priorities for climate change adaptation and disseminate tailored messages locally	NFU and AHDB
Consult on abstraction licensing reform (late 2013)	Defra
Following decisions on the direction of reform for the abstraction regulation system, review the available guidance and support for farmers to manage their water availability and consider whether there is a case for change in the light of reform and the need to adapt to climate change prior to introducing new legislation in the next Parliament	Defra
The government to work with the Association of Drainage Authorities (ADAs) and others, to identify existing good practice and explore role of Internal Drainage Board (IDB)	Defra
Review of the Soil Protection Review (under pillar 1 of the Common Agricultural Policy) completed by the end 2013 to provide baseline protection for agricultural soils which will ensure soils are resilient as possible	Defra
The continuation of the Catchment Sensitive Farming (CSF) project	Defra/EA/NE/FC/RPA
EA Climate Ready Support Service to work with/in partnership with the agriculture industry to develop and promote adaptation activity as part of a network of demonstration farm activity	EA
EA Climate Ready Support Service to work with the agriculture and forestry industry to develop, promote and embed adaptation good practice, common messages, tools and guidance within the industry	EA/ industry
Embed adaptation into the RDPE	Defra

Focus area 2: Resilience in forestry

Objective 16: To increase the resilience of the forestry sector by increasing the level of management in England's woodlands and the uptake of adaptation good practice in woodland creation and restocking.

168. Our woodlands will need to be increasingly resilient to cope with the potential changes in climate and more frequent weather extremes. Actively managing more sites, preserving and enhancing species diversity and embedding adaptation skills and knowledge will help to ensure that our woodlands continue to deliver a wide range of benefits. Taking climate change into consideration in woodland creation and restocking will be particularly important given the long time-scales involved.

169. The government's Forestry and Woodlands Policy Statement sets out a new approach to forestry policy, a clear hierarchy of protecting, improving and expanding our woodland assets.[56] The 3 inter-related priorities below will help to increase resilience and drive adaptation to climate change:

- look to protect trees, woods and forests from the increasing threats of pests and diseases as well as climate change
- improve their contribution to economic growth, people's lives and nature
- expand their area to further increase the economic, social and environmental benefits they provide

170. The commitment to increase levels of woodland management should help adaptation, as well-managed woodlands are likely to be more resilient to climate change. The policy statement also sets out how targeted woodland creation can deliver a broad range of ecosystem services to aid adaptation in other sectors, as well as developing a more resilient woodland resource.

171. The Forestry Commission's Adaptation Plan sets out particular steps which, alongside industry action, are essential for building a sustainable forestry sector.[57] These actions include the further development of advice and guidance on species diversification, implementation of the Climate Change Action Plan for Public Forests[58], promotion of woodland management planning and the embedding of adaptation actions as standard practice in the application of forestry regulations and in forestry measures in the RDPE. The Forestry Commission (FC) is also working with members of the England Woodland and Timber Partnership (EWTP) to promote the 'UK Forestry Standard (UKFS) Forests and Climate Change Guidelines' more widely, and to increase the diversity and supply of suitable planting stock.[59]

56 **http://www.defra.gov.uk/publications/files/pb13871-forestry-policy-statement.pdf**
57 **http://archive.defra.gov.uk/environment/climate/documents/adapt-reports/11public-bodies/pbs-forestry-comm.pdf**
58 **http://www.forestry.gov.uk/pdf/InternetCCAP.pdf/$FILE/InternetCCAP.pdf**
59 **http://www.forestry.gov.uk/pdf/FCFC001.pdf/$FILE/FCFC001.pdf**

The England Woodland and Timber Partnership

The EWTP will develop a Climate Change Action Plan as the forestry sector's contribution to the National Adaptation Programme. It will focus on: raising awareness, developing and promoting good practice, increasing the availability of good quality seeds and trees to support diversification, developing the sector's skills, increasing the uptake of the UKFS and continuing to promote increased woodland creation and usage of solid wood products.

Actions to address priority risks

EWTP to publish a Climate Change Action Plan, including commitments from main partner organisations	EWTP
Implementation of the FC England's Outline Adaptation Plan as published in its Adaptation Reporting Power Report	FC
Promotion and development of guidance to underpin the UK Forestry Standard Forests and Climate Change Guidelines	Defra/FC

Focus area 3: Resilience to pests and disease

Objective 17: To increase resilience to pests and disease to help protect biodiversity, maintain agricultural and forestry productivity and protect the UK's ability to export products.

172. Pests and disease pose a significant risk to the sustainability of the agriculture and forestry sectors and the wider natural world. Recent events, such as ash dieback (due to 'Chalara') have only served to underline this. Proportionate action is needed to manage the threat of outbreaks and pest infestations, to protect the viability of farms and woodlands and to protect the UK's ability to export products. There are gaps in the evidence base which will need to be filled to properly inform longer term planning.

173. Preparing for and managing risk from plant disease is one of Defra's top priorities. The Secretary of State commissioned an independent Tree Health and Plant Biosecurity Expert Task Force (THPBETF), convened by Defra's Chief Scientific Adviser, to look at ways to prevent pests and diseases from entering the country in the future and to better manage those that are already present. The Task Force has reported and the government will respond shortly.

174. The implementation of the 'Tree Health and Plant Biosecurity Action Plan' is being accelerated as recommended by the Independent Panel on Forestry and the THPBETF.[60]

60 **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69330/pb13657-tree-health-actionplan.pdf**

It aims to strengthen import control activities and protocols, improve our surveillance strategy for tree pests and disease and raise the public's and professionals' awareness of them. It will also make the best use of existing evidence and commission new work to strengthen the evidence base on how climate change will affect the spread of pests and disease.

175. The Food and Environment Research Agency (FERA), working with Defra and the Health and Safety Executive's Chemicals Regulation Directorate (CRD), will review the extent to which current plant health protection programmes integrate climate risk, establishing where further evidence is required. This will inform Defra's evidence plans within its plant health portfolio. Following decisions on the structure and function of FERA, a decision will be taken on whether FERA will be asked to prepare a voluntary adaptation report.

176. Adaptation strategies are needed to build longer-term resilience to pests and diseases in a changing environment. The Tree Health and Plant Biosecurity Evidence Plan recognises that trees help to mitigate climate change, while also being at risk from it directly and indirectly.[61] A strategic Tree Health and Plant Biosecurity Initiative, within the framework of the Living With Environmental Change (LWEC) partnership, will include research that helps develop longer-term strategies for adaptation and resilience to current and future pest and disease threats in a changing environment. In general, climate change scenarios will also be included in risk assessments for new pest and disease threats, thereby helping to protect our plant resources, including crops and plants in the wider environment.

177. Animal health and welfare is already a priority for the government. For example, Defra is strengthening surveillance and monitoring systems for exotic and endemic animal diseases, working in partnership with agencies and industries. In response to the CCRA which pointed to a lack of understanding of the direct effects of climate change on the livestock sector, Defra will improve the evidence base. It will do this by working with industry, research partners and European colleagues to examine different sectors, welfare indicators and management practices. Defra will also continue to press the EU to adopt a harmonised approach to disease surveillance and horizon scanning.

178. Defra is also working with its agencies (AHVLA, FERA and NE) and with wildlife and wild bird specialists (including the Wildfowl and Wetlands Trust and the British Trust for Ornithology) to look at emerging threats to biodiversity as a result of climate change.

179. Invasive non-native species (INNS) are one of the main threats to biodiversity globally and cost the English economy more than £1.3 billion annually. Climate change will enable some INNS to become more common and some INNS which are currently benign, to become invasive. Defra will review the Invasive Non-native Species Framework Strategy for Great Britain (2008) to ensure that the approach of prevention, detection, rapid response, long-term mitigation and control continues to take account of new and emerging risks.

61 **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/181846/pb13929-evidenceplan-tree-health-plant-biosecurity.pdf.pdf**

Actions to address priority risks

Implementation of the research and evidence theme of the Tree Health and Plant Biosecurity Action Plan	Defra/FERA/FC
Independent THPBETF to look at ways to prevent new and emerging pests and disease from entering the country in the future and to better manage those that have already arrived. The Task Force reported in May 2013 and the government will respond initially in the summer.	Defra
Review the extent to which current plant health protection programmes integrate climate risk, establishing where further evidence is required	Defra/FERA/CRD (HSE)
Following decisions on the structure and function of FERA decide whether FERA is asked to prepare a voluntary adaptation report	FERA
Initiate a Tree Health and Plant Biosecurity Research Initiative to provide interdisciplinary research that supports the health and resilience of UK trees, woodlands and their associated biodiversity and ecosystem services in a changing environment, including climate change	Defra/LWEC
Improve the evidence base relating to impacts of climate change on animal disease and press the EU for a harmonised approach to disease surveillance	Defra
Review the Invasive Non-native Species Framework Strategy for Great Britain (2008)	Defra

Focus area 4: Innovation and evidence

Objective 18: To embed climate change adaptation into agriculture, horticulture and forestry research programmes, in order to improve knowledge of likely climate impacts and contribute to the development and uptake of climate resilient crops, tree and livestock species as well as relevant technologies.

180. Biological systems are complex, so trying to project the combined effect of multiple climate impacts upon them in the context of a number of uncertain variables is an inexact science. To effectively adapt to climate change and exploit opportunities, we need to both improve our knowledge and develop strategies that effectively manage this uncertainty.

181. The government recognises the importance of developing well-adapted trees, crops and livestock species. Given the long lead times involved, work needs to start now to ensure timely deployment of well-adapted species. To adapt to unprecedented growing conditions, pioneering new approaches to selecting and developing varieties with the necessary combination of physiological traits will be required. This will ensure important forestry and agriculture species are adapted to future climates, including the combinations of day length, temperature extremes, carbon dioxide concentrations and rainfall patterns that have never previously been experienced. Similar adaptation of livestock species, particularly to temperature extremes and potentially different diets, can also be anticipated.

Research forests

Research forests have been established in England, Scotland and Wales to develop and test adaptation strategies for forestry. These, together with collaborative action at the European scale through research programmes such as the REINFORCE species trials will provide valuable insight to inform adaptation strategies.

182. Modern genetics, breeding techniques and effective knowledge transfer could all play a role in building the climate resilience of the agricultural sector. The government's new Agri-Tech Strategy will recognise that climate change will have an impact on the sustainable intensification of agriculture and meeting global food security challenges and sets out the need to increase development and uptake of emerging technologies and improve skills. The Strategy will draw on evidence such as the sector-led 'Feeding the Future' report to inform future actions/implementation.

Feeding the Future Report

The Feeding the Future Report looks to inform the industry on specific areas for action. The industry-led Report recognises the importance of modern genetics and breeding techniques and effective knowledge transfer for climate resilience. The intention of the Report's commissioning group is to use the recommendations as a basis for dialogue with both government and industry funders of research and knowledge transfer, including divisions of AHDB and future Technology Strategy Board funding. This Report will help focus both basic and more applied research in the areas which will deliver greatest economic returns to the UK.

183. While advanced conventional plant breeding techniques will clearly play a role in the development of sustainable and climate-resilient crops, recent reports and studies have pointed to Genetic Modification (GM) as being an important tool for addressing the unprecedented challenges that lie ahead.[62] The government is therefore keen to encourage the development of a wide range of technologies and is working to unblock the EU regulatory regime to allow fair market access for GM products which have undergone a comprehensive environmental risk assessment.

184. The long-term nature of forestry and the urgency of action requires the development of approaches that effectively manage uncertainty. In Autumn 2013 the Forestry Commission will publish the revised Science and Innovation Strategy for British Forestry. The Strategy will include the development of robust evidence to inform climate change adaptation for forestry and to support actions to increase the resilience of British woodland and the ecosystem services it provides for society.

62 Reports from the OECD, Royal Society and the Foresight Global Food and Farming Futures study led by the Government Chief Scientific Adviser.

185. The government also recognises the critical importance of developing soil science capacity to protect and enhance our soils in the face of pressures such as climate change and to enable sustainable intensification. Defra is undertaking a significant research programme to explore how soil degradation can affect the soil's ability to support vital ecosystem services such as flood mitigation, carbon storage and nutrient cycling. This will be delivered alongside two joint BBSRC and Natural Environment Research Council (NERC) research programmes on soils being proposed with an overall budget of £12million. NERC has approved funding for a £5.5million five year programme on soils. The initial BBSRC-led call (lasting 3 to 5 years) will be focused on the latest technologies (eg imaging methods and meta-genomics) and integrated research approaches to increase our understanding of important interactions between crops, microbes and soil processes in agricultural systems. This will be followed by a prospective NERC-led 5 year programme to help predict how soils are likely to function in the context of changes in climate and land use. Outputs would be used to inform future decisions on local and regional management of soils for food security and climate mitigation.

Biotechnology and Biological Sciences Research Council (BBSRC)

BBSRC are contributing €3million to a €18million ERANET+ programme which brings together researchers from 16 countries to develop resilience around crops and livestock systems. Areas the programme will focus on include preserving soil, water and genetic sources, emerging and re-emerging pests and diseases and socio-economic aspects of adaptation. New technologies which aid adaptive water and soil management will be investigated, including those that: improve water harvesting, increase water efficiency and efficient fertilisation practices, monitor and reduce greenhouse gases and increase and verify soil and biomass carbon stocks.

186. The ECR report describes extreme weather as carrying greater risks for agriculture than changes in long term average climate conditions.[63] Consultation with the industry also highlighted extreme weather events as a particular concern for agriculture. Research to develop and assess the effect on agriculture of a range of plausible extreme weather event scenarios is underway and will be used to inform policy development and industry action. This work will also inform Defra's new Sustainable Intensification Research Platform which will develop integrated approaches to land management that can sustainably provide food and deliver environmental outcomes. The Research Platform will include research on the wider contextual drivers for decision-making on UK farms, including the influences of climate, global commodity markets, consumer choice, the development of markets for ecosystem services and the demand for biofuels.

187. At EU level Defra is working with European partners on the development of a Joint Programming Initiative to coordinate EU research on agriculture, food security and climate change.

63 **http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18016**

Actions to address priority risks

Commitment to innovation and development of new technology, and to overcome barriers to its uptake and drive sustained growth through the Agri-Technology Strategy	BIS/Defra
Publication of the revised UK Science and Innovation Strategy for British Forestry by Autumn 2013	FC
All soils will be managed sustainably, and degradation threats tackled successfully by 2030 as outlined in the government's statement of intention in the NEWP. Within this, there was a commitment for a four-year research programme to look at the effects of soil degradation on soil function	Defra
BBSRC action on soils research programme	BBSRC
NERC action on soils research programme	NERC
BBSRC collaboration in EU Adaptation ERANET+	BBSRC

This National Adaptation Programme covers 2013 to 2018.
A NAP covering 2018 to 2023 has been published on GOV.UK

Chapter 6

Photograph of Rutland Water courtesy of Anglian Water

Chapter 6: Natural Environment

***Vision**: "The natural environment, with diverse and healthy ecosystems, is resilient to climate change, able to accommodate change and valued for the adaptation services it provides."*

188. The natural world, its biodiversity, landscapes and ecosystems is critically important for our wellbeing and economic prosperity. Our ecosystems provide us with a wide range of services including clear air, clean water, green space, as well as contact with nature. However, the ability of ecosystems to produce these services at current levels will be vulnerable to climate change. The natural world is in a perpetual state of change, but the increasing pace of change will place unprecedented pressures on access to and use of our natural resources. The scale of this was recognised by Professor Sir John Lawton's independent review (2010) of England's wildlife sites and ecological network, which clearly concluded that England's collection of wildlife areas is fragmented and does not represent a coherent and resilient ecological network which is capable of responding to climate change and other pressures.[64]

189. As conditions change, there is a big risk that species in terrestrial, coastal, freshwater and marine environments that are particularly sensitive to temperature changes, will not be able to move northwards to suitable cooler habitats. This could result in the loss of vulnerable species. Other urgent risks include flooding and coastal erosion, low river flows, reduced water quality and drier soils, all of which can damage habitats. The risk of pests, disease and invasive non-native species may also increase (see Chapter 5) and important landscapes and heritage sites may also be threatened.

190. Climate change presents some opportunities. The economic benefits provided by the natural environment's regulating and provisioning services are likely to increase. This may create new markets if these services can be given a monetary value. The habitat range for some species may increase and some new and valued non-native species may enter the UK. For example, our fishing industry may benefit from increased numbers of fish such as sea bass, red mullet, boarfish and squid. There are also recreational opportunities linked to and possible increases to rural tourism if we experience warmer summers.

191. There are 4 main objectives for this theme. They focus on building ecological resilience, accommodating the changes that are inevitable, valuing how the natural environment can help other sectors become more resilient and improving the evidence base. These objectives reflect the principles set out in the Natural Environment White Paper (NEWP).[65]

64 **http://archive.defra.gov.uk/environment/biodiversity/documents/201009space-for-nature.pdf**
65 **http://www.official-documents.gov.uk/document/cm80/8082/8082.asp**

CCRA Risk	Description
FL15	Flood risk for Scheduled Ancient Monument sites
BD5	Species unable to track changing 'climate space'
BD9	Changes in species migration patterns
BD2	Risks to species and habitats due to coastal evolution
BD1	Risks to species and habitats due to drier soils
BD14	Ecosystem risks due to low flows and increased water demand
BD7	Risks to coastal habitats due to flooding
BD10	Biodiversity risks due to warmer rivers and lakes
MA2a	Decline in marine water quality due to sewer overflows
MA3	Ocean acidification
MA6	Northward spread of invasive and non-native species
WA2	Low summer river flows

Focus area 1: Building ecological resilience to the impacts of climate change

Objective 19: To build the resilience of wildlife, habitats and ecosystems (terrestrial, freshwater, marine and coastal) to climate change, to put our natural environment in the strongest possible position to meet the challenges and changes ahead.

192. Ecosystems can become more resilient to the impacts of climate change and the government is keen to improve the environment, including through taking action to adapt. Particularly important policies include joining up the management of the natural environment at a larger scale, often termed 'landscape scale approach' and making sure protected sites are in good condition, sufficiently large, numerous and where possible connected.[66, 67] Coastal zones, uplands and wetlands are among the habitats of high biodiversity value that are particularly sensitive to climate change.

66 Such as Sites of Special Scientific Interest and National Nature Reserves.
67 As suggested by Lawton in 'Making Space for Nature' 2010.

193. The case for strong, healthy ecosystems has been well defined in recent the government policies, in particular 'The Natural Choice: Securing the Value of Nature' White Paper (2011), 'Biodiversity 2020', the 'Water for Life' White Paper (2012), the 'Marine Policy Statement' (2011) and the 'Forestry and Woodland Policy Statement' (2013).[68, 69, 70, 71] A priority for the NAP is to implement these framework policies in a way that increases the resilience of our natural environment. The government will also embed actions to increase climate resilience into the Rural Development Programme for England 2014–2020 (see Chapter 5).

194. The government wants to see more integrated approaches to terrestrial biodiversity and ecosystems management that reflect both local and larger scale priorities. Nature Improvement Areas (NIAs) and Local Nature Partnerships (LNPs) have been established to facilitate this. The NAP will help us to ensure that these approaches embed good adaptive management practices. This will increase the likelihood that more species will be able to survive changes in climate, through increasing local population resilience and the colonisation of new areas.

Nature Improvement Areas

Local authorities, communities, landowners, businesses and conservation organisations are working in partnership to create better connected habitats over a landscape scale. These will help create areas in which wildlife can thrive and adapt to climate change. The first 12 NIAs began work in April 2012 and have already made good progress in uniting people around plans that provide for both communities and wildlife. Building on this success, the government is now encouraging others to adopt this approach voluntarily.

195. Recognising this, Natural England (NE) is piloting adaptive management approaches in NIAs, and the EA's Climate Ready Support Service is working with LNPs to develop advice and tools to help land managers and advisers take informed decisions about climate risks and adaptation actions. Equally, the tools and guidance provided to the forestry sector by the Forestry Commission (FC) will help to adapt our ancient and native woodland, as will the government's ambition to bring more of England's woodlands into sustainable management.

The Crown Estate

The Crown Estate manages a diverse property and land portfolio representing a range of adaptation opportunities and challenges at a local level. They work with a variety of partner organisations to establish projects focusing on adaptation in terms of biodiversity, building design, and changes in agricultural and forestry. Educational engagement aims to improve understanding of the challenges. For instance the Forests for the Future school education pack looks at the role of forests in climate change adaptation. In addition climate change factors have been integrated into investment decision making process to improve our understanding of future risks.

68 **http://www.official-documents.gov.uk/document/cm80/8082/8082.asp**
69 Biodiversity 2020' sets the strategic direction for biodiversity policy and a series of major outcomes for terrestrial, coastal, freshwater and marine environments. Through its implementation the government aims to make significant progress in protecting and enhancing biodiversity.
70 **http://www.official-documents.gov.uk/document/cm82/8230/8230.asp**
71 **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf**

196. In 2011, the government set out the long term priorities for the water industry in the Water White Paper. This set out the evidence and made the case for change to plan now to protect the resilience of future water supplies. This planning should take into account climate change, population growth, patterns of demand and the need for resilience to hazards such as drought and flooding.

197. Through River Basin Management Planning, the government aims to provide a resilient, sustainable water environment that protects existing quality and promotes improvements where there are significant benefits. These benefits will be judged across a range of ecosystem services, including the provision of sufficient clean water for drinking, recreation, wildlife and adapting to a changing climate.

The Rivers Trust

The Rivers Trust movement adopts an ecosystem approach to the management of river catchments, working with a wide range of Defra partners to enhance freshwater resources nationwide. Much of this work implements action 'on the ground' that reduces the risk to freshwater from climate change. The provision of advice to farmers, for example, leads to reductions in soil erosion and the associated loss of carbon from rural land. Soft engineering measures are also implemented to slow and retain water on the hillside. Not only does this reduce flood risk downstream, it also helps to maintain summer base flow in rivers.

198. The EA is currently developing the second cycle of River Basin Management Plans for delivery in 2015 and the assessment of climate change risks and necessary adaptation actions will be integrated within them.

199. The EA, other parts of Defra and interested parties have also been piloting a catchment-based approach since March 2012. This involves the development of plans to address water quality issues and which recognise and integrate other local priorities. The pilots have been supported by the EA Climate Ready Support Service to develop and embed adaptation good practice. This learning will inform the wider roll-out of the catchment approach in 2014. This is the sort of innovative approach that the regulatory framework can enable to help deliver long term resilience, including to climate change.

200. The government is committed to reforming the water abstraction regulation system to protect rivers and water bodies from over abstraction as pressures increase from climate change and population growth (see Chapter 5).

201. The government also recognises that for the reformed abstraction regime to be sustainable, the current problem of over abstraction needs to be addressed. The EA is working to reduce the environmental impact of the over abstraction of water through its Restoring Sustainable Abstraction (RSA) programme. It has reviewed thousands of licences and changed many of the most damaging. The Water Act 2003 contains a power which will allow licenses to be modified without compensation where this is to prevent serious environmental damage.[72] As highlighted in the Water White Paper, Defra, Ofwat and the EA are working to move funding for water companies for restoring sustainable abstractions into the Water Price Review process to deliver the best value for customers.

202. To address increased pressures on coastal habitats the EA will work alongside partners including local councils to ensure that Shoreline Management Plans (SMPs) value the ecosystem benefits to the wider environment. SMPs will address flood control and potential habitat losses from climate change including how to compensate for losses at nature reserves and designated sites.

203. While the impacts of climate change on the marine environment are less certain, it is important that robust strategies are developed to manage them. Protecting and restoring marine habitats will increase their resilience to climate change and Defra has committed to designating at least 25% of English waters as Marine Protected Areas. These will enable Defra to create a series of conservation zones as a well managed network of habitats that will aid the movement of species affected by climate change and decrease threats such as over-fishing.

204. Well managed fish stocks are much less susceptible to climate impacts.[73] However as a consequence of climate change, in some cases, fish stocks will not be able to sustain the same level of fishing they have experienced in the past. More flexible regional fisheries management will help accommodate the changes in species distribution and allow fisheries managers to make use of the opportunities these changes may bring. The government is seeking a conclusion to the EU negotiations by the end of 2013 of a reformed Common Fisheries Policy, which will deliver sustainable use of fish stocks, a healthy marine environment and a prosperous fishing industry. The fishing industry and management of fisheries will need to examine how species distribution may change in order to capitalise on any possible opportunities.[74]

205. In co-operation with the seafood industry, Seafish will prepare a voluntary report under the Adaptation Reporting Power (ARP) to assess how climate change will affect the functioning of the fishing and wider seafood industry and the actions necessary to address these risks. The Marine Management Organisation will also prepare a voluntary report under the ARP to assess how climate change will impact on the delivery of its functions, such as the development of marine spatial plans and the issuing of licenses. It will consider what needs to be done to address the risks identified.

72 **http://www.legislation.gov.uk/ukpga/2003/37/contents**
73 **http://www.mccip.org.uk/media/8911/37453%20mccip%20english%20lorez.pdf**
74 The 2012 'Economics of Climate Resilience' study indicated that some species (for example sea bass, sardine, anchovy and squid) may benefit from future climate change.

206. Given the uncertainty around the effects on the marine environment, the government is working directly with other marine organisations through the Marine Climate Change Impacts Partnership (MCCIP). The MCCIP aims to develop and share knowledge, guidance, best practice tools and strategies for the sector and to identify current shortcomings in UK marine climate science. This is supported through the new Cefas Marine Climate Change Centre (MC^3).[75]

207. Improving the environment is not only based on conserving the value of nature but on protecting England's landscapes, archaeological sites and historic buildings that people value. Many of these are threatened by climate change, most notably flooding to ancient monuments, but also coastal erosion and seasonal groundwater depletion affecting the foundations of buildings. The National Heritage Protection Plan sets out how English Heritage together with partners in the heritage sector, will prioritise and deliver heritage protection from 2011 to 2015. This includes actions such as the continuation of 'Rapid Coastal Zone Assessment Surveys' that record and assess the risk to heritage assets on the coast. It also focuses research on developing the evidence base that is required to ensure that appropriate decisions are made to avoid unnecessary degradation.[76]

English Heritage and the Church of England's 'Shrinking the Footprint' campaign

As protectors and custodians of many of the nation's historic assets, English Heritage and the Church of England will develop voluntary adaptation reports under the Secretary of State's ARP. Once they have assessed the risks and developed strategies to address these, they will develop a joint action plan alongside other historic asset managers to ensure the nation's historic assets are as resilient to climate change as they can be.

75 Centre for Environment, Fisheries and Aquaculture Science.
76 **http://www.english-heritage.org.uk/professional/advice/advice-by-topic/marine-planning/shoreline-management-plans/rczas-reports/**

Actions to address priority risks

Support landscape scale partnerships such as Local Nature Partnerships and Nature Improvement Areas to embed adaptation in their work	Defra/NE/EA
Embed adaptation into delivery of the Natural Environment White Paper and Biodiversity 2020	NE
Embed adaptation into implementation of the Water Framework Directive and Water White Paper	Defra/EA
Pilot catchment based approaches to water management	EA
The second cycle of the River basin management plans will integrate climate change risk assessment and adaptation	EA
Review abstraction licences to prevent serious environmental damage	EA
Implement actions to increase resilience in the marine and coastal environments	EA
Seek a reformed Common Fisheries Policy for the sustainable use of fish stocks and a healthy marine environment	Defra
Marine Management Organisation climate change adaptation report published by 2014	Marine Management Organisation
Marine industry report on climate impacts published by 2014	Seafish
English Heritage and the Church of England's environmental campaign will produce separate reports on the effects of climate change on their assets and estates and subsequently form a working group with other historic environment managers to produce an action plan	English Heritage/ Shrinking the Footprint
Develop a strategic plan for coastal realignment	EA/Natural England
Take climate change into account in the National Heritage Protection Plan (NHPP)	English Heritage and partners

Focus area 2: Preparing for and accommodating inevitable change

Objective 20: To take action to help wildlife, habitats and ecosystems accommodate and smoothly make the transition through inevitable change.

208. While there is uncertainty about the rate, severity and nature of potential climate change impacts, it is clear that the character and distribution of habitats and the species that live in them will change. At a local level, changing conservation priorities need to be assessed and planned for, such as by providing habitats for new species that arrive to colonise sites.

Nationally and at the landscape level, careful thought needs to be given to whether current plans and strategies will deliver resilient ecological networks under different scenarios. The Natural Environment White Paper (NEWP) and Biodiversity 2020, have started to consider this by setting challenging visions for 2050 as well as more immediate outcomes for 2020.

The Royal Society for the Protection of Birds (RSPB), National Trust, The Wildlife Trusts and Woodland Trust

These organisations are starting to plan for scenarios for a 2ºC world, while seeking to understand more about the impacts of a 4ºC rise: "We recognise the importance of collaboration at a national and a landscape scale to create a resilient natural environment and ecological networks. We are embedding climate change adaptation measures into our site management to build resilience and accommodate change, as our special nature sites will continue to be critically important as reservoirs of wildlife. We will look to work in partnership with Defra and its agencies to share knowledge and best practice and build a national network of sites and landscape scale initiatives that deliver the best for biodiversity with current and future climate changes. We will also engage our supporters to help them understand that some change is inevitable and that the changes in our management activities are part of a carefully planned transition."

209. The conservation priorities of a particular site may change with the climate. NE will review existing protected sites and consider protecting new areas as the climate changes. Organisations that manage nature reserves, including the RSPB, the Wildlife Trusts, the National Trust and the Woodland Trust, will work with EA as well as NE to share evidence and best practice in management planning. This will enable these important sites to make the transition in ways that allow them to retain high biodiversity value, thereby enabling them to play a vital nature conservation role as part of a connected and coherent series of sites along with other protected areas.

210. Some degree of change in the wildlife and habitats of nature sites is inevitable but this may not always be well understood, particularly at the local level. Effective communication work with both land managers and the public is therefore essential to ensure that proactive adaptation measures do not experience uninformed local opposition. NE and partners are developing an adaptation manual that can be used by land managers and conservation practitioners to help them better understand local impacts. Several environmental organisations are also developing their own strategies to educate their members and visitors to their sites.

Actions to address priority risks

Promote landscape scale activity, e.g. the government response to 'Making Space for Nature'	Defra
Develop a strategy for notification and review of designated areas to consider implications of climate change	NE
Develop tools to improve delivery including a climate change adaptation manual and vulnerability tools for conservation and land managers	EA/NE

Focus area 3: Valuing the wider adaptation benefits the natural environment can deliver

Objective 21: To promote and gain widespread uptake in other sectors of adaptation measures that benefit, or do not adversely affect, the natural environment.

211. Decisions taken in other sectors can have a positive or detrimental impact on the ability of the natural environment to adapt. It is important that adaptation plans in other sectors take account of the role of the natural environment and develop solutions that work with the grain of nature.

212. Working innovatively with natural systems and promoting 'Ecosystem Based Adaptation' approaches can create opportunities to reduce costs and provide multiple benefits for society. Some examples include planting trees in cities to cool the air or managing flood risk through the creation of wetlands. These approaches can benefit biodiversity, provide recreational space and reduce costs compared to air conditioning. However, these approaches also need better decision support tools, a clearer framework for their use and new ways to better value the services they deliver and to seek payment from those who benefit.

213. As a first step Defra developed the 'National Ecosystem Assessment' (2011). This helps to better understand both the true value derived from the natural environment and the possible future threats to the goods and services it provides. Defra is now developing tools to help decision makers to take account of the value of nature and to find approaches which maximise the benefits society gets from its ecosystems. Alongside this, NE has worked with the Green Infrastructure Partnership (GIP) to develop tools and advice that help local decision makers better understand how green infrastructure and 'Ecosystem Based Approaches' can also support local objectives and help build greater resilience in a changing climate.

214. Defra has since published a number of reports on how investing in natural infrastructure can deliver a range of benefits for society.[77] The ECR report sought to begin to analyse the costs and benefits of using natural approaches to flood risk management by suggesting appropriate methodologies for analysis.[78]

215. Defra is looking at how paying for ecosystems services could work. In Spring 2013 Defra published the 'Payment for Ecosystem Services (PES) Action Plan' alongside best practice guidance on taking forward PES schemes.[79] This emphasised that PES design should take account of climate change and recognised that climate change itself may make the case stronger for investing in natural solutions. The NEWP contained a commitment to set up the business-led Ecosystems Market Task Force. Its role is to review the opportunities available to UK businesses to develop markets which value and protect the environment. The Task Force reported in March 2013. In its report it laid out a number of recommendations to the government, some of which are relevant to adaptation. Defra will consider these in its response to the report.

77 **https://www.gov.uk/ecosystems-services**
78 **http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18016**
79 **http://www.gov.uk/government/publications/payments-for-ecosystem-services-pes-action-plan**

216. The NEWP established the Natural Capital Committee and the Green Economy Council.[80] They work to prioritise actions that support and improve the UK's natural assets. A priority area is the protection of peatlands that enable water purification, carbon sequestration, flood risk management and habitat creation. Ministers from across the UK outlined their intentions to aim to enhance the natural capital of UK peatlands in a letter to the IUCN UK Peatland Programme (a partnership of environmental bodies working to promote peat restoration). Actions include reducing peat used in horticulture in England to 0 by 2030.

217. The planning process is a major point in the decision making process where adaptation needs to be considered. The European Directive on Environmental Impact Assessment (EIA) includes within its scope the consideration of the impact on a proposed development of climate change. The European Commission recently published guidance to improve the consideration of climate change and biodiversity in the EIA process.

The Institute for Environmental Management and Assessment (IEMA)

IEMA is taking a proactive approach with its members in considering the importance of climate change and the natural environment to their activities. While the proposed addition to the Environmental Impacts Assessment Directive (EIA) may take until 2016 to come into force in the UK, IEMA has a programme of work that will ensure many of the UK's assessments already consider climate change adaptation well before 2016. This work programme includes webinars on the forthcoming EC guidance on integrating climate change and biodiversity into the EIA and Strategic Environmental Assessments process, as well as launching new climate change, biodiversity and EIA information pages and advice notes.

Actions to address priority risks

Embedding understanding of climate change into Payment for Ecosystem Services and the business case for investing in natural solutions	Defra
Defra response to the Ecosystem Markets Services Task Force	Defra

Focus area 4: Improving the evidence base

Objective 22: To improve the evidence base to enhance the knowledge and understanding of decision makers, land managers and others of the impacts of climate change on the natural environment and how best we can influence adaptation or accommodate change.

80 Set up in light of the Natural Environment White Paper to provide advice to the Economic Affairs Cabinet Committee on the state of English Natural Capital.

218. Whilst there are many adaptation actions that can be taken now, there is significant uncertainty that limits our capacity to make informed decisions. It is essential that the knowledge base continues to be developed to help users better understand the need to adapt and to identify appropriate measures to do so.

219. The CCRA highlighted important gaps in the data that need to be addressed to better understand the impacts of climate change on biodiversity. In response, Defra and its agencies have worked with the Living With Environmental Change (LWEC) partnership to develop biodiversity and water 'Climate Change Impact Report Cards' to better understand current uncertainty. Defra has also commissioned new research that will feed into the Biodiversity Impacts of Climate Change Observation Network (BICCO-net[81]) that will extend work to cover freshwater systems, conduct more detailed analysis to separate climate change impacts from other drivers of change, develop climate change indicators and continue to support knowledge transfer.

Marine Climate Change Impacts Report Card

A Marine Climate Change Impacts Report Card was originally developed by the Marine Climate Change Impacts Partnerships (MCCIP) in 2006 and is updated annually. This identifies the observed impacts and where possible the magnitude and timing of possible future impacts and brings together co-ordinated advice from a range of scientists, government, agencies and NGOs. Following the success of these annual reports, NE and the EA developed further cards on water and terrestrial biodiversity.

220. To address uncertainty surrounding the impact of climate change on river flows and their ability to meet environmental targets, the EA is scoping a new long term research effort to improve environmental flow indicators and inform future water resource planning.

221. Scientific work on ocean acidification and its impacts has been carried out by a wide range of UK research centres, university groups, government bodies and other organisations. In 2010 most of that effort was brought together by the UK Ocean Acidification (UKOA) research programme. This is a £12.4million, 5 year initiative funded by Defra, DECC and NERC to increase the understanding of ocean acidification processes and reduce uncertainties in predicting ocean acidification impacts. This will go a long way to addressing the uncertainty of the risk highlighted in the CCRA.

Actions to address priority risks

Further develop the Biodiversity Climate Change Impacts Network (BICCO-net) through data gathering and dissemination	Defra and partners including devolved administrations
LWEC Climate Change Report Cards for Terrestrial Biodiversity and Freshwater will be published on the web in Summer 2013 along with the continued publication of the successful MCCIP report cards	LWEC and Partners, MCCIP
Undertaking of UK Ocean Acidification research programme	Defra/DECC/NERC

81 **http://bicco-net.org/**

The National Adaptation Programme covers 2013 to 2018.
A New one for 2018 to 2023 has been published on GOV.UK

Chapter 7

Chapter 7: Business

***Vision**: "UK businesses are resilient to extreme weather and prepared for future risks and opportunities from climate change."*

222. The impacts of a changing climate will increase the risk of financial loss or damage to businesses, but will also offer wide ranging opportunities to UK businesses, whether they are producing goods or providing services. The relationship to the growth agenda has two aspects.

223. First, it is about reducing the risks that could constrain economic growth. For example, Unilever estimated that the impacts of climate change led to an additional €200 million ($260 million) of losses in 2011 alone.[82] The total financial uninsured costs of the 2007 floods were estimated to be £4 billion.[83] The heatwave of 2003 was estimated to have cost £500 million to the economy.[84] The CCRA suggests that the combined annual average domestic and commercial flood insurance claims could increase to between £700 million to £1 billion by the 2080s.[85]

224. If businesses can manage these risks with minimal disruption and revenue loss, they will be better able to maintain a competitive position. This message is reinforced by the Prince of Wales's UK Corporate Leaders Group, which has endorsed the case for mainstreaming business continuity planning so that it is responsive to the challenges ahead.[86] It is also supported by the Confederation of British Industry (CBI).

CBI

The CBI believes that meeting the challenges of climate change is not just about addressing risk. It is also about cultivating opportunity. It makes sense for individual businesses to start to incorporate changes in the climate into their own planning. For example, increasing the flood resilience of buildings, infrastructure and homes reduces the immediate costs of insuring vulnerable assets at a premium.

In addition, establishing leadership in the development of new adaptation technologies and expertise will also carve out new export opportunities for UK businesses in a growing international market.

82 Thomsen Reuters at 12th April 2013. See **http://www.trust.org/item/?map=uncomfortable-bedfellows-in-the-fight-against-climate-change**
83 Review of summer floods 2007, Environment Agency (2007). See http://www.environment-agency.gov.uk
84 The sensitivity of UK manufacturing firms to extreme weather events. Martin, Muuls and Ward, Centre for Economic Performance (CEP/LSE), & Grantham Research Institute on Climate Change 2011.
See **http://downloads.theccc.org.uk.s3.amazonaws.com/ASC%202nd%20Report/LSE_final.pdf**
85 CCRA – Business Theme See http://randd.defra.gov.uk
86 Prince of Wales's UK Corporate Leaders Group endorsement of business continuity planning via a range of business activities.
See **http://www.princeofwales.gov.uk**

225. Secondly, organisations will benefit from capitalising on business opportunities that arise from the need to manage the risks from climate change and extreme weather events. There is potential for growth in this area of the UK economy. A report produced by k-Matrix on 'Adaptation and Resilience to Climate Change activities in the UK and global economy' forecasts average annual growth of over 5% up to 2017/18 where the forecast series ends.[87]

226. Further research about the risks and opportunities for businesses is needed to help support future economic growth. A particularly important area is that of supply chains and their role in delivering productivity and growth. Climate change impacts that occur abroad will bring additional threats and opportunities to the UK economy because of the nature of international supply chains.

227. The climate-related risks faced by businesses include flooding (direct damage to assets and indirect damage via supply chain disruption), threats to water availability and overheating of premises.[88] Other priority risks from the CCRA are summarised in the table below.

CCRA Risk	Description
FL7a/b	Non-residential (business) properties at significant risk of flooding, and linked to Expected Annual Damage (EAD) to non-residential (business) property due to flooding
WA3/WA5	Reduction in water available for public supply and public water supply-demand deficits
EN2	Energy demand for cooling
BU7	Insurance industry exposure to UK flood risks means that mortgage provision threatened due to increased flood risk

Focus area 1: Enabling business competitiveness through resilience

Objective 23: To raise awareness and understanding amongst businesses about climate change risks.

Objective 24: To increase the extent to which businesses are actively considering climate change impacts in their risk management and resilience planning and decision-making processes and taking appropriate adaptive action.

87 BIS (2012) 'Adaptation and Resilience (Climate Change)' p26. K-Matrix (2012) 'Adaptation and resilience (climate change)' report available online at **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31721/12-p144-adaptation-and-resilience-climate-change-2010-11.pdf.**

88 According to the CCRA, overheating could lead to a deterioration in working conditions for staff and affect productivity. Employers have a responsibility to provide a reasonable temperature for indoor workplaces. A legislative framework exists (Workplace (Health, Safety and Welfare) Regulation 1992) to ensure that workplace temperatures inside buildings should be reasonable. The Health and Safety Executive (HSE) will be revising guidance on this issue.

228. Evidence from Ipsos Mori (2013) shows that the number of businesses saying that they are taking action to adapt to climate change has increased significantly from around 1 in 4 (24%) in 2009 to around 1 in 3 (34%) of the businesses surveyed in 2012.[89] Large businesses are most likely to be taking action compared to Small and Medium Sized Enterprises (SMEs). The same research shows that most (76%) of the businesses surveyed would act if it saved them money, but also that there is sometimes confusion about what adaptation means. This points to the need to further raise awareness about adaptation and also about how good climate risk management can save money.

229. In 2012 Defra commissioned the Carbon Disclosure Project (CDP) to gather evidence of how UK businesses are adapting to climate change.[90] The main findings are:

- whilst 80% of responding FTSE100 companies identified substantive risks to their business due to climate change, less than 50% incorporated climate change adaptation into their businesses strategies
- there is a marked diversity between attitudes and approaches to risk and adaptation needs in different business sectors, e.g. the term 'adaptation' is rarely understood.

230. The CDP will consider including more specific questions around adaptation strategies in future questionnaires for major businesses, with a focus on the cost of adaptation and potential liabilities from climate risks.

231. It is up to businesses to decide individually what level of risk they can accept. However, there are issues to address. An analytical paper 'The Economics of the National Adaptation Programme' published by Defra explores this further. While it is important for the government to help remove barriers to action, policy should be developed in such a way that does not crowd out private investment in adaptation and keeps a clear focus on cost-effectiveness.

232. The government has a role in helping businesses to understand the potential risks and opportunities through developing and disseminating information and tools. The government will also encourage businesses to review their strategic frameworks and models, promote knowledge sharing in areas of good practice (eg flexibility to prevent irreversible decision-making) and target support for those sectors facing the highest risks or greatest barriers to adaptation.

233. Much of the government's work to raise awareness and increase understanding in the private sector is being led by the EA Climate Ready Support Service working in partnership with trade and professional bodies. In addition, the Cabinet Office has produced a guide for SMEs called 'Business Continuity for Dummies' and work by Institute for Environmental Management and Assessment (IEMA) is helping build capacity in businesses through increasing adaptation skills, professional competences and the use of standards.

89 **http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module+More&Location=None&ProjectID=18552**
90 CDP (2012). Insights into Climate Change Adaptation by UK Companies. See **http://archive.defra.gov.uk**

Climate Ready Support for Businesses

The EA is working with the Continuity Forum and the British Standards Institution (BSI) to monitor and review uptake and use of extreme weather and climate change requirements in appropriate standards and accreditations used in continuity planning. The work will encourage businesses to increase their use of existing standards and accreditations for the wider benefit of preparing for a changing climate.

The EA is also working with Climate UK to roll out a Business Resilience Health Check tool to help businesses in supply chains and SMEs adapt to climate change. The process tool is designed to help identify the parts of a business most vulnerable to extreme weather and climate change, and will prompt action. The next step is to increase awareness of the health check tool at a national level, such as through trade bodies.

Actions to address priority risks:

Pilot a climate resilience training programme to support SMEs	Defra
Raise awareness and provide tools and guidance for SMEs, including raising awareness of the Business Resilience Health Check tool	EA, Climate UK
Cabinet Office guide for SMEs 'Business Continuity for Dummies'	Cabinet Office
Develop professional standards for environmental and sustainability professionals and guidance on building the adaptation business case.	IEMA

Focus area 2: Opportunities

Objective 25: To raise awareness and understanding amongst businesses about domestic and international adaptation opportunities.

234. The impacts of a changing climate will bring new opportunities in both domestic and overseas markets for businesses which offer adaptation goods and services. The government has a role to help businesses to be aware of these opportunities.

Federation of Small Businesses (FSB) and Climate North East collaboration

The FSB has been working collaboratively with Climate North East (linked to Climate UK). In recognition of the range of businesses that contribute to climate resilience and the low carbon economy, both parties collaborated to organise the first 'Big Eco Show' in September 2012. The business community has welcomed such events as they provide a catalyst to make genuine trade connections, to collaborate and gain inspiration and inspire adaptation action.

235. Encouragingly, a number of development banks are taking climate change adaptation into consideration when financing major infrastructure projects both in the UK and across Europe. These include the European Bank for Reconstruction and Development, the European Investment Bank and the newly formed UK Green Investment Bank. This helps to create the right sort of investment climate for those companies who are managing their own risks, or are helping to manage risks to other organisations.

The UK Green Investment Bank (GIB)

The GIB will help accelerate additional capital for infrastructure. It is incorporating climate change resilience into its sustainability and green impact policies and considering climate resilience in its investment decision making as part of its standard technical and green risk assessment processes. Where appropriate the bank will commission external assessment of the scale and nature of the extreme weather and climate risks associated with proposed investments.

Domestic opportunities

236. Defra is collaborating with the Technology Strategy Board (TSB) to fund successful bids from a design competition to develop innovative solutions for adaptation in infrastructure. This fulfils a commitment in the 2011 National Infrastructure Plan.[91] As a result, the competition is supporting the development of 3 innovative solutions: a stackable flood barrier, a zero-energy rainwater harvester, and catchment scale modelling to improve urban drainage systems design. The competition will help to bring innovative climate resilience products and services to market. A second stage of the design competition will run from 2013.[92]

237. The academic community is also playing its part in the global knowledge and expertise economy, where programmes such as LWEC are bringing together academia and industry to target adaptation products and services or to simply explore adaptation innovations.[93]

238. The changing climate may change tourism patterns. English Heritage has recognised the risks and has recently produced a bulletin that sets out the risks faced by heritage assets and the direction of travel. It is working in partnership with others, such as E.ON to manage the risks.[94] In addition, the report 'England: A Strategic Framework for Tourism 2010 – 2020' from Visit England identifies the need to address the implications of climate change through its Wise Growth action plan.

91 National Infrastructure Plan 2012, p44. See **https://www.gov.uk/government/publications/national-infrastructure-plan-update-december-2012**

92 Innovation forms a driver for productivity which can deliver short-term economic growth benefits. See the Economics of the National Adaptation Programme document.

93 Living with Environmental Change Programme. See **http://www.lwec.org.uk/ongoing-research**

94 English Heritage Conservation Bulletin 57 – Adapting to Climate Change. See **http://www.english-heritage.org.uk/publications/conservation-bulletin-57**

239. At the local level, local government is playing a pivotal role in developing Local Development Plans. These plans act as a catalyst for resilient economic growth in an area. EA Climate Ready will also support the LGA's Climate Local initiative to signpost tools, guidance and evidence to support councils in working with local businesses on resilient economic growth. Climate UK will work with LEPs to raise awareness and support best practice in assessing and managing climate change risks and opportunities to the local economy. The Defra Network, including Natural England, Environment Agency, Forestry Commission and the Marine Management Organisation has also issued an offer to LEPs and to the City Deals process, to help LEPs protect the environment and promote growth, which is sustainable and resilient to a changing climate.[95]

Local Enterprise Partnerships (LEPs)

LEPs are working with local authorities in Cheshire and Warrington, Greater Manchester, and Avonmouth Severnside to identify climate change risks to businesses and are reviewing adaptation strategies. The case study run by the Greater Manchester Combined Authority (GMCA) will identify climate change risks related to economic development priorities in the Greater Manchester Strategy, including transport infrastructure, housing development, town and regional centres, employment locations, energy infrastructure and science and innovation assets. This work will identify which economic development priorities are most at risk from climate change impacts and provide the framework for communicating with Defra partners in order to co-develop action to manage them.

The Greater London Authority (GLA) & the London Climate Change Partnership (LCCP)

The GLA, with LCCP, is undertaking a scoping study to understand the adaptation economy in London, through analysing the sub-sectors and identifying how the sector could and should develop, to meet future local, national and international demand. As a leading global city, London is ideally placed to market its adaptation know-how, products and services to a global and national audience. For example, the 'adaptation and resilience' sub-sector (which also includes activities not specifically addressing climate change) generated £12 billion in the UK in 2011/12. In the same period this sub-sector generated sales of £2.5 billion in 2011-12 in London. In the same period, the climate change element of this sub-sector in London had a turnover of £431 million and employed nearly 4,000 people, demonstrating the potential for growth.

EU growth funding

240. The government is currently developing the Structural and Investment Funds Growth Programme for England covering 2014 to 2020. The programme will set out how EU funds will be used to drive growth across the country, in line with priorities developed by the LEPs through their Local Investment Strategies. As 1 of 11 thematic objectives of the programme,

95 **http://www.environment-agency.gov.uk/research/planning/147616.aspx**

an adaptation policy statement and guidance to LEPs will be developed to ensure that adaptation is embedded in the development and implementation of local strategies. This will help ensure that measures that support both growth and adaptation are brought forward under the programme and that investments are resilient to climate change.

241. Initial government guidance to LEPs recognises the potential for the Structural and Investment Funding to be used to manage flood risk where it can deliver economic growth. The government will consider this further as it develops more detailed guidance for LEPs and agrees the UK Partnership Agreement with the EU Commission.[96, 97] LEPs have also been asked to consider the following adaptation measures in their investment strategies:
    - capacity building within the LEPs and the social sector (acknowledging that climate change will have a disproportionate impact on the socially vulnerable)
    - innovation in the growing adaptation goods and services market
    - business skills for managing risk
    - green infrastructure which also addresses water and flood risks (particularly in high-risk areas or in new business parks) and resource efficiency

International opportunities

242. A resilient UK business community will have more opportunities to compete internationally as resilience reinforces the reliability of UK businesses in international supply chains if they are at low risk of causing disruption.

243. Evidence suggests that adaptation goods and services is a growing international market. In 2010-11, the provision of goods and services which improve adaptation and resilience to climate change in the UK was a £2.1 billion industry with over 21,000 employees. In the same period, global activities were worth an estimated £65.8 billion. This is an emerging market with a domestic growth rate of 3.9% for 2010-11 and a forecasted UK growth rate of 7.1% by 2017-18.[98]

244. The recent report to the government on 'International threats and opportunities from climate change to the UK' (ITOCC)[99] highlighted, for example, the following trade opportunities and threats:
    - Opportunities in increased potential to export UK adaptation goods and services and support physical and financial assets abroad due to economic damages from extreme weather where there are strong UK interests

96 Due summer 2013.
97 The UK is required to develop and agree a Partnership Agreement with the EU Commission by December 2013 outlining objectives and priorities for investment.
98 K matrix (2012) 'Adaptation and Resilience (Climate Change). Report commissioned by BIS. K-matrix will soon be publishing updated figures for adaptation and resilience goods and services for the year 2011-12. Available online. See **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31716/11-1033-adaptation-and-resilience-climate-change-2009-10.pdf**
99 **http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18348**

- Threats in increased damages to physical and financial assets abroad due to economic damages from extreme weather and increased volatility in food prices

245. This report contributes to our understanding of the risks from climate change to UK interests overseas. It will supplement the existing body of analysis that informs the government's humanitarian, development and foreign policies and thus help the UK to better address the impacts of climate change around the world.

246. The FCO will use the report to support its international influencing strategy, which is designed to contribute to a change in the global political conditions and ambition required to achieve an agreement in 2015 on limiting global CO_2 emissions. In particular the report will be used to support UK thinking on the potential economic costs to the UK and global economy of failing to address climate change.

247. UK Trade & Investment (UKTI), working with Foreign and Commonwealth (FCO) climate change attachés in overseas markets, identifies and facilitates international commercial opportunities for UK companies with adaptation expertise. This includes bringing UK experience to the attention of the government decision-makers and private sector procurers. For example UKTI promotes the UK water industry privatised model as a sustainable solution in providing water and wastewater services. This includes reduced energy consumption through energy produced from wastewater treatment processes and reducing leakage and risk of flooding while improving potable/grey and industrial water quality for re-use.

High Value Business Opportunities involving Thailand

The UK is continuing to position itself as Thailand's partner as it seeks to develop its water and flood management initiatives resulting from the 2011 floods. This is a high-value business opportunity (approx £1.9 billion). The government promotes and supports UK companies to access these opportunities either directly, by introducing UK companies to major project proponents and Defra partners, or indirectly by ensuring that the Thai authorities (and the appointed project business consortia) are aware of UK capability as well as by supporting the Thai Government through capability building activities. A good example is the training provided to a number of Thai government officials at Cranfield University on Flood Risk.

Actions to address priority risks

Promotion and facilitation of international commercial opportunities for UK companies with adaptation expertise	UKTI, FCO, UK companies
Defra and TSB take forward a second phase of infrastructure design competition to seek innovative products to support infrastructure resilience	Defra/TSB

Focus area 3: Supply chains

Objective 26: To help businesses better understand and manage climate change risks to their supply chains.

248. The CCRA highlighted a risk of possible decreases in output for UK businesses due to an increase in supply chain disruption as a result of extreme weather events.[100] Recent weather events in the UK have tested the resilience of domestic supply chains. Worldwide economic and natural shocks of recent times such as volcanic ash clouds, tsunamis and earthquakes have also shown the fragility of long distance and single-source supply chains.

249. How supply chains are affected by these type of events depends on a range of factors. The recent ECR project explored these supply network issues further, and found that certain types of supply chains are likely to be at high risk from climate change:[101]

- high complexity: where businesses are dependent on receiving large numbers of components from many organisations across a wide geographic area
- low substitutability: where inputs are specialised and where limited (or no) alternative sources exist
- low flexibility: where inventories are kept low due to a business model's reliance on 'just in time' production

250. To illustrate these findings, the ECR Business chapter investigated the supply chain interruption of a large multinational original equipment manufacturer. Current preparations were inadequate, implying that there could be a substantial impact on business continuity and up to 6 months loss of production. However, by taking appropriate adaptation action this could reduce to a short-term impact of 2 to 4 weeks. The ECR outlined that the cost saving of reducing shutdown time could be hundreds of millions of pounds.

251. The ITOCC report provides important context for Defra's work in looking at the global impacts on sustainability of food supply. It builds on some of the themes from the government's Foresight report on the Future of Food and farming and will be considered alongside other evidence in future policy development. In particular, Defra is scoping a project on global food modelling and research to compare existing models aimed at integrating environmental impacts (including climate change) with global agricultural production and international food security over the longer term and is working with other UK funders through the Global Food Security Programme to co-ordinate research (approx £400 million) and internationally through the EU Joint programming Initiative on Food, Agriculture and Climate change (JPI-FACCE), EuraNet Susfood programme and the Global Research Alliance to take a multi-disciplinary systems approach to a range of global food security challenges. Please also see Chapter 5.

100 HM Government Climate Change Risk Assessment summary, UK Climate Change Risk Assessment: Government Report, p24. See **https://www.gov.uk**

101 'Economics of Climate Resilience' (ECR) Business chapter. Further information on the specific barriers and enablers of adaptation that business may face are contained within the ECR report.

Report on International Threats and Opportunities of Climate Change in the UK – Food supply chains (Price Waterhouse Coopers)

PwC's report to Defra shows that the UK is unlikely to experience food scarcity in the short term but supply disruptions in a major food producing country may lead to sharp rises in prices or temporary shortages of particular foodstuffs. In the longer term, the change in availability of certain commodities may require switching of trading partners away from current ones. This represents both opportunities and risks for businesses when managing growth in the sector.

252. The government is providing clarity and building business confidence for investment and growth through its Industrial Strategy. This strategy will enhance investor confidence and growth and should help reduce the risks from international climate change impacts. Already, big global companies are increasingly showing a preference for co-locating important elements of their supply chains with their UK manufacturing operations.

253. As part of the Industrial Strategy the government is focusing on building collaborative strategic partnerships with relevant major sectors. Some of these may face serious impacts from a changing climate, most notably the 'enabling sectors', such as energy, construction and to some extent 'knowledge-intensive services', such as the information economy and 'advanced manufacturing' such as automotive and aeronautical sectors.

254. Through programmes such as the 'Advanced Manufacturing Supply Chain Initiative' or the Manufacturing Advisory Service, BIS continues to give support to a range of sectors. This often includes investment in capital equipment, associated research and development and improved skills and training support. This type of support could also be relevant to suppliers and supply chains that need to adapt to a changing climate.

255. The EA's Climate Ready Support Service has developed guidance to help UK business supply chains understand and manage domestic and international climate change risks. The EA is also working with a number of retail organisations to pilot the guidance and test how the retail supply chain can be made more resilient.

256. Tomorrow's Company has recently published a paper that considered the importance of partnerships and collaborations across business supply chains to help tackle climate change adaptation, and includes case studies on the benefits of partnerships.[102]

257. The role of trade bodies to support all parties in supply networks is crucial. Examples of the considerable amount of work being carried out by these organisations are set out below.

Trade bodies

British Retail Consortium (BRC) has agreed a commitment on climate change adaptation with its members through its environment and sustainability initiative 'A Better Retailing Climate'.[103]

Actions by BRC members include:

- examining climate related impacts on specific product categories (eg fresh food)
- setting targets to ensure that buildings have climate change mitigation plans
- constructing energy and water efficient stores
- contributing to the Product Sustainability Forum convened by the Waste Resources Action Programme
- working with suppliers and investing in research to ensure that farming and food supply chains are in a robust position to adapt in the future

EEF, the Manufacturers Organisation for UK Manufacturing, published 'Be Prepared – Monitoring supply chains; Maximising resilience'[104], advice which outlines steps for manufacturers to take to minimise exposure to future events.

EEF has also surveyed its members to assess resilience to recent extreme events. Local natural disasters, such as flooding or heavy snow, affected over 60% of UK manufacturers with international impacts being felt too. Impacts can be especially acute for companies competing on the basis of customer service, speed of delivery and quality. Surveys results showed that 25% of UK manufacturers have begun to consider what a changing climate could mean for them, whilst 50% have not yet considered it.

Food and Drink Federation has developed guidance, 'Sustainable Sourcing: Five Steps Towards Managing Supply Chain Risk', to help food businesses assess and respond to the pressures on the global food system coming from a range of factors, including the impacts of climate change. The guide explains how to map a supply chain, identify priority issues and devise action plans to address these. It complements FDF's *Every Last Drop* guidance on managing water use along the supply chain. Over the course of the next few years FDF will be developing a much more extensive web-based resource, providing up-to-date information on best practice and links to further advice.

102 Tomorrow's Company (2013), 'Partnerships between business and local organisations to tackle the impacts of climate change. A report for Climate Ready Environment Agency'.

103 A Better Retailing Climate, BRC (2008-12). See **http://www.brc.org.uk/brc_policy_content.asp?iCat=43&iSubCat=673&spolicy=Environment&sSubPolicy=A+Better+Retailing+Climate**

104 Be Prepared – Monitoring Supply Chains; Maximising Resilience, EEF (2012). See **http://www.eef.org.uk/NR/rdonlyres/F2A5E320-715F-4304-B47E-F2270AB2E809/21155/BePreparedmonitoringsupplychainsmaximisingresilien.pdf**

Actions to address priority risks

Guidance on supply chains: work with food and beverage and priority SME sectors	EA

Focus area 4: Maintaining growth through research and understanding

Objective 27: To undertake research to increase the understanding of climate change impacts on growth and the economy, working with investors, insurers and other industry partners.

258. Climate change will have an impact on the global economy. Many models that seek to quantify the macroeconomic impact of climate change conclude that the economic impact of climate change will be relatively mild.[105] However, in general these models fail to account adequately for low probability, high impact events and only focus on a limited number of economic sectors.

259. Recent research points towards potentially large, or even catastrophic, economic consequences if low probability-high impact events occur.[106] Many long term investors, such as pension and insurance providers, are concerned that we do not fully understand the effects of climate change risk on future economic growth. The government therefore plans to work with long term investors to appraise current modelling techniques and better understand how extreme events may affect the UK economy.

260. There is a need to improve understanding of the impacts of climate change on industries such as pension providers and insurance. This would better enable these industries to seize the growth opportunities that climate change provides and minimise the risks. The banking and insurance industries could help to raise awareness and encourage and support action amongst a wide variety of organisations that they work with.

261. Defra has published a pilot research project 'The macroeconomics of climate change' to review the links between climate change and economic growth.[107] In theory, the benefits of adaptation can outweigh the costs. Economic growth should be greater with adaptation compared to business as usual if we reduce climate risk as the net damages of climate change should be lower.

105 See, for example, William Nordhaus' 'Dynamic Integrate Climate Economy' (DICE) and Chris Hope's 'Policy Analysis of Greenhouse Effect' (PAGE) model.
106 Recent modelling incorporating low probability, high impact events include Ackerman et al (2009) and Dietz (2011).
107 **http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID18639**

262. The project report concludes that further research is necessary to quantify the value of adaptation at the macroeconomic level. A disconnection exists between the latest advances in academic research and the latest model development. Macroeconomic models of climate change are therefore not yet useful to inform government policy. In response, the government will be developing well-informed policy questions to help guide future research into this area.

Institutional Investors Group on Climate Change (IIGCC)

IIGCC believes that climate change presents major long-term risks to the global economy and is likely to have substantial impacts on investments in the decades ahead. This will occur through direct impacts on UK assets (eg commercial real estate). However, potentially more significant are the impacts on investments outside the UK and impacts on the international assets and supply chains of UK companies. The IIGCC is concerned that climate impacts could be more severe and rapid than previously assumed and about the potential for climate change to exacerbate other problems via the energy-food-water nexus. IIGCC believes that well-designed climate change and clean energy policies will mitigate these risks and also present significant opportunities for investors. It is also important that adaptation measures that reduce unavoidable climate impacts are implemented.

Actions to address priority risks

Undertaking research on climate economics, with long term investors, to improve economic modelling of extreme climatic events	Research consultancies specialising in adaptation

Chapter 8

Chapter 8: Local Government

***Vision**: "Local Government plays a central role 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".*

263. 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.

264. As providers of important services and as community leaders, local councils will play a pivotal role in leading, supporting and driving delivery of many actions highlighted throughout this report. There is also a crosscutting role for councils in supporting local adaptation action. In recognition of this, local government representatives, through the Local Adaptation Advisory Panel (see LAAP box below) have helped steer the development of this chapter.

Local Adaptation Advisory Panel for England

The LAAP has been set up to provide advice to central government from a local perspective, enhancing the capacity of local leadership to help build resilience. It will develop strong links with other important national partners and networks to remove barriers to adaptation and help shape a fully supportive framework for local adaptation. Many councils already have their own plans to adapt to a changing climate. LAAP's role is to support local ambition, identify and share best practice and be an influential voice to government to ensure there is the right level of support to local needs. They will provide advice on how this work benefits business, residents and supports economic prosperity.

265. The actions highlighted in this report should be considered in the context of the Localism Act 2011, which gives local government new freedoms, flexibilities and responsibilities. In particular, the Act provides for a 'general power of competence'. This means that local councils may do anything that individuals generally may do unless it is expressly prohibited, restricted or limited. This will enable local councils to work together with businesses, communities and other councils to drive down costs while meeting local needs and priorities.

266. Councils manage a range of climate risks relating to their estates and the services they provide. They work with local communities and businesses to increase resilience. These risks are cross-cutting. This is reflected in the local government objectives below.

267. The cross-cutting objectives in this chapter were drafted for councils and their partners, in consultation with LAAP. They fall into 2 broad categories:

- raising awareness, building capability and making the case for action
- providing a framework for action

Focus Area 1: Raising awareness, building capability and making the case for action

Objective 28: To raise and maintain the profile of adaptation with local authorities and promote action to embed climate resilience across local authority services and responsibilities.

Objective 29: To support local government to build a credible business case for action and take well-informed decisions both internally across service areas and externally with their local communities and businesses.

268. In May 2012, government ministers and local authority elected members jointly recognised the importance of local adaptation action at a summit meeting (see box below). They also recognised the need for central and local government to continue to work together to support locally led action which is set out in a commitment under Focus Area 2 below.

Raising Political Awareness (Joint LGA, Defra and DCLG summit of 24 May 2012)

Central government acknowledges the importance of locally-led action on climate change to strengthen resilience to current and future climate risk. The government will work with the LGA to develop a framework for action that sets out a clear narrative on ways in which councils can build climate resilience.

Councils can help to increase the resilience of local places and communities, including by:

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

269. In order to build climate resilience, councils and partners have been working together to raise awareness of adaptation. To complement this work, LAAP will develop a programme aiming to set out climate risks and good adaptation practice for a wide range of councils across England. In order to do this, LAAP will use its existing networks and work with partners from across the government, LGA, Climate UK and the EA.

270. One of the main challenges for councils and partners is to raise awareness of the need to make a strong economic and social case for action to address climate risks (including longer term risks) to council, business and community leaders. Building a clear business case and identifying projects with multiple benefits is therefore essential to ensure that the risks associated with a changing climate are effectively balanced against other priorities and pressures.

271. The EA's Climate Ready Support Service will support local councils and partners by developing tools and resources to help councils realise the benefits of taking action to reduce risks and to exploit any economic opportunities.

272. Sharing best practice is invaluable for demonstrating how climate resilience can be embedded across council business and managed as a part of council risk management. This may encourage others to act. The LAAP provides a forum to champion adaptation activity across local government, identifying best practice and providing expert input to the development of tools and support available under the Climate Ready programme. The EA's Climate Ready Support Service will also help build the capacity of councils through the provision of training and support materials.

Developing a business case for adaptation

The EA's Climate Ready Support Service is:

- making Kent County Council's Severe Weather Impacts Monitoring System (SWIMS) accessible to all local authorities, which will help councils and their partners to record how their service delivery is affected by severe weather
- developing a 'Business Case for Adaptation' which aims to complement existing climate change adaptation guidance for businesses and local authorities.

Actions to address priority risks

The LAAP develops, publishes and runs a programme of work with local government officers and councillors to explain climate risks and actions for councils' service areas	LAAP and contributing partners: EA, Climate UK, LGA, government
The LAAP champions and disseminates examples of local authority work to embed adaptation in councils	LAAP and contributing partners: EA, Climate UK, LGA, government
The EA through its Climate Ready Support Service • acts as a tool for all councils • provides support to develop the local business case for adaptation • suppports the development of resources under the Climate Local initiative, including briefing packs relevant to council service areas and priorities	EA and LGA
The EA through its Climate Ready Support Service will help to build the capacity of councils through delivering councillor training and support materials	EA and LGA

Focus area 2: A framework for action

Objective 30: To ensure the policy framework for local government supports councils to increase community resilience in partnership with local and regional players.

Objective 31: To support sector-led activities, which allow councils to make local commitments to address their own unique challenges and opportunities arising from a changing climate.

273. A framework for local adaptation action must have flexibility to respond to local needs but also provide the coherence and clarity for local leaders to effectively prioritise action and develop partnerships.

274. These partnerships may include Local Enterprise Partnerships (see Chapter 7), Local Nature Partnerships and Neighbourhood Planning Forums.[108] Depending on local circumstances, such groups may allow councils to promote joint ownership and delivery of adaptation actions with a wider range of local Defra partners, communities and businesses.

108 **https://www.gov.uk/government/policies/giving-communities-more-power-in-planning-local-development/supporting-pages/neighbourhood-planning**

275. Current legislation and policy frameworks (see diagram below) allow councils to address climate risks. The government will continue to work with the local government sector on the adaptation policy framework to ensure it is joined up through liaison with the LAAP, the LGA, groups such as Core Cities and the EA's Climate Ready Support Service.

276. The government will also carry out an appropriate assessment of vulnerability to the impacts of climate change as part of the assessment of all new policies, programmes and projects, whether revenue, capital or regulatory[109] and will ensure that any policy or initiative which increases the cost of providing local authority services is properly assessed and fully funded by the relevant department.[110]

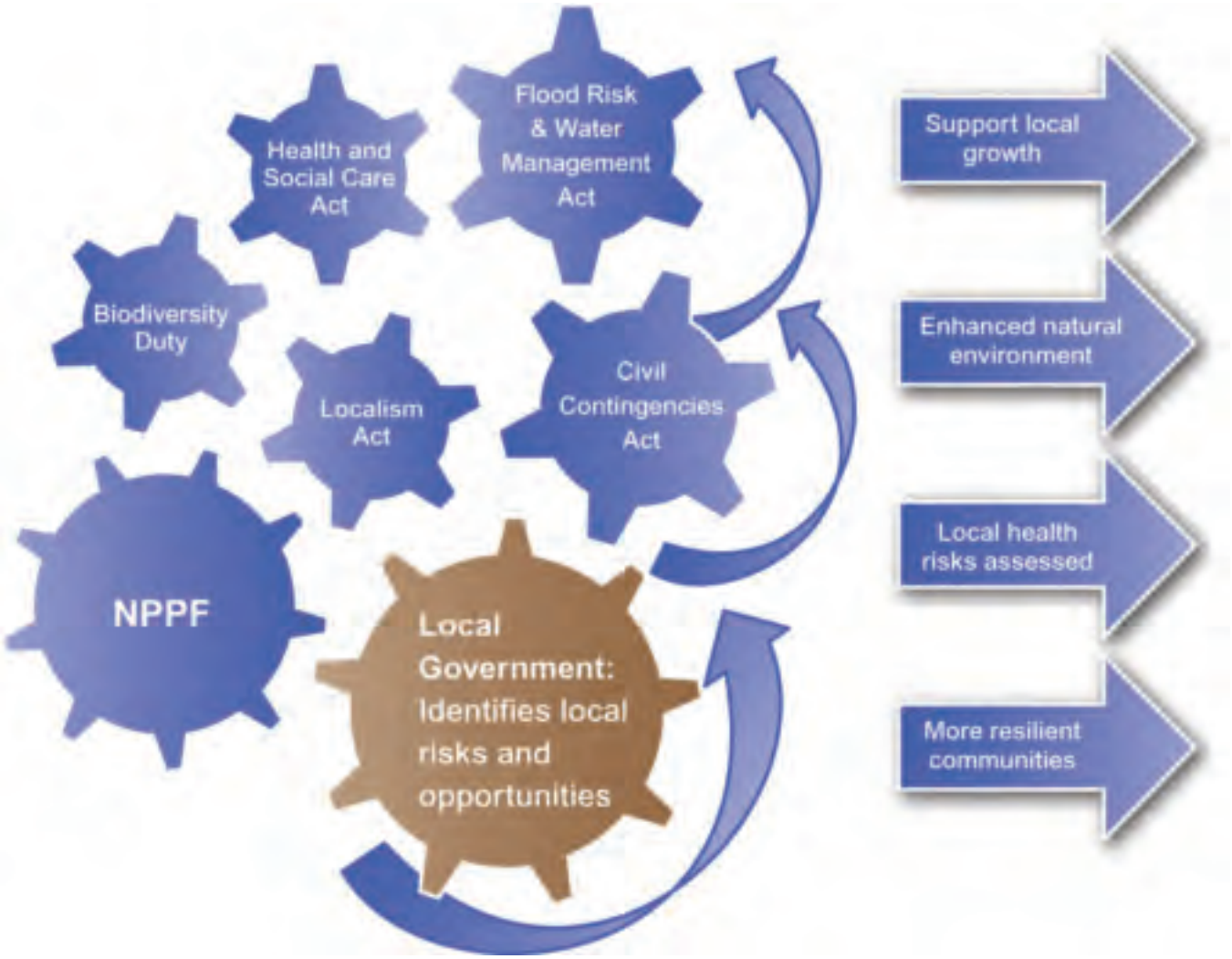

Illustration of range of legislative and policy drivers that enable local action on climate adaptation

109 **http://www.hm-treasury.gov.uk/d/green_book_complete.pdf**
110 **https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/5960/1926282.pdf**

277. A range of local government-led initiatives are helping to build capacity on adaptation and to embed climate considerations in local thinking and decision making. This is acknowledged and supported by the government as a means for locally led action to strengthen resilience to current and future climate risk. For example, the LGA's Climate Local initiative (see box below) and the NAP Cities Commitment comprising the 9 largest cities across England and developed as part of the NAP both encourage and support local adaptation action, providing access to practical support and establishing networks to share learning.

278. The LGA's councillor-led Inland Flood Risk Management Group also provides support to councils on their role in reducing and managing flood risks.

Climate Local

Climate Local is an initiative to drive, inspire and support council action to reduce carbon emissions and to improve resilience to the impacts of the changing climate. Launched in 2012, by the LGA, more than 60 councils have signed the Climate Local commitment. In signing up, individually or in partnership, councils make a public commitment to act on a set of local priorities. They also agreed to support other councils by sharing details of their actions and learning. Successes to date include:

- West Sussex County Council used a risk assessment toolkit to understand the climate impacts on older residents and has redesigned its adult services to protect vulnerable people at risk from climate-related illnesses and death
- Liverpool City Council is helping vulnerable communities to adapt, prepare and respond to flooding by piloting a Community Resilience Group led by community champions
- Cheshire West and Chester Council are working with the Local Enterprise Partnership to improve business resilience at strategic growth sites. This will enable the economic development risks to be managed whilst highlighting any potential business opportunities a changing climate could bring.

For further information about Climate Local and the councils involved see: w**ww.local.gov.uk/climate-change**

Cities Commitment

More than 80% of England's people live in urban areas, where intricate systems of interdependent infrastructure and activity are especially sensitive to potential disruption from climate and weather impacts. Maintaining critical services and ensuring safety and prosperity will depend on the continuity of those systems. When cities are competing for investment on the international stage they will come under increasing pressure to demonstrate long-term resilience. In recognition of the need for concerted action among cities, London Councils, the Greater London Authority and the Group of Core Cities have committed to working together to increase the resilience of their city spaces (see their full agreement at the end of the chapter).

Actions to address priority risks

The government, informed by advice from local government partners will ensure that, where a case is made, government legislation, policy and programmes are joined up to continue to enable and support councils to build resilience to the impacts of climate change	Government contributing partners: LAAP, LGA
LGA will develop, run and promote Climate Local as a council-led initiative to support and share progress on climate change, including local action to build resilience	LGA
The Core Cities Group, London Councils and the Greater London Authority (GLA) will promote adaptation action within the councils of England's largest cities as set out in the Cities Commitment	Core Cities Group, London Councils, GLA contributing partners: EA, government
EA's Climate Ready Support Service will work with the Core Cities Group, London Councils and the GLA to identify their unique support requirements and how learning can be shared with other councils	EA

Commitment to action by Core Cities, London Councils and the Greater London Authority (NAP Cities Commitment)

Cities face complex challenges in the face of a changing climate. Higher population density, including a larger proportion of vulnerable groups, concentrated assets, infrastructure, transport systems, buildings, schools, hospitals and businesses are expected to be acutely impacted by increased severity and frequency of flooding, higher summer temperatures, heat waves, extreme weather events and increased pressure on water resources.

Core Cities (councils from Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield), London Councils and the Greater London Authority (GLA) acknowledge that while city councils face significant budgetary constraints they play a key role in addressing risks from a changing climate.

Innovative solutions to the climate challenge

Core Cities, London Councils and the GLA commit, where local vulnerabilities and priorities dictate, to work together over the next 5 years with their partners, including central government, businesses, civil society and communities, to deliver innovative solutions to climate change, based on the following framework of principles.

1) Embed climate risk management in the **Built Environment** by:
   - consideration of the potential for cities to demonstrate, how 'sustainable development' – as set out in the National Planning Policy Framework – can be applied in a city context
   - encouraging and supporting developers and their clients to factor in climate adaptation, drawing on case studies and best practice, for example from the Technology Strategy Board's Design for Future Climate competition
   - promoting collaboration with the academic community to develop innovative solutions and decision making
   - exploring how action can be better targeted to localities and those in the community likely to be most at risk from climate impacts, for example through mapping and other spatial analysis
   - promoting green and blue infrastructure in the context of spatial planning, flood risk management responsibility within local government and Local Nature Partnerships, integrated with the work of the sector led Green Infrastructure Partnership
   - working with the government, during the review of housing standards and planning guidance, to ensure appropriate consideration of local impacts of climate change

2) Strengthen the climate resilience of **infrastructure** by:
   - clarifying the relationship, with the government, between utilities, regulators, transport authorities and city councils to allow greater involvement in planning and managing local utility infrastructure
   - closer working with Water UK, Ofwat and between water companies to allow closer working on approaches for water retention, water supply, treatment and re-circulation, to increase water efficiency and safeguard community wellbeing

3) Address and build resilience to the **Health and Wellbeing** impacts of climate change by:
   - providing exemplars to demonstrate how the local health and social care system can build preparedness and resilience to the health risks, for example through the work of the Health and Wellbeing Boards and Directors of Public Health
   - increasing understanding of vulnerable groups by more effective working between councils, front line service providers and voluntary organisations. With assistance from currently available tools and guidance documents to reflect action needed to support them within council corporate plans and community 'resilience' plans
   - promoting climate resilience within local communities, for example supporting initiatives from communities themselves and those organisations that work with them, for example flood forums and community groups

4) Address climate impacts on **Business and Services** by:
   - working through existing relationships with businesses and community members to raise awareness and encourage actions to:
     – build long term resilience to a changing climate
     – promote innovation in the exploitation of opportunities arising from climate change
   - embedding consideration of economic implications of climate risks within the work programmes of Local Enterprise Partnerships
   - providing exemplars for local business by factoring in long term climate impacts into
     – council business continuity planning
     – council procurement contracts with suppliers

5) Work jointly to **develop a business case** that increases understanding of the benefits of early action, as well as the risks of inaction, by the development of a model approach to business case management. This will help make the case for resilience action, illustrate best practice methods and approaches for council members and Defra partners including civil society and business, and demonstrate the economic resilience of cities.

List of acronyms

AACE	Association of Ambulance Chief Executives
ADA	Association of Drainage Authorities
ADEPT	Association of Directors of Environment, Economy Planning and Transport
AHDB	Agriculture and Horticulture Development Board
AHVLA	Animal Health and Veterinary Laboratories Agency
ARCADIA	Adaptation and Resilience in Cities: Analysis and Decision making using Integrated Assessment
ARCC (CN)	Adaptation and Resilience to a Changing Climate (Co-ordination Network)
ARCOES	Adaptation and Resilience of Coastal Energy Supply
ARIES	Adaptation and Resilience In Energy Systems
ARP	Adaptation Reporting Power
BBSRC	Biotechnology and Biological Sciences Research Council
BIOCC-net	Biodiversity Impacts of Climate Change Observation Network
BIS	Department for Business, Innovation and Skills
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CAA	Civil Aviation Authority
CBI	Confederation of British Industry
CCRA	Climate Change Risk Assessment
CDP	Carbon Disclosure Project
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CFE	Campaign for the Farmed Environment
CFOA	Chief Fire Officers' Association
CIBSE	Chartered Institute of Buildings Services Engineers
CLUES	Challenging Lock-in Through Urban Energy Systems
CRD	Chemicals Regulation Directorate
CREW	Community Resilience to Extreme Weather
CSF	Catchment Sensitive Farming
CSO	Combined Sewer Overflow
DCLG	Department for Communities and Local Government
DECC	Department of Energy and Climate Change
DeDeRHECC	Design and Delivery of Robust Hospital Environments in a Changing Climate
Defra	Department for Environment, Food & Rural Affairs
DfT	Department for Transport
DH	Department of Health

DNO	Distribution Network Operator
EA	Environment Agency
EAD	Expected Annual Damage
ECR	Economics of Climate Resilience
EH	English Heritage
EIA	Environmental Impact Assessment
EMR	Electricity Market Reform
ENA	Energy Networks Association
EPSRC	Engineering and Physical Sciences Research Council
EWTP	England Woodland and Timber Partnership
EWWF	England and Wales Wildfire Forum
FAS	Farming Advice Service
FC	Forestry Commission
FCERM	Flood and Coastal Erosion Risk Management
FERA	Food and Environment Research Agency
FutureNet	Future Resilient Transport Networks
GBS	Government Buying Standards
GIB	Green Investment Bank
GIP	Green Infrastructure Partnership
GLA	Greater London Authority
GM	Genetic Modification
GRaBS	Green and Blue Space adaptation for urban areas and eco towns
HA	Highways Agency
HMEP	Highways Maintenance Efficiency Programme
HPA	Health Protection Agency
HSE	Health and Safety Executive
IDB	Internal Drainage Boards
IEMA	Institute for Environment Management and Assessment
INNS	Invasive Non-Native Species
ITRC	Infrastructure Transitions Research Consortium
IUCN	International Union for Conservation of Nature
IUK	Infrastructure UK
JSNA	Joint Strategic Needs Assessment
LAAP	Local Adaptation Advisory Panel

LANDEX	Land based colleges aspiring to Excellence
LCCP	London Climate Change Partnership
LEP	Local Enterprise Partnership
LGA	Local Government Association
LHRP	Local Health Resilience Partnership
LLFA	Lead Local Flood Authority
LNP	Local Nature Partnership
LRF	Local Resilience Forum
LTIS	Long Term Investment Strategy
LWEC	Living With Environmental Change
MBE KTN	Modern Built Environment Knowledge Transfer Network
MCCIP	Marine Climate Change Impacts Partnership
MUSCOs	Multiple-Utility Service Companies
NCVO	National Council for Voluntary Organisations
NE	Natural England
NERC	Natural Environment Research Council
NEWP	Natural Environment White Paper
NFU	National Farmers Union
NHBC	National House Building Council
NHS	National Health Service
NHS EPRR	NHS Emergency Preparedness, Resilience and Response
NIA	Nature Improvement Area
NPPF	National Planning Policy Framework
NPS	National Policy Statement
OFGEM	Office of Gas and Electricity Markets
OFWAT	Office of Water Services
ORR	Office of Rail Regulation
PES	Payment for Ecosystem Services
PHE	Public Health England
RASE	Royal Agricultural Society of England
RDPE	Rural Development Programme for England
RESNET	Resilient Electricity Networks for GB.
RIBA	Royal Institute of British Architects
RIIO	Revenue = Incentives+Innovation+Outputs

RSA	Restoring Sustainable Abstraction
RSPB	Royal Society for the Protection of Birds
RSSB	Rail Safety and Standards Board
SAB	Sustainable Drainage Systems Approving Body
SAP	Standard Assessment Procedure
SDMP	Sustainable Development Management Plan
SDU	Sustainable Development Unit for the NHS, public health and social care system
SMEs	Small and Medium Sized Enterprises
SMPs	Shoreline Management Plans
SNACC	Suburban Neighbourhood Adaptation to a Changing Climate
SPS	Strategy and Policy Statement
SRP	Sector Resilience Plan
SuDS	Sustainable Drainage Systems
SWM	Sustainability West Midlands
TCPA	Town and Country Planning Association
TfL	Transport for London
THPBETF	Tree Health and Plant Biosecurity Expert Task Force
TRaCCA	Tomorrow's Railway and Climate Change Adaptation
TSB	Technology Strategy Board
UHI	Urban Heat Island
UKCIP	UK Climate Impacts Programme
UKCP09	UK Climate Projections (2009)
UKFS	UK Forestry Standard
UKRLG	UK Roads Liaison Group
UKOA	UK Ocean Acidification
WRMP	Water Resource Management Plan
WWP	Water White Paper

Glossary of terms

Adaptation – a change in natural or human systems in response to the impacts of climate change. These changes moderate harm or exploit beneficial opportunities and can be in response to actual or expected impacts. There are various types of adaptation, such as:

- **Planned adaptation** – the result of a deliberate policy decision, and most likely include action that is required to return to, maintain, or achieve, a desired state.
- **Maladaptation** – could mean either:
  - any changes in natural or human systems which inadvertently increase vulnerability to the hazards of climate change;
  - an adaptation that does not succeed in reducing vulnerability but increases it instead;
  - spending a disproportionate amount of effort and investment on adaptation beyond what is required.
- **No regret (adaptation) options** – could be activities which would provide immediate economic and environmental benefits and continue to be worthwhile regardless of future climate. They would be justified under all plausible future scenarios, including without climate change.

Adaptive capacity – describes the ability of a sector to design or implement effective adaptation measures, using information on possible future climate change and extreme weather to moderate potential damage, take advantage of opportunities or to cope with the consequences.

Natural Adaptive Capacity – describes the ability of a species or natural system to adjust to climate change and extreme weather to moderate potential damage, to take advantage of opportunities or to cope with the consequences.

Baseline – a baseline is a state against which a change is measured. For example, a 'current baseline' is made up of observable, present-day conditions.

Capacity – is the combination of all the strengths and resources available within a community, society or organisation which can reduce the level of risk, or the effects of a disaster. It can also be described as capability.

Capacity building – in the context of climate change, capacity building describes developing the right skills and capabilities to help countries adapt to climate change. This also includes helping them to mitigate their greenhouse gas emissions.

Climate – the climate can be described simply as the 'average weather', typically looked at over a period of 30 years. It can include temperature, rainfall, snow cover, or any other weather characteristic.

Climate Change – this refers to a change in the state of the climate, which can be identified by changes in average climate characteristics which persist for an extended period, typically decades or longer.

Climate space – the area of land which is climatically suitable for a particular species or habitat.

Confidence – in a scientific context, confidence describes the extent to which the findings of an assessment are considered valid, based on the type, amount, quality, and consistency of evidence.

Ecosystem Services – the benefits to society from resources and processes provided by ecosystems can be described as *ecosystem services*. These can include: pollination and disease control, providing food and fuel, regulating the flow of water through land to both prevent flooding and filter clean drinking water, and the aesthetic and amenity value of the countryside.

Extreme weather – includes unusual, severe or unseasonal weather; or weather at the extremes of the range of weather seen in the past.

Greenhouse gases – a number of gases whose presence in the atmosphere traps energy radiated by the Earth. This is called the greenhouse effect. These gases can be produced through natural or human processes. Carbon dioxide is the most important greenhouse gas. Other gases are: methane, fluorinated gases, ozone and nitrous oxide.

Hazard – a situation or event which *could* cause harm. A hazard does not *necessarily* cause harm.

Impact – in the context of climate change, an effect of climate change (eg flooding, rails buckling, etc.). See consequence.

Likelihood – the chance of an event or outcome occurring, usually expressed as a probability.

Mitigation – describes action to reduce the likelihood of an event occurring or reduce the impact if it does occur. This can include reducing the causes of climate change (eg emission of greenhouse gases); as well as reducing future risks associated with climate change.

Model – in its broadest sense, a model is a representation of how a system works and can be used to understand how the system will respond to inputs and other changes.

Probability – is used to describe the chance or relative frequency of particular types of event occurring. It can also include sequences or combinations of such events.

Projection – any plausible description of the future and the pathway that leads to it. A specific interpretation of a 'climate projection,' refers to an estimate of future climate developed using models of the Earth's climate. Projections are not predictions. Projections include assumptions, for example, on future socio-economic and technological developments, which might or might not happen. They therefore come with some uncertainties.

- **UKCP09** – The UK Climate Projections (UKCP09) provide plausible future projections of climate change for different time periods and different possible scenarios of greenhouse gas emissions. These represent plausible scenarios illustrating a range of possible future changes.

Resilience – describes the ability of a social or ecological system to absorb disturbances while retaining the same basic ways of functioning, and a capacity to adapt to stress and change.

Risk – combines the chance that an event will occur with how large its impact could be, in social, economic or environmental terms. For example: the costs of damage, number of people affected or areas of land affected by a specific climate effect.

Risk Assessment – is an analysis of risks and their impacts to provide information for decision making. Often, risk assessment will consider a particular impacted [party], like a building or population. The process usually includes identifying hazards which could have an impact; and assessing the likelihoods and severities of impacts.

Risk Management – putting in place plans to avoid unacceptable consequences of risks.

Scenario – a scenario is a plausible description of a possible future state of the world. These use specific assumptions on how aspects of the world might change, like economies, social trends, changes in technology, environmental changes, etc., based upon the best understanding available. These can include:

- **Socio-economic scenario** – is a plausible description of the future population, Gross Domestic Product and other socio-economic aspects.
- **Climate Change Scenario** – is a plausible description of the change in climate by a certain time in the future. These scenarios are developed using models of the Earth's climate. Climate models and are based upon scientific understanding of the way that the land, ocean and atmosphere interact and their responses to factors that can influence climate in the future, such as greenhouse gas emissions.

Sensitivity – in this context, the degree to which a system is affected, either adversely or beneficially, by climate variability or change.

Severe weather – refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life.

Stakeholder – People, including organisations, who have an investment, financial or otherwise, in the consequences of any decisions taken.

Sustainable – referring to buildings, ecosystems, businesses, etc, which have a capacity to endure, over the longer term and in spite of change. This is in the context of environment/social/economic influences.

Threshold – the magnitude or intensity that must be exceeded for a certain reaction, phenomenon, result, or condition to occur or be manifested.

Uncertainty – Situation where the current state of knowledge is such that (1) the order or nature of things is unknown, (2) the consequences, extent, or magnitude of circumstances, conditions, or events is unpredictable, and (3) credible probabilities to possible outcomes cannot be assigned.

Vulnerability – the degree to which an individual or a system is susceptible to adverse effects. In this context, the adverse effects of climate change, including extreme events. Vulnerability is influenced by the system's sensitivity and its adaptive capacity, as well as the magnitude of the change.

Weather – refers to the state of the atmosphere, across space and time, and includes temperature, cloudiness, rainfall, wind, and other meteorological conditions.

Register of Actions

As required under Paragraph 58, Part 4 of the Climate Change Act 2008 (c.27), this document presents: (a) the objectives of Her Majesty's Government in relation to adaptation to climate change; (b) the Government's proposals and policies for meeting those objectives; and (c) the time-scales for introducing those proposals and policies addressing the risks identified in the most recent climate change risk assessment, as at July 2013.

Policy Area	Objectives
Built Environment	**Objective 1:** To work with individuals, communities and organisations to reduce the threat of flooding and coastal erosion, including that resulting from climate change, by understanding the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and making sure that other plans take account of them.
	Objective 2: To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development, including infrastructure, that minimises vulnerability and provides resilience to the impacts of climate change.
	Objective 3: To help businesses and industries in the sector to access skills, training, knowledge and tools to understand and manage climate change risks.
	Objective 4: To ensure that investors and developers have the financial and appraisal decision tools needed to support and promote adaptation to climate change.
	Objective 5: To increase the resilience of homes and buildings by helping people and communities to understand what a changing climate could mean for them and to take action to be resilient to climate risks.
	Objective 6: To explore and build understanding of the long term implications of climate change for the location and resilience of population centres.
Infrastructure	**Objective 7:** To ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events.
	Objective 8: To develop regulatory frameworks to support and promote a resilient and adaptive infrastructure sector.
	Objective 9: To better understand the particular vulnerabilities facing 'local' infrastructure (e.g. local highways) from extreme weather and long term climate change so as to determine actions to address the risks.
	Objective 10: To develop understanding and promote expertise in managing interconnected and interdependent services to minimise the risks of cascade failures which could be exacerbated by climate change; and identify how systems thinking can support this.

Policy Area	Objectives
Health	**Objective 11:** To reduce the risk of death and illness associated with severe weather events and climate change and increase preparedness and resilience to the impacts on public health.
	Objective 12: To promote climate resilience within the NHS, public health and social care system to ensure continuity of services and resilient assets/ estates including the ability to deal with the increased demand for services associated with severe weather related events.
	Objective 13: To minimise the impact of climate change on vulnerable groups in society by strengthening their resilience to better prepare for, respond to and recover from future climate risk.
	Objective 14: To promote and strengthen community resilience to severe weather related events linked to climate change (preparation, response and recovery) and the climate resilience of the emergency services and other Category 1&2 Responders of the Local Resilience Forums (LRFs).
Agriculture and Forestry	**Objective 15:** To increase the resilience of agriculture by effectively managing the impact of volatility in the occurrence and severity of rainfall events on water availability, flooding, soil erosion and pollution due to runoff.
	Objective 16: To increase the resilience of the forestry sector by increasing the level of management in England's woodlands and the uptake of adaptation good practice in woodland creation and restocking.
	Objective 17: To increase resilience to pests and disease to help protect biodiversity, maintain agricultural and forestry productivity and protect the UK's ability to export products.
	Objective 18: To embed climate change adaptation into agriculture, horticulture and forestry research programmes to improve knowledge of likely climate impacts and ensure timely development and uptake of relevant technology alongside well adapted crops, tree and livestock species as well as relevant technologies.

Policy Area	Objectives
Natural Environment	**Objective 19:** To build the resilience of wildlife, habitats and ecosystems (terrestrial, freshwater, marine and coastal) to climate change, so as to put our natural environment in the strongest possible position to meet the challenges and changes ahead.
	Objective 20: To take action to help wildlife, habitats and ecosystems accommodate and smoothly transition through inevitable change.
	Objective 21: To promote and gain widespread uptake in other sectors of the use of adaptation measures that benefit and/or do not adversely affect the natural environment.
	Objective 22: To improve the evidence base, to enhance the knowledge and understanding of decision makers, land managers and others of the impacts of climate change on the natural environment and how best we can influence adaptation or accommodate change.
Business	**Objective 23:** To raise awareness and understanding amongst businesses about climate change risks.
	Objective 24: To increase the extent to which businesses are actively considering climate change impacts, in their risk management and resilience planning and decision-making processes, and taking appropriate adaptive action.
	Objective 25: To raise awareness and understanding amongst businesses about domestic and international climate change opportunities.
	Objective 26: To help businesses better understand and manage climate change risks to their supply chains.
	Objective 27: To undertake research to increase the understanding of climate change impacts on growth and the economy, working with investors, insurers and other industry partners.
Local Government	**Objective 28:** To raise and maintain the profile of adaptation with local authorities and promote action to embed climate resilience across local authority services and responsibilities.
	Objective 29: To support local government to build a credible business case for action and take well-informed decisions both internally across service areas and externally with their local communities and businesses.
	Objective 30: To ensure the policy framework for local government supports councils to increase community resilience in partnership with local and regional players.
	Objective 31: To support sector-led activities, which allow councils to make local commitments to address their own unique challenges and opportunities arising from changing climate.

Built Environment

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 1: To work with individuals, communities and organisations to reduce the threat of flooding and coastal erosion, including that resulting from climate change, by understanding the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and making sure that other plans take account of them.				
FL6b Expected Annual Damage (EAD) to residential property due to flooding **FL7b Expected Annual Damage (EAD) to non-residential property due to flooding** **FL13 Ability to obtain flood insurance for residential properties** **FL6a Residential properties at significant risk of flooding** **FL2 Vulnerable people at significant risk of flooding**	Defra Flood Management to evaluate the partnership funding approach for flood management.	**FL6b, FL7b, FL13, FL6a, FL2**	Defra Flood Management	By April 2015
	Defra Flood Management and the Environment Agency to fully embed property level protection within the partnership funding approach.	**FL6b, FL13, FL6a**	Defra Flood Management and Environment Agency	By April 2015
	Defra Flood Management to evaluate risk management authority delivery of their roles and responsibilities established under the Flood and Water Management Act 2010.	**FL6b, FL7b**	Defra Flood Management	By April 2015
	Defra Flood Management and the Environment Agency to work towards meeting the requirements of the European Floods Directive and embed evolving understanding of surface water flooding in policy and delivery approaches.	**FL6b, FL7b, FL13**	Defra Flood Management and Environment Agency	From December 2013 for surface water mapping; December 2015 for local strategies and flood risk management plans
	Defra Flood Management to take forward potential action on new arrangements for flood insurance, subject to the outcome of negotiations.	**FL6b, FL13**	Defra Flood Management	2013/2014
	Defra Water, Sustainable Drainage Systems team to take forward implementation of Flood and Water Management Act 2010 in April 2014, subject to Parliament approval, setting out national standards for sustainable drainage systems in new developments and redevelopments.	**FL6b, FL7b, FL13, FL6a**	Defra Water, Sustainable Drainage Systems team	By end of 2014
	Defra and the Environment Agency to implement the Flood and Coastal Erosion Risk Management Strategy for England: • Government expects to spend £2.3bn on flooding and coastal erosion risk management over the 4 years to March 2015; • Strategy will enable 165,000 households to benefit from new and improved defences, flood forecasting and early warning systems; • Targeted to those most at risk and living in deprived areas; and • £148M expected from private funding and local government.	**FL6b, FL7b, FL13, FL6a**	Defra Flood Management and Environment Agency	Ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Environment Agency to maintain and enhance our capacity to respond to flood events.	**FL6b, FL7b, FL13, FL6a**	Environment Agency	Ongoing
	The Environment Agency to continue to develop and improve the flood warning service for surface water flood risks. This will include: • more accurate forecasts of flooding from all sources; • warnings and geographically-specific flood information; • longer lead times for flood forecasts and warnings; and • more innovative ways of sharing locally-specific information.	**FL6b, FL7b, FL13, FL6a**	Environment Agency	Ongoing
	Defra, the Environment Agency and local government to work together to help develop a single information portal to share consistent high-level information on flooding.	**FL6b, FL7b, FL13, FL6a**	Defra, Environment Agency	Ongoing
	Cranfield University and the Adaptation and Resilience in a Changing Climate (ARCC) Coordination Network published the finding of the Community Resilience to Extreme Weather Project (CREW). This included detailed pluvial and fluvial flood modelling for South-East London.	**FL6b, FL7b, FL13, FL6a**	Cranfield University/ ARCC coordination network	Project was completed in November 2011
Objective 2: To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development, including infrastructure, that minimises vulnerability and provides resilience to the impacts of climate change.				
FL6b Expected Annual Damage (EAD) to residential property due to flooding **FL7b Expected Annual Damage (EAD) to non-residential property due to flooding** **FL13 Ability to obtain flood insurance for residential properties** **FL6a Residential properties at significant risk of flooding** **BE3 Overheating of buildings** **FL2 Vulnerable people at significant risk of flooding** **FL7a Non-residential properties at significant risk of flooding**	Local planning authorities to work with their communities, the Environment Agency and partners to put in place up to date local plans consistent with the National Planning Policy Framework (NPPF), including policies on tackling climate-related impacts, such as flooding and coastal change.	**FL6b, FL7b, FL13, FL6a**	Local planning authorities	Authorities have been encouraged to get up to date local plans in line with the NPPF in place as quickly as possible
	The Department for Communities and Local Government to update planning guidance to support the implementation of the National Planning Policy Framework's policies on adapting to climate change, in the light of the review of Government planning practice guidance.	**ALL CCRA BUILT ENVIRONMENT RISKS**	Department for Communities and Local Government	Summer 2013
	Town and Country Planning Association, supported by Climate UK, has produced guidance: 'Planning for Climate Change, Guidance for local authorities' (2012). This will continue to be promoted by Climate UK via local partnerships networks and events with local authorities.	**FL6b, FL7b, FL13, FL6a, EN2, BE9, WA5**	Town and Country Planning Association	Published in 2012

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
WA5 Public water supply-demand deficit **EN2** and BE9 **Increased energy demand for cooling** and reduced energy demand for heating	Environment Agency Climate Ready service to provide input into the development of planning guidance to support the National Planning Policy Framework regarding adaptation to future flood risk and water resources.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5**	Environment Agency Climate Ready	2013 – 2014
	Environment Agency Climate Ready service to make tools and advice available to planners and developers on future climate risk. This will continue to be promoted by Climate UK via local partnerships, networks and events with local authorities.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5**	Environment Agency Climate Ready	Ongoing
	Environment Agency Climate Ready service to provide guidance and tools to local Environment Agency teams so they can promote climate change adaptation in their advice to local authorities and developers as part of their role as a consultee to the planning process.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5**	Environment Agency Climate Ready	Ongoing
	The Green Infrastructure Partnership to promote greater use of Green Infrastructure to achieve better resilience for the built environment in a changing climate. Climate UK partner Sustainability West Midlands will be piloting work with Local Nature Partnerships and Local Enterprise Partnerships in the West Midlands to trial a joint investment project in green infrastructure to deliver economic, environmental and adaptation benefits.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5**	Defra, Green Infrastructure Partnership	Ongoing
	Environment Agency Climate Ready service will support the Local Government Association's Climate Local initiative as a means of signposting advice, tools and examples that can help councils take action to improve the resilience of the local built environment. This will continue to be promoted by Climate UK via local partnerships networks and events with local authorities.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5**	Environment Agency Climate Ready	2013 onwards
Objective 3: To help businesses and industries in the sector to access skills, training, knowledge and tools to understand and manage climate change risks.				
FL6b Expected Annual Damage (EAD) to residential property due to flooding **FL7b Expected Annual Damage (EAD) to non-residential property due to flooding** **FL6a Residential properties at significant risk of flooding** **BE3 Overheating of buildings** **FL7a Non-residential properties at significant risk of flooding**	Department for Communities and Local Government commissioned and published a literature review and gap analysis on overheating in homes.	**BE3**	Department for Communities and Local Government	Published in 2012
	Zero Carbon Hub to undertake a programme of work with the house-building industry to increase understanding and awareness of overheating risk in new-build homes.	**BE3**	Zero Carbon Hub	2013
	The Department of Energy and Climate Change to review the relevant part of the Standard Assessment Procedure (SAP) in 2015, in relation to internal temperature of dwellings.	**BE3**	Department of Energy and Climate Change	2015

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
EN2 and BE9 **Increased energy demand for cooling** and Reduced energy demand for heating **WA5 Public water supply-demand deficit** **FL2 Vulnerable people at significant risk of flooding** **BE1 Urban Heat Island effect** **FL12a/b Hospitals and schools at significant risk of flooding** **HE2 Summer morbidity due to higher temperatures** BE5 Effectiveness of green space for cooling BU10 Loss of staff hours due to high internal building temperatures **OPPORTUNITIES:** HE5 Decline in winter mortality due to higher temperatures HE6 Decline in winter morbidity due to higher temperature	National House-Building Council Foundation Guidance on 'Understanding Overheating' published.	**BE3**	National House-Building Council Foundation	2012
	The Technology Strategy Board have published a scoping guide to aid built-environment practitioners to identify climate change information.	**BE3**	Technology Strategy Board	2010
	The Technology Strategy Board to disseminate the lessons learned from the 'Design for Future Climate Competition' in developing adaptation strategies for buildings. This work considered issues around thermal comfort (cold and overheating), construction (stability, weatherproofing etc) and water cycle (flooding and water demand). To also include publication of the +45 adaption strategy reports and a Royal Institute of British Architects book summarising main lessons and understanding. www.connect.innovateuk.org/web/design-for-future-climate/overview	**BE3, WA5, FL6a/b, FL7a/b**	Technology Strategy Board	End of 2013
	The Green Deal Guidance is a joint Energy Saving Trust/Waterwise document which was published in 2012. www.waterwise.org.uk/resources.php/55/green-deal-guidance-for-the-water-sector	**BE3, WA5**	Energy Saving Trust	Published in 2012
	Royal Institute of British Architects Guide to Sustainability Practice published. www.architecture.com/SustainabilityHub/Publications/RIBAGuidetoSustainabilityinPractice.aspx	**ALL CCRA BUILT ENVIRONMENT RISKS**	Royal Institute of British Architects	Published in 2012
	Environment Agency Climate Ready service to collaborate with Modern Built Environment Knowledge Transfer network to promote climate change adaptation.	**ALL CCRA BUILT ENVIRONMENT RISKS**	Environment Agency Climate Ready	During 2013
	Environment Agency Climate Ready service to determine skills gaps in the built environment sector and address skills gaps through partnership working.		Environment Agency Climate Ready	Ongoing
	Environment Agency Climate Ready service to make skills and training on climate change adaptation resources available to decision-makers in the built environment sector. This will continue to be promoted by Climate UK via local partnerships, networks and events with local authorities.	**FL6b, FL7b, FL6a, EN2,** BE9, **WA5**	Environment Agency Climate Ready	Ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Adaptation and Resilience in a Changing Climate (ARCC) Coordination Network to coordinate communication between researchers and decision-makers across the Network to facilitate the co-production of creditable and salient evidence for policymakers and practitioners working in the built environment. Details of recently completed, ongoing and planned ARCC-related projects are below. www.arcc-cn.org.uk/	**MOST BUILT ENVIRONMENT CCRA RISKS**	Oxford University	Until 2017
	ARCC Project 'Community Resilience to Extreme Weather': • assessed the effectiveness and cost of a range of adaptation measures in dwellings to reduce overheating. A retrofit toolkit has been produced aimed at a range of users including designers, housing professionals, local authorities and home owners; • carried out detailed pluvial and fluvial flood modelling for South East London; • considered effects on residential house price and recovery time as a consequence of future flooding events; and • used water resource management modelling tools for London region to establish future aggregate predictions of water resource requirement. www.extreme-weather-impacts.net	**BE3,** BE9, **FL2, FL6b, WA5,** WA4	14 UK universities	2012
	ARCC Project: 'Low Carbon Futures' is further developing an overheating tool to predict future indoor temperatures for a range of building types. www.arcc-cn.org.uk/project-summaries/completed-projects/low-carbon-futures/	**BE3, EN2**	Heriot-Watt University	LCF tool available 2012, further development in 2013
	ARCC Project 'Built Infrastructure for Older People in Conditions of Climate Change' is: • providing evidence on current and future risks to the health of older people due to extreme weather events, including heatwaves and coldwaves; • mapping the projected occurrence of extreme weather events, including flooding, for the 2030s and the concentrations of potentially vulnerable older populations, to help inform community resilience; • demonstrating how to assess potential flood hazards to built infrastructure, including utilities, and to indicate possible adaptation options; and • exploring how data on National Health Service infrastructure can be used in combination with flood risk data to inform local resilience planning. www.dur.ac.uk/geography/research/researchprojects/biopiccc/	HE1, **HE2,** HE3, HE5, HE6, **FL2, FL7a, FL12a/b**	Durham University	Until 2013; flood-mapping published 2012

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	ARCC Project 'Suburban Neighbourhood Adaptation in a Changing Climate': • modelled current and future overheating risk in suburban neighbourhoods and tested a range of possible adaptation packages for their effectiveness, feasibility and acceptability, at the building and neighbourhood levels; and • investigated current and future flooding risks for dwellings and the public realm in suburban areas and tested a number of potential adaptations for their effectiveness, feasibility and acceptability. www.snacc-research.org/	**BE3,** BE5, BE9, **FL6a**	University of the West of England, Oxford Brookes University	2012
	ARCC Project: 'Adaptation and Resilience in Cities: Analysis and Decision-making using Integrated Assessment' (ARCADIA) is • mapping non-residential areas under threat of surface water flooding for a given industrial sector under differing future scenarios, including an estimation of damage to buildings; • developing a spatial weather generator to model future temperature variations in urban areas; • estimating the number of people at risk of thermal discomfort in residential buildings under a variety of future scenarios; • modelling reduced labour productivity due to overheating in buildings; & • estimating increased mortality risk due to high temperatures under future scenarios. www.arcc-cn.org.uk/project-summaries/arcadia/	**FL7a/b, BE3,** BE1, BU10, **HE1**	Oxford University	Until 2013
Objective 4: To ensure that investors and developers have the financial and appraisal decision tools needed to support and promote adaptation to climate change.				
FL6b Expected Annual Damage (EAD) to residential property due to flooding	The Building Research Establishment (BRE) to Review BRE Environmental Assessment Method (BREEAM) to ensure that it promotes the need to take account of climate change adaptation.	**FL6b, FL7b, FL13, FL6a, EN2, BE3, WA5**	Building Research Establishment	Ongoing
FL7b Expected Annual Damage (EAD) to non-residential property due to flooding **FL13 Ability to obtain flood insurance for residential properties** **FL6a Residential properties at significant risk of flooding** **BE3 Overheating of buildings** **HE1 Summer mortality due to higher temperatures** **HE2 Summer morbidity due to higher temperatures**	HM Government to develop Government Buying Standards (GBS) for central Government procurement of construction and construction-related products.	**FL7b, FL7a, EN2, BE9, BE3, WA5**	Defra; Central Government bodies are held responsible for meeting commitments	GBS for construction and GBSs for certain construction products already in place; Initial review to take place Spring 2013; Potential development of new standards subject to recommendations of initial review; Summer 2013

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
FL7a Non-residential properties at significant risk of flooding **EN2** and BE9 **Increased energy demand for cooling** and Reduced energy demand for heating **WA5 Public water supply-demand deficit** EN10 Energy transmission efficiency capacity losses due to heat	Environment Agency Climate Ready service to develop guidance on making a business case for climate change adaptation.	**ALL CCRA BUILT ENVIRONMENT RISKS**	Environment Agency Climate Ready	2013
	Environment Agency Climate Ready service to disseminate sector-led best practice guidance and research on Green Infrastructure. This will be continued to be promoted by Climate UK via local partnerships networks and events with local authorities.	**ALL CCRA BUILT ENVIRONMENT RISKS**	Environment Agency Climate Ready	2013
	Environment Agency Climate Ready service to develop a resources framework that links the research community and resources to the various decision-makers in the built environment sector. Projects are already underway to address main gaps in resources related to the role of green infrastructure and to develop a business case tool.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5**	Environment Agency Climate Ready	2013 onwards
	Environment Agency Climate Ready service to provide input into the Housing Standards Review, promoting climate change adaptation in emerging new housing standards.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5, BE3, HE1, HE2**	Environment Agency Climate Ready	2013
Objective 5: To increase the resilience of homes and buildings by helping people and communities to understand what a changing climate could mean for them and to take action to be resilient to climate risks.				
FL6b Expected Annual Damage (EAD) to residential property due to flooding	The Department of Energy and Climate Change to continue circulating guidance on how to avoid overheating in homes that are being retrofitted.	**BE3, EN2**	Department of Energy and Climate Change	Ongoing
FL7b Expected Annual Damage (EAD) to non-residential property due to flooding	The Department of Energy and Climate Change to take steps to better understand overheating in existing homes, working with the Good Homes Alliance.	**BE3, EN2**	Department of Energy and Climate Change	Ongoing
FL13 Ability to obtain flood insurance for residential properties **FL6a Residential properties at significant risk of flooding**	The Department for Communities and Local Government to appropriately consider climate change adaptation in its review of the framework of Building Regulations and local housing standards.	**ALL CCRA BUILT ENVIRONMENT RISKS**	Department for Communities and Local Government	Ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
BE3 Overheating of buildings **HE1 Summer mortality due to higher temperatures** **HE2 Summer morbidity due to higher temperatures** **EN2** and BE9 **Increased energy demand for cooling** and Reduced energy demand for heating **WA5 Public water supply-demand deficit** **BE1 Urban Heat Island effect**	The London Climate Change Partnership (LCCP) has produced recommendations to improve policy and practice relating to hot weather planning and heat risk management. This has focused on the social housing and care home sector, with three target audiences: • decision-makers in the social housing and care home sectors; • decision-makers within London's urban systems; and • national level decision-makers who are responsible for policy, legislation and guidance relevant to heat risk management in the UK. www.climatelondon.org.uk/publications/overheating-thresholds-report/	**HE1, HE2, BE3, EN2,** BE9	London Climate Change Partnership (LCCP)	Second phase of project: 2013
	Environment Agency Climate Ready service to support promotion of products to encourage householders to adapt to climate change by working with the DIY retail sector, to promote products and information.	**FL6b, FL7b, FL13, FL6a, EN2,** BE9, **WA5**	Environment Agency Climate Ready	Ongoing
	Defra to oversee the implementation of Commission regulation (EU) no 206/2012 of 6 March 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners and comfort fans.	**BE3, EN2**	Defra	2013
	Defra to work with water companies to encourage efficiency campaigns such as Anglian Water's 'Love Every Drop'.	**WA5**	Defra	Ongoing
	Defra to develop policy on voluntary labelling of water products.	**WA5**	Defra	Ongoing
	Defra, Environment Agency and Ofwat to develop evidence through pilots for catchment-wide approaches, in order to inform how the water sector can become more climate resilient.	**WA5**	Defra, Environment Agency, Ofwat	Ongoing
	Environment Agency to develop capacity-building to help regional staff review and offer feedback on water company climate change and resilience plans in the run up to 2014 water price review (PR14) implementation.	**WA5**	Environment Agency	Ongoing to 2013
	Defra and the Environment Agency to implement water availability actions from the Water White Paper as outlined in the four activities, below:	**WA5**	Defra, Environment Agency	Ongoing
	Defra to prepare draft Water Bill for pre-legislative scrutiny.	**WA5**	Defra	Ongoing
	Defra to develop a new abstraction regime with the Environment Agency that takes climate change adaptation into account.	**WA5**	Defra	Ongoing

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Environment Agency and water companies to follow new planning guidelines for the next water resource management planning round, in order to prepare for new water resources plans.	**WA5**	Environment Agency, water companies	2013 onwards
	Defra, Environment Agency and Ofwat to: • explore how different timelines and reporting periods need to be aligned as recommended by the Water White Paper and • co-ordinate the price review and water resource management plan processes, to ensure that respective objectives and outcomes are joined-up and burdens are minimised.	**WA5**	Defra, Environment Agency, Ofwat	Ongoing
Objective 6: To explore and build understanding of the long term implications of climate change for the location and resilience of population centres.				
FL6b Expected Annual Damage (EAD) to residential property due to flooding **FL7b Expected Annual Damage (EAD) to non-residential property due to flooding** **FL13 Ability to obtain flood insurance for residential properties** **FL6a Residential properties at significant risk of flooding** **FL8a Roads at significant risk of flooding** **WA10 CSO spill frequency** **TR1 Disruption of traffic due to flooding** **WA5 Public water supply-demand deficit**	Environment Agency to disseminate the National Coastal Erosion Risk Mapping best-practice method for calculating erosion risk nationally, based on evidence including data from the latest climate change projections.	**FL6b, FL7b, FL13, FL6a**	Environment Agency	Ongoing
	Environment Agency to develop Shoreline Management Plans based on ideas and evidence emerging from the £11M Coastal Change Pathfinder programme, providing a large-scale assessment of the physical risks associated with coastal processes.	**FL6b, FL7b, FL13, FL6a**	Environment Agency	Ongoing
	Environment Agency to develop Catchment Flood Management Plans with relevant partners, to promote good adaptation.	**FL6b, FL7b, FL13, FL6a**	Environment Agency	Ongoing
	Defra and the Environment Agency to build partnerships with water companies and Lead Local Flood Authorities (LLFAs) to produce area drainage plans. LLFAs to produce a set of surface water flood maps by the end of 2013, in partnership with water companies (e.g. 'Drain London', which involves Thames Water and London Boroughs).	**WA10, FL8a, TR1**	Lead Local Flood Authorities and water companies, Environment Agency, Defra	2013 onwards
	Environment Agency to lead project on 'Accounting for future uncertainties in Flood and Coastal Erosion Management.	**FL6b, FL7b, FL13, FL6a**	Environment Agency	March 2013
	Environment Agency Climate Ready service to provide input into the development of planning guidance to support the National Planning Policy Framework regarding adaptation to long-term future flood risk [and water resources] management.	**FL6b, FL7b, FL13, FL6a, WA5**	Environment Agency Climate Ready	2013 onwards

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Infrastructure

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 7: To ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events.				
WA3 Reduction in water available for public supply **EN1 Energy infrastructure at significant risk of flooding** **FL11b Sub-stations at significant risk of flooding** **FL11a Power stations at significant risk of flooding** **FL8a/b Roads and Railways at significant risk of flooding** **WA10 Combined Sewer Overflow spill frequency** **TR1 Disruption to road traffic due to flooding** **WA5 Public water supply demand deficits** **EN2 Energy demand for cooling** BE2 Increased subsidence risk due to rainfall changes WA6 Population affected by water supply-demand pressures TR2 Landslide risks on the road network TR5 Rail buckling risk TR6 Scouring of road and rail bridges EN4 Risk of restrictions in water abstraction for energy generation TR4 Cost of carriageway repairs due to high summer temperatures EN3 Heat related damage/disruption to energy infrastructure EN10 Energy transmission efficiency capacity losses due to heat – over ground BU5 Loss of productivity due to ICT disruption	**1 – Cross Cutting**			
	1(a) – Policy			
	To produce infrastructure planning guidance for Environment Agency and Planning Inspectorate, as part of building climate resilience into infrastructure planning.	**EN1, FL11a, FL11b, FL8a, FL8b, TR1**	Environment Agency, Planning Inspectorate and Applicants	2013
	Defra to develop and implement the next round of the Adaptation Reporting Power, inviting updated reporting from infrastructure providers/sectors.	**ALL CCRA INFRASTRUCTURE RISKS**	Defra	2013 onwards
	The Cabinet Office to provide guidelines that identify the Climate Change Risk Assessment as a source of information from which sector resilience responders can draw on when considering updates to their plans, ahead of the next round of Sector Resilience Plans.	**ALL CCRA INFRASTRUCTURE RISKS**	Cabinet Office	2013
	1(b) Delivery			
	Environment Agency Climate Ready service to share, through the Infrastructure Operators Adaptation Forum, best practice on climate resilience, interdependency risk management and consistent approaches amongst infrastructure organisations.	**ALL CCRA INFRASTRUCTURE RISKS**	Environment Agency Climate Ready and Infrastructure Operators Adaptation Forum	Ongoing
	The Infrastructure Operators Adaptation Forum to consider reviewing barriers to climate change in Adaptation Reporting Power reports from infrastructure organisations and to find ways to overcome these barriers.	**ALL CCRA INFRASTRUCTURE RISKS**	Infrastructure Operators Adaptation Forum, Environment Agency Climate Ready, Infrastructure organisations	2013 onwards
	To run a competition to raise the profile of climate resilient infrastructure and to encourage development of innovative products and services that facilitate climate resilience.	All risks	Defra	2013 – 2014
	2 – Energy			
	2(a) – Policy			
	The Department of Energy and Climate Change (DECC) to consider the impacts of climate change when implementing the Energy Security Strategy.	**FL11a, EN1 FL11b,** EN10	Department of Energy and Climate Change	Ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	The Department of Energy and Climate Change to ensure that the Capacity Market could, if initiated, help adapt the energy system to both intermittent sources of generation and future weather conditions by factoring the changing climate into capacity market demand projections.	**FL11a, EN1** **FL11b,** EN10	Department of Energy and Climate Change	2013
	New energy infrastructure will take account of climate change in line with National Policy Statements. The Department of Energy and Climate Change will review the adequacy of this policy to deal with the changing climate.	**FL11a, EN1 FL11b,** EN10	Department of Energy and Climate Change, Infrastructure applicants, Defra	Ongoing
	2(b) Delivery			
	Energy network providers to: • update ETR138 (an influential industry policy document that governs adaptation action) through the reconvening of an ETR138 working group to address resilience issues; e.g. surface water flooding and dam inundation; and • share best practice through the industry group to manage risks between National Grid and local network providers.	**EN1, FL11b**, EN3	Energy network providers; e.g. transmission network, operators and distribution network operators. Energy Networks Association	Ongoing
	To progress commitments to provide flood protection to assets, in line with Pitt Review recommendations. Completion of the original flooding resilience programme to address river and sea flood risks with an allowance for climate change effects within the next regulatory price control period. [This is subject to agreement with the industry's regulator Ofgem and as with all network investment, the initiatives must provide value for customers.] To consider whether current information on surface water flooding is accurate enough to develop meaningful risk assessments which can be used to justify expenditure.	**FL11a/b, EN1**	Energy Networks Association	Electricity Transmission 2013 to 2021 Electricity Distribution 2015 to 2023
	Energy Networks Association to consider further research into energy demand for cooling as part of reviewing wider network resilience. Any research will also be impacted by the considerable research and development effort that is currently being directed to understand the impact of low carbon targets, and the resulting low carbon generation/ loads, on network development including the application of smart grid techniques.	**EN2**	Energy Networks Association	2012 – 2018

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Energy Networks Association to: • build knowledge about the de-rating risks associated with transmission networks; • consider further work on 'Energy Project 2' with the Met Office; and • consider review of industry standards and specifications to build capacity to manage climate change risk.	EN3	Energy Networks Association	2012 to 2018
	To take forward plans to consider barriers to adaptation capacity, alongside future issues (e.g. smart metering, electric cars and heat pumps) to target adaptation action.	EN10	Energy Networks Association, electricity network companies	2013 onwards
	Energy generation companies to monitor future flood risks to energy generation infrastructure, drawing on Defra/Environment Agency flood management policies (covering flood warning, emergency, Catchment Flood Management Plans, Shoreline Management Plans, local strategy policies).	**EN1, FL11a,** EN3	Energy generation companies	Ongoing
	Energy UK to continue to convene a national level working group to consider a range of climate risks.	**EN1, FL11a,** EN3	Energy UK	Ongoing
	To consider future water availability through representation on Defra's Abstraction Reform Advisory Group. To collaborate with the Environment Agency and Department of Energy and Climate Change, to model water demand in the electricity generation sector to 2050. To communicate with Defra about assessing impacts of reform options on abstractors and the environment.	**WA3, WA5**	Energy UK, Environment Agency, Department of Energy and Climate Change, Defra	2013 to 2014
	3 – Transport			
	3(a) – Policy			
	Embed climate resilience in highway, rail, aviation and maritime policies and strategies e.g.: • the 2013 Road Strategy; • ports (2012) National Policy Statements (NPS) and future Aviation and National Networks NPSs; • 2013 Aviation Policy Framework which balances the costs and benefits of aviation, including the need for climate change adaptation; and • project management and appraisal of major transport schemes such as HS2. • Network Rail Strategic Business Plan for 2014-19 (published January 2013) which includes the need to future-proof critical infrastructure against the impacts of changing weather.	**TR1**, TR2, TR4, TR5, TR6, **FL8a, FL8b**	Department for Transport	2013 onwards

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	The Department for Transport to include climate change in departmental risk management, business planning, project management and appraisal processes.	**TR1,** TR2, TR5, TR6, **FL8a,FL8b, TR4**	Department for Transport	2013 onwards
	The Department for Transport to include the need to address climate resilience in departmental research and guidance.	**TR1,** TR2, TR5, TR6, **FL8a, FL8b, TR4**	Department for Transport	2013 onwards
	The Department for Transport to devise methods of sharing knowledge and best practice within and between transport sectors e.g. supporting and establishing working groups.	**TR1,** TR2, TR5, TR6, **FL8a,FL8b, TR4**	Department for Transport	2013 onwards
	3(b) Delivery			
	To embed climate resilience into highway, rail, aviation and port operations (e.g. contingency planning). To make best use of exemplars with respect to (iconic) climate change resilient infrastructure management, utilising experience from projects and programmes already embedding adaptation.	**FL8a/b, TR1**, TR2, TR5	Transport operators, Infrastructure Operator's Adaptation Forum, Department for Transport, Environment Agency Climate Ready	Ongoing
	To lead the second phase of research on the project *Tomorrow's Railway and Climate Change Adaptation* (TRaCCA), a research programme delivering further assessment of projected climate change risks and decision support tools (e.g. changes in precipitation and sea level rise leading to flooding and overtopping of rail infrastructure, track buckling and bridge scour).	**FL8b,** TR5, TR6	Rail Safety and Standards Board, Network Rail, Transport for London, Office of Rail Regulation, Department for Transport	2012 to 2014; 2nd phase -T1009 TRaCCA 2013 to 2015
	Through the Highways Agency Adaptation Strategy and Framework, to: • undertake minimum actions to maintain a safe and serviceable network; • monitor the rate of climate change and the subsequent effects on particular assets; • update operating procedures; • develop futureproof designs; • undertake contingency planning; and • apply retro fit solutions.	**TR1,** TR2, TR4, TR6, **FL8a.**	Highways Agency	2013 onwards

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Highways Agency to research the issue of bridge scour (building on their advice Assessment of Scour at Highway Structures and standard for the 'Design Manual for Roads and Bridges').	TR6	Highways Agency	2012 to 2015
	Highways Agency to: • make available to academia data on the condition of its earthworks; • maintain earthworks risk assessments; and • monitor the most susceptible slopes and embankments to extreme weather. [Academic research has covered this area in the recent past (e.g. the CLIFFS and BIONICS evidence programmes)	TR6	Highways Agency, Academia	Ongoing
	4 – Water			
	4(a) – Policy			
	Defra and others to develop evidence and pilots for catchment-wide approaches to water management, in order to inform how the water sector can become more climate resilient through the provision of soft and hard infrastructure.	**WA6, WA10,** EN4	Defra, Environment Agency, Ofwat, water companies	2013 onwards
	The Environment Agency to develop capacity building to help regional staff review and offer feedback on water company water resource management plans in the run up to 2014 water pricing review. www.environment-agency.gov.uk/business/sectors/32425.aspx	**WA3, WA5,** WA6, **WA10**	Environment Agency	Until 2013
	To implement water availability actions from the Water White Paper (WWP) as shown below:			
	Defra to prepare draft Water Bill for pre-legislative scrutiny.	**WA3, WA5,** WA6	Defra	Ongoing
	Defra to develop a new abstraction regime with the Environment Agency that takes climate change adaptation into account.	**WA3, WA5,** WA6	Defra	2013 onwards
	Water companies to follow new planning guidelines for the next water resource management planning round, in order to prepare for new water resources plans.	**WA3, WA5,** WA6	Water companies	2013 onwards
	Defra to include measures for hot water savings in the Green Deal, starting in 2013. There is an opportunity for water companies to form partnerships with Green Deal providers to offer joint energy/water retrofit programmes.	**WA3, WA5,** WA6	Defra	Early 2013 onwards (for Green Deal finance availability)
	Defra to consider whether to amend the Water Industry Act to ensure water companies are able to build Sustainable Drainage Systems, to meet their statutory duty to effectively drain an area.	**WA10**	Defra	2013 onwards

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	To increase communication with water companies via partnership-working with local authorities over the development of area drainage plans as appropriate and Sustainable Drainage Systems for new development, where achievable and cost beneficial. This activity is also enabled via the Flood and Water Management Act (2010) duty to co-operate. (This is linked to Built Environment Theme action on management of surface water in built-up areas.)	**WA10**	Water companies, Water UK	2013 onwards
	The Environment Agency to commission and implement a new Drainage Strategy Framework and supporting Good Practice Guidance. This aims to help water companies, working with others, to develop strategies to manage future drainage risks, including those resulting from climate change. Ofwat is also working with the Environment Agency and industry to embed resilience planning principles.	**WA10**	Environment Agency, water companies, Water UK, Ofwat	2013 to 2025
	4(b) Delivery			
	Water Companies to update sewerage management plans, working with local authorities, as part of developing and maintaining supply, sewer and drainage infrastructure networks over the long term, providing resilience to climate change.	**WA3, WA5,** WA6 WA8, **WA10**	Water companies	Ongoing
	To build partnerships with water companies and Lead Local Flood Authorities (LLFAs) to align Drainage Area Plans. Sewerage Management Plans and Strategic Drainage Frameworks (where appropriate, since these are non-statutory and industry recognised documents) and to help inform Local Flood Risk Management Strategies.	**WA10, FL8a, TR1**	Environment Agency, LLFAs, water companies, Defra	2013 onwards
	The Environment Agency to produce a set of Surface Water Flood Maps in partnership with water companies and Lead Local Flood Authorities (LLFAs). (Examples include Drain London, involving Thames Water and London Boroughs).	**WA10, FL8a, TR1**	Environment Agency, LLFAs and water companies, Defra	2013 onwards
	To invest in activity that encourages customers to enhance their resilience, such as in maintaining and cleaning blockages from their sewer system due to customers disposing fats, oils and grease items down their sinks and toilets. Examples includes Anglian Water 'Keep it Clear' and Yorkshire Water 'Doing the Dirty' campaigns.	**WA10, FL8a, TR1**	Lead Local Flood Authorities, water companies, Environment Agency, Defra	2013 onwards
	To test the consequences of an extreme drought, and plan for this scenario.	**WA3, WA5,** WA6	Water UK, water companies, Defra, Environment Agency	2012 to 2013

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Water companies to finalise their drought plans, taking into account lessons learnt from the recent drought.	**WA3, WA5,** WA6	Water companies, Water UK	2013 to 2016
	To develop maps to show the existing raw and treated water transfers between companies, to be used to illustrate the 'water grid' that already exists. The tool will inform debate on water transfers.	**WA3, WA5,** WA6	Water companies, Water UK	2012 to 2013
	To undertake a lessons-learned review and Water UK policy review to consider what gaps exist in current Water UK policy and what needs to be done to address these gaps. To develop a document to be published externally, setting out the industry's vision for increased resilience.	**WA3, WA5,** WA6	Water companies, Water UK	2013
	To hold a series of workshops and seminars to share best practice and knowledge across the water industry, including the following topics: effluent re-use; desalination; and flexible abstraction.	**WA3, WA5,** WA6, **WA10**	Water companies, Water UK	2012 to 2013
	To lead a project encouraging affected business sectors to: • have contingency plans for times when the public water supply is under stress; • move to the use of highly water efficient equipment across their businesses; and • develop professional training in best practice in resilience management.	**WA3, WA5,** WA6, **WA10**	Water companies, Water UK	Ongoing
	5 – Academia			
	To make full use of Adaptation and Resilience in a Changing Climate (ARCC) research and specific projects that can feed into wider policy and delivery. Projects shown below and described in greater detail here: www.arcc-cn.org.uk/	See below	Academia	See below
	Delivery of cross cutting ARCC Projects: MUSCOs – Multiple-Utility Service COmpanies.	**MOST CCRA INFRASTRUCTURE RISKS**	University of Leeds	2011 to 2016
	Delivery of cross-cutting ARCC projects: ITRC – Infrastructure Transitions Research Consortium.	**MOST CCRA INFRASTRUCTURE RISKS**	University of Oxford	2011 to 2016
	Delivery of Energy ARCC Projects: ARCOES – Adaptation and Resilience of COastal Energy Supply.	**EN1, EN2,** EN3, EN4, EN10, FL8, FL11	University of Liverpool	2011 to 2016
	Delivery of Energy ARCC Projects: ARIES – Adaptation and Resilience In Energy Systems.	**EN1, EN2,** EN3, EN4, EN10	University of Edinburgh	2011 to 2016
	Delivery of Energy ARCC Projects: RESNET – RESilient Electricity NETworks for GB.	**EN1, EN2,** EN3, EN4, EN10	University of Manchester	2011 to 2016

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Delivery of Transport ARCC Projects: FutureNet – Future Resilient Transport Networks.	**TR1,** TR2,TR5, TR6, **FL8a, FI8b**	University of Birmingham	2011 to 2016
	Delivery of Water ARCC Projects: ARCC Water – Water System Resilience.	**WA3, WA5,** WA6	University of Oxford	2011 to 2016
	Delivery of cross cutting ARCC Projects: Undermining infrastructure – Avoiding the scarcity trap.	**MOST CCRA INFRASTRUCTURE RISKS**	University of Leeds	2011 to 2016
	Delivery of cross cutting ARCC Projects: All in One – Feasibility analysis of supplying all services through one utility product.	**MOST CCRA INFRASTRUCTURE RISKS**	Cranfield University	2011 to 2016
	Delivery of cross cutting ARCC Projects: CLUES – Challenging Lock-in through Urban Energy Systems.	**MOST CCRA INFRASTRUCTURE RISKS**	University College London	2011 to 2016
	Delivery of cross cutting ARCC Projects: STEP-CHANGE – Sustainable Transport Evidence and modelling Paradigms: Cohort Household Analysis to support New Goals in Engineering design.	**MOST CCRA INFRASTRUCTURE RISKS**	University of Birmingham	2011 to 2016
	Delivery of cross cutting ARCC Projects: Retro-fit2050 – Re-engineering the city 2020-2050: Urban foresight and transition management.	**MOST CCRA INFRASTRUCTURE RISKS**	University of Cardiff	2011 to 2016
	Delivery of cross cutting ARCC Projects: Infrastructure Business Models.	**MOST CCRA INFRASTRUCTURE RISKS**	Academia – various	2011 to 2016

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 8: To develop regulatory frameworks to support and promote a resilient and adaptive infrastructure sector.				
WA3 Reduction in water available for public supply **EN1 Energy infrastructure at significant risk of flooding** **FL11b Sub-stations at significant risk of flooding** **FL8a/b Roads/Railways at significant risk of flooding** **FL11a Power stations at significant risk of flooding** **WA10 Combined Sewer Overflow spill frequency** **TR1 Disruption to road traffic due to flooding** **WA3 Reduction on water available for public supply** **WA5 Public water supply demand deficits** WA10 Combined Sewer Overflow spill frequency WA6 Population affected by water supply-demand pressures EN10 Energy transmission efficiency capacity losses due to heat – over ground TR2 Landslide risks on the road network TR5 Rail buckling risk	**1 – Cross Cutting**			
	1(a) – Policy			
	To share knowledge on climate change adaptation amongst the cross-sector Joint Regulators Group on regulatory approaches to adaptation, via seminars and other collaborations.	**ALL**	Ofgem, Ofwat, Office of Rail Regulation, Civil Aviation Authority	2013
	1(b) Delivery			
	To assess risks to electricity generation related to water use (e.g. considering future issues such as water use in Carbon Capture and Storage); Energy UK's continued representation on Defra's Abstraction Reform Advisory Group.	EN4	Environment Agency partnership project with Energy UK, Department of Energy and Climate Change	2013 to 2014
	2 – Energy			
	2(a) – Policy			
	To develop a regulatory framework that actively supports a resilient and adaptive energy infrastructure sector through: • Ofgem's Impact Assessment guidance; and • advice on the next Price Control Review. (RIIO – ED1) covering Distribution Network Operators (DNOs).	**EN1, FL11a/b,** EN10, EN4, EN3	Ofgem, Ofwat, Office of Rail Regulation, Civil Aviation Authority	2013 to 2014
	The Department of Energy and Climate Change to consider promoting climate resilience through the Strategy and Policy Statement for Ofgem that will replace the existing Social and Environmental Guidance, subject to passage of the second session Energy Bill.	**EN1, FL11a/b,** EN10, EN4, EN3	Department of Energy and Climate Change	2014 to 2015
	2(b) Delivery			
	To integrate climate resilience into Distribution Network Operators business planning for electricity distribution price control review (RIIO – ED1) and to implement actions.	**EN1,** EN10	Distribution Network Operators, Energy Networks Association	2013 to 2023

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
EN4 Risk of restrictions in water abstraction for energy generation TR4 Cost of carriageway repairs due to high summer temperatures TR6 Scouring of road and rail bridges EN3 Heat related damage/disruption to energy infrastructure BU5 Loss of productivity due to ICT disruption WA6 Population affected by water supply-demand pressures	**3 – Transport**			
	3(a) – Policy			
	The Department for Transport to incorporate climate change resilience into transport regulator frameworks, to ensure action is taken via the Office of Rail Regulation and the Civil Aviation Authority.	**FL8b,** TR5	Department for Transport	2013 onwards
	3(b) Delivery			
	To work in partnership to continually develop and enhance extreme weather resilience management for rail infrastructure. (To be monitored at high level.)	TR5, TR6, FL8b	Network Rail, Office of Rail Regulation, Department for Transport	Control Period 4 and Control Period 5 2014 - 2019
	To support 'Tomorrow's Railways and Climate Change Adaptation' research programme to: • further assess risks posed by projected climate change including track buckling and bridge scour; • incorporate findings into Control Period 5 (2014/2019); • monitor at the highest level; and • enhance understanding and communication of these risks to the sector.	TR5, TR6	RSSB, Network Rail, Office of Rail Regulation, Department for Transport	Control Period 5: 2014-2019
	4 – Water			
	4(a) – Policy			
	To develop a regulatory framework that actively supports a resilient and adaptive water infrastructure sector.	**WA10,** WA6, EN4	Defra, Ofwat	
	Defra to integrate climate resilience into Strategic Policy Statement and Social and Environmental Guidance for Ofwat and to implement guidance. Ofwat to consult on new approaches to regulating water efficiency and leakage.	**WA3, WA5,** WA6, **WA10**	Defra, Ofwat	2013 to 2014
	The Environment Agency (EA) to ensure Water Resource Management Plans meet EA and Ofwat guidance.	**WA10,** WA6, EN4	Environment Agency	2013 to 2014
	4(b) Delivery			
	Water companies to integrate climate resilience into business planning for the 2014 Water Pricing Review (PR14).	**WA3, WA5,** WA6, **WA10**	Water companies	2013 to 2014
	5 – Academia			
	5(a) Policy / 5(b) Delivery			
	To make full use of academic knowledge (e.g. through the Engineering and Physical Sciences Research Council-funded ARCC network) that can feed into wider regulatory activity; e.g. ARIES, RESNET, CLUES, ARCC Water, Transforming Utility Conversion.	**ALL**	Academia	2013 to 2016

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 9: To better understand the particular vulnerabilities facing 'local' infrastructure (e.g. local highways) from extreme weather and long term climate change so as to determine actions to address the risks.				
EN1 Energy infrastructure at significant risk of flooding **FL11b Sub-stations at significant risk of flooding** **FL8a/b Roads/Railways at significant risk of flooding** **WA10 Combined Sewer Overflow spill frequency** **TR1 Disruption to road traffic due to flooding** WA6 Population affected by water supply-demand pressures BE2 Increased subsidence risk due to rainfall changes TR2 Landslide risks on the road network TR5 Rail buckling risk TR4 Cost of carriageway repairs due to high summer temperatures TR6 Bridge Scour EN3 Heat related damage/disruption to energy infrastructure BU5 Loss of productivity due to ICT disruption [TRANSPORT RISKS CAVEAT: All the CCRA transport risks were identified for national/strategic transport, rather than for local infrastructure so these risks may not be the same for local transport.]	**1 – Cross Cutting**			
	1(a) – Policy			
	To support the Local Government Association's Climate Local initiative as a means of signposting advice, tools and examples that can help councils take action to improve the resilience of local transport and energy infrastructure.	**FL8a/b, WA10, TR1,** TR2, TR4, TR5, BE2, TR6	Environment Agency Climate Ready	2013 onwards
	1(b) Delivery			
	Climate UK, with Environment Agency Climate Ready support, to promote the use of Climate Local Transport and Energy guides.	**EN1,** EN3, **FL8a, FL8b, TR1,** TR2, TR3, TR4	Climate UK and Environment Agency Climate Ready	2013 onwards
	2 – Energy			
	2(a) – Policy			
	No actions identified with this objective at present.			
	2(b) Delivery			
	No actions identified with this objective at present.			
	3 – Transport			
	3(a) – Policy			
	To use existing local organisations and networks such as ADEPT, UK Roads Liaison Group, Climate UK and Local Adaptation Advisory Panel to share knowledge and best practice with respect to local highways.	FL8a, FL8b,WA10, TR1, TR2, TR4, TR5, TR6, BE2	Department for Transport, local organisations and networks (e.g. ADEPT, UKRLG, Climate UK, Local Adaptation Advisory Panel)	2013 onwards
	3(b) Delivery			
	Transport for London to consider the feasibility of a comprehensive flood risk review for the London Underground network, taking into account predicted changes to rainfall patterns.	**EN1, FL8b,** TR5	Transport for London	2013 onwards
	Environment Agency, Climate UK, ADEPT and Department for Transport to build capacity of local highways engineers and other relevant spatial planning and flood risk practitioners on climate resilience.	**FL8a, Fl8b, WA10, TR1,** TR2, TR4, TR5, BE2, TR6	Environment Agency, Climate UK, Derpartment for Transport and ADEPT	2013

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	4 – Water			
	4(a) – Policy			
	No actions identified with this objective at time of publication.			
	4(b) Delivery			
	Water companies to share experience in managing Combined Sewer Overflow (CSO) surface water / flood risks, customer engagement, development of Sustainable Drainage Systems and in the use of innovative solutions and partnership working.	**WA10**	Water companies and Water UK	2013 onwards
	To approve drainage systems in new developments and redevelopments, especially where these relate to highways, before construction can begin, in accordance with Sustainable Drainage System National Standards. (To follow after Government implements Schedule 3 of the Flood and Water Management Act 2010, in April 2014.)	**FL8a, WA10**	Local Authority Sustainable Drainage System Approving Body (SAB)	2014 onwards
	Local authorities and water companies to take forward pluvial flood risk management through partnership working under the Flood and Water Management Act 2010 and the duty to cooperate. To publish surface water flood maps by end 2013.	**FI8a**	Local Authorities and water companies	2013 onwards
	5 – Academia			
	5(a) – Policy and delivery			
	To complete and disseminate academic knowledge (e.g. through the Engineering and Physical Sciences Research Council funded Adaptation and Resilience in a Changing Climate (ARCC) network) that can feed into local policy and delivery e.g. using Retrofit2050, STEP-CHANGE projects.	**ALL**	Adaptation and Resilience in a Changing Climate (ARCC) network, Academia	2013 onwards
	ARCC project: Retrofit 2050. Re-engineering of the city 2020-2050 – urban foresight and transition management.	**FL8a, FI8b, TR1,** TR2, TR4, TR5, BE2	Adaptation and Resilience in a Changing Climate (ARCC) network, Academia – Cardiff University	2013 to 2014
	ARCC project: STEP-CHANGE. Sustainable Transport evidence and modelling Paradigms: Cohort Household Analysis to support New Goals in Engineering design.	**FL8a, FI8b, TR1,** TR2, TR4, TR5, BE2	Adaptation and Resilience in a Changing Climate (ARCC) network, Academia – University of Birmingham	2013 to 2014

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	ARCC project: Futurenet. Research to inform future resilient transport networks.	**FL8a, FI8b, TR1,** TR2, TR4, TR5, BE2	Adaptation and Resilience in a Changing Climate (ARCC) network, Academia – University of Birmingham	Completed by 2013
Objective 10: To develop understanding and promote expertise in managing interconnected and interdependent services to minimise the risks of cascade failures which could be exacerbated by climate change; and identify how systems thinking can support this objective.				
WA3 Reduction in water available for public supply **EN1 Energy infrastructure at significant risk of flooding** **FL11b Sub-stations at significant risk of flooding** **FL8a/b Roads/Railways at significant risk of flooding** **FL11a Power stations at significant risk of flooding** **TR1 Disruption to road traffic due to flooding** **WA5 Public water supply demand deficits** **WA10 Combined Sewer Overflow spill frequency** EN10 Energy transmission efficiency capacity losses due to heat – over ground TR2 Landslide risks on the road network EN4 Risk of restrictions in water abstraction for energy generation	**1 – Cross Cutting**			
	1(a) – Policy			
	Environment Agency Climate Ready service to develop a more consistent approach to assessing climate risk and enable the Infrastructure Operators' Adaptation Forum to share approaches on and discuss interdependencies between infrastructure systems; to manage a number of barriers highlighted in the reports prepared by organisations through the first round of the Adaptation Reporting Power (ARP).	**FL8a/b, FL11a/b, EN1,** EN10, BU5, EN3, EN4	Infrastructure Operators Adaptation Forum and Environment Agency Climate Ready	2013 to 2015
	Infrastructure UK to develop knowledge on interdependencies and systems-thinking through the Interdependencies Planning and Management Framework and Infrastructure Policy Time-lines project.	**ALL CCRA INFRASTRUCTURE RISKS**	Infrastructure UK	2013 to 2014
	1(b) Delivery			
	To support the spread of expertise and knowledge in managing cascade failure risks amongst organisations and umbrella groups at local and regional levels. To showcase good examples of joint-working on interdependencies through information presented on the Environment Agency's Climate Ready website.	**FL8a/b, FL11a/b, EN1, EN10,** BU5, EN3, EN4	Environment Agency, Climate UK, Infrastructure Operators Adaptation Forum, Academia	2013 to 2016
	To address interdependencies via regional or sub-regional analysis, knowledge sharing, and via capacity building activity.	**WA10,** WA6	Climate UK Infrastructure theme	2013 to 2016
	The Institute of Environmental Management and Assessment to update their advice resources (e.g. Environmental Impact Assessment (EIA) and climate change hub, a new EIA advice note that addresses climate resilient infrastructure) and start a targeted communications campaign to manage interdependency risks between infrastructure and the environment.	**ALL CCRA INFRASTRUCTURE RISKS**	Institute of Environmental Management and Assessment	2013 to 2016

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
EN3 Heat related damage/disruption to energy infrastructure BU5 Loss of productivity due to ICT disruption WA6 Population affected by water supply-demand pressures	**2 – Energy**			
	2(a) – Policy			
	No actions at this time.			
	2(b) Delivery			
	Environment Agency to improve understanding of how the energy sector's demand for water may change between now and 2050, to inform both the planned reform of abstraction licensing and future energy policy.	**WA3, WA5,** WA6	Environment Agency project in partnership with Energy UK (via Energy Emergency Executive Committee), Defra, Department of Energy and Climate Change, electricity generators	2013 to 2014
	3 – Transport			
	3(a) – Policy			
	No actions at this time.			
	3(b) Delivery			
	To support the Rail Safety and Standards Board funded Tomorrow's Railway and Climate Change Adaptation (TRaCCA) research programme, delivering assessment of system interdependencies.	FL8b, TR5, TR6	Rail Safety and Standards Board, Network Rail, Office of Rail Regulation, Department for Transport	2013 [T1009 TRaCCA 2013 to 17]
	4 – Water			
	4(a) – Policy			
	No actions at this time.			
	4(b) Delivery			
	To address dependency risks through current work underway between Energy Network Organisations and water companies. For example Northumbria Water and National Grid/local distributor work to address interdependencies. (Similar work is ongoing with Anglian Water and UK Power Networks, to consider dependencies between energy and water treatment.)	**WA3, WA5,** WA6, **WA10, EN1**	Water companies, National Grid, Distribution Network Operators	2012 onwards

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	5 – Academia			
	5(a) – Policy			
	To collaborate on interdependencies with respect to systems thinking, arising from Engineering the Future 'Timelines' project in conjunction with Infrastructure UK and associated evidence projects in academia such as under the Adaptation and Resilience in a Changing Climate (ARCC) network (e.g. Infrastructure Transitions Research Consortium (ITRC) and development of new infrastructure business models centres).	**ALL CCRA INFRASTRUCTURE RISKS**	Infrastructure UK, Engineering the Future, ARCC network	2013
	5(b) Delivery			
	To provide evidence to help infrastructure operators and policy makers to address cascading failure risks, through delivery of the Infrastructure Transitions Research Consortium.	**ALL CCRA INFRASTRUCTURE RISKS**	Infrastructure Transitions Research Consortium	2011 to 2015

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Healthy and Resilient Communities

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 11: To reduce the risk of death and illness associated with severe weather events and climate change and increase preparedness and resilience to the impacts on public health.				
HE1 Summer mortality due to higher temperatures **BE3 Overheating of Buildings** **HE2 Summer morbidity due to higher temperatures** **MA2a Decline in marine water quality due to sewer overflows** **HE9 Sunlight/UV Exposure** **HE10 Effects of floods/storms on mental health**	To promote and implement the Heatwave Plan for England (reviewed annually): By 2014 the Plan will improve its reach to local authorities and include advice on action beyond the health sector, for example on the role of blue and green infrastructure, housing design and transport in helping reduce health risks associated with overheating and air pollution during heatwaves. Individuals, groups and communities most susceptible to heat impacts will also be actively targeted. PHE will explore the relevance of these plans to other extreme weather events using an all hazards approach. The Heatwave Plan will also include advice on avoiding over-exposure to UV.	**HE1, HE2,** BE3, HE4a/b, **BE1, HE9**	Department of Health, Public Health England, Government with Local Authorities, communities, civil society and others involved	By 2014
FL2 Vulnerable people at significant risk of flooding **FL12a Hospitals at significant risk of flooding** **BE1 Urban Heat Island effect** HE3 Extreme weather event (flooding and storms) mortality	To promote and implement the Cold Weather Plan for England.	Non-CCRA risks: cold snaps	Department of Health, Public Health England, Government with Local Authorities, communities, civil society and others involved	Reviewed annually
HE7 Extreme weather event (flooding and storms) injuries HE4a Mortality due to summer air pollution (ozone) HE4b Morbidity due to summer air pollution (ozone) BD12 Wildfires due to warmer and drier conditions MA2b Risks of human illness due to marine pathogens MA1 Risk of Harmful Algal Blooms due to changes in ocean stratification	The Sustainable Development Unit for the National Health Service (NHS), public health and social care system to: a) continue to promote adaptation action across the NHS as part of Board level Sustainable Development Management Plans (SDMPs), further underpinned by the requirement to develop SDMPs under the Department of Health Public Health Outcomes Framework; and b) report to Government on progress for the climate change component of SDMPs under the Adaptation Reporting Power of the Climate Change Act 2008.	**ALL CCRA HEALTH RISKS**	National Health Service Sustainable Development Unit, National Health Service England, Department of Health, Public Health England	a) Ongoing b) June – July 2015

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Risks additional to CCRA Tier 2 • health impacts of all severe weather events associated with climate change including cold weather snaps • aeroallergens • water and food-borne diseases • vector-borne diseases • indoor environment	To implement local, evidence-based actions to address health risks from climate change and to prepare, respond and recover to severe weather events associated with climate change, for example through Joint Strategic Needs Assessments, Joint Health and Wellbeing Strategy and Local Health Resilience Partnerships.	**ALL CCRA HEALTH RISKS**	Directors of Public Health, health & wellbeing boards, Clinical Commissioning Groups	April 2013 onwards
	To continue to use NHS Emergency Planning Guidance 2005, Department of Health NHS Emergency Planning Guidance 2009: planning for the psychological and mental health care of people affected by major incidents and disasters; Public Health England advice and evidence on mental health impacts of flooding.	HE3, **HE10, FL2** and **HE1, HE2**	Department of Health, National Health Service England, Public Health England	Ongoing
	The Environment Agency Climate Ready service to develop, pilot and test a health adaptation tool, specifically geared to the needs of the health sector.	**ALL CCRA HEALTH RISKS**	Environment Agency Climate Ready	2013 to 2014
	To support community resilience through promotion and implementation of: a) The National Flood Emergency Framework for England (health impacts integrated) and Local Multi-Agency Flood Plans; b) National Recovery Guidance, Strategic Co-ordinating Groups, local Recovery Coordination Groups; c) Local Health Resilience Partnerships; and d) Public Health England for evidence base, technical support, guidance and materials and public health intelligence.	HE3, **HE10, FL2**	a) HMG, Defra, Department of Health, Public Health England and Local Resilience Forums b) Local Authorities, Local Resilience Forums, Cabinet Office, Department for Communities and Local Government	a) by end of 2013 for national framework b) ongoing c) from April 2013 onwards d) ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
			c) Local Authority Directors of Public Health, Department of Health, National Health Service England d) Public Health England	
	The Environment Agency Climate Ready team to support the Local Government Association's Climate Local initiative, signposting advice, tools and examples that can help councils to address health risks.	**ALL CCRA HEALTH RISKS**	Environment Agency Climate Ready, Public Health England	2013 onwards
	To continue to use the Strategic Health Asset Planning & Evaluation toolkit (SHAPE): mapping flood risk to health and social care infrastructure and developing its potential.	HE3, **HE10, FL2**	Department of Health, National Health Service, Environment Agency, Public Health England	Ongoing
	To tackle emissions of ground level ozone precursors: Defra to continue to work with international and UK partners to reduce emissions of pollutants leading to transboundary air pollution through, for example, the Gothenburg Protocol. Defra, Department of Health and Public Health England will work with councils to encourage action to support co-benefits between climate change and air quality, and encourage it to be taken into account when taking local action to improve air quality.	HE4a/b	Defra, Department of Health, Public Health England	Ongoing
	Defra to produce better-targeted air pollution information and advice that reaches people most susceptible to the associated health impacts.	HE4a/b	Defra with interest from Department of Health, Local Authorities, Public Health England, civil society groups	Ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Defra to support further research into how climate change might impact the formation of ground level ozone in the UK.	HE4a/b	Defra, with interest from Public Health England	Commissioning from 2013
	Public Health England, with the Met Office and partners, to produce targeted advice and research on aeroallergens such as pollen, and their effects on health; work led by Public Health England for evidence base, technical support, guidance, materials and public health intelligence.	Non CCRA: aeroallergens	Public Health England, Met Office and other partners	Ongoing
	The Environment Agency, Public Health England, Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Food Standards Agency (FSA) and the Marine Climate Change Impacts Partnership (MCCIP) to work together to: • improve understanding of the climate change impacts on marine and freshwater pathogens (such as Vibrios and norovirus); • improve understanding of the potential for increases in blooms and changes in patterns/frequency of harmful marine algae; and • develop strategies to reduce the associated risks.	MA1, **MA2a**&b	Environment Agency, Public Health England, Centre for Environment, Fisheries and Aquaculture Science, Food Standards Agency, Marine Climate Change Partnership	Ongoing
	Within high risk catchments, to reduce pathogen loads within rivers, lakes and coasts under policies set out in the Defra 'Water for Life' White Paper and the EU Water Framework and Bathing Water Directives.	MA1, **MA2a**&b	Environment Agency, Defra and partners	Ongoing
	Defra to support targeted early warnings of marine/freshwater pathogens to recreational and shellfisheries users, warnings from water companies for Combined Sewer Overflow discharges.	MA1, **MA2a**&b	Defra, water companies, Environment Agency, Food Standards Agency, Centre for Environment, Fisheries and Aquaculture Science, Public Health England	Ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	To implement environmental and public health surveillance that has the capability to detect and monitor exposure and health risks from freshwater/marine pathogens and Harmful Algal Blooms, in addition to algal toxins associated with climate change.	MA1, MA2b	Defra, Food Standards Agency, Centre for Environment, Fisheries and Aquaculture Science, Public Health England, Department of Health, Environment Agency, water companies, Drinking Water Inspectorate, Local Authorities	Ongoing
	To implement early warning and scanning surveillance systems for endemic and invasive vector species and vector borne diseases which will help monitor how climate change is affecting abundance and distribution of endemic vectors (including human exposure), and whether non-native species are becoming established.	Non CCRA: Vector-borne diseases	Public Health England, Animal Health and Veterinary Laboratories Agency, Environment Agency and partners	Ongoing
	To provide surveillance and epidemiology of food borne illness, examine trends and new risks including climate change and to identify and manage outbreaks.	Non CCRA: Food-borne diseases	Public Health England, working with Food Standards Agency	Ongoing
	The Food Standards Agency, Defra, Public Health England and the food industry to work in partnership to reduce food borne illness through the promotion of good practice both in the food industry and in the home through initiatives such as the Food Standard Agency's Food Hygiene Campaign and Food-borne Disease Strategy. To also research how climate change may influence the risk from food-borne illness.	Non CCRA: Food-borne diseases	Public Health England, Food Standards Agency, Defra and partners, such as food industry	Ongoing
	Maintain and, where possible, expand real-time UV monitoring that is available to the public for their own protection.	**HE9**	Public Health England, with partners	Ongoing

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 12: To promote climate resilience within the NHS, public health and social care system to ensure continuity of services and resilient assets/estates including the ability to deal with the increased demand for services associated with severe weather related events.				
HE1 Summer mortality due to higher temperatures **BE3 Overheating of buildings** **HE2 Summer morbidity due to higher temperatures** **HE10 Effects of floods/storms on mental health** **FL2 Vulnerable people at significant risk of flooding** **FL12a Hospitals at significant risk of flooding**	To support community resilience through: a) Civil Contingencies Act 2004; continued promotion and implementation of National Health Service Emergency Planning Guidance 2005; Department of Health to promote and implement National Health Service Emergency Planning Guidance 2009: planning for the psychological and mental health care of people affected by major incidents and disasters: interim national strategic guidance; b) Continued promotion and implementation of Department of Health, Public Health England Heatwave Plan and Cold Weather Plans; and c) Get Ready for Winter initiative	**HE10, FL2,** HE3, HE7 and **HE1, HE2** and cold snaps	a) National Health Service England, Department of Health b) Department of Health, Public Health England c) cross-Government, multi-agency, civil society, communities	Ongoing
BE1 Urban Heat Island effect **EN2 and BE9 Increased energy demand for cooling** HE3 Extreme weather event (flooding and storms) mortality HE7 Extreme weather event (flooding and storms) injuries HE4a Mortality due to summer air pollution (ozone) HE4b Morbidity due to summer air pollution (ozone) BD12 Wildfires due to warmer and drier conditions **Risks additional to CCRA Tier 2** • health impacts of all severe weather events associated with climate change including cold weather snaps • water and food-borne diseases • vector-borne diseases	To support community resilience through: a) National Flood Emergency Framework for England (Health impacts integrated) and Local Multi-Agency Flood Plans; b) National Recovery Guidance; and c) Local Health Resilience Partnerships.	HE3, HE7, **HE10, FL2, FL12a**	a) HMG, Defra, Department of Health, Public Health England, Environment Agency and Local Resilience Forums b) Cabinet Office, Department for Communities and Local Government c) Local Authority Directors of Public Health, Department of Health, National Health Service England	a) by end of 2013 for national framework b) ongoing c) from April 2013 onwards

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Public Health England (PHE) to promote and disseminate PHE information and guidance notes on health impacts of flooding, evidence, technical support and related public health intelligence.	**HE10, FL2**	Public Health England with involvement of Department of Health, Environment Agency, Local Authorities, Directors of Public Health, National Health Service England	Ongoing
	Strategic Health Asset Planning & Evaluation toolkit (SHAPE) development, including mapping of flood risk to health and social care infrastructure.	**FL12a,** HE3, HE7, **HE10, FL2**	National Health Service, Department of Health, Environment Agency, Public Health England	Ongoing
	National Health Service Premises Assurance Model (PAM) to strengthen climate resilience matters.	**FL12a, BE3**	Department of Health, National Health Service	Ongoing (2013 to 2015)
	Climate resilience reporting in National Health Service estates and business continuity information frameworks development, including Estates Returns Information Collection and Resilience of Estates and Facilities Services data collections.	**FL12a, BE3**	Department of Health, National Health Service Information Centre, National Health Service	Ongoing (2013 to 2015)
	ARCC Project 'Design and Delivery of Robust Hospital Environments in a Changing Climate' research project is: • assessing the potential increase in energy demand for mechanical cooling in hospitals unless low-energy refurbishment strategies are deployed; • investigating the increased demand for mechanical cooling in hospitals and the need to exploit low energy cooling techniques; • studying current and future overheating risk in representative 'type' hospital buildings and assessing costed refurbishment options; and • analysing the use of intermediate green spaces to help cool hospital buildings. www-edc.eng.cam.ac.uk/robusthospitals/	**EN2**	Cambridge University	Project completion in 2013-2014; film to capture main findings 2013

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	To keep climate resilience issues under review within national best practice guidance for the design, engineering and operation of healthcare facilities.	**FL12a, BE3**	Department of Health, National Health Service	Ongoing
Objective 13: To minimise the impact of climate change on vulnerable groups in society by strengthening their resilience to better prepare for, respond to and recover from future climate risk.				
ALL RISKS IDENTIFIED IN CCRA HEALTH AND WELLBEING CHAPTER.	Environment Agency Climate Ready team to support the Local Government Association's Climate Local initiative, signposting advice, tools and examples that help councils address risks to vulnerable groups.	**MANY CCRA RISKS**	Environment Agency Climate Ready	2013 onwards
	Environment Agency Climate Ready team to continue to share information and promote understanding of the risks to different vulnerable groups, specifically including: • supporting local councils through the dissemination of tools and guidance on how to map vulnerable groups and best communicate with communities; and • supporting and disseminating learning about the gaps and barriers which exist for effective engagement with voluntary organisations on climate resilience work, using networks through the National Council for Voluntary Organisations.	**MANY CCRA RISKS**	Environment Agency Climate Ready, National Council for Voluntary Organisations	2013 onwards
	National Council for Voluntary Organisations to explore how to build its 'vulnerable people and climate change' programme to: • provide information for voluntary and community organisations about the likely impacts of climate change on their work and beneficiaries; • support voluntary organisations to incorporate climate change into strategic and operational planning; and • enable voluntary organisations to help shape and contribute to wider responses.	**MANY CCRA RISKS**	National Council for Voluntary Organisations	2013 to 2014

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 14: To promote and strengthen community resilience to severe weather related events linked to climate change (preparation, response and recovery), and the climate resilience of the emergency services and other Category 1&2 Responders of the Local Resilience Forums.				
ALL RISKS ASSOCIATED WITH SEVERE WEATHER EVENTS WHERE LOCAL RESPONDERS, EMERGENCY SERVICES AND COMMUNITY RESILIENCE CAN PLAY A ROLE	To support community resilience through: the Strategic National Framework on Community Resilience; and the Government Community Emergency Plan Toolkit. Government promotion of community resilience to current and future severe weather events working through Cabinet Office Community Resilience Programme, including cross-Whitehall coordination.	**MANY CCRA RISKS**	Cabinet Office, HMG and partners	Ongoing
	Environment Agency Climate Ready service to support the Local Government Association's Climate Local initiative to signpost advice, tools and examples that help councils build community resilience to the impacts of climate change.	**MANY CCRA RISKS**	Environment Agency Climate Ready	2013 onwards
	Local responders and Local Resilience Forums to promote and build community resilience to the impacts of extreme weather events and climate change.	**MANY CCRA RISKS**	Local Resilience Forums, local responders, communities and partners (e.g. Public Health England for evidence base, technical support on health impacts)	Ongoing
	Communities and civil society groups to take action to build resilience to extreme weather events and impacts of climate change.	**MANY CCRA RISKS**	Communities, civil society and voluntary groups	Ongoing
	To maintain the Community Resilience Knowledge Hub on the Emergency Planning College web portal, to allow sharing of best practice, case studies and tools.	**MANY CCRA RISKS**	Cabinet Office, HMG and partners	2013 onwards
	Fire & Rescue and Ambulance services to report on a voluntary basis to Government on progress to increase resilience to the impacts of climate change and respond to an increase in severe weather events.	**MANY CCRA RISKS**	Chief Fire Officers' Association, Association of Ambulance Chief Executives	By April 2014

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	Having published the *Vegetation Fire Risk Management and Control Measures,* the Forestry Commission to continue to help landowners reduce the likelihood and severity of vegetation fires in the UK. www.forestry.gov.uk/fr/INFD-7WKJDJ	BD12	Forestry Commission	Ongoing
	Forestry Commission to develop new guidance ('*Building Wildfire Resilience into Forest Management Planning*') to support the UK Forestry Standard and assist landowners to build resilience to wildfires.	BD12	Forestry Commission	2013 onwards
	Fire & Rescue Service to review local risks and the service's capability to deal with a severe wildfire, through their Integrated Risk Management Plan process.	BD12	Chief Fire Officers' Association, Fire and Rescue Service	Ongoing
	England and Wales Wildfire Forum (EWWF) to continue to provide a focus for public, private and third sector organisations to work together to reduce the effect of wildfire occurrences. EWWF are already: • issuing guidance to land managers to reduce the risk of wildfire occurrence; and promoting preparation of an effective response and recovery when they do occur; and • addressing the main gaps in wildfire knowledge and research.	BD12	Members of EWWF	Ongoing
	Get Ready for Winter Campaign to raise awareness of ways to reduce impacts of severe winter weather.	**HE 10, FL2, FL12a,** HE3, HE7	Cabinet Office, HMG and partners	Ongoing

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Agriculture and Forestry

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 15: To increase the resilience of agriculture by effectively managing the impact of volatility in the occurrence and severity of rainfall events on water availability, flooding, soil erosion and pollution due to runoff.				
AG5 Increases in water demand for irrigation of crops **FL4b Agricultural land at risk of regular flooding** AG4 Drier soils (due to warmer and drier summer conditions) AG2a Flood risk to high quality agricultural land WA8a Number of unsustainable water abstractions (agriculture) AG11 Increased soil erosion due to heavy rainfall AG7a Reduction in milk production due to heat stress AG7b Reduction in dairy herd fertility due to heat stress AG8a Increased duration of heat stress in dairy cows AG8b Dairy livestock deaths due to heat stress	Defra to complete research projects forming phase 1 of the evidence for future agriculture water demand and costs/benefits of adaptation actions to increase the resilience of the sector to changing water availability; and to identify and prioritise critical areas for further investigation and development.	AG11, **AG5,** AG2a, WA8a, AG4, **FL4b**	Defra	By September 2013
	Defra to consult on the reform of abstraction licensing to encourage abstractors such as farmers to use water more efficiently and share water, increasing resilience to climate change; and to look to introduce legislation to enact the new approach in the next Parliament. Implementation would then start as soon as possible once the new system has been piloted.		Defra	By December 2013
	Defra, through the Water Bill, to introduce reforms that will enable farmers and other potential suppliers to enter the competitive water supply market. The Bill will also provide ministers with powers to introduce regulations to make it easier for farmers and landowners to sell excess water from on-farm reservoirs and other water storage facilities direct to water companies.		Defra	Summer 2013
	Defra to complete a research project to establish the costs and benefits of Internal Drainage Boards taking an increased role in managing water availability risks (e.g. facilitation role in the uptake on-farm storage) to help define their wider role in water management moving forwards.		Defra	Initial study complete April 2013 (further work subject to findings)
	Following decisions on the direction of reform for the abstraction regulation system, Defra to review the available guidance and support for farmers to manage their water availability, considering whether there is a case for change in the light of reform and the need to adapt to climate change prior to introducing new legislation in the next Parliament.	**AG5,** AG2a, WA8a, **FL4b**	Defra	By 2015
	Defra to embed adaptation in the design and implementation for the next Rural Development Programme for England (2014 to 2020), focussing action where the risks are greatest, supporting skills development and knowledge exchange and ensuring RDPE investments continue to offer good value for money.	AG11, **AG5,** AG2a, WA8a, AG4, **FL4b**	Defra	By end 2013

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Natural England to test Farm Resilience Plans to provide farmers with a way of identifying the potential impacts of climate change on their farm. The results of the pilot will be used to inform development of agri-environment and advice programmes in the next Rural Development Programme for England.	AG11, **AG5,** AG2a, WA8a, AG4, **FL4b**	Natural England	By end 2013
	Defra to complete a review into the status of the UK's aging drainage infrastructure to inform future action. The review includes farmers' perceptions of drainage quality, the need for maintenance and the ecosystem services delivered by drainage or the lack thereof.	AG2a, AG11	Defra	Review complete July 2013
	Defra to complete a review of the Soil protection Review (under pillar 1 of the CAP) by the end of 2013 to provide baseline protection for agricultural soils, ensuring soils are as resilient as possible.	AG4, AG11	Defra	End 2013
	Defra, the Environment Agency and Natural England to ensure measures championed by Catchment Sensitive Farming account for future climate change, making farming businesses more resilient.	AG11	Defra, Environment Agency, Natural England	Ongoing
	Environment Agency Climate Ready service to liaise with agriculture and forestry practitioners to develop, promote and embed adaptation good practice, common messages, tools and guidance within the industry.	**ALL AGRICULTURE AND FORESTRY RISKS IN CCRA**	Environment Agency Climate Ready	Until March 2015
	Environment Agency Climate Ready service to work with forestry partners to support adaptation skills provision within the sector.	**ALL FORESTRY RISKS IN CCRA**	Environment Agency Climate Ready	Until March 2014
	Environment Agency Climate Ready service to work with agriculture and business sector partners to test and promote guidance to increase resilience of supply chains to climate change.	**ALL AGRICULTURE RISKS IN CCRA**	Environment Agency Climate Ready	Until March 2014
	Environment Agency Climate Ready service to work with agriculture industry partners to develop and promote adaptation activity as part of a network of demonstration farm activity.	**ALL AGRICULTURE RISKS IN CCRA**	Environment Agency Climate Ready	Until March 2015
	Through the next phase of the agriculture industry's Campaign for the Farmed Environment (CFE), the National Farmers Union, working with Agriculture and Horticulture Development Boards and other interested parties, to build national awareness of the priorities for climate change adaptation and disseminate locally those customised practices considered to be most relevant to the circumstances of farming enterprises in each.	**ALL AGRICULTURE RISKS IN CCRA**	National Farmers Union, Agriculture and Horticulture Development Board	Ongoing

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Defra to encourage development of climate change resilient livestock production systems (particularly for dairying) through support funding under successor arrangements to the Rural Development Programme for England scheme. Also to work with Cattle Health and Welfare Group (CHAWG) to encourage appropriate good practice amongst dairy farmers.	AG7a/b, AG8a/b	Defra	2014
	Defra to develop plausible scenarios and establish a methodology for estimating the economic impact of extreme weather on agriculture and assess the robustness of adaptation actions taken by farmers.	AG11, **AG5,** AG2a, WA8a, AG4, **FL4b**	Defra	Initial study complete April 2013 (further work subject to findings)
Objective 16: To increase the resilience of the forestry sector by increasing the level of management in England's woodlands and the uptake of adaptation good practice in woodland creation and restocking.				
ALL FORESTRY-RELATED RISKS HIGHLIGHTED BY THE CCRA, BUT MOST NOTABLY: **FO1a Forest extent affected by Red Band Needle Blight** **FO4a Decline in potential yield of beech trees in England** **FO1b Forest extent affected by green spruce aphid** **FO2 Loss of forest productivity due to drought** AG11 Increased soil erosion due to heavy rainfall AG4 Drier soils (due to warmer and drier summer conditions BD12 Wildfires due to warmer and drier conditions	Government and the Forestry Commission to implement main actions from Government's Forestry and Woodlands Policy Statement: • aiming to increase the area of woodland in active management to 66% by 2018 • exchanging knowledge with advisors from across the sector on how to take a low burden, risk-based approach to implementing the UK Forestry Standard; • working with businesses and civil society to increase the total capacity and capability available to provide targeted advice about woodland management; • publishing research on the potential impact of different ways of incentivising landowners to manage and create woodland; and • working with businesses on industry-led actions which increase the amount of timber being sold and help woodland owners manage their woodlands.	**ALL FORESTRY RISKS IN CCRA**	Defra, Forestry Commission	Ongoing
	Defra and the Forestry Commission to work with businesses on industry-led actions, through 'Grown in Britain', to increase the amount of British timber being sold and to help owners manage their woodlands.	**ALL FORESTRY RISKS IN CCRA**	Defra, Forestry Commission England	Ongoing
	The Forestry Commission to review the woodland management position in 2018, in conjunction with the sector, and to decide whether further joint action is necessary to bring more woodland under management.	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England	2018
	The Forestry Commission to support the Royal Forestry Society to include an Urban Forestry category in their 'Excellence in Forestry' Awards.	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England	2013

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	The Forestry Commission to: • continue to implement the Natural Environment White Paper and Biodiversity 2020, including by encouraging woodland management and creation that helps conserve and enhance wildlife; and • work with the sector to find new ways of encouraging landowners to plant more trees where it best suits them and their local conditions.	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England	Ongoing
	The Forestry Commission to pilot an approach that would reduce the regulatory burden on landowners wishing to plant woodland, by clarifying where a full Environmental Statement is unlikely to be required.	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England	2014
	The Forestry Commission to: • introduce a carbon registry and a group scheme for the Woodland Carbon Code, to support further work on carbon accounting in wood products and underpin new woodland planting in guidance to businesses on reporting greenhouse gas emissions and reductions; • work with other organisations and initiatives to support the further development of markets in forest carbon and other ecosystem services such as water and biodiversity; • publish new guidance on Building Wildfire Resilience into Forest Management Planning, to support implementation of the UK Forestry Standard; and • develop contingency plans for major fire and windstorm events.	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England	2013
	The Forestry Commission to continue to implement the Climate Change Action Plan for the Public Forest Estate, including a focus on: • increased diversification to reduce risk; • managing carbon within the forest; and • planning for the unexpected.	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England	Ongoing implementation, will be reviewed in 2016; 5 year plan started in 2011
	Defra, the Forestry Commission and Natural England to ensure that adaptation and resilience are supported by the design and implementation of forestry measures in the next Rural Development Programme for England (2014 to 2020).	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England, Defra, Natural England	2014 to 2020

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Members of the England Woodland Timber Partnership (EWTP) to develop an action plan and implement the actions accordingly, covering: • outreach and guidance – embedding messages and disseminating useful information; • promotion of best practice, standards and guidelines; • identification of species to support diversification and adaptation; • knowledge transfer; • enabling inter-departmental coherence regarding the forestry sector; and • ensuring education and training frameworks are appropriate.	FO1a, AG11, AG4, **FO4a,** BD12, **FO1b, FO2**	England Woodland Timber Partnership	Until 2015
	Forestry Commision England to implement voluntary Adaptation Reporting Power Report 'Climate Change Risk Assessment – Forestry Commission England Invited Report' under the terms of the Reporting Powers of the Climate Change Act (2008).	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission England	Ongoing
	Defra and Forestry Commission England to promote UK Forestry Standard Forests and Climate Change Guidelines.	**ALL FORESTRY RISKS IN CCRA**	Defra, Forestry Commission England	Ongoing
Objective 17: To increase resilience to pests and disease to help protect biodiversity, maintain agricultural and forestry productivity and protect the UK's ability to export products.				
FO1a Forest extent affected by Red Band Needle Blight **FO1b Forest extent affected by green spruce aphid** AG3 Risk of crop pests and diseases BD3 Risk of pests to biodiversity BD4 Risk of disease to biodiversity	Defra and the Forestry Commission to implement main actions from Government's Forestry and Woodlands Policy Statement, including: • giving greater priority to tree and plant health than ever before; • reviewing the arrangements and resources needed for tree health in light of the final report of the Tree Health and Plant Biosecurity Expert Taskforce; and • implementing the Chalara Management Plan with the Food and Environment Research Agency and others.	**ALL FORESTRY RISKS IN CCRA**	Defra, Forestry Commission England, Food and Environment Research Agency	Ongoing; Tree Health and Plant Biosecurity Expert Taskforce Final Report: end of 2013
	The Food and Environment Research Agency, working with Defra and the Chemicals Regulation Directorate to review the extent to which current plant health protection programmes integrate climate risk, to establish where further evidence is required. Findings will be presented to the UK Plant Strategy Board, and the UK Plant Health and Varieties and Seeds Advisory Boards, to agree necessary follow-on work.	AG3	Food and Environment Research Agency	2013
	Defra to implement the research and evidence theme of the Tree Health and Plant Biosecurity Action Plan.	**FO1a, FO1b,** AG3	Defra	Spring 2015

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Independent Tree Health and Plant Biosecurity Expert taskforce, convened by Defra's Chief Scientific Adviser, to look at ways to prevent pests and diseases from entering the country in the future and to better manage those already present.	**FO1a, FO1b,** AG3	Defra	Task Force to report in May 2013; Government to respond summer 2013
	The Food and Environment Research Agency to embed impact of future environmental change in all pest risk assessments carried out on new pest and disease threats to UK plants.	**FO1a, FO1b,** AG3	Food and Environment Research Agency	Ongoing
	Defra, with other funders in the Living With Environmental Change partnership, to initiate a Tree Health and Plant Biosecurity Research Initiative. The initiative will provide interdisciplinary research to support the health and resilience of UK trees, woodlands and their associated biodiversity and ecosystem services in a changing environment.	**FO1a, FO1b**	Defra, Living With Environmental Change partnership	Ongoing
	The Living With Environmental Change partnership, through the development of a Tree Health Programme, to invest in research that will further our understanding of the influence and impact of climate change on pests and disease and of the development of adaptive control strategies.	**FO1a, FO1b**	Living With Environmental Change partnership	January 2014 to December 2019
	Defra to fill gaps in the evidence base of the direct effects of climate change on endemic livestock pests and disease to better inform future monitoring, surveillance and adaptation action.	No risk metric in CCRA	Defra	Ongoing
	Defra to lobby the European Commission to increase its capacity to anticipate and monitor new and emerging exotic livestock diseases across Europe through regular research funding into future threats and increased surveillance activity.	No risk metric in CCRA	Defra	Ongoing
	Defra, working with the Animal Health and Veterinary Laboratories Agency, the Food and Environment Research Agency, Natural England's wildlife and wild bird specialists, to identify and assess emerging threats to biodiversity as a result of climate change.	BD3, BD4	Defra	Ongoing
	Defra to review the Invasive Non-native Species Framework Strategy for Great Britain (2008).	**ALL AGRICULTURE AND FORESTRY RISKS IN CCRA**	Defra	By end of 2014

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Defra to continue to consider where the threats from plant pests and pathogens might relate to poorly managed adaptation of invasive non-native species and identify the appropriate action.	**ALL AGRICULTURE AND FORESTRY RISKS IN CCRA**	Defra	Ongoing
Objective 18: To embed climate change adaptation into agriculture, horticulture and forestry research programmes to improve knowledge of likely climate impacts and ensure timely development and uptake of relevant technology alongside well adapted crops, tree and livestock species.				
ALL AGRICULTURE AND FORESTRY RISKS AND OPPORTUNITIES IDENTIFIED IN THE CCRA BUT MOST NOTABLY: **AG5 Increases in water demand for irrigation of crops** AG2a Flood risk to high quality agricultural land AG3 Risk of crop pests and diseases AG4 Drier soils (due to warmer and drier summer conditions) AG11 Increased soil erosion due to heavy rainfall BD8 Changes in soil organic carbon WA9b Potential decline in water quality due to diffuse pollution WA8a Number of unsustainable water abstractions (agriculture)	The Department for Business, Innovation and Skills and Defra to overcome barriers to innovation and development of new technology and to its uptake, to drive sustained growth through the Agri-Technology Strategy.	**ALL AGRICULTURE AND FORESTRY RISKS IN CCRA**	Department for Business, Innovation and Skills and Defra	Strategy launched Summer 2013
	The industry-led 'Feeding the Future' report's Joint Commissioning Group to use the report's recommendations as a basis for dialogue with both government and industry funders of research and knowledge transfer, including divisions of Agriculture and Horticulture Development Board and future Technology Strategy Board funding.	AG2a, AG3, AG4, **AG5,** AG11	Agriculture and Horticulture Development Board, Technology Strategy Board, National Farmers Union, Agricultural Industries Confederation, Royal Agricultural Society of England	Ongoing
	All soils to be managed sustainably and degradation threats to be tackled successfully by 2030, as outlined in the Government's statement of intention in the Natural Environment White Paper. Within this, there is a commitment for a four year research programme to look at the effects of soil degradation on soil function.	AG4, AG11, BD8, WA9b	Defra	Completion by 2015

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	The Biotechnology and Biological Sciences Research Council to contribute €3m to a €18m+ ERANET+ EU research programme which brings together researchers from sixteen countries to develop resilience around crops and livestock systems. Areas the programme will focus on include preserving soil, water and genetic sources, emerging and re-emerging pests and diseases, and socio-economic aspects of adaptation. New technologies which aid adaptive water and soil management will be investigated, including those that: • improve water harvesting; • increase efficiency of water and fertilisation practices; • monitor and reduce greenhouse gas; and • increase and verify soil and biomass carbon stocks.	AG4, AG11, BD8, WA9b	Biotechnology and Biological Sciences Research Council	2018
	In parallel with the Biotechnology and Biological Sciences Research Council, the Natural Environment Research Council to lead a 5 year programme to better predict how soils function under changes in climate and land use. Outputs would be used to inform future decisions on local and regional management of soils for food security and climate mitigation.	AG4, AG11, BD8, WA9b	Natural Environment Research Council	2018
	The Forestry Commission to publish the revised Science and Innovation Strategy for British forestry. The strategy will develop robust evidence to inform climate change adaptation strategies for forestry and support actions to increase the resilience of British woodland and the ecosystem services it provides to society.	**ALL FORESTRY RISKS IN CCRA**	Forestry Commission	Autumn 2013
	Defra to develop plausible scenarios and establish a methodology to estimate the economic impact of extreme weather on agriculture and assess the robustness of adaptation actions taken by farmers to these. The findings of this work will inform Defra's new Sustainable Intensification Research Platform which will develop integrated approaches to land management that sustainably provide food and environmental outcomes.	**ALL AGRICULTURE RISKS IN CCRA**	Defra	Initial study complete April 2013 (further work subject to findings)
	Defra to investigate the resilience of UK agriculture to climate change and other external factors through the new Sustainable Intensification Research Platform.	**ALL AGRICULTURE RISKS IN CCRA**	Defra	Platform will run until 2016
	Defra to fund a project looking at water use efficiency traits in crops at different carbon dioxide levels, to inform breeding programmes and make more efficient use of water in a changing climate.	AG4, **AG5,** WA8a	Defra	Project completed by end 2013

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Natural Environment

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 19: To build the resilience of wildlife, habitats and ecosystems (terrestrial, freshwater, marine and coastal) to climate change, so as to put our natural environment in the strongest possible position to meet the challenges and changes ahead.				
TERRESTRIAL ECOSYSTEMS				
BD5 Species unable to track changing 'climate space' **BD9 Changes in species migration patterns** **BD10 Biodiversity risks due to warmer rivers and lakes** **BD14 Ecosystem risks due to low flows and increased water demand** **BD1 Risks to species and habitats due to drier soils** **BD2 Risks to species and habitats due to coastal evolution** **MA2a Decline in marine water quality due to sewer overflows** **MA6 Northward spread of invasive non-native species** WA7 Insufficient summer river flows to meet environmental targets BD8 Changes in soil organic carbon BD11 Generalist species more able to adapt than specialists WA9a Potential decline in summer water quality (point source pollution) WA9b Potential decline in water quality due to diffuse pollution BD13 Water quality and pollution risks BD3 Risks of pests to biodiversity BD4 Risks of diseases to biodiversity	To take forward commitments as laid out in Biodiversity 2020, which sets the strategic direction of policy for protecting and enhancing biodiversity. www.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf	**BD1, BD5, BD9,** BD11	Government policy – delivery by Non Governmental Organisations	By 2020
	The Environment Agency to work with the Wetland Vision partnership to capture biodiversity adaptation benefits from the project.	**MA6, BD5, BD9,** BD11	Partnership	Ongoing
	Natural England to use their vulnerability assessment and mapping tools (eg to help inform the spatial targeting of incentive scheme interventions).	WA7, **BD14,** WA9a, WA9b, BD13, BD11	Natural England	Ongoing to 2014
	Natural England to publish National Character Area profiles and statements that include climate change threats and opportunities.	WA9a, WA9b, **BD14, MA2a,** BD11	Natural England	By April 2014
	Natural England to publish National Character Area climate change vulnerability studies, which will include suggestions for adaptation action.	**BD1,** BD2, BD4, **BD5,** BD11	Natural England	2013 onwards
	Natural England to publish an online climate change adaptation manual for land managers and conservation practitioners, summarising evidence and best practice advice on dealing with climate change adaptation.	**BD1,** BD2, BD4, **BD5,** BD8, **BD9,** BD10, BD12	Natural England	Autumn 2013
	Defra to ensure that adaptation is integral to the development of agri-environment schemes in the next Rural Development Programme.	**BD5, BD9**	Defra	By 2014
	Natural England, Environment Agency and the Forestry Commission to develop advice and tools to help land managers and advisors to take informed decisions about adaptation and upskilling their own staff (see specific risks).	**ALL CCRA NATURAL ENVIRONMENT RISKS**	Natural England, Environment Agency, Forestry Commission	Ongoing
	To ensure newly-established Nature Improvement Areas have the necessary knowledge and tools to build adaptation into their work.	**BD5, BD9**	Nature Improvement Areas	First 3 year programme finishes in 2014
	To make Local Nature Partnerships aware of the risks associated with climate change and able to build adaptation to climate change into their plans, strategies and work.	**BD5, BD9**	Local Nature Partnerships	Ongoing

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
BD12 Wildfires due to warmer and drier conditions **BU2 Monetary losses due to tourist assets at risk from flooding.**	Natural England to agree with partners a prioritised programme for species, allocating responsibilities for action. Natural England to work with a range of bodies, encouraging community action to make the natural environment more resilient to climate change.	BD11, BD3, BD4, **BD5, BD9**	Natural England	Spring (2013, species programme)
	Defra to establish alerts, surveillance and rapid response plans for detecting and tackling the arrival of selected invasive non-native species.	BD11, **MA6,** BD3, BD4	Defra	Ongoing
	Defra and its agencies to implement, review and improve Diffuse Water Pollution Plans for Protected Areas under the Water Framework Directive, factoring in climate change, which will be critical to improving habitat and species resilience to climate pressures.	WA9b	Defra and Agencies	Plans will be completed by April 2012 for Natura 2000 protected sites
	Environment Agency Climate Ready service will support the Local Government Association's Climate Local initiative as a means of signposting advice, tools and examples that can help councils take action to improve the resilience of the natural environment.	**ALL CCRA NATURAL ENVIRONMENT RISKS**	Environment Agency Climate Ready	Until 2014
	Non-governmental organisations (see owners) to work in partnership to build resilience of the natural environment by developing ecological networks that allow species to move between sites.	**BD5, BD9**	Royal Society for the Protection of Birds, National Trust, The Wildlife Trust and Woodland Trust	Ongoing
	Non-governmental organisations (see owners) to plan for a 2-4 degree mean global temperature rise at their sites.	WA7, **BD14,** BD3, BD4, BD11, **BD5, BD9,** BD10, **BU2, BD1**	RSPB, National Trust, The Wildlife Trust and Woodland Trust	Ongoing
	The Forestry Commission, working with the woodland sector, to increase the resilience of England's woodland resource by: • aiming to increase the area of woodland in active management to 66% by 2018; • working with businesses and civil society to increase the total capacity and capability available to provide targeted advice about woodland management; • publishing new guidance on Building Wildfire Resilience into Forest Management Planning to support implementation of the UK Forestry Standard [2013]; and • developing contingency plans for major fire and windstorm events [2013].	BD11, BD3, BD4, **BD5, BD9,** BD12	Forestry Commission	Ongoing

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	The Forestry Commission, Natural England and Defra to ensure that implementation of Keepers of Time and the Open Habitats policy, in line with the Ancient and Native Woodland Practice Guide, enhances landscape resilience to climate change.	**BD5**	Forestry Commission	Ongoing
	The Crown Estate to continue to build resilience of their forests to wildfires by building into the design and development of forest design plans alternative species choice and firebreak management. To continue to work with South East England Wildfire Group to drive, innovate and implement best practice.	BD12	Crown Estate	New 20 year forest design plan to be completed by March 2014
FRESHWATER ECOSYSTEMS				
FL15 Flood risk for scheduled ancient monument sites **BD14 Ecosystem risks due to low flows and increased water demand** **FL4b Agricultural land at risk of regular flooding** **BD7 Risks to coastal habitats due to flooding** **BD10 Biodiversity risks due to warmer rivers and lakes** **BD1 Risks to species and habitats due to drier soils** WA8 Number of unsustainable water abstractions (total) WA7 Insufficient summer river flows to meet environmental targets BD11 Generalist species more able to adapt than specialists WA9a Potential decline in summer water quality (point source pollution) WA9b Potential decline in water quality due to diffuse pollution BD13 Water quality and pollution risks	In 2014/15 the Environment Agency to develop the second cycle River Basement Management Plans, implementing the Water Framework Directive. Between June and December 2013, the Environment Agency to consult on its approach to addressing Significant Water Management Issues (SWMI) going into the second cycle of river basin management plans. This will include the approach to addressing challenges posed by climate change.	WA7, **BD14, FL4b,** WA9a/b, BD13	Environment Agency	By 2015
	By the end of 2013, Defra and the Environment Agency to have reviewed the progress made within the catchment approach pilots, including how climate risks are being considered. This work will help develop tools for catchment managers, to consider resilience to climate variability and change in the wider roll-out of the catchment approach in 2014.	WA7, **BD14,** WA9a, WA9b, **BD1**	Defra, Environment Agency	By end 2013
	The Environment Agency to monitor the effects of climate change and continue to review its monitoring networks, to ensure that they are adequate.	**ALL CCRA NATURAL ENVIRONMENT RISKS**	Environment Agency	Ongoing
	The Environment Agency to develop and use natural means of flood defence using ecosystem-based approaches with biodiversity co-benefits. This will include: • restoration of original river morphologies and flood plain function; • catchment management to retain water through soils; and • increased use of soft coastal defences and managed realignment.	BD7, **FL15**	Environment Agency	Ongoing
	The Environment Agency to work hand in hand with other delivery partners to deliver their 'Keeping Rivers Cool' project, to provide the evidence base and implementation for providing riparian shade using natural ecosystems for warming rivers and lakes.	BD10, **BD14**	Environment Agency and Partners	By end 2016

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Defra to consult on the reform of the abstraction licensing, to: • encourage abstractors to use water more efficiently and share water; and • to help meet water quality targets under a changing climate. Defra will look to introduce legislation to enact the new approach by early in the next Parliament.	WA7, WA8	Defra	By Dec 2013
	The Environment Agency to continue to take forward its Restoring Sustainable Abstraction (RSA) programme.	WA7, WA8	Environment Agency	Ongoing
	Canal & Rivers Trust to follow up actions published in their Adaptation Reporting Power report (originally requested in the British Waterways first phase of reporting).	**BD10, BD14**	Canal & Rivers Trust	By end of 2012
	The Forestry Commission to work with Natural England, the Environment Agency and others to contribute to improving the freshwater environment through targeted woodland creation and management, as outlined in the 'Woodland for Water Action Plan' and through implementation of the UK Forestry Standard's Forests and Water Guidelines: • addressing agricultural diffuse water pollution; • contributing to flood alleviation; • limiting thermal stress through riparian planting; and • avoiding significant planting in areas where groundwater supplies are constrained or acidification of groundwater remains a risk.	WA7, **BD14, FL4b,** WA9a/b, BD13	Forestry Commission	2013 onwards
	Through its programme of catchment management, The Rivers Trust to implement actions to adapt to climate change, protecting our freshwaters and the ecosystem services they provide.	BD3, BD4, BD11	The Rivers Trust	2013 onwards
MARINE ECOSYSTEMS				
MA2a Decline in marine water quality due to sewer overflows **BD7 Risks to coastal habitats due to flooding**	Defra to develop a programme of measures to achieve Good Environmental Status in our waters. Where relevant, the Programme of Measures will take account of prevailing conditions including climatic changes caused by human induced climate change.	**MA2a, MA3,** MA10, MA8, MA1, WA9a/b, BD13	Defra	By publication of the next CCRA
	The Marine Management Organisation to prepare marine plans that include policies for climate adaptation. The preparation of new plans will include horizon scanning to evaluate the potential longer term risks and opportunities from climate change. Ten Marine Plans for the whole of the English marine area will be completed by 2021.	MA1, **MA2a, MA3,** MA4a, MA4b, **MA6,** MA8, MA9	Marine Management Organisation	First plans for east coast areas adopted by the end of 2013

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MA3 Increased ocean acidification **MA6 Northward spread of invasive non-native species** MA10 Disruption to marine ecosystems due to warmer waters FL14b Priority habitats lost due to coastal erosion MA8 Potential disruption to breeding of seabirds and intertidal invertebrates MA1 Risk of harmful algal blooms due to changes in ocean stratification WA9a Potential decline in summer water quality (point source pollution) WA9b Potential decline in water quality due to diffuse pollution MA9 Decline in productivity of 'cold water' fish and shellfish stocks MA4a Changes in fish catch latitude/ centre of gravity (cod, haddock) MA4b Changes in fish catch latitude/ centre of gravity (plaice, sole) BD6 Environmental effects of climate mitigation measures	Defra will establish Marine Conservation Zones to contribute to an ecologically coherent network of Marine Protected Areas (MPAs), with the first marine conservation zones designated in 2013. Defra has committed to designating at least 25% of English Waters as Marine Protected Areas by 2016. Completion of the network and, where appropriate, management measures are expected to take account of expected impacts of climate change.	MA1, **MA2a, MA3,** MA4a, MA4b, **MA6,** MA8, MA10	Defra	First zones designated in 2013
	'Seafish' organisation to work with those involved in the seafood supply chain to understand climate change risks and mitigating action.	MA4a, MA4b, **MA6**	Seafish	To initiate by end 2013
	The Marine Climate Change Impacts Partnership to publish a new report card summarising the latest evidence on impacts of climate change on the UK's marine environment. A mid-term review of the second programme will evaluate its effectiveness in improving understanding of climate impacts.	MA1, **MA3,** MA4a, MA4b, **MA6,** MA8, MA10, WA9b	Marine Climate Change Impacts Partnership	By end 2013
	Through its 'Climate Smart' working initiative, the Marine Climate Change Impacts Partnership to colaborate with selected marine sectors to develop adaptive capacity, using the best available evidence on climate impacts.	MA1, **MA3,** MA4a, MA4b, **MA6,** MA8, MA10, WA9b, BD6	Marine Climate Change Impacts Partnership	2013 onwards
	The Marine Management Organisation to publish a climate change adaptation report describing the steps they are taking to respond to climate change through their statutory functions.	MA1, **MA2a, MA3,** MA4a, MA4b, **MA6,** MA8, MA9	Marine Management Organisation	By 2014
	As the industry body with a remit to support the profitability and sustainability of the seafood industry, 'Seafish' to publish a climate change adaptation report describing the steps industry are taking to respond to climate change.	MA4a, MA4b, **MA6**	Seafish	By 2014
	Defra to consider the opportunities to the marine industry, as suggested in the Economics of Climate Resilience project.	MA4a, MA4b, MA7	Defra	2013
	The Environment Agency to identify those species and habitats that are most vulnerable by undertaking a vulnerability assessment (eg salmonids & other fish species).	MA1, MA4a, MA4b, **MA6,** MA8, MA10	Environment Agency	By 2015, but budget dependent

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COASTAL ECOSYSTEMS				
BD7 Risks to coastal habitats due to flooding **BD2 Risks to species and habitats due to coastal evolution** **BD14 Ecosystem risks due to low flows and increased water demand** **MA2a Decline in marine water quality due to sewer overflows** **MA3 Ocean acidification** MA8 Potential disruption to breeding of seabirds and intertidal invertebrates MA1 Risk of harmful algal blooms due to changes in ocean stratification FL14b Priority habitats lost due to coastal erosion	The Environment Agency to identify main areas of erosion through the National Coastal Erosion Risk Mapping project. This will allow identification of potential locations of important habitats that will help better accommodate changing species climate envelopes.	**BD2**	Environment Agency	Coastal erosion risk maps published 2011 to 2012
	Natural England to develop plans to compensate for losses at threatened coastal National Nature Reserves, taking into account land with potential 'future natural' status (eg Great Fen project).	**BD7, BD2,** FL14b	Natural England	Ongoing (as part of management planning cycle)
	The Environment Agency to identify areas suitable for restoration or creation of priority coastal habitats, as well as working with partners including local authorities to better align shoreline management plans and marine plans to ensure no net loss [or net gain] of priority habitats.	**BD2, BD7,** FL14b	Environment Agency	By 2020
	Environment Agency flood and coastal risk management activities to value the ecosystem benefits to the wider environment while meeting targets and legal duties.	**BD7, BD14,** MA1, **MA2a,** MA3, MA8, FL14b	Environment Agency	Ongoing
	As owner of nearly one tenth of the coast of England, Wales and Northern Ireland, the National Trust are to continue to run a programme of work as laid out in the 'Shifting Shores' publication, taking into account climate change.	**BD2, BD7**	National Trust	2013 onwards
HISTORIC ENVIRONMENTS				
FL15 Flood risk for scheduled ancient monument sites **BD7 Risk to coastal habitats due to flooding** **FL4b Agricultural land at risk of regular flooding** WA9a Potential decline in summer water quality (point source pollution)	English Heritage to publish a climate change adaptation report describing the steps they are taking to respond to climate change.	**FL15, BD7,** BU2	English Heritage	By end 2014
	'Shrinking the Footprint' organisation to publish a climate change adaptation report for the Church of England, describing the steps they are taking to respond to climate change on their estates.	**FL15,** BU2	Church of England	By end 2014
	English Heritage and 'Shrinking The Footprint' team to develop a working group, also including other organisations who manage but may not own ancient monuments, to produce an action plan on how to tackle the risks to historic environments.	**FL15, BD7,** BU2, WA9a, WA9b, **FL4b**	Partnership	By Summer 2013

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WA9b Potential decline in water quality due to diffuse pollution BU2 Monetary losses due to tourist assets at risk from flooding BE5 Effectiveness of green space for cooling	English Heritage to continue to implement actions laid out in the National Heritage Protection Plan, that lays out how the sector will prioritise and deliver heritage protection until 2015. www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/	**FL15, BD7,** BU2	English Heritage	2013 to 2015
Objective 20: To take action to help wildlife, habitats and ecosystems accommodate and smoothly transition through inevitable change.				
ALL RISKS IDENTIFIED IN THE NATURAL ENVIRONMENT CHAPTER OF THE CCRA	Natural England to develop a strategy for the notification and review of designated areas (eg Sites of Special Scientific Interest etc.) that considers the implications of climate change.	**BD1, BD2, BD5,** BD6, BD8, **BD9,** BD11	Natural England	Strategy adopted July 2012. Reviewed in 2016
	Defra to continue to commit to reducing peat used in horticulture to zero by 2030 (Natural Environment White Paper commitment).	**BD1,** BD8	Defra	By 2030
	Natural England to use their vulnerability assessment and mapping tools to help inform the spatial targeting of agri-environment schemes.	**BD5,** BD8, **BD9, BD14**	Natural England	Ongoing
	English National Parks (working with other sectors) to update their adaptation reports, addressing progress against planned actions and highlighting any further action that could be taken within their parks.	**BD1,** BD3, BD4, **BD5**	English National Parks	By end 2014
	Through 'The Big Tree Plant', Defra, the Forestry Commission and supportive partners to provide advice on suitable trees to plant in urban areas in the face of a changing climate.	**BD1,** BD3, BD4, BD11	Partnership: Defra, Forestry Commission	Ongoing
	The Non-Governmental Organisation (NGO) sector to monitor and review climate change adaptation (and other actions) at their sites, on a regular basis. For example, the Royal Society for the Protection of Birds (RSPB) are to review the effectiveness of management prescriptions annually, with site objectives (including the actions required to achieve them) reviewed every five years.	**BD1,** BD3, BD4, BD12	NGO sector; Natural England	Annually
	The Royal Society for the Protection of Birds to continue to restore and re-create new areas of priority habitat, to offset losses predicted to occur as a result of climate change (e.g. intertidal habitat and freshwater reedbeds).	**BD5, BD9,** FL14b	Royal Society for the Protection of Birds	Ongoing
	Through their 'Futurescapes' and 'Living Landscape' programmes, the Royal Society for the Protection of Birds and Wildlife Trusts to integrate climate change adaptation and mitigation into their work, to restore the natural environment at the landscape scale.	**BD5,** BD6, **BD9,** FL14b	Royal Society for the Protection of Birds, Wildlife Trusts	Ongoing

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	The Ministry of Defence to increase their resilience to the impacts of climate change by completing Climate Impact Risk Assessments at priority sites. Where the Climate Impacts Risk Assessment identifies main risks to the rural estate these will be integrated and managed as part of the establishment's management systems; these may be Integrated Rural Management Plans, which define the long-term land management strategy for the rural estate balanced with military requirements.	FL14b, **FL15,** BD2, BD7	Ministry of Defence	By March 2015
	The Ministry of Defence (MoD) to complete an Overarching Strategic Risk Assessment for their estate, including a review of risks highlighted in the UK Government Climate Change Risk Assessment which could affect MoD land.	**FL15**	Ministry of Defence	By December 2013
	Defra to review its marine environmental monitoring and surveillance programmes to assess whether they are well suited to the detection of changes in state that can be associated with climate change.	MA1, MA10	Defra	By end 2013
Objective 21: To promote and gain widespread uptake in other sectors of the use of adaptation measures that benefit and/or do not adversely affect the natural environment.				
ALL RISKS IDENTIFIED IN THE NATURAL ENVIRONMENT CHAPTER OF THE CCRA.	The Environment Agency to promote the use of green and blue infrastructure, for example parks and water bodies, as a way of adapting the urban environment, by building evidence and working closely with the Green Infrastructure Partnership.	BE5, **BD5, BD9, BD10,** BD11	Environment Agency	By end 2015
	The Green Infrastructure Partnership to identify, develop and disseminate tools and evidence to support organisations to justify, plan and deliver green infrastructure that will help places, people and wildlife adapt to climate change.	BE5, **BD5, BD9, BD10**	Green Infrastructure Partnership	Ongoing
	Guided by Section 40 of the Natural Environment and Rural Communities Act (2006), all public authorities, including local authorities, to have regard to conserving biodiversity whilst exercising their functions.	**ALL CCRA NATURAL ENVIRONMENT RISKS**	Range of authorities including all local councils	Ongoing
	The Institute of Environmental Management and Assessment to review their online hub on Environment Impact Assessments and climate change and to update this following quarterly reviews. www.iema.net/eia-cc	**BD5, BD9**	Institute of Environmental Management and Assessment	April 2013 onwards
	The Institute of Environmental Management and Assessment to provide advice to their members on Environmental Impact Assessments (EIAs) and climate change by launching their new advice note: 'Taking account of climate change in EIA', as well as providing a series of webinars.	**BD5, BD9**	Institute of Environmental Management and Assessment	Mid-April 2013

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
	Defra to work in partnership with the International Union for Conservation of Nature UK Peatlands Programme, to support the testing, development and launch of a pilot UK Peatland Carbon Code.	**BD1, BD9**	Defra, IUCN UK	By September 2013
	Defra to review the scope, through the Payments for Ecosystems Services Action Plan (published spring 2013) and its the subsequent implementation, for the delivery of natural environment/green infrastructure solutions for increasing resilience to climate risks, through enabling and encouraging the use of payments for ecosystem services.	WA7, **BD14,** BD7, BD13, BD6	Defra	By 2015
	Defra supported by the Department of Energy and Climate Change to work with others to establish a research programme to fill evidence gaps about impacts on the natural environment of the level of infrastructure needed to cut greenhouse gas emissions by 80% by 2050. The research will be used in a strategic way, to inform pathways to 2050 and enable informed judgements to be made on the best ways to achieve greenhouse gas benefits, energy security, affordability and protection of the natural environment.	BD6	Defra	By 2015
	Defra to publish a response to the recommendations of the Ecosystems Markets Task Force, including the potential for actions to increase resilience.	BD3, BD4, **BD5,** BD6, **BD9, BD10,** BD11	Defra	Summer 2013
	Building on of the UK National Ecosystem Assessment, Defra to develop a project to increase our understanding of how future climate change is likely to affect ecosystems.	**BD14 and evidence gaps**	Defra	Spring 2014
	Defra, Natural England and the Forestry Commission to support and promote the role of green infrastructure in adapting the urban environment to climate change.	BE5, **BD5, BD9,** BD11, **BD10**	Defra, Natural England, Forestry Commission	Ongoing
	The Crown Estate to build resilience of their forests to wildfires by building into the design and development of forest design plans alternative species choice and firebreak management. They will continue to work with south-east England wildfire group to drive, innovate and implement best practice.	BD12	Crown Estate	New 20 year forest design plan to be completed by March 2014

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 22: To improve the evidence base, to enhance the knowledge and understanding of decision makers, land managers and others of the impacts of climate change on the natural environment and how best we can influence adaptation or accommodate change.				
Addressing the evidence gaps identified in the CCRA and providing evidence to underpin adaptation responses to other risks, such as BD5, MA3, BD8, WA7, BD4, BD11, **BD9, BD10, BD14,** BD3, WA7 **and BD2** **Summary of Evidence gaps identified in the CCRA:** **1. Interactions** • Understand interactions, shifts in species, habitats, landscape structure BICCO NET, Living With Environmental Change Report Cards • Space and time: e.g. effects on migratory pathways • Cause effect pathways e.g. harmful algal blooms), effects of other drivers of change • Land use methods and models to integrate biodiversity adaptation with climate change mitigation • Develop methods to improve integration of protected areas into wider landscape • Long and short term, regional and national ecosystem sensitivity (especially freshwater and marine), 'tipping points' for maintaining adaptive capacity • Tradeoffs between sectors – adaptation in one should not constrain it in another	Defra and partners to continue working with the Climate Change Committee to develop indicators of both climate change risks and adaptation for ecosystems and biodiversity, amongst indicators for other sectors.	**BD2,** BD3, **BD5, BD9, BD10,** BD11 and **evidence gaps**	Defra, Climate Change Committee, Defra partners	Ongoing to 2014
	Defra to publish Biodiversity and Ecosystems Evidence Plan that will address climate change amongst the plan's priorities.	**BD2,** BD3, **BD5, BD9, BD10,** BD11 and **evidence gaps**	Defra	2013 to 2018
	Defra to help policy makers and others to develop informed views and assist in formulation of integrated policies for low carbon energy and biodiversity. Publication of the Defra-funded research project: 'Towards integration of low carbon energy and biodiversity policies: an assessment of impacts of low carbon energy scenarios on biodiversity in the UK' and an assessment of a framework for determining indirect land-use change impacts based on UK bio-energy demand scenarios.	**Evidence gaps**	Defra	2013
	Natural England to assess the role of Nature Improvement Areas (NIAs) in climate change adaptation and to encourage decision-makers to consider climate change in their management plans, including using some of the new models for climate vulnerability and ecological connectivity.	**Evidence gaps**	Natural England	The project completed Spring 2013, but NIAs will be reporting progress annually using indicators, up until 2015
	The Environment Agency to encourage Local Nature Partnerships to consider their role in planning strategically on a large scale for climate change.	**Evidence gaps**	Environment Agency	Project completes April 2013

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2. Consequences • Effectiveness of long term landscape scale approaches (eg upland water retention) • Genetic diversity – to enable evolutionary adaptation and manage genetic constraints • Epidemiological – pest and diseases • Effectiveness of long term landscape scale approaches • Drivers and values of ecosystem services (eg implications on fishing fleets, the industry and economies) • Water management/hydrological regimes, potable supplies and effects on species • Systematic collation and integration of biodiversity monitoring (including phenology) with environmental and climate variables, at a range of spatial and temporal scales.	Defra, the Department of Energy and Climate Change and the Natural Environment Research Council to work with partners of a 5 year research programme on ocean acidification. The programme focuses on: • impacts on upper ocean biogeochemistry; • impacts on benthic (seafloor) ecosystems; • impacts on commercially-important species and socio-economic implications; • impacts of previous ocean acidification events, on geological timescales; and • regional and global modelling of impacts, including ecosystem responses and climate feedbacks. www.oceanacidification.org.uk/	**MA3**	Natural Environment Research Council, Defra, Department of Energy and Climate Change	Programme running until 2015
	Natural England to deliver a suite of research reports to support adaptation decisions: • Potential climate change safe havens for wild species; • Risks and opportunities for species as a result of climate change; • Evaluation of the risks of favouring invasive species by increasing landscape connectivity; • The role of landscape and site scale characteristics in making species populations resilient to climate change and extreme events; • Palaeo-ecological evidence to inform identification of potential refugia and areas for ecological restoration; • A habitat drought indicator for the UK; and • Drought impacts on biodiversity and ecosystem services: a review of evidence needs.	**Evidence gaps**	Natural England	2013 to 2014
	Defra and the Natural Environment Research Council to continue support for the Environment Change Network central coordination unit, which manages and collects long term monitoring data for a range of biodiversity and environmental variables.	**Evidence gaps**	Defra and Natural Environment Research Council	Review in 2014
	The Biodiversity Climate Change Impacts Network to continue to facilitate the bringing together of data from a range of existing monitoring regimes to assess the effects of climate change on the UK's biodiversity and to consider the potential for development of biodiversity indicators of the effects of climate change.	**Evidence**	Partnership led by Defra	Concludes in 2014

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	Defra to undertake a research programme to explore how soil degradation can affect a soil's ability to support vital ecosystem services such as flood mitigation, carbon storage and nutrient cycling; and how best to manage our lowland peatlands in a way that supports efforts to tackle climate change (Natural Environment White Paper commitment).	**BD1,** BD8	Defra	
	The Environment Agency to scope a new long term research effort to improve environmental flow indicators, inform future water resource planning, address uncertainty surrounding the impact of climate change on river flows and the Environment Agency's ability to meet environmental targets.	WA7, **BD14**	Environment Agency	Scoping to be completed by March 2014
	The Living With Environmental Change Climate Change 'Impacts Report Cards' for Biodiversity and the Fresh Water Environment to demonstrate robust evidence of the effects of climate change on species, habitats and ecosystems as far as possible to date.	BD3, BD4, BD13	Living With Environmental Change – Partnerships	Publication in Summer 2013
	The Forestry Commission to publish the revised Science and Innovation Strategy for British forestry. The strategy will develop robust evidence to inform climate change adaptation strategies for forestry and support actions to increase the resilience of British woodland and the ecosystem services it provides to society.	**ALL FORESTRY-RELATED CCRA NATURAL ENVIRONMENT RISKS**	Forestry Commission	Early 2014
	Defra, Natural England, the Environment Agency and the Marine Management Organisation to establish an information-sharing group on climate change adaptation actions relating to biodiversity and ecosystems.	**ALL CCRA NATURAL ENVIRONMENT RISKS**	Defra, Natural England, Environment Agency, Marine Management Organisation	From summer 2013
	Natural England to establish a project on long-term monitoring based around establishing detailed monitoring at up to 40 National Nature Reserves to provide an understanding of the main drivers of change, including climate change.	BD3, BD4, **BD5, BD9,** BD11, BD14	Natural England	Ongoing

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Business

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 23: To raise awareness and understanding amongst businesses about climate change risks.				
FL7a Non-residential properties at significant risk of flooding **FL7b Expected Annual Damage (EAD) to non-residential property due to flooding** BU2 Monetary losses due to tourist assets at risk from flooding BU3 Risk of restrictions in water abstraction for industry BU4 Risks of business disruption due to flooding BU5 Loss of productivity due to ICT disruption BU8 An expansion of tourist destinations in the UK BU9 A decrease in output for businesses due to supply chain disruption BU10 Loss of staff hours due to high internal building temperatures	Environment Agency Climate Ready service to develop an evidence base to support decision-making for a Communications Strategy covering prioritised sectors.	**ALL CCRA BUSINESS RISKS**	Environment Agency Climate Ready	By end of 2013
	Environment Agency Climate Ready, Climate UK and the Climate Change Partnerships to increase the number of people in businesses who have an accredited skill or qualification related to climate change adaptation.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Environment Agency Climate Ready and Climate UK	Until financial year 2013-14
	Climate UK to work with local authorities and Local Enterprise Partnerships to assess and manage climate risks and opportunities for local economies through awareness-raising, signposting guidance and encouraging the sharing of good practice.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Climate UK and the Climate Change Partnerships	Until financial year 2013-14
	Environment Agency Climate Ready will support the Local Government Association's (LGA) Climate Local initiative as a means of signposting advice, tools and examples that can help councils work with the business community to increase resilience.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Environment Agency Climate Ready	2013 onwards
	Environment Agency Climate Ready and Climate UK to work with Environment Agency Regulated Businesses to provide guidance and training on how to assess climate risk and develop their own climate change adaptation plans.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Environment Agency Climate Ready and Climate UK	2013 onwards
	Environment Agency Climate Ready service to encourage businesses in areas at high risk of flooding to undertake a flood risk assessment, register for appropriate flood warnings and undertake appropriate measures to ensure their property and community is protected.	BU2, BU4, BU5, BU9, **FL7a/b**	Environment Agency Climate Ready	June 2013 onwards
	The Institute of Environmental Management and Assessment to develop professional standards in environmental and sustainability professionals.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Institute of Environmental Management and Assessment	By end of 2013
	The Institute of Environmental Management and Assessment to develop guidance on building the adaptation business case.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Institute of Environmental Management and Assessment	By end of April 2013
	The Carbon Disclosure Project to consider including more specific questions around adaptation strategies in future questionnaires for major businesses, with a focus around cost of adaptation and potential liabilities from climate risks.	**ALL CCRA BUSINESS RISKS**	Carbon Disclosure Project	2013-2014

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 24: To increase the extent to which businesses are actively considering climate change impacts, in their risk management and resilience planning and decision-making processes, and taking appropriate adaptive action.				
FL7a Non-residential properties at significant risk of flooding **FL7b Expected Annual Damage (EAD) to non-residential property due to flooding** **BE3 Overheating of buildings** **WA5 Public water supply-demand deficits** BU10 Loss of staff hours due to high internal building temperatures BU2 Monetary losses due to tourist assets at risk from flooding BU3 Risk of restrictions in water abstraction for industry BU4 Risks of business disruption due to flooding BU5 Loss of productivity due to ICT disruption **OPPORTUNITIES** BU8 An expansion of tourist destinations in the UK AG1c Climate Change Adaptation Services	Environment Agency Climate Ready service to work in partnership with others to continue to develop the business case for actions to address the risks and opportunities from climate change.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Environment Agency Climate Ready	Up to financial year 2013-14
	Environment Agency Climate Ready and Climate UK to develop and promote web-based risk assessment tools and other relevant guidance that will increase the number of businesses undertaking climate change risk assessments, adaptation actions and taking advantage of business opportunities.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Environment Agency Climate Ready and Climate UK	Up to financial year 2013-14
	Environment Agency Climate Ready and Climate UK to increase the number of businesses using management standards to manage climate risks.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Environment Agency Climate Ready and Climate UK	Ongoing
	Department for Culture, Media and Sport to deliver the "England: A Strategic Framework for Tourism 2010 – 2020" ambitions to grow the visitor economy and address the climate-related impacts outlined.	BU8, BU2 **and ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Department for Culture, Media and Sport	By end of 2014
	The Health and Safety Executive to review their guidance regarding work place temperatures following a consultation.	BU10, **BE3**	Health and Saftey Executive	By end of 2013
	Waste and Resources Action Programme to reduce water demand/ usage and increase water efficiency for businesses through Federation House Commitment voluntary agreement; currently 70+ signatories across 278 sites (food and drink manufacturers). Signatories pledge to reduce water use to contribute towards the industry target of reducing water use by 20% by 2020.	BU3, **WA5**	Waste and Resources Action Programme (WRAP)	Ongoing, with annual measurement and reporting water usage to the Federation House Commitment
	Waste and Resources Action Programme to reduce water demand/ usage and increase water efficiency for businesses through 'Rippleffect' a package of support, advice and tools for small and medium enterprises.	BU3, **WA5**	Waste and Resources Action Programme (WRAP)	Ongoing
	Defra and the Deparment for Business, Innovation and Skills to gather the evidence base on the size and structure of the adaptation market, including the demand for types of specific products and services.	AG1c	Defra and Department for Business, Innovation and Skills	Ongoing

Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 25: To raise awareness and understanding amongst businesses about domestic and international climate change opportunities.				
ALL CCRA BUSINESS RISKS OPPORTUNITIES AG1c Climate Change Adaptation Services Opportunities for innovative building services and urban planning in the UK and overseas, for example in the design of sustainable buildings and developments. UK based infrastructure operators, consultancies and investors may have opportunities to capitalise on global climate change adaptation activity.	Climate UK to identify and support Climate Change Champions to promote climate change opportunities for businesses and to demonstrate the benefits of addressing climate resilience.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Climate UK	By end of 2013 and beyond
	Defra to work through UK Trade and Investment, with Foreign and Commonwealth Office, UK companies and the Department for Business, Innovation and Skills to promote and faciltate international commercial opportunities for UK companies with adaptation expertise.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Defra, UK Trade and Investment	Ongoing
	Department for International Development and the Foreign and Commonwealth Office to use the *PwC International Threats and Opportunities from Climate Change to the UK (ITOCC)* report to: contribute to the continued monitoring of the risks of climate change to UK interests overseas; and supplement the existing body of analysis that informs the Government's humanitarian, development and foreign policies, and thus help the UK better address the impacts of climate change around the world.	**Domestic risks posed by international impacts - identified in CCRA, but no risk metric**	Department for International Development and the Foreign and Commonwealth Office	2013 and Onwards
	Foreign and Commonwealth Office to use the PwC ITOCC report to support their international influencing strategy, which is designed to contribute to a change in the global political conditions and ambition required to achieve an agreement in 2015 on limiting global CO2 emission. In particular the report will be used to support UK thinking on the potential economic costs to the UK and global economy of failing to address climate change.	**Domestic risks posed by international impacts - identified in CCRA, but no risk metric**	Foreign and Commonwealth Office	2013 and onwards.
	The Green Investment Bank to: incorporate climate change resilience into its sustainability and green impact policies; and consider climate resilience in its investment decision-making as part of its standard technical and green risk assessment processes. Where appropriate, the Green Investment Bank to commission external assessment of the scale and nature of the extreme weather and climate risks associated with proposed investments.	**ALL CCRA BUSINESS RISKS**	Green Investment Bank	2013 onwards

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	Through shared leadership: UK Trade and Investment to work with Defra, the Foreign and Commonwealth Office and the Department for Business, Innovation and Skills, to promote and facilitate domestic and international commercial opportunities for UK companies with adaptation expertise.	AG1c	UK Trade and Investment	From 2013 onwards
	Environment Agency Climate Ready, Climate UK and the Department for Business, Innovation and Skills to work in partnership with others to encourage supply chain resilience in the business sectors that have been identified as a priority.	BU9	Environment Agency Climate Ready, Climate UK, Department for Business, Innovation and Skills	By end of 2015
Objective 26: To help businesses better understand and manage climate change risks to their supply chains.				
OPPORTUNITIES: **MA5 Opening of Arctic shipping routes due to ice melt.** **ALL CCRA BUSINESS RISKS, most notably:** **FL7a/b Non-residential properties at significant risk of flooding and Expected Annual Damage (EAD) to non-residential** **WA5 Public water supply-demand deficits.** BU4 Risks of business disruption due to flooding. BU9 A decrease in output for businesses due to supply chain disruption.	Environment Agency Climate Ready service to complete a pilot project to ensure the guidance on supply chain resilience is effective.	BU9	Environment Agency Climate Ready	By end of 2014
	Environment Agency Climate Ready service to develop good practice guidance to assess and manage risks to supply chains.	BU9	Environment Agency Climate Ready	May 2013 onwards
	The Department for Business, Innovation and Skills to develop an Industrial Strategy which will provide confidence for investment and growth, and the development of resilient supply chains.	BU9	Department for Business, Innovation and Skills	Summer 2013
	Environment Agency Climate Ready service to develop guidance on supply chains: working with and priority small-medium enterprise sectors in the food and beverage sector.	BU9	Environment Agency Climate Ready	2013 onwards

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Climate Change Risk Assessment (CCRA) risks addressed by objective (highest order CCRA risks in bold)	Actions	CCRA risks tackled by action	Owner(s)	Timing
Objective 27: To undertake research to increase the understanding of climate change impacts on growth and the economy, working with investors, insurers and other industry partners.				
BU1 Climate risks to investment funds (uncertain). **BU7 Insurance industry exposure to UK flood risks.** BU6 Mortgage provision threatened due to increased flood risk. BU2 Monetary losses due to tourist assets at risk from flooding.	Defra to continue to liaise with other Government Departments, the private sector and academia to explore further research needs around how investments and insurance sectors may take into account climate risks and what opportunities exist to support these sectors in managing these risks.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Defra with support	By end of 2015
	Defra Climate Ready team to review the 'Macro-economics of climate change' report ' to explore whether the links between climate change and economic growth need to be better understood, sharing key findings with the Department for Business, Innovation and Skills (BIS) and to develop further action (if required) with BIS.	**ALL CCRA BUSINESS RISKS AND OPPORTUNITIES**	Defra Climate Ready, The Department for Business, Innovation and Skills	By end of 2015

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Local Government (Cross Cutting Theme)

Actions	Owner(s)	Timing
Objective 28: To raise and maintain the profile of adaptation with local authorities and promote action to embed climate resilience across local authority services and responsibilities.		
The Local Adaptation Advisory Panel to develop, publish and run a programme of communication with local government officers and councillors to explain climate risks and actions for councils services areas.	Local Adaptation Advisory Panel, with contributions from: Environment Agency Climate Ready, Climate UK, Local Government Association, HM Government	September 2013-2014
The Local Adaptation Advisory Panel to champion and disseminate examples of local authority work, to embed adaptation in councils.	Local Adaptation Advisory Panel, with contributions from: Environment Agency Climate Ready, Climate UK, Local Government Association, HM Government	September 2013-2014
Objective 29: To support local government to build a credible business case for action and take well-informed decisions both internally across service areas and externally with their local communities and businesses.		
The Environment Agency, through its Climate Ready Support Service, to develop tools and guidance and make them available and accessible to all Local Authorities. This will include: • rolling out Kent's Severe Weather Impacts Monitoring System as a tool; • providing support to develop the local business case for adaptation; and • supporting the development of resources under the Climate Local initiative including briefing packs relevant to council service areas and priorities.	Environment Agency Climate Ready, Contributing partners: Climate UK, Kent County Council, Local Government Association	2013-2014
Objective 30: To ensure the policy framework for local government supports councils to increase community resilience in partnership with local and regional players.		
HM Government, informed by advice from the Local Government partners will ensure that, where a case is made, government legislation, policy and programmes are joined up to continue to enable and support local authorities to build resilience to the impacts of climate change.	HM Government, Contributing partners: Local Adaptation Advisory Panel, Local Government Association	2013-2014
Objective 31: To support sector-led activities, which allow councils to make local commitments to address their own unique challenges and opportunities arising from a changing climate.		
The Local Government Association will develop, run and promote Climate Local as a council-led initiative to support and share progress on climate change, including local action to build resilience.	Local Government Association	Up to March 2014. Ongoing.
The Core Cities Group, London Councils and the Greater London Authority will promote adaptation action within the councils of England's largest cities as set out in the Cities Commitment.	Core Cities Group, London Councils, Greater London Authority	From 2013-2014
The Climate Ready Support Service will work with the Core Cities Group, London Councils and the Greater London Authority to identify their unique support requirements and how learning can be shared with other local authorities.	Environment Agency Climate Ready	2013-2014
The Environment Agency through its Climate Ready Support Service and the Local Government Association will help to build the capacity of councils through delivering councillor training and support materials.	Environment Agency Climate Ready, Local Government Association	2013-2014

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Actions	Owner(s)	Timing
LOCAL GOVERNMENT RELEVANT OBJECTIVES ALSO APPEARING IN OTHER POLICY-THEME ACTION SPREADSHEETS:		
BUILT ENVIRONMENT		
Objective 1: To work with individuals, communities and organisations to reduce the threat of flooding and coastal erosion, including that resulting from climate change, by understanding the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and making sure that other plans take account of them.		
Defra Flood Management to evaluate risk management authority delivery of their roles and responsibilities established under Flood and Water Management Act.	Defra Flood Management	By April 2015
Defra, the Environment Agency and local government to work together to help develop a single information portal to share consistent high-level information on flooding.	Defra, Environment Agency	Ongoing
Objective 2: To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development, including infrastructure, that minimises vulnerability and provides resilience to the impacts of climate change.		
Environment Agency Climate Ready team to support the Local Government Association's Climate Local initiative as a means of signposting advice, tools and examples that can help councils take action to improve the resilience of the local built environment. This will continue to be promoted by Climate UK via local partnerships networks and events with local authorities.	Environment Agency Climate Ready	2013 onwards
The Department for Communities and Local Government to update planning guidance to support the implementation of the National Planning Policy Framework's policies on adapting to climate change, in the light of the review of government planning practice guidance.	Department for Communities and Local Government	Summer 2013
Environment Agency Climate Ready team to provide guidance and tools to local Environment Agency teams so they can promote climate change adaptation in their advice to local authorities and developers as part of their role as a consultee to the planning process.	Environment Agency Climate Ready	Ongoing
Local planning authorities to work with their communities, the Environment Agency and partners in putting in place up to date local plans consistent with the National Planning Policy Framework, including policies on tackling climate-related impacts, such as flooding and coastal change.	Local planning authorities	Authorities have been encouraged to get up to date local plans in line with the NPPF in place as quickly as possible
Environment Agency Climate Ready service to make tools and advice available to planners and developers on future climate risk. This will continue to be promoted by Climate UK via local partnerships networks and events with local authorities.	Environment Agency Climate Ready	Ongoing

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Town and Country Planning Association supported by Climate UK (CUK), has produced guidance: 'Planning for Climate Change, Guidance for local authorities' (2012). This will continue to be promoted by CUK via local partnerships networks and events with local authorities.	Town and Country Planning Association	Published in 2012
Objective 3: To help businesses and industries in the sector to access skills, training, knowledge and tools to understand and manage climate change risks.		
Environment Agency Climate Ready service to make skills and training on climate change adaptation resources available to decision-makers in the built environment sector. This will continue to be promoted by Climate UK via local partnerships, networks and events with local authorities.	Environment Agency Climate Ready	Ongoing
Objective 4: To ensure that investors and developers have the financial and appraisal decision tools needed to support and promote adaptation to climate change.		
Environment Agency Climate Ready service to disseminate sector-led best practice guidance and research on Green Infrastructure. This will continue to be promoted by Climate UK via local partnerships networks and events with local authorities.	Environment Agency Climate Ready	2013 onwards
Objective 5: To increase the resilience of homes and buildings by helping people and communities to understand what a changing climate could mean for them, and to take action to be resilient to climate risks.		
The Department for Communities and Local Government to appropriately consider climate change adaptation in its review of the framework of Building Regulations and local housing standards.	Department for Communities and Local Government	Ongoing
Objective 6: To explore and build understanding of the long term implications of climate change for the location and resilience of population centres.		
Defra and the Environment Agency to build partnerships with water companies and Lead Local Flood Authorities (LLFAs) to produce area drainage plans. LLFAs to produce a set of surface water flood maps by the end of 2013, in partnership with water companies (eg 'Drain London', which involves Thames Water and London Boroughs).	Lead Local Flood Authorities and water companies, Environment Agency, Defra	2013 onwards
INFRASTRUCTURE		
Objective 7: To ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events.		
To increase communication with water companies via partnership-working with local authorities over the development of area drainage plans as appropriate and Sustainable Drainage Systems for new development, where achievable and cost-beneficial. This activity is also enabled via the Flood and Water Management Act (2010) duty to co-operate. (This is linked to Built Environment Theme action on management of surface water in built-up areas.)	Water companies, Water UK	2013 onwards
Water companies to update sewerage management plans, working with local authorities, as part of developing and maintaining supply, sewer and drainage infrastructure networks over the long term, providing resilience to climate change.	Water companies	Ongoing

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Actions	Owner(s)	Timing
To build partnerships with water companies and Lead Local Flood Authorities to align Drainage Area Plans. Sewerage Management Plans and Strategic Drainage Frameworks (where appropriate, since these are non-statutory and industry recognised documents) and to help inform Local Flood Risk Management Strategies.	Environment Agency, Lead Local Flood Authorities, water companies, Defra	2013 onwards
The Environment Agency to produce a set of Surface Water Flood Maps by from the end of 2013, in partnership with water companies and Lead Local Flood Authorities. (examples include Drain London, involving Thames Water and London Boroughs).	Environment Agency, Lead Local Flood Authorities and water companies, Defra	2013 onwards
To invest in activity that encourages customers to enhance resilience, such as in maintaining and cleaning blockages from their sewer system due to customers disposing fats, oils and grease items down their sinks and toilets. Examples includes Anglian Water 'Keep it Clear' and Yorkshire Water 'Doing the Dirty' campaigns.	Lead Local Flood Authorities and water companies, Environment Agency, Defra	2013 onwards
Objective 9: To better understand the particular vulnerabilities facing 'local' infrastructure (e.g. local highways) from extreme weather and long term climate change so as to determine actions to address the risks.		
Environment Agency, Climate UK, ADEPT and Department for Transport to build capacity of local highways engineers and other relevant spatial planning and flood risk local authority professions, on climate resilience.	Environment Agency, Climate UK , Department for Transport and ADEPT	2013
Support the Local Government Association's Climate Local initiative as a means of signposting advice, tools and examples that can help councils take action to improve the resilience of local transport and energy infrastructure.	Environment Agency Climate Ready	2013 onwards
Use existing local organisations and networks such as ADEPT, UK Roads Liaison Group, Climate UK and Local Adaptation Advisory Panel to share knowledge and best practice with respect to local highways.	Department for Transport, local organisations and networks (eg ADEPT, UKRLG, Climate UK, Local Adaptation Advisory Panel)	2013 onwards
To take forward pluvial flood risk management through partnership working under the Flood and Water Management Act 2010 and the duty to cooperate. To publish surface water flood maps by the end of 2013.	Local Authorities and Water Companies	2013 onwards
To approve drainage systems in new developments and redevelopments especially where these relate to highways, before construction can begin, in accordance with SuDS National Standards. (this will follow after Government implements Schedule 3 of the Flood and Water Management Act 2010 in April 2014).	Local Authority SuDS Approving Body (SAB)	2014 onwards

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HEALTH		
Objective 11: To reduce the risk of death and illness associated with severe weather events and climate change and increase preparedness and resilience to the impacts on public health.		
Promotion and continued implementation of the Department of Health and Public Health England 'Heatwave Plan for England' (reviewed annually). By 2014 the Plan will improve its reach to local authorities and include advice on action beyond the health sector, for example: • on the role of blue and green infrastructure; and • housing design and transport in helping reduce health risks associated with overheating and air pollution during heatwaves. Individuals, groups and communities most susceptible to heat impacts will also be actively targeted. PHE will explore the relevance of these plans to other extreme weather events using an all hazards approach. The Heatwave Plan will also include advice on avoiding over-exposure to UV.	Department of Health, Public Health England, Local Authorities, Government, with civil society and other sectors involved	By 2014 Reviewed annually
To promote and implement the Cold Weather Plan for England.	Department of Health, Public Health England, Government with Local Authorities, communities, civil society	Reviewed annually
To implement local, evidence-based actions to address health risks from climate change and to prepare, respond and recover to severe weather events associated with climate change, for example through Joint Strategic Needs Assessments, Joint Health and Wellbeing Strategy and Local Health Resilience Partnerships.	Directors of Public Health, health and wellbeing boards, Clinical Commissioning Groups, Public Health England (evidence base, technical support, guidance and materials and public health intelligence)	April 2013 onwards
Support community resilience through the: a) National Flood Emergency Framework for England (health impacts integrated) and Local Multi-Agency Flood Plans; b) National Recovery Guidance, Strategic Co-ordinating Groups, local Recovery Coordination Groups; c) Local Health Resilience Partnerships; and d) Public Health England for evidence base, technical support, guidance and materials and public health intelligence.	a) HMG, Defra, Department of Health, Public Health England and Local Resilience Forums b) Local Authorities, Local Resilience Forums, Cabinet Office, Department for Communities and Local Government c) Local Authority Directors of Public Health, Department of Health, National Health Service England d) Public Health England	a) end of year b) ongoing c) from 2013 d) ongoing
Environment Agency Climate Ready team to support the Local Government Association's Climate Local initiative, signposting advice, tools and examples that help councils address health risks.	Environment Agency Climate Ready Service, Public Health England	2013 onwards

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To tackle emissions of ground level ozone precursors: Defra to continue to work with international and UK partners to reduce emissions of pollutants leading to transboundary air pollution through, for example, the Gothenburg Protocol. Defra, Department of Health and Public Health England will work with councils to encourage action to support co-benefits between climate change and air quality, and encourage it to be taken into account when taking local action to improve air quality.	Defra, Department of Health, Public Health England	Ongoing
Defra to produce better-targeted air pollution information and advice that reaches people most susceptible to the associated health impacts.	Defra with interest from Department of Health, Local Authorities, Public Health England, civil society groups	Ongoing
To implement environmental and public health surveillance that has the capability to detect and monitor exposure and health risks from freshwater/marine pathogens and Harmful Algal Blooms, in addition to algal toxins associated with climate change.	Defra, Food Standards Agency, Centre for Environment, Fisheries and Aquaculture Science, Public Health England, Department of Health, Environment Agency, water companies, Drinking Water Inspectorate, Local Authorities	Ongoing
Objective 12: To promote climate resilience within the NHS, public health and social care system to ensure continuity of services and resilient assets/estates including the ability to deal with the increased demand for services associated with severe weather related events.		
To support continued community resilience through: a) National Flood Emergency Framework for England (Health impacts integrated) and Local Multi-Agency Flood Plans; b) National Recovery Guidance; and c) Local Health Resilience Partnerships.	a) HMG, Defra, Department of Health, Public Health England, Environment Agency and Local Resilience Forums b) Cabinet Office, Department for Communities and Local Government c) Local Authority Directors of Public Health, Department of Health, National Health Service England	a) by end of 2013 for national framework b) ongoing c) from April 2013 onwards
Public Health England to provide information, guidance notes, evidence, technical support and related public health intelligence on health impacts of flooding.	Public Health England with involvement of Department of Health, Environment Agency, Local Authorities, Directors of Public Health, National Health Service England	Ongoing
Objective 13: To minimise the impact of climate change on vulnerable groups in society by strengthening their resilience to better prepare for, respond to and recover from future climate risk.		
Environment Agency Climate Ready to support the Local Government Association's Climate Local initiative, signposting advice, tools and examples that help councils address risks to vulnerable groups.	Environment Agency Climate Ready	2013 onwards

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Environment Agency Climate Ready to continue to share information and promote understanding of the risks to different vulnerable groups, specifically including: • supporting local councils through the dissemination of tools and guidance on how to map vulnerable groups and best communicate with communities; and • supporting and disseminating learning about the barriers to effective engagement with voluntary organisations on climate resilience work, using networks through the National Council for Voluntary Organisations.	Environment Agency Climate Ready, National Council for Voluntary Organisations	2013 onwards
Objective 14: To promote and strengthen community resilience to severe weather related events linked to climate change (preparation, response and recovery), and the climate resilience of the emergency services and other Category 1&2 Responders of the Local Resilience Forums.		
Local responders and Local Resilience Forums to promote and build community resilience to the impacts of extreme weather events and climate change.	Local Resilience Forums, local responders, communities and partners (eg Public Health England for evidence base	Ongoing
Environment Agency Climate Ready team to support the Local Government Association's Climate Local initiative to signpost advice, tools and examples that help councils build community resilience to the impacts of climate change.	Environment Agency Climate Ready	2013 onwards
NATURAL ENVIRONMENT		
Objective 19: To build the resilience of wildlife, habitats and ecosystems (terrestrial, freshwater, marine and coastal) to climate change, so as to put our natural environment in the strongest possible position to meet the challenges and changes ahead.		
To ensure newly-established Nature Improvement Areas have the necessary knowledge and tools to build adaptation in to their work.	Nature Improvement Areas	Ongoing
The Environment Agency to identify areas suitable for restoration or creation of priority coastal habitats, as well as working with partners including local authorities to better align shoreline management plans and marine plans to ensure no net loss [or net gain] of priority habitat.	Environment Agency	By 2020
To make Local Nature Partnerships (LNPs) aware of the risks associated with climate change and enable LNPs to build adaptation to climate change into their plans, strategies and work.	Local Nature Partnerships	Ongoing
Environment Agency Climate Ready service will support the Local Government Association's Climate Local initiative as a means of signposting advice, tools and examples that can help councils take action to improve the resilience of the natural environment.	Environment Agency Climate Ready	2013 onwards
Objective 21: To promote, and gain widespread uptake in other sectors of the use of adaptation measures that benefit and/or do not adversely affect the natural environment.		
Guided by section 40 of the Natural Environment and Rural Communities Act, all public authorities, including local authorities, to have regard to conserving biodiversity, whilst exercising their functions.	Range of authorities including all local councils	Ongoing
Objective 22: To improve the evidence base, to enhance the knowledge and understanding of decision makers, land managers and others of the impacts of climate change on the natural environment and how best we can influence adaptation or accommodate change.		

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Natural England to assess the role of Nature Improvement Areas (NIAs) in climate change adaptation and to encourage decision-makers to consider climate change in their management plans, including using some of the new models for climate vulnerability and ecological connectivity.	Natural England	The project completed Spring 2013, but NIAs will be reporting progress annually using indicators, up until 2015
The Environment Agency to encourage Local Nature Partnerships to consider their role in planning strategically on a large scale for climate change.	Environment Agency	Project completes April 2013
BUSINESS		
Objective 23: To raise awareness and understanding amongst businesses about climate change risks.		
Climate UK to work with local authorities and Local Enterprise Partnerships to assess and manage climate risks and opportunities for local economies through raising awareness, signposting guidance and encouraging the sharing of good practice.	Climate UK and the Climate Change Partnerships	Until financial year 2013-14
Environment Agency Climate Ready service will support the Local Government Association's Climate Local initiative as a means of signposting advice, tools and examples that can help councils work with the business community to increase resilience.	Environment Agency Climate Ready	2013 onwards
Objective 25: To raise awareness and understanding amongst businesses about domestic and international climate change opportunities.		
Climate UK to work with Local Enterprise Partnerships to raise awareness and support best practice in assessing and managing local economy climate change risks and opportunities.	Climate UK	2013 and onwards.
Defra and the Department or Business, Innovation and Skills to develop the EU Growth Programme for England (covering 2014 to 2020) and ensuring that adaptation is embedded in the development and implementation of local strategies. A programme objective includes development of an adaptation policy statement and guidance to Local Enterprise Partnerships.	Defra and Department for Business, Innovation and Skills	2013 and onwards.
Greater London Authority with the London Climate Change Partnership to undertake a scoping study to understand the adaptation economy in London through analysing the sub-sectors and identifying how the sector could and should develop to meet future local, national and international demand.	Greater London Authority, London Climate Change Partnership	2013-2014

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