Select Committee on Climate Change

Report

October 2006

 [1]

The Adonis Blue Butterfly, symbol of the Kent Wildlife Trust. The emergence dates for this butterfly are now up to 20 days earlier compared to a few decades ago[2], a good example of how climate change may be affecting Kent now. However, in the North Downs of Kent, the Adonis Blue Butterfly relies on a food plant that is susceptible to drought[3]. The hotter, drier climate predicted for Kent by 2080 because of climate change could therefore threaten its long-term existence.

reduce

Kent County Council

[1] © Photo: Butterfly Conservation/Ken Willmott. Picture of Adonis Blue Butterfly used with kind permission of Butterfly Conservation. Website: http://www.butterfly-conservation.org/index.php

[2] *Millennium Atlas of Butterflies in Britain and Ireland*, Jim Asher et al, Oxford, 2001.

[3] Evidence received from the Kent Wildlife Trust at the hearing on 28 April 2006, (paragraph 9).

CONTENTS

1 Foreword by the Chairman of the Select Committee

> **"It is not necessary to change.**
>
> **Survival is not mandatory".**
>
> *- William Edwards Deming (1900 – 1993)*

Climate change has become a high profile issue and rightly so. It represents a very real threat to the residents of Kent. I do not say this lightly. The predicted scenarios for Kent covering the period between the 2020's and the 2080's will have major impacts on life in the county. The predicted effects under the "high emissions" scenarios make alarming reading. Southeast England will suffer more than most parts of the UK and Kent will bear the brunt of this due to its geography and geology. As a county, we are more exposed than most and this will require a robust and effective response.

Fortunately, we **can** do something about climate change. There are proven, pragmatic solutions. The Select Committee has identified these under the headings of "Adaptation", "Mitigation" and "Community Leadership". The recommendations impact the work of Kent County Council ("KCC") across most of its directorates.

Some argue it does not matter what we do here in Kent to address climate change, as others in the world are creating more of the problem. I have an enduring memory of hearing the evidence of Becky Ribbens, a Member of the Kent Youth County Council. Becky's words were a powerful reminder that our efforts to tackle climate change must succeed if we are to ensure our children inherit a world fit to live in. We do not want our children to look back and ask why we did not do enough when we knew the consequences. Kent's emissions may be relatively small globally, but they are significant nonetheless and we must show leadership if we are to change many of the world's damaging habits.

If asked how KCC is doing in tackling climate change issues, the answer would be fair, but must do better. A good start has been made and there is some excellent work underway and the KCC staff driving this should be congratulated. There is a real need, however, to ensure a more clearly defined strategy to enable better delivery of the relevant policies.

Some solutions will cost, but will be cheaper and easier to achieve now than if left to implement in the undetermined future. KCC is in a position to accommodate a longer "pay-back" period to achieve this. As energy and other costs increase, these solutions become relatively less expensive.

Time is not on our side. The most recent reports suggest man has less than a decade in which to make an impact on climate change. If we delay, we risk turning a dangerous possibility into a dangerous certainty. KCC must lead by implementing solutions in its own estate and operations. KCC must partner with the people of Kent to better understanding of climate change issues and their solutions.

The Select Committee heard many witnesses via hearings and written evidence. The Select Committee also heard from Members of the Public who attended Local Boards where climate change was the topic of discussion. This was the first time a Select Committee Topic Review was discussed at Local Boards and the attendance demonstrates the importance of the issue to Kent residents. On behalf of the Select Committee, may I thank everyone who gave their time and evidence.

I began this foreword with a quotation. I will end with one. A reminder to change our ways in order to avoid the worst predictions for climate change. In evidence we heard if everyone on the planet lived as we do in southeast England, we would need 3.5 “Planet Earth’s” to sustain us. In conversation at Local Boards, I found telling people the Garden of England may not be able to grow apples made many think deeply. John Galsworthy once wrote ‘If you do not think about your future you cannot have one.’ Time not just to think but to act – the future is closer and rather less comfortable than many of us realised.

Mr Chris Wells, Chairman of the Select Committee.

2 Executive Summary

2.1 Why the Select Committee Has Taken Place and its Purpose

2.1.1 Climate change[4] is an issue of growing public concern and awareness. It is also an increasing priority for government at international[5], national[6] and local[7] level. The Policy Overview Co-ordinating Committee established a Select Committee on Climate Change in August 2005. The purpose of the Select Committee was to:

- Produce a strategic report and recommendations on behalf of the former Strategic Planning Policy Overview Committee (SPPOC) (now the Environment and Regeneration Policy Overview Committee (ERPOC)).

- Report its recommendations to ERPOC, Cabinet and full Council.

[4] For the definition of climate change used in this report, please see section 4.1.2. For a further detailed definition, please see the glossary.

[5] For example, the formation of the Intergovernmental Panel on Climate Change ("IPCC") in 1988, assembled by the world's governments to provide scientific advice on climate change. See www.ipcc.ch/about/about.htm.

[6] For example, the formation of the UK Climate Impacts Programme ("UKCIP") in 1997, see evidence in this report and www.ukcip.org.uk.

[7] For example, the Nottingham Declaration on Climate Change to which Kent County Council is a signatory. This is a declaration for Local Authorities to commit to tackling the impact of climate change. See www.lga.gov.uk/Briefing.asp?lsection=59&id=SXB9C9-A77F8CF8&ccat=216.

2.1.2 The Terms of Reference for this Select Committee are:

- The impact of climate change in short, medium and long terms for Kent's economy, society and environment, including related impacts of extreme weather conditions.

- KCC's Community Leadership role in adapting to and mitigating the impact of climate change. This includes recognising ways that KCC can directly and indirectly influence our contribution to climate change.

2.1.3 The strength and volume of the evidence presented leads the Select Committee to readily accept the scientific consensus that climate change over and above that which can be explained by natural variation is happening, and that human activity is responsible. As such, acceptance of these propositions is the most - indeed, the only - sensible basis for future policy development on climate change.

2.1.4 Three of the biggest obstacles for securing a commitment to action on climate change are that:

- Some of its most dramatic predicted effects seem a long way off, and it is difficult to predict when they might occur.

- There is some awareness of the impact of global warming on distant parts of the planet – the polar ice caps, expanding deserts, low lying Pacific island states, for example – but very little understanding and awareness of the profound changes facing Kent.

- It is difficult to attribute any particular extreme weather event – whether that be the current drought or the flooding in New Orleans in 2005 for example – to climate change.

2.1.5 Having considered these questions in some detail, however, the Select Committee believes that:

- The evidence that climate change, over and above that which can be explained by natural variability, is already happening is overwhelming. As such, it needs to be addressed as a problem for today, not just for tomorrow, particularly as the warming we will experience until the 2040s has already been determined by past emissions.

- The impacts of climate change for the UK will be acute. Kent will experience some of those impacts, notably rising temperatures and reduced summer rainfall, more sharply than any other part of the country.

- Uncertainty is not an excuse for inaction. Governments, central or local, are likely to face grave political consequences if they do not act and the impacts become more apparent, which they may do rapidly and unexpectedly.

2.2 Recommendations

2.2.1 The Select Committee's recommendations are summarised below and are not ranked in order of importance. The detail supporting recommendations are in the report as indicated and readers are referred to these sections for further details.

No.	Summary Description of Recommendation.	Section for Detail.	Detailed Recommendation Section Reference / (Page)
1	An explicit corporate acceptance of climate change and how human activity contributes to it.	Is Climate Change Happening?	4.2.3 / (page 19)
2	Detailed assessment of climate change impacts on KCC services and development of adaptive responses.	Adaptation	6.3.8 / (page 49)
3	Ensure climate change impacts on flood risk, water resources and emergency planning are taken into account.	Adaptation	6.11.5 / (page 72)
4	Provide support for better sustainable energy advice to Kent's residents.	Mitigation	7.5.7 / (page 81)

No.	Summary Description of Recommendation.	Section for Detail.	Detailed Recommendation Section Reference / (Page)
5	Complete a feasibility study for use of biomass in KCC buildings and replace conventional fuels with bio-fuels in KCC vehicles where possible.	Mitigation	7.7.7 / (page 85)
6	Increase support for energy efficiency and renewable energy, particularly micro-generation, in the KCC estate and across Kent as a whole.	Mitigation	7.9.13 / (page 96)
7	Review transport policy to achieve an overall reduction in emissions from transport in the KCC estate and across Kent as a whole.	Mitigation	7.12.8 / (page 103)
8	Make more efficient use of land in the development process and meet higher standards of sustainable construction.	Mitigation (and adaptation)	7.17.3 / (page 110)
9	Introduce a Climate Change Action Plan, supported by clear targets.	Community Leadership	8.4.10 / (page 125)
10	High profile communications programme.	Community Leadership	8.5.5 / (page 127)
11	Clarify political and management leadership and accountability on climate change within KCC.	Community Leadership	8.6.4 / (page 129)
12	Improve education on climate change impacts.	Community Leadership	8.7.6 / (page 132)

3 Introduction and Background

3.1 Select Committee on Climate Change Membership

3.1.1 The Select Committee on Climate Change ("the Select Committee") consisted of eight Members of Kent County Council ("KCC"), five Conservative, two Labour and one Liberal Democrat:

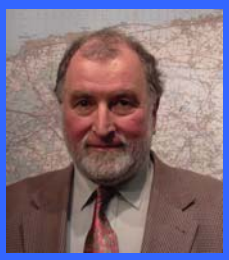
Mrs Christine Angell
Labour
Dartford East

Mr Adrian Crowther
Conservative
Sheppey

Mrs Trudy Dean
Liberal Democrat
Malling Central

Mr Charles Hibberd
Conservative
Birchington & Villages

Mr David Hirst
Conservative
Herne Bay



Mr Godfrey Horne MBE
Conservative
Tonbridge

Mr Tom Maddison
Labour
Dartford West

Mr Chris Wells
Conservative
Margate & Cliftonville

Chairman

3.2 Overview of Process

3.2.1 In spring 2006, the Select Committee received evidence from a wide range of stakeholders, scientific experts, KCC Officers, campaigning organisations and sector representative organisations. The Select Committee also received evidence from national government, regional bodies and local authorities within and outside Kent.

3.2.2 Evidence was received either orally at Select Committee hearings or via requests for written evidence. A full list of witnesses, who attended Select Committee hearings, as well as visits made and written evidence received can be found in section 11 and Volume 3 of this report.

3.2.3 For the first time in a Select Committee process within KCC, the public were able to add their comments directly through Local Board meetings in Dartford, Thanet and Shepway where climate change was the topic of discussion. Members of the public were also able to contribute by completing an answer to the question "Name one thing that you think KCC should be doing to tackle climate change". The evidence received is shown in Appendix 1.

3.3 Structure of Report

3.3.1 The Select Committee found that to address the impact of climate change, a distinction must be made between adaptation[8] – adjusting to the predicted or actual impacts - and mitigation[9] – addressing the causes by reducing greenhouse gases in the atmosphere. The other key themes that arose during review are:

- Providing strategic leadership.
- Leading by example in managing KCC's own estate.
- Service provision (KCC services and services that KCC can influence).
- Community leadership.

3.3.2 In this report, the Select Committee wishes to emphasise both:

- The impact of climate change on Kent.
- The links climate change has with other issues that people are interested in.

3.3.3 In addition, the Select Committee wishes to ensure that this report appeals to a wide audience. This audience can be classified as follows:

- Readers interested in the Executive Summary (short report) only.

[8] A definition of Adaptation can be found in the glossary.

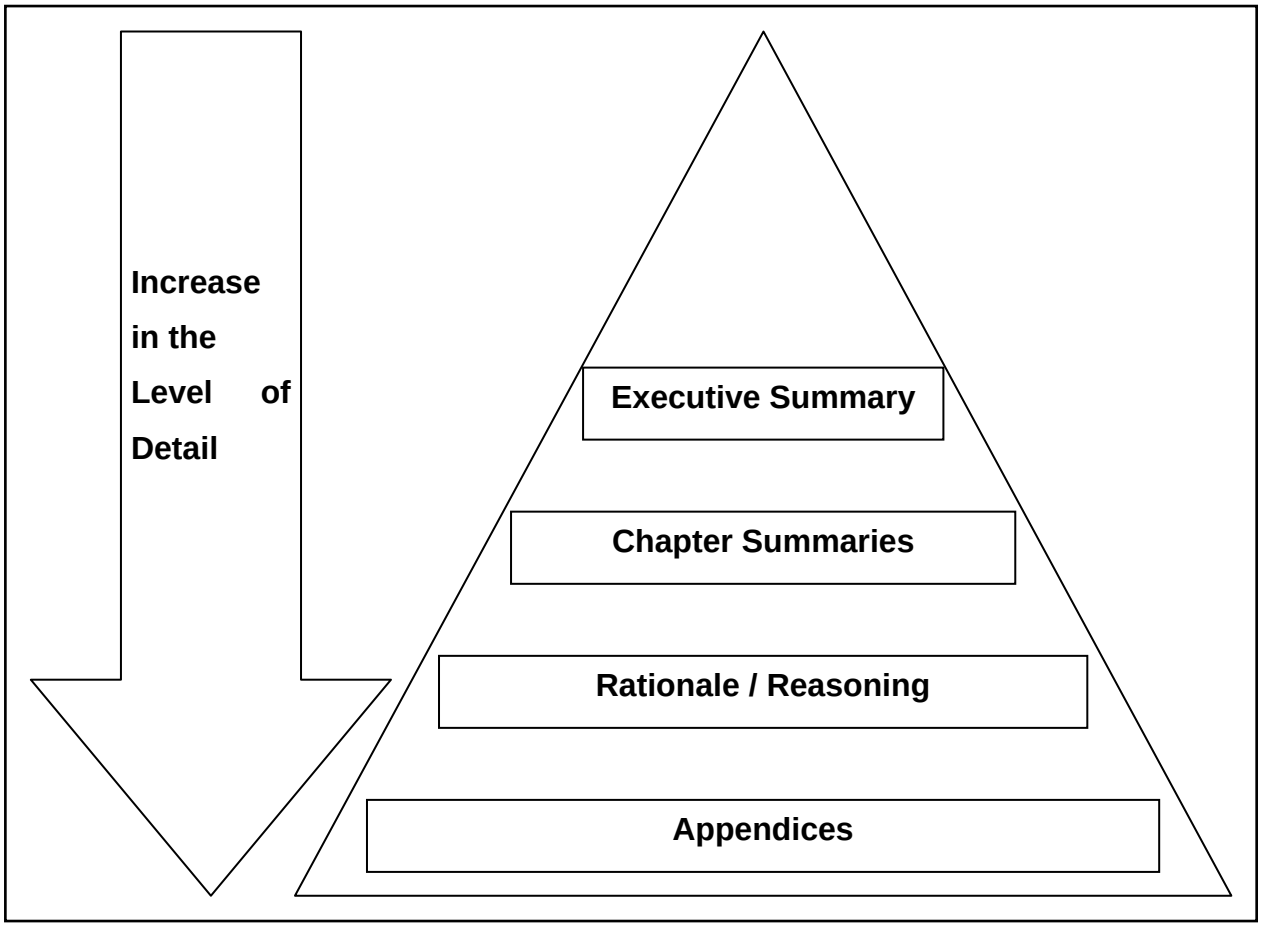
[9] A definition of Mitigation can be found in the glossary.

- Readers interested in particular aspects of the report only.

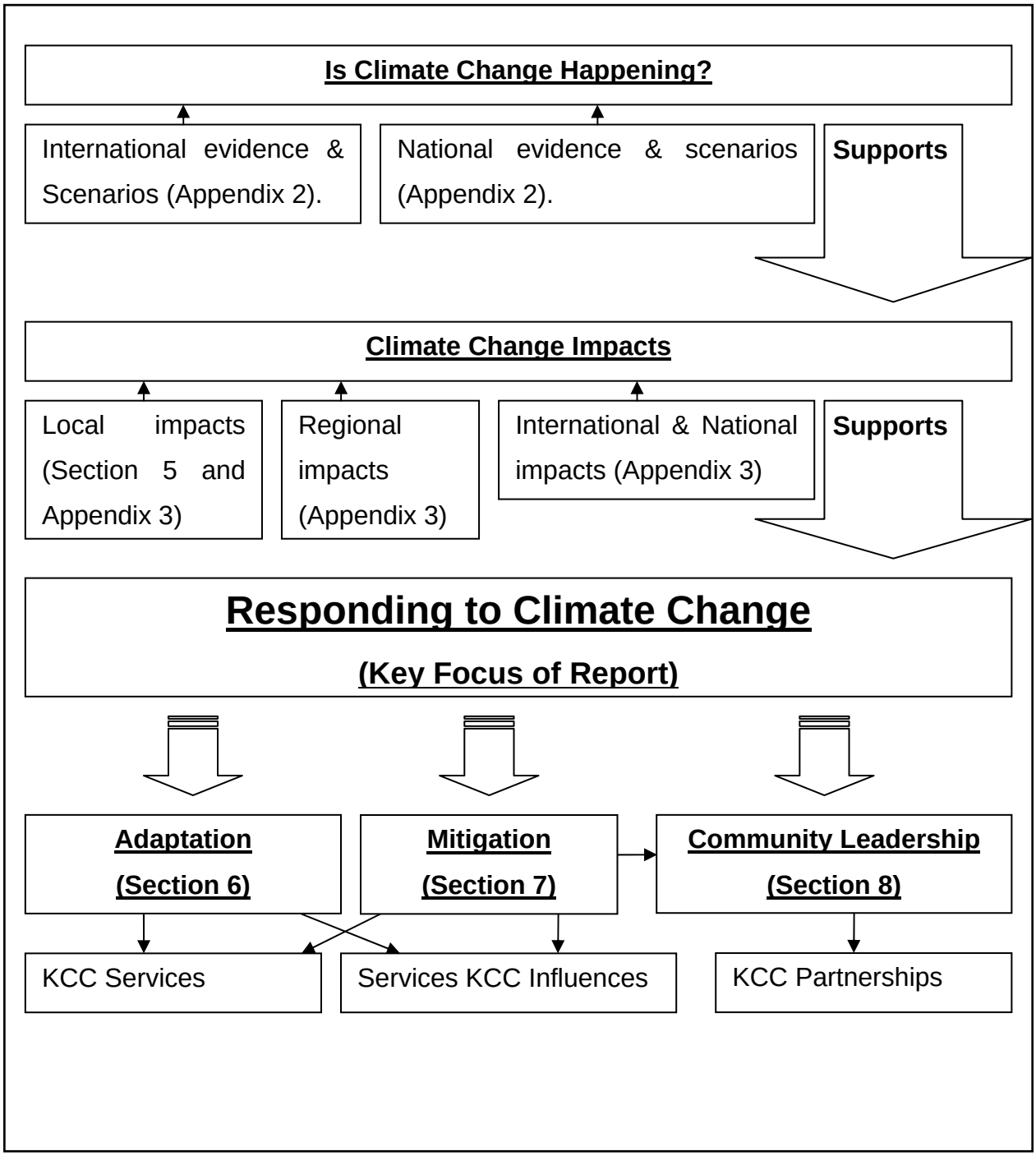
- Readers interested in reading the whole report to understand all the aspects of the impact of climate change on Kent.

3.3.4 To aid the understanding of this report by readers, the report is structured as indicated in diagram 3.3.5. Further details of how key themes link with each other is shown in diagram 3.3.6. A full glossary that gives definitions for key terms and abbreviations used in this report, including terms such as climate change, adaptation and mitigation, can be found in section 10 at the end of the report.

3.3.5 **Diagram 3.3.5:** Structure of report



3.3.6 **Diagram 3.3.6:** Structure of key themes



4 Is Climate Change Happening?

4.1 Background

4.1.1 The Select Committee started its inquiry by taking a considerable amount of evidence on the two key questions in the international debate about climate change:

- Is climate change happening?
- How much is it influenced by human activity?

4.1.2 The earth's climate is, of course, always changing, but for the purposes of this report 'climate change' should be understood to mean change which is greater than can be explained by the 'natural' variation in the earth's climate alone[10]. The Select Committee heard that there is an almost universal consensus within the global scientific community that the earth is warming up[11]. It did so by 0.6ºC during the last century and this is accepted even by previously sceptical members of the scientific community.

[10] A more detailed definition of climate change can be found in the glossary.

[11] Evidence received, *inter alia*, from Mr Peter Moore, KCC Environment Strategy Manager at the hearing on 3 April 2006, as well as Mr Mark Goldthorpe at the hearing on 10 April 2006, Mr Peter Martin of Carbon**sense** at the hearing on 12 April 2006 and Mr Gerry Metcalf of UKCIP at the hearing on 3 May 2006. See also the UKCIP02 scenarios for the United Kingdom: http://www.ukcip.org.uk/resources/publications/documents/UKCIP02_briefing.pdf

4.1.3 While 0.6ºC may not sound significant, the EU has identified 2ºC as the level beyond which climate change would cease to be 'safe'. Even below this level would not necessarily be 'comfortable', bearing in mind that the difference in average global temperature between today and the last ice age is about 5ºC. In this light, a rise of 1.5ºC in average temperature Kent by the 2020s and up to 6ºC by the end of the century - the former now seems inevitable as a result of past emissions, and the latter is likely unless we reduce global carbon dioxide emissions substantially - should be a cause of great concern[12].

4.1.4 The extent to which human activity influences climate change proves slightly more controversial. There is clear consensus within the Intergovernmental Panel on Climate Change and the wider scientific community that the strong warming of the last 50 years cannot purely be explained by 'natural' variation and is mostly due to human activity, particularly the burning of fossil fuels. This has pushed atmospheric levels of carbon dioxide, with which there is a direct relationship with global temperature, from below 300 parts per million in the early 20th century to 380 parts per million today – its highest level for hundreds of thousands of years[13].

4.1.5 Details of the scientific evidence received by the Select Committee and how it proves climate change can be found in Appendix 2.

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[12] Evidence received from Mr Peter Moore, KCC Environment Strategy Manager, at the hearing on 3 April 2006.

[13] See note 11 *supra*.

4.2 Acceptance That Climate Change is Happening

4.2.1 A recurring theme in evidence was that corporate acceptance of climate change is a key issue[14].

4.2.2 The Select Committee is convinced that the importance of corporate acceptance of climate change and acknowledgment of the contribution of human activities to it, is an important step for KCC and this forms the basis of the Select Committee's first recommendation.

4.2.3 **Recommendation 1**: An explicit corporate acceptance of climate change and how human activity contributes to it.

The Select Committee recommends that KCC explicitly acknowledge:

1. Climate change over and above that which can be explained by natural variation is happening and accelerating.

2. The impacts of climate change pose significant risks to the services provided by KCC and to Kent's communities.

3. KCC has a responsibility for Kent's residents and future generations to adapt to and mitigate climate change.

[14] For example, see evidence received from Mr Jim Boot of Maidstone Borough Council at the hearing on 26 April 2006 (see paragraphs 5 and 11), Mr Gerry Metcalf of UKCIP at the hearing on 3 May 2006 (see paragraphs 13 *et seq)* and Mr Steve Waller of I&DeA at the hearing on 3 May 2006 (paragraphs 3 and 7 *et seq)*.

4.2.4 The scientific consensus is reflected in a high degree of political consensus[15] that man-made climate change is happening and requires an urgent and co-ordinated response. Evidence received demonstrated that the most effective response to climate change occurred where there was cross-party agreement[16]. The Select Committee wishes to highlight this very important point.

4.3 Why Climate Change is Relevant to Local Authorities

4.3.1 As climate change will affect the 'social, economic and environmental well-being' of the community, local authorities have duties and powers under the Local Government Act 2000 to address this.

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[15] For example, quotes from senior Labour, Conservative and Liberal Democrat MP's:

"If what the science tells us about climate change is correct, then unabated, it will result in catastrophic consequences for our world…… surely the balance of risk for action or inaction has changed". *The Rt. Hon. Tony Blair MP, Prime Minister.* See www.pm.gov.uk/output/Page6333.asp.

"The need to tackle climate change is urgent….the effects of climate change are being felt right here, right now. We need to act now. Tony Blair was right to make climate change a central component of the G8 agenda". *The Rt. Hon David Cameron MP, Leader of HM Opposition.* See http://comment.independent.co.uk/commentators/article323747.ece

"We aim to push climate change up the political agenda and make it more likely that the radical action necessary will be taken. The challenge of climate change is so serious that parties need to strive to find common ground". *Mr Norman Baker MP, speaking when he was the Environment Spokesperson for the Liberal Democrats.*

See: http://www.epolitix.com/EN/News/200601/177b7917-b5ab-415e-86ea-8bd0e20d8546.htm

[16] Evidence in relation to Woking Borough Council received from Mr John Thorp of the Energy Conservation and Solar Centre at the hearing on 15 May 2006, (paragraphs 3,4 and 14).

4.3.2 Government guidance also emphasises that local authorities consider the impact of climate change on their own estate, planning, long-term policies, community strategies, emergency procedures and service planning. The Government published a revised UK Climate Change Programme in March 2006 which indicated that a new carbon reduction performance reporting requirement is to be introduced for local authorities after Continuous Performance Assesment ("CPA") finishes in 2007[17].

4.3.3 The Select Committee concludes that this, coupled with the Climate Change and Sustainable Energy Act 2006[18] and tougher planning guidance on climate change[19], clearly demonstrates why climate change must be included in local authority planning now.

4.3.4 The Select Committee also notes that KCC has a responsibility as an employer to consider the impact of climate change on staff.

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[17] Evidence received from Mr Steve Waller of I&DeA at the hearing on 3 May 2006 (paragraph 4).

[18] The Act gives new powers and duties to local authorities to promote micro-generation and energy efficiency.

[19] The Department for Communities and Local Government is currently drafting a Planning Policy Statement on Climate Change, with which all local authority spatial plans will have to accord, and will consult on the draft later this year. Evidence received from Mr Rob Shaw of the Town and Country Planning Association at the hearing on 12 April 2006 (paragraph 14 *et seq)*.

4.3.5 Within KCC, the policy basis for action can be found in the Nottingham Declaration signed by KCC[20] in 2001, the Kent Environment Strategy[21] in 2003 and the *Vision for Kent* document[22], Kent's community strategy, which identifies climate change as one of seven major cross-cutting challenges facing Kent. The Select Committee notes however that further action is required to translate these commitments into action and this is discussed in section 8.4.

4.3.6 Across the County, there is also an emerging consensus for action on climate change, evidenced by submissions from the Kent Partnership, District Councils in Kent, such as Ashford and Tunbridge Wells Borough Councils[23] and oral evidence presented by Maidstone Borough Council[24]. This is discussed further under Community Leadership in section 8.

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[20] See note 7 *supra.*

[21] *Climate Change Impacts for Kent, the impacts of climate change on Kent's environment, society and economy, (See Appendices for Sector by Sector impact)*. Report submitted and presented to the Select Committee by Mr Peter Moore, KCC Environment Strategy Manager, on 3 April 2006. See Appendix 5.

[22] Written evidence from the Kent Partnership.

[23] Written evidence from these organisations.

[24] Evidence received from Mr Jim Boot of Maidstone BC at the hearing on 26 April 2006 .

5 Climate Change Impacts on Kent

5.1 Summary of Points Covered in Section

- **Key climate change impacts like higher summer temperatures, increased flood risk and increased frequency of drought will affect Kent more than most other parts of the UK for a variety of demographic and geographic reasons. Kent therefore has atypical needs and this must be stressed.**

- **Climate change poses major social, economic and environmental challenges for the quality of life in Kent.**

- **While climate change may also bring benefits and opportunities, some of these may be temporary and are likely to be substantially outweighed by the costs and disadvantages.**

- **Kent-specific information on climate change impacts is limited and there is a need for further research to help different sectors understand the impacts and respond effectively**

- **In seeking to adapt to the impacts of climate change, it is vital that we avoid steps which will simply accelerate climate change by increasing the emission of greenhouse gases.**

5.2 Section Introduction

5.2.1 This section covers:

- What climate change will mean for Kent.
- Recent experiences of extreme weather in Kent associated with climate change.
- Strategic infrastructure impacts of climate change in Kent.
- What makes Kent particularly vulnerable to climate change.
- Positive benefits Kent can expect from climate change.
- Negative impacts of climate change on Kent.
- The balance of positive and negative impast of climate change on Kent.

5.3 What Will Climate Change Mean for Kent?

5.3.1 The Select Committee received considerable evidence quantifying the international, national and regional impacts of climate change which is summarised in Appendix 3.

5.3.2 There is far less Kent-specific information available. However, reference to the UK Climate Impacts Programme's (UKCIP) 2002 Scenarios[25] - known as 'UKCIP02' - demonstrates that due to its geographic location and long coastline, Kent is expected to suffer greater impacts from climate change than other areas of the South East[26].

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[25] See: http://www.ukcip.org.uk/resources/publications/pub_dets.asp?ID=14

[26] It is suggested an example of this can be found in evidence received from the Environment Agency at the hearing on 28 April 2006 (paragraph 7). The Environment Agency noted that of the approximately £200m annual budget for maintaining flood defences for the UK, £20m (10% of the total) is spent in Kent, compared to £4m (2%) in Sussex and £1m (0.5%) in Hampshire.

5.3.3 The Select Committee concluded that based on all the evidence, Kent has atypical needs. This is an important point and the Select Committee stresses that it must be emphasised when considering actions to prepare for the impact of climate change.

5.3.4 The Select Committee noted from feedback in Appendix 1 and at the Local Boards where climate change was discussed that the public wanted information on key Kent impacts of climate change. Such information is therefore presented in the main body of the report.

5.3.5 The Select Committee particularly noted evidence received from Mr Peter Moore, KCC's Environment Strategy Manager, in his report *Climate Change Impacts in Kent*[27] on Kent-specific impacts that was prepared for this Select Committee.

5.3.6 This evidence details the range of impacts facing Kent. The Select Committee found this useful as a reference point for the drafting of this report. The Select Committee also feels that this information should be made available to readers who require more detail on Kent-specific impacts. This report is therefore included in Appendix 4.

[27] *Climate Change Impacts for Kent, the impacts of climate change on Kent's environment, society and economy, (See Appendices for Sector by Sector impact)*. Report submitted and presented to the Select Committee by Mr Peter Moore, KCC Environment Strategy Manager, on 3 April 2006.

5.4 Recent Experiences of Extreme Weather

5.4.1 Kent's recent experience of extreme weather conditions is vividly represented by:

- The great storm of October 1987, with gusts of wind recorded at a speed of 90 knots (103 mph) in parts of Kent, a ship capsizing at Dover and a ferry being driven ashore near Folkestone[28].

- The River Darent experiencing low flows and running dry in the 1980s and 1990s, combined with episodes of flooding more recently[29].

- Extensive and repeated winter flooding in 2000[30].

- The heatwave of 2003, during which the highest UK temperature since records began of 38.5 degrees Celsius was recorded in Kent at Brogdale, near Faversham on 10 August 2003[31].

- The drought of 2005-06, a result of successive dry winters, with hosepipe bans in force throughout the winter in certain areas of Kent[32].

- Bewl Water, one of the main reservoirs serving Kent, at a record low in January 2006[33] requiring it to be re-filled with water diverted from the River Medway.

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[28] See: http://www.metoffice.com/education/secondary/students/1987.html

[29] See: http://www.bbc.co.uk/kent/news/stories/200301/03/floods.shtml

[30] See: http://news.bbc.co.uk/1/hi/england/kent/4363522.stm

[31] See: http://www.metoffice.com/climate/uk/extremes/index.html

- The heatwave of July 2006 which broke records for the hottest average temperature for the month of July and the record for the hottest July day – 36.5ºC at Wisley, Surrey[34].

- Unexpected heavy snowfall in spring 2006 in parts of Kent[35].

5.4.2 It is impossible to prove a direct link with climate change and any one of these events, but they clearly fit the scientific predicted pattern of more extreme weather events.

5.4.3 Across Kent, other less dramatic changes are being recorded which suggest that climate change is already having an impact. These include:

- Sea level rises. For example, those recorded at Sheerness show an increase of nearly 300mm between 1850 and 2000[36] resulting in higher storm surges.

- Earlier emergence dates for butterfly species - up to 20 days earlier[37] in the case of the Adonis Blue, symbol of the Kent Wildlife Trust.

- Earlier arrival and breeding success of bird species, for example the Hobby, which require a warmer climate[38].

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[32] For example, a hosepipe ban has been in force since August 2005 in the Mid-Kent Water supply area. See http://www.midkentwater.co.uk/drought/current%20restrictions.htm

[33] See note 21 *ibid*.

[34] See: http://news.bbc.co.uk/1/hi/uk/5219848.stm

[35] See: http://news.bbc.co.uk/1/hi/england/4894934.stm

[36] See: http://www.defra.gov.uk/environment/statistics/globatmos/kf/gakf14.htm

[37] *Millennium Atlas of Butterflies in Britain and Ireland*, Jim Asher et al, Oxford, 2001.

5.5 Strategic Infrastructure

5.5.1 Examples of climate change impacts on strategic infrastructure include:

5.5.2 Kent's coastal towns - many coastal communities will face climate change impacts such as sea level rise, increased flood risk and extremes of weather. In the long-term, s*ome* parts of *some* communities may become economically and environmentally unsustainable.

5.5.3 Kent's ports and airports – changes in storm patterns and wave energy pose risks to port infrastructure, such as buildings, roads and runways, and services.

5.5.4 Dungeness Power Station - the shingle ridge which protects the power station from coastal flooding is constantly replenished by moving shingle (via both natural and man-made processes) from elsewhere on the peninsula. While the power station itself is adequately protected, surrounding low-lying land on the peninsula could be flooded[39].

5.5.5 The Dover-Folkestone Railway - the line is only slightly above sea level at some points and protection from erosion in the long-term will require expensive maintenance of coastal defences.

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[38] 'Global warming could be expected to help a species on the northern edge of its range in Europe…Hobbies would appear to be arriving back on their breeding territories one or two weeks earlier than was recorded thirty years ago.' Kent Ornithological Society *Kent Bird Report 1999*, 2001.

[39] See indicative floodmap at section 6.10.6A .

5.5.6 The A20 at Shakespeare Cliff - the proximity of the A20 to the cliff edge is striking on the western approach to Dover. If allowed to continue naturally, erosion of the chalk cliff will eventually reach the road in the long-term. Other trunk roads and minor roads could face similar pressures in future, requiring sustained investment commitments.

5.5.7 River Medway flood defences - the Medway is one of the longest rivers in the south east (110km) and defended upstream of Tonbridge by a flood defence scheme that currently offers protection in events of greater than 1 in 100 years probability. This calculation is based on historic records. Climate change will mean re-assessing the level of such protection.

5.5.8 The Thames Gateway – parts of the Thames Gateway are susceptible to flooding and development in this area could exacerbate the problem. Flooding in the Thames Gateway is discussed further in section 6.10.3.

5.6 Factors which Make Kent Vulnerable to Climate Change

5.6.1 Several factors combine to make Kent atypically exposed to climate change impacts:

5.6.2 North, south and east facing coasts, exposed to erosion, rising sea levels - exacerbated by the fact the south east is "sinking"[40] - storm surge and wave damage.

[40] Of the 5.4mm per year sea level rise used by the Environment Agency as the current figure for the South East, it is estimated that about 1mm per year, or less than 20%, is due to this geological

5.6.3 A high proportion of low-lying land (see diagram 6.10.6A) and high vulnerability to saline pollution of freshwater supplies[41].

5.6.4 Over 50,000 properties at risk of flooding[42]. In addition, a large proportion of the population in these areas may be considered as "vulnerable" and may require special assistance in the event of flooding.

5.6.5 High traffic volumes both within and through the county because of our international gateway status and areas of urban density, resulting in emissions and air quality problems will be exacerbated by climate change – for example many serious heat-related illnesses in 2003 were linked to air quality episodes triggering respiratory difficulties[43].

5.6.6 A relatively developed landscape[44] - a significant factor in flood risk calculations, as developed land does not perform its natural function of soaking up water in the same way as undeveloped land.

"sinking". This is known as isostatic sea level rise. See: http://www.environment-agency.gov.uk/yourenv/eff/1190084/natural_forces/sealevels/

[41] Evidence received from Mr John Archer of the National Farmers Union at the hearing on 12 April 2006 (paragraph 4).

[42] EA figures cited in *Kent Environment Strategy: 2005 Progress Report, p28*, KCC March 2005. This document can be found at: http://www.kent.gov.uk/NR/rdonlyres/192B4EB8-BDBC-4090-BBD0-F8CEB67AB57E/134/fullprogressreport2006.pdf

[43] See: http://news.bbc.co.uk/1/hi/health/3162949.stm

[44] For example, see the EU-wide *Corine Land Cover Survey*, p13 published in 2000: http://terrestrial.eionet.europa.eu/CLC2000/docs/publications/corinescreen.pdf . The *Kent Habitat Survey 2003,* p8, estimated that Kent's "urban" area was 13%. See: http://www.kentbap.org.uk/assets/library/documents/KHS_2003.pdf

5.6.7 Reliance on groundwater sources for about 75%[45] of our public water supply, making us vulnerable to drought.

5.6.8 Projections of housing and commercial development which will exacerbate some of the identified impacts above - approximately 120,000 new homes are planned over the next 20 years[46].

5.6.9 Proximity to continental Europe, increasing the risks of new, invasive species[47] or diseases arriving via Kent.

5.7 Positive Benefits of Climate Change for Kent

5.7.1 Climate change may have some beneficial impacts for Kent[48]. The more positive aspects Kent can be expected to enjoy are:

- The development potential of domestic **tourism**, at least until beneficial change such as a warmer climate reaches the point of becoming uncomfortable or unsustainable due to, for example, water scarcity.

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[45] See deposit documents supporting the Kent and Medway Structure Plan ("KMSP"): http://www.kmsp.org.uk/chapter09.html

[46] See: http://news.bbc.co.uk/1/hi/business/5263778.stm. This point is further discussed in section 7.15.1.

[47] For example, see evidence received from Mr Richard Moyse of the Kent Wildlife Trust at the hearing on 28 April 2006 (paragraph 4 *et seq)*.

[48] *Climate Change Impacts for Kent, the impacts of climate change on Kent's environment, society and economy, (See Appendices for Sector by Sector impact)*. Report submitted and presented to the Select Committee by Mr Peter Moore, KCC Environment Strategy Manager, on 3 April 2006.

- The development potential of **agriculture** due to a longer growing season, subject to these benefits not being outweighed by the disadvantages of, for example, water stress or increased survival rates of agricultural pests and disease.

- The potential to capture more **energy** reaching the county from **renewable sources**, such as solar, wind, wave, and tidal power.

- The arrival of new and welcome additions to our native **flora and fauna** as their 'climate space' moves northward, assuming these gains are not outweighed by losses or the impact of less welcome, invasive species.

- Fewer cold-related deaths.

- Benefits for specific enterprises such as vineyards[49].

5.8 Negative Impacts of Climate Change on Kent

5.8.1 The Select Committee heard a large number of examples of negative climate change impacts which are detailed in the report *Climate Change Impacts for Kent*. Rather than repeat these here, the Select Committee would simply highlight some of the most striking negative impacts for Kent:

[49] Evidence received from Mr John Archer of the National Farmers Union at the hearing on 12 April 2006 (paragraph 4).

- The increased risk of coastal and fluvial **flooding**, arising from a combination of rising sea levels, more extreme weather leading to tidal surge and localised flash flooding, worsening the effect of the south east gradually 'sinking' due to geological change.[50]

- The prospect of 60% less summer rainfall by the 2080s – the impact of which can be imagined in the context of water shortages and **drought** orders currently across the south east[51].

- The risks to **health** from an increase in heat-related illness and death, water borne and air borne disease and breathing problems like asthma exacerbated by air quality incidents, triggered by more frequent and extreme heat-waves[52].

- The substantially increased **financial costs** of insuring and maintaining houses and other buildings in the face of increased subsidence and damage from extreme weather.[53]

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[50] See note 40 *supra*.

[51] See note 32 *supra*.

[52] Department of Health, reported in *Climate Change Impacts for Kent*, March 2006. The DoH issued a report in 2001 specifically on the health impacts of climate change in the UK. See: http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4007935&chk=aPZEuj

[53] Association of British Insurers, reported in *Climate Change Impacts for Kent*, March 2006. The ABI website has a section that specifically addresses climate change impacts on insurance: http://www.abi.org.uk/Display/default.asp?Menu_ID=1140&Menu_All=1,946,1140&Child_ID=506

- The possibility that our climate would no longer support our characteristic **wildlife** such as bluebells or the Adonis Blue butterfly, the symbol of the Kent Wildlife Trust, by the 2080s[54].

- The threat to Kent's **landscapes** and status as 'the Garden of England' as some of the traditional fruit-growing for which the County is internationally renowned could be no longer viable by the end of the century[55].

5.9 The Balance of Positive and Negative Impacts of Climate Change in Kent

5.9.1 In addition to the above, the *Climate Change Impacts in Kent*[56] report also details sector impacts in appendices to that report. Having considered all the evidence presented, the Select Committee agrees with the following conclusions:

5.9.2 The negative impacts of climate change outweigh the positive impacts in the overwhelming majority of sectors.

5.9.3 Most of the potentially positive impacts, for example developments in tourism, agriculture and opportunities for renewable energy, still require active intervention by policy makers and stakeholders.

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[54] Evidence received from Mr Richard Moyse of the Kent Wildlife Trust at the hearing on 28 April 2006 referring to the BRANCH (Biodiversity Requires Adaptations in North West Europe under a Changing Climate) and MONARCH **(**Modelling Natural Resource Responses to Climate Change) studies. (See paragraphs 4 and 9).

[55] See note 49 *supra*.

[56] See note 27 *supra.*

5.9.4 The negative impacts are so wide-ranging that every sector has a stake in reducing its' contribution to climate change and adapting to those changes that are now inevitable over the next 30 years.

5.9.5 There will be a need to avoid counter-productive adaptation to climate change – such as measures which, in seeking to respond to changing conditions, are actually likely to make them worse. For example, increased use of fossil fuels to power air-conditioning.

5.9.6 Even in sectors where positives may outweigh the negatives, such as tourism, the apparent benefits may still be transient rather than permanent, or be cancelled out by competing impacts. For example, water stress might constrain expansion of tourism.

6 Preparation for the Impact of Climate Change – Adaptation

6.1 Summary of points covered in section

- **Climate change until about the 2040s will be determined by past levels of greenhouse gas emissions, making adaptation an urgent necessity rather than a 'wait-and-see' option.**

- **The impacts of climate change will affect every KCC service directorate in different ways.**

- **Detailed study of the impacts on the full range of services currently provided by KCC is necessary as a starting point for planning adaptive responses.**

- **Water resources, flood risk and emergency planning are key areas for adaptation where the pressures of climate change are already being felt.**

- **Water resources are becoming stretched and more sustainable approaches to managing them are required, prioritising measures to reduce demand.**

- **A greater emphasis on sustainable flood risk management in addition to conventional flood defence, with efforts to reduce risk and raise awareness being a priority to help communities learn to live with flood risk.**

- **Increased flood risk raises difficult questions about the future of communities in areas already at risk, and about the scale, location and design of new development.**

- **An urgent review of Kent's emergency planning framework to take account of climate change impacts is recommended.**

6.2 Section Introduction

6.2.1 This section covers the following themes:-

- Adaptation for KCC services.
- Adaptation for the wider community.

6.3 Adaptation for KCC Services

6.3.1 Greenhouse gases[57] remain in the atmosphere for several decades – which means that even if we were able to stop the emission of carbon dioxide tomorrow, climate change for the short and medium term - through to the 2040's – has already been determined by the historic level of emissions.

6.3.2 In responding to climate change, it is vital we adapt to the predicted changes likely to happen between now and 2040. This is adaptation. It is important to also reduce emissions to minimise future climate change. This is mitigation, which is addressed in section 7.

6.3.3 Table 6.3.4 indicates the range of impacts which climate change may have on KCC services and possible adaptive responses.

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[57] There are a number of naturally occurring and man-made greenhouse gases whose emission into the atmosphere contributes to global warming. Carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_20) are among the main ones and while carbon dioxide is less potent than other greenhouse gases, the quantity of emissions is so large – it accounts for 85% of the UK's total emissions of greenhouse gases - that it remains the main contributor to global warming. This explains the fact that the general discourse on climate change, including in this report, tends to address 'carbon dioxide' or simply 'carbon' rather than 'greenhouse gases' as a whole. For a more detailed definition of greenhouse gases, please see the glossary. See also appendix 2.

6.3.4 **Table 6.3.4:** Summary of Climate Change Impacts on KCC Service Delivery

KCC SERVICE DIRECTORATE/DIVISION	**POTENTIAL CLIMATE IMPACT**	**POSSIBLE ADAPTIVE RESPONSE**
Adult Services	Increased heat stress and pollution leading to poorer air quality and an increase in related illness among vulnerable people, including breathing difficulties.	Ensure adequate shading and cooling available in places where care is delivered, increased need for treatment measures and water for re-hydrating patients/customers
	Fewer cold-related deaths but vulnerable groups still requiring care in winter	Ensure adequate provision for groups at risk from cold weather/extreme events
	Disproportionate impacts of extreme weather events on vulnerable groups. Ensuring water supply to vulnerable groups in event of standpipes being used in drought.	Assistance with costs and provision of advice associated with disruption, repairs, loss of earnings, uninsured property etc. Measures to ensure water gets to vulnerable groups in event of standpipe use.
	Increased risk of new diseases reaching UK due to warmer climate	Promote preventative measures and ensure treatments available
	Higher risk of sunburn/skin cancer due to hotter summers and outdoor lifestyles	Raise awareness of dangers, ensure shade in public areas, ‘slip/slap/slop’ sunblock campaigns
	Higher temperatures likely to increase cases of food poisoning	Raise awareness of food hygiene, revise best practice, increase resources for enforcement

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
	Increase in water-borne and vector-borne diseases (e.g. in care homes and hospitals)	Promote preventative measures and ensure treatments available
Children, Families and Education	Increased risk of heat-stress in educational establishments and pollution leading to poorer air quality leading to increase in related illness among children, including breathing difficulties.	Ensure adequate shading and cooling available, ensure water and other treatment measures available
	Increased risk of structural damage and disruption to school transport as well as stranded children from extreme weather	Ensure high standards of sustainable construction reflect climate change pressures and that plans for disruption due to extreme weather are in place and up-to-date
	Loss of trees and shrubs in school grounds due to drier summers	Plant drought-tolerant plants, harvest rainwater for use on site
	Schools at heart of community affected by extreme weather, flood risk, air quality etc	Raise awareness in and beyond the classroom about 'learning to live' with climate change
	Longer growing season for plants, need for year-round grass maintenance	Adapt maintenance schedules and resources and minimise energy implications thereof

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
Communities	Increased risk of flooding, drought, heatwaves and extreme weather events	Ensure emergency plans, procedures and resources in place to meet increased risk
	Increased risk of new animal and plant diseases reaching UK due to warmer climate	Promote preventative measures and ensure treatments available
	Disproportionate impacts of extreme weather events on vulnerable groups	Assistance with costs and provision of advice associated with disruption, repairs, loss of earnings, uninsured property etc
	Increased heat stress and related illness among vulnerable people	Incorporate climate related risks in 'healthy lifestyles' work
	Increased potential for outdoor lifestyles	Reflect changing recreational habits and needs in sports plans, policies and proposals
	Impacts of hotter summers and warmer winters on comfort in public buildings (e.g. libraries)	Reflect climate impacts in building specification and design
	Higher temperatures likely to increase cases of food poisoning	Ensure Kent Scientific Services prepared to cope with such trends
Property	Higher summer temperatures affect thermal comfort	Upgrade energy efficient heating and ventilation and ensure operation to maximum efficiency. Consider stating maximum working temperature for staff"

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
	Wetter winters cause damp, condensation and related problems	Upgrade weather-proofing systems and manage internal environment
	High risk to buildings in floodplain/coastal areas	Consider flood-proofing or relocation
	Impacts of hotter, drier summers, warmer, wetter winters, increased risk of flooding etc	Revise best practice and supplementary planning guidance according to latest evidence on climate change impacts Use thermal properties of materials to improve cooling Reduce solar heating using recessed windows, roof overhangs and shades
	Increased subsidence risk from soil shrinkage in hotter, drier summers	Plan for preventative and remedial maintenance of existing stock
	Higher risk to properties in floodplains or coastal margins	Restrict development in floodplain / instigate flood-proofing, sustainable flood management policies and raise awareness of increased risk
	Warmer temperatures affect living environment	Use thermal properties of materials to improve cooling, fit energy efficient cooling systems, preferably powered by renewable sources
	Increased risk of foundation subsidence	Promote changes to procedures and enforcement

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
	Longer growing season for plants, year-round grass maintenance	Adapt maintenance schedules and resources and minimise energy implications thereof
	Loss of trees and shrubs due to drier summers	Plant drought-tolerant species Harvest rainwater
	Increased problems from damp	Promote change to procedures and include measures for wetter conditions
Environment and Regeneration	Climate change impacts on quality of life	Develop climate change communications programme, segmenting audiences/messages Raise awareness in business community of risks and costs of impacts/measures to respond

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
	Impacts on biodiversity with a squeeze on 'climate space' for some and an expansion for others, including invasive species	Re-link and de-fragment habitats and create green corridors to help species adapt and migrate
	Increased risks/costs of maintaining historic buildings, changes to character of parks, additional water requirements of gardens	Development of new, proactive management approaches
	Waste will decay faster in higher summer temperatures	Review waste storage facilities and collection schedules
	Higher summer temperatures and higher, more intense winter rainfall may affect landfill	Review design and operation of sites to reflect climate change impacts
	Some opportunities e.g. tourism, agriculture, green technology, demand for new products	Encourage businesses to adapt to new market conditions and take advantage of opportunities

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
	Increased risk of flooding from sea level rise and extreme weather	Ensure statutory plans, local development frameworks, area plans and master plans address flood risk Avoid development in areas at risk Promote sustainable approach to flood risk - emphasis on 'management', less on 'defence' Insist on Sustainable Urban Drainage Systems
	Increased coastal erosion	Ensure statutory plans and local development frameworks take account of erosion Avoid developments in areas at risk
	Hotter, drier summers leading to water stress	Address long-term water supply-demand pressures in plans and when considering development proposals Ensure water demand management is prioritised in plans, policies and proposals If pursuing new resources, ensure sustainable options are promoted (e.g. take into account energy needs of schemes)
	Increased potential for outdoor lifestyles	Reflect changing recreational habits and needs in plans, policies and proposals

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
	Increased risk of disruption to key services (e.g. energy supply)	Reduce risk through promotion of alternatives and self-sufficiency (e.g. micro-generation from renewable sources, local food) in plans/proposals
	Increased risk of flooding, drought and extreme weather events	Promote appropriate planning and design policies in new development and adaptations for existing development
	Increase in environmental inequalities (e.g. impact of poor air quality on deprived communities)	Increase support and advice for customers Work with others to tackle problems at source
Kent Highways Services	Increase in air quality episodes exacerbated by hot weather	Ensure transport policy reduces emissions, implement air quality action plans
	Increased risk of disruption due to wetter winters (flooding) and extreme weather	Plan to flood-proof or re-site infrastructure and plan routes to minimise disruption
	Increased risk to infrastructure from flooding, sea level rise and coastal erosion	Plan to defend, re-route or abandon infrastructure
	Increased temperature causing service disruption and heat stress to public	Avoid exposed places and provide shade or cooled waiting areas
	Increased rain intensity affecting embankments, bridges, washing debris into gullies	Review maintenance of embankments and bridges, increase gully emptying

KCC SERVICE DIRECTORATE/DIVISION	POTENTIAL CLIMATE IMPACT	POSSIBLE ADAPTIVE RESPONSE
	Drier summers increase road subsidence, higher temperatures lead to surface damage	Review road structure design, implement remedial work for existing roads
	Longer growing season may lead to increase growth rates for road verges and hedges	Revise maintenance schedules, plant slower growing plants in landscaping schemes
	Warmer winters will reduce risk of frost and ice	Reduced need for gritting and road salting
	Higher levels of dust in the air	May need to hose down streets
	Wetter winters and increased rainfall intensity causing local flash flooding	Increase ditch clearing and gully emptying to remove blockages

6.3.5 Table 6.3.4 clearly shows the impact climate change could have on all KCC service directorates and what action they could take to adapt. Some of these changes are potentially catastrophic should nothing be done to counter the impact of climate change. The table is, however, simply illustrative at this stage and further study of the potential impacts for KCC is required. A co-ordinated approach is needed across all directorates for identifying and responding to climate change impacts across KCC. The Select Committee recommends that climate change adaptation becomes a mainstream consideration in KCC's service planning and delivery.

6.3.6 This means that the impacts and responses identified by further study must be reflected in future business plans of all directorates. The staff themselves should also be involved in identifying the impacts and adaptations required to help ensure that this thinking becomes mainstream.

6.3.7 In delivering services, KCC also generates significant greenhouse gas emissions. While the primary focus of the further study recommended here is adaptation, in the process of identifying impacts and adaptation responses, it would also be sensible to identify opportunities for mitigating future climate change by reducing emissions arising from the delivery of our services.

6.3.8 **Recommendation 2:** Detailed assessment of climate change Impacts on KCC services and development of adaptive responses.

The Select Committee recommends:-

1. KCC's Chief Officers Group should commission a study looking ahead to the 2020's, 2050's and 2080s to comprehensively assess the implications of climate change for all services currently delivered by KCC.

2. This study to be conducted by KCC staff and led by a cross-directorate steering group of senior officers using the UK Climate Impacts Programme recommended tools[58] to identify:
   a) Key impacts on services.
   b) Appropriate adaptive measures.
   c) Accountability for taking these measures forward.
   d) Opportunities for reducing emissions in the delivery of services.

3. These outputs to be reflected in future business plans of all directorates to ensure that climate change becomes a mainstream consideration in KCC's work.

[58] For adaptation wizard, see: http://www.ukcip.org.uk/resources/tools/adapt.asp . For Nottingham Declaration action pack, see: http://www.nottinghamddeclaration.org.uk

6.4 Adaptation for the Wider Community

6.4.1 The report *Climate Change Impacts for Kent*[59] contained at Appendix 4 details the possible impacts of climate change and the likely adaptive responses which may be required for a range of key sectors. The Select Committee endorses these assessments and encourages KCC to use them as the basis for establishing an active and ongoing dialogue with those sectors about what they can do to respond to climate change. The Select Committee also wishes to highlight three of these sectors which are of particular concern and are discussed further in this section:

- Water resources
- Flood risk
- Emergency Planning

6.4.2 In addition, air quality and energy conservation also have an adaptation impact. These issues are discussed further under mitigation in section 7.

6.5 Water Resources - the Supply Demand Balance

6.5.1 The water companies estimate that they will be able to meet Kent's overall water supply requirements up until 2010[60], with a number of local capacity and quality issues being addressed through investment. The Select Committee noted that beyond 2010-15, the industry considers that most areas will need to rely on new resources such as transfers from other areas or new reservoirs.

[59] See note 21 *supra.*

6.5.2 The water companies have a statutory obligation to meet demand in response to growth and to promote the efficient use of water. This is the basis for the 'twin-track' approach to water resource planning – reducing demand while at the same time exploring options for increasing supply, informed by the principle that surplus water should be transferred to areas in deficit before new resources such as reservoirs are developed. A number of variables will influence the future availability of water in Kent:

- Climate change - likely to result in increased rainfall in winter, reduced rainfall in summer and increased evaporation.

- Actual levels of growth - current pressure from central government is for them to be higher than levels in the Sustainable Communities Plan.

- Changes in abstractions and the licensing regime - likely to reduce pressure as old licences are revoked.

- Implementation of water company investment plans, in themselves dependent on prices, planning consents and other criteria which beyond 2010 are less certain.

- Extent and impact of demand management measures - there are limited mechanisms for their enforcement.

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[60] *Kent and Medway Structure Plan*, *working paper 13 ("Water Supply and Waste Water Treatment")*, September 2003, paragraph 2.13.

- Impact of meeting Water Framework Directive requirements - likely to reduce the amount of water available for public water supply by placing a stronger 'ring-fence' around the amount of water required to maintain high water quality and meet environmental needs.

- Public concern for the maintenance of a healthy water environment, particularly among those who use it for recreation, angling, sailing etc.

6.5.3 The Select Committee notes that the balance of these pressures suggests that Kent could face a 'double whammy' of reduced water availability at peak periods, as a result of climate impacts and Water Framework Directive compliance, and increased underlying demand as a result of housing and related growth and the fact that demand tends to increase in hot weather at the time supply is most limited[61].

6.5.4 The risk of future short-term supply restrictions is now very real. Hosepipe bans are an accepted mechanism for water companies to introduce in times of drought[62]. The Select Committee questions if the public would tolerate standpipes. The frequency of the need for such measures is assessed by looking back at previous dry years, the '1 in 10 dry year' being used as the benchmark. However, climate change means that hindsight is becoming less reliable as an indicator of the future and there appears to be scope for taking greater account of climate change impacts in these calculations.

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[61] *Climate Change Impacts for Kent, the impacts of climate change on Kent's environment, society and economy, (See Appendices for Sector by Sector impact)*. Report submitted and presented to the Select Committee by Mr Peter Moore, KCC Environment Strategy Manager, on 3 April 2006.

6.6 Water Resources - Reducing Demand for Water

6.6.1 The most sustainable way of addressing the challenge of over-stretched water resources is undoubtedly to use less. While awareness campaigns in response to the drought have recently resulted in significant reductions in demand, this is against a background of rising per capita demand for water. This suggests that awareness raising alone will be an inadequate response, and has led to a growing interest in 'demand management' – policies and practices to reduce domestic and commercial water use. The most commonly cited methods of reducing demand are:

- Water metering: experience suggests that water use is reduced by metering. Only about 20% of houses in Kent are metered[63]. The Environment Agency are now calling for 100% metering[64] across Kent.

- Water pricing: Any perception of low price for water inevitably results in inefficient use. There may be more scope for promoting tariffs which send clearer signals to users about the value of water[65] while protecting vulnerable groups.

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[62] See note 32 *supra*

[63] *Kent and Medway Structure Plan*, *working paper 13 ("Water Supply and Waste Water Treatment")*, September 2003, paragraph 2.29.

[64] See: http://www.environment-agency.gov.uk/news/1308135

[65] An example of this was noted by Members of the Select Committee on a visit to a Hillreed Homes development in Ashford on 7 July 2006 where such a scheme had been successfully introduced. KCC has also set up the Kent Water Demand Management Group, which is a partnership between planning authorities and the water industry and there is a tariff trial in Kent. See: http://www.environment-agency.gov.uk/commondata/acrobat/bulletin_75_final_1311022.pdf

- Water efficient fixtures[66]: water efficient taps, water-displacement devices for cisterns, dual flush toilets and low-flow showers are among the simple technologies which can all be installed in new and existing development.

- Waterless urinals, urinal control devices and 'restrictaflow' valves offer further potential in commercial, industrial, retail and public premises[67].

- Water efficient appliances[68]: appliances such as washing machines and dishwashers are now rated for water efficiency as well as energy efficiency.

- Water efficient gardening[69]: use of rain water collection, re-use of kitchen waste-water, drought tolerant turf, drought resilient plants, mulching mats and micro-irrigation systems can all help suppress demand, particularly during peak periods.

- Water efficient design[70]: some of the above features can be easily incorporated into new commercial and domestic development along with innovations such as permeable paving.

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[66] For further details, please see the following: http://www.kent.gov.uk/NR/rdonlyres/91ED1D20-75A7-4D84-8AD5-C264169C13AC/0/waterefficienthomes.pdf

[67] See note 66 *ibid.*

[68] See note 66 *supra*

[69] See note 66 *supra*

[70] See note 66 *supra*

- Rainwater harvesting[71]: rainwater collected from roofs and hard surfaces can be used for some domestic purposes such as toilet flushing and clothes washing through systems involving the capture, filtration, storage and plumbing into appliances.

- Grey water systems[72]: currently seen as more viable in commercial, industrial and public buildings than in households, these involve the separation of 'grey' waste water from sinks etc from 'black' waste water from toilets. The former can then be treated and re-used for toilet flushing and plant watering.

- Reduced leakage: the problem of leakage continues to be vast in scale and a cause of serious concern[73].

[71] See note 66 *supra*

[72] See note 66 *supra*

[73] See for example the July 2006 figures from the water industry regulator, OFWAT: http://www.ofwat.gov.uk/aptrix/ofwat/publish.nsf/Content/pn2206#footnotes. See also a recent

6.6.2 The problem with almost all of the above measures is not their effectiveness, which is largely beyond doubt, but the extent of their application. The system of water regulation funds investment to reduce leakage up to what is known as the 'economic level of leakage' - the point where spending to reduce leaks exceeds the value of water saved[74]. This might be very different from what might be considered the 'sustainable level' which would reflect the wider environmental and social costs of wasted water. The result is that the regulatory system tolerates, and effectively guarantees, high levels of leakage. Similarly, current planning law contains only limited mechanisms to ensure that, for example, all new homes maximise water efficiency, and it is therefore left to developer and consumer preference to 'opt in' to water efficiency measures above the statutory minimum.

6.6.3 While this will always be the case with some behavioural choices made by consumers, the Environment Agency estimates that technical solutions to water efficiency, if installed universally, could achieve savings of up to 25-30%.

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letter from OFWAT to the water companies detailing the latest position on leakages: http://www.ofwat.gov.uk/aptrix/ofwat/publish.nsf/Content/rd1106

[74] See note 73 *supra*.

6.6.4 It has been suggested that the voluntary approach to achieving higher standards of water efficiency, preferred by Government as set out in its Code for Sustainable Homes, may need to be strengthened in order to achieve increased water efficiency[75]. Many commercial enterprises stand to gain financially from increased water efficiency[76]. Making them aware of this potential will be important.

6.6.5 The Select Committee suggests that for Kent, the best approach may be a twin-track approach of lobbying Government for changes to ensure higher statutory standards of water efficiency, as well as developing our own standards and seeking to meet them in the interim.

6.7 Water Resources - New Sources of Supply

6.7.1 Predictions of increased winter rainfall and reduced summer rainfall as a result of climate change point to an increased emphasis on winter storage reservoirs. However, our reliance on increasing reservoir capacity to augment water supply may be restricted in future by climate change. As the experience of recent months has shown, the existence of a reservoir is no guarantee that there will be water available to fill it.

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[75] See for example a paper for the Institute for Public Policy Research's Commission on Sustainable Development in the South East: http://www.environmenttimes.co.uk/cgi-local/newspro/viewnews.cgi?newsid1111402319,49451

[76] Members of the Select Committee saw this at first hand when reviewing water efficiency measures at a new development being built by Hillreed Homes in Ashford. See also: http://www.environment-agency.gov.uk/commondata/acrobat/bulletin_75_final_1311022.pdf

6.7.2 It also means that new reservoirs may address the medium-term dilemma of how to meet increased demand for water as a result of housing growth. This does not solve the long-term problem of reduced water availability and merely pushes it slightly further away. Measures to reduce demand to sustainable levels are more likely to work in this respect.

6.7.3 The Select Committee notes that a number of the measures identified to increase water supply in future will significantly increase the demand for energy, either because they require large scale pumping of water, such as inter-regional transfers, or because they are inherently energy intensive processes, such as desalination. If these energy needs are not met from renewable sources there is a serious concern that such measures could simply add to the problem of climate change to which they are intended to be at least in part a response.

6.8 Flood Risk

6.8.1 Evidence to the Select Committee was received principally from the Environment Agency[77], Mr Nick Rowe, KCC's Emergency Planning Officer[78], Mr John Archer of the National Farmers Union[79] and as written evidence from local authorities in Kent[80] and wildlife organisations[81].

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[77] See in particular note 26 *supra*

[78] Evidence received at the hearing on 26 April 2006, as well as written evidence subsequently

[79] Evidence received at the hearing on 12 April 2006.

[80] See in particular written evidence from Ashford and Tunbridge Wells Borough Councils.

[81] See in particular evidence from Mr Richard Moyse of Kent Wildlife Trust and written evidence from the RSPB and English Nature, which highlighted how wildlife habitats can depend on flooding, and are impacted by defences and how managed retreat where this occurs can create areas that are beneficial to wildlife.

6.8.2 Flooding was a particular issue raised by the public at Local Board meetings in Dartford, Thanet and Shepway when climate change was the topic for discussion[82]. An example of this included concerns raised at the Shepway Local Board meeting on 22 May 2006. Residents of Romney Marsh raised their concerns to Members of the Select Committee over possible breaches at areas such as Galloways and Jury's Gap.

6.8.3 In Kent, there are risks from both coastal and fluvial[83] flooding. Diagram 6.10.6A is an indicative[84] flood map for Kent[85]. This graphically illustrates the risk of flooding that affects many parts of Kent, such as the Thames Gateway and Ashford growth areas, the Wantsum Channel, the Isle of Sheppey and Romney Marsh.

6.8.4 Flood risk is increasing as a result of climate change. Rising sea levels and more extreme weather leading to storm surges, and the fact that the south east is gradually 'sinking' due to geological change[86], will increase the risk of coastal flooding. Extreme storms will also increase the risk of fluvial flooding and localised flash flooding. The Department of Trade and Industry's authoritative *Foresight Future* flooding report[87] on flooding suggests that without action to reduce emissions, by the 2080s:

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[82] See section 3.2.3.

[83] Flooding associated with rivers and streams.

[84] See section 6.10.1 for a further explanation of 'indicative'.

[85] Map provided in written evidence from Mr Peter Moore, KCC Environmental Strategy Manager.

[86] See note 40 *supra*.

[87] See: http://www.environment-agency.gov.uk/subjects/flood/763964/?version=1&lang=_e

- The costs of flooding could rise from £1 billion per annum today to £27 billion

- Damage from coastal erosion could increase by 3-9 times.

- The number of people at high risk of flooding in the UK could rise from 1.6 million today to 2.3-3.6 million.

6.8.5 If the proportion of these changes were reflected in Kent, the impacts would be massive. In addition, there is a significant overlap between areas at risk of flooding and areas of deprivation in Kent, based on benefit claimant rate[88]. A large proportion of the population in deprived communities may require special assistance in the event of flooding. Memories of Hurricane Katrina and its impact on New Orleans in the United States of America in 2005 vividly illustrate this scenario.

[88] Map provided in written evidence from the KCC Supporting Independence Programme showing all benefit claim rates by ward area in Kent. When compared to the indicative flood risk map for Kent, the Select Committee noted that areas with the highest % working age population claiming benefits are in some cases also in flood risk area.

6.8.6 Flood risk is not simply an issue for the built environment. While the National Farmers Union noted that farmers are happy to farm on flood plains, it was added that they would want to see measures in place to deal with any losses that may occur in the event of flooding. In addition, farmers, particularly in parts of North and East Kent near the coasts, are also concerned about saltwater intrusion into freshwater ground supplies that they use. The risk of this is predicted to increase with climate change[89].

6.9 Flood Risk – Flood Defence Versus Flood Management

6.9.1 Historically, the approach to flood defence has been based on resisting natural forces through heavy engineering[90]. Climate change means that such approaches will become increasingly unsustainable, both economically and environmentally. The rising costs of defence will be too high to be borne by coastal communities alone, while there will be a limit to the extent to which general taxation will foot the bill. Inter-tidal habitats such as mudflats and saltmarsh will also be squeezed as rising sea levels push them against hard defences. The result could be that many of the internationally designated sites which ring the Kent coast could be threatened or lost altogether unless we change our approach to managing flood risk.

[89] Evidence received from Mr John Archer of the National Farmers Union at the hearing on 12 April 2006 (paragraphs 4 and 9).

[90] For further information, please see the Environment Agency's website: http://www.environment-agency.gov.uk/subjects/flood/1217883/1217968/1218048/?lang=_e

6.9.2 *Making Space for Water*[91], the title of a major government policy document published in 2004, hinted at the principles behind its preferred policy for coastal erosion and flood management. This approach, presaging a major shift in emphasis from flood defence to flood management, is being followed through by the Environment Agency. This means using more 'soft' defences, working more with nature rather than against it, allowing flood plains to perform their natural function and, is some cases, ceding land to the sea to reduce flood risk elsewhere, known as managed realignment. It is generally said that Kent has limited opportunities for managed realignment[92], and while geography and the developed coastline are certainly limiting factors, it may be that options currently regarded as politically or practically undesirable will have to be considered as climate change impacts increase.

[91] *Making Space for Water: Taking forward a new Government strategy for flood & coastal risk management.* Published by DEFRA. See: http://www.defra.gov.uk/environ/fcd/policy/strategy.htm

[92] See for example the limited opportunities for managed realignment in the Shoreline Management Plans covering Kent's coast: http://www.se-coastalgroup.org.uk/

6.9.3 The Select Committee notes that if we recognise that an increase in flood risk is inevitable, and that we will not always be able to afford to defend against it, there are two important implications for Kent. First, we will have to learn to live with increased flood risk, and KCC will have a major role to play in helping communities understand the risks and prepare for them to minimise the social and economic costs of inevitable flooding. Alternatively, and in the longer-term, it may be that some parts of some communities may have to relocate. The Select Committee believes that KCC has a key role in leading such debates. The Select Committee is also concerned that the reality of the impact of climate change should not be denied by any who may be intent on attracting large-scale commercial and housing development to areas for which climate change will bring an unacceptably high risk of flooding.

6.10 Flood Risk - Flood Risk and Planning

6.10.1 The indicative flood risk map of Kent expresses flood risk before the impact of defences is taken into account. Much of the North Kent coast is, of course, defended to a high standard of about 1:1000 - e.g. from the Thames Barrier to the Isle of Grain. East of this, some areas are defended to a lower standard while the condition of defences in other areas remains unknown. The Select Committee notes that flood defence to a 1:1000 year standard does not mean that the area 'will not flood for a thousand years' - rather, it means that over the course of 1,000 years, the area would only be expected to flood once. This one flood could, however, still be catastrophic, and could still happen any time. This raises major questions about locating large scale new development and strategic assets in areas facing high flood risk.

6.10.2 Central government has strengthened planning guidance to reduce flood risk in new development and ensure that it does not increase flood risk elsewhere[93]. It strengthens the requirements for Flood Risk Assessments to accompany planning applications, includes a sequential test to ensure that low risk sites are considered before high risk sites, and includes measures to increase the flood resilience of new development. The Select Committee welcomes this and urges KCC to work closely with the Environment Agency and district councils to ensure that this guidance is observed in planning decisions.

6.10.3 The issue of flood risk has drawn particular attention in the Thames Gateway, where the insurance industry[94] and Environment Agency[95] among others have expressed concern as part of a campaign to ensure that the most at risk areas are avoided and adequate steps are taken to defend against floods where development does go ahead. While concentrating development on sites facing lower risk is clearly a sensible adaptation, the Select Committee is concerned that there may be occasions where this would conflict with the sequential test to develop brownfield sites before greenfield, and also with the need to reduce emissions arising from new development[96].

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[93] See DEFRA news release on 'Strengthened planning policy for flood risk areas': http://www.communities.gov.uk/index.asp?id=1002882&PressNoticeID=1852

[94] The Association of the British Insurance Industry ("ABI") has prepared a specific report: http://www.abi.org.uk/Display/default.asp?Menu_ID=1140&Menu_All=946,1140,0&Child_ID=480

[95] See: http://www.environment-agency.gov.uk/business/444304/502508/1188512/1189198/ and page 10 of the document "The Climate is Changing, Time to Get Ready": http://www.environment-agency.gov.uk/commondata/acrobat/ea_cc_eng.2_1057452.pdf

[96] These policies are indicated in the Kent and Medway Structure Plan ("KMSP"). The KMSP was adopted in July 2006. Chapter 9 (p 57 *et seq)* considers climate change issues specifically, although policies elsewhere in the KMSP are also relevant.

6.10.4 For example, flood risk could be reduced by building on greenfield sites on higher ground, but if those sites are poorly connected by public transport and reinforce car dependency, require removal of vegetation and need additional infrastructure to service them, the result will be a substantial increase in emissions. Flood risk for the individual development will have been addressed in the short-term, but flood risk for society as a whole, and existing development which remains in the ever-rising flood plain, in the long-term will not have been. Prioritising well-defended brownfield sites, which tend to be defended anyway because their previous uses required it, and building at higher densities on them would help minimise these potential conflicts.

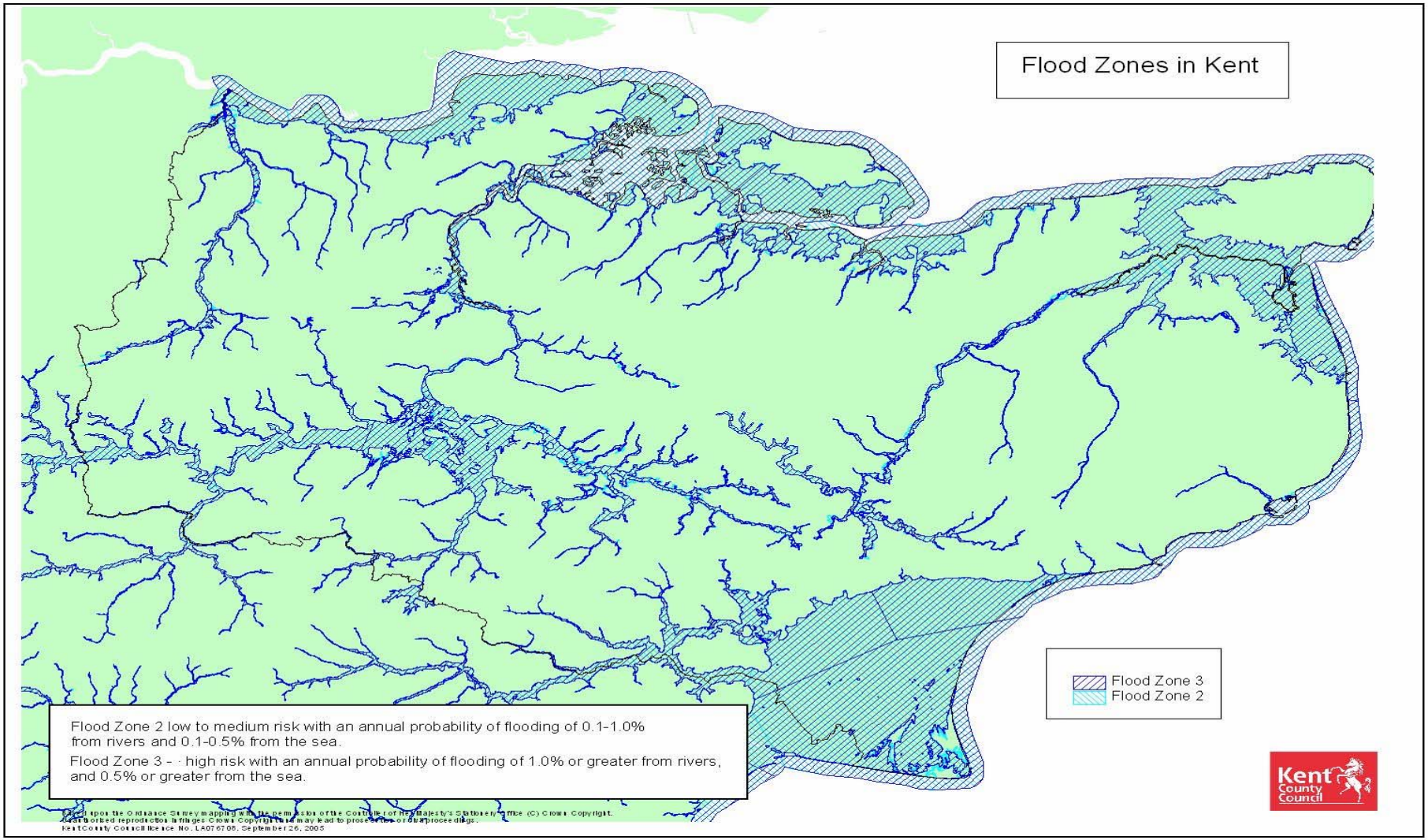
See: http://www.kmsp.org.uk/pdfs/KMSPAdoptedPolsKDJul06.pdf

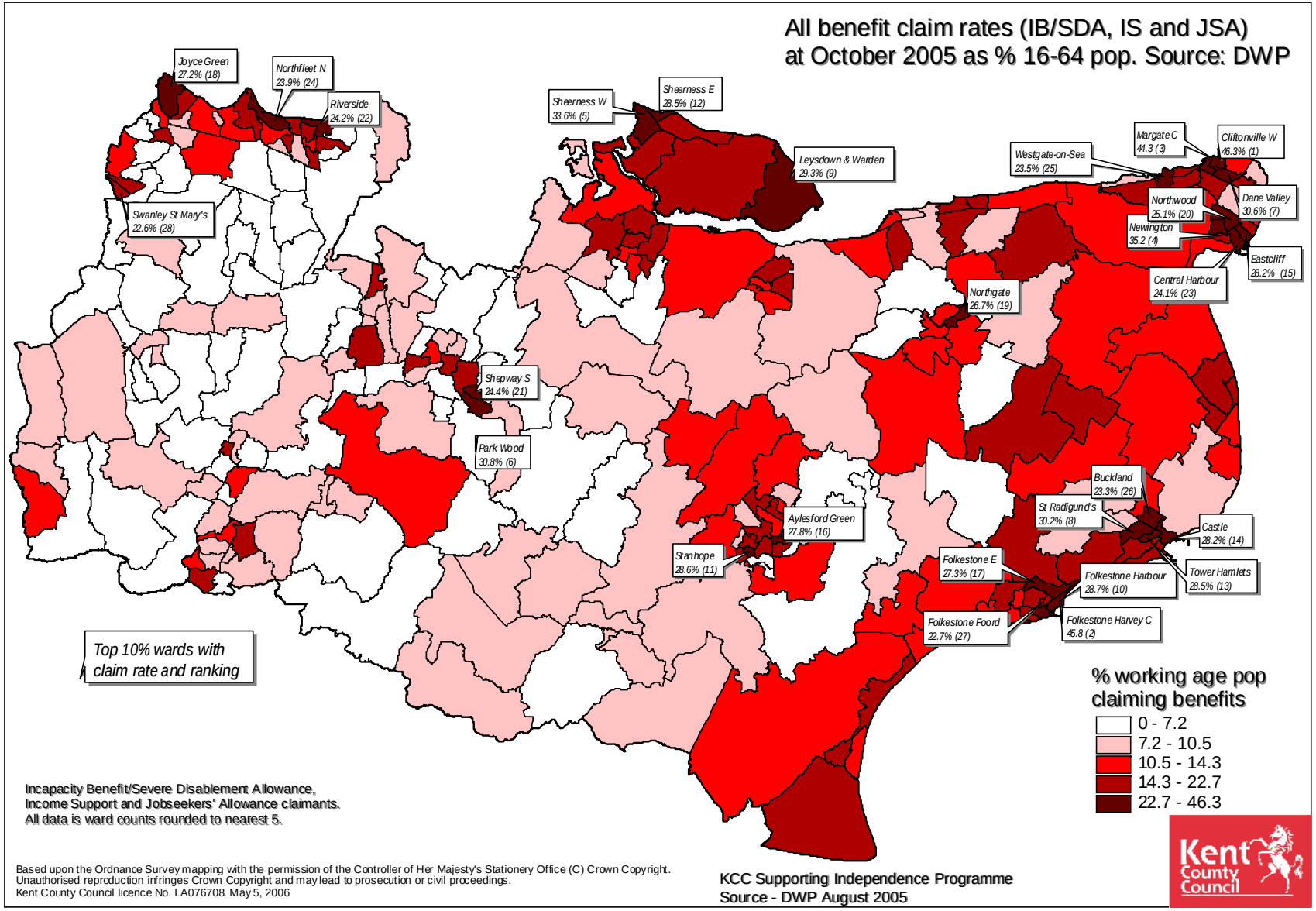
6.10.5 When considering flood risk and new development, planners clearly need to set a point in time against which to calculate flood risk. For example, the working assumption on flood risk in the Kent Thameside part of the Thames Gateway is of a 1:1000 in 2030[97]. Given predictions of accelerated climate change later in the century, and as it is envisaged the buildings now being erected lasting beyond 2030, it may be that we should be seeking to assess flood risk closer to the end of the lifetime of a development. The forthcoming 'probabilistic' scenarios promised by the UK Climate Impacts Programme, which will express the likelihood of climate impacts as a probability for a given point in time, may provide a more robust basis for taking this longer term view[98].

6.10.6 **Diagrams 6.10.6A** – Indicative Flood Map of Kent and **6.10.6B** – All Benefit Claim Rates at October 2005 as a % 16-64 Population.

[97] Written evidence received from Peter Moore, KCC Environment Strategy Manager.

[98] See: http://www.ukcip.org.uk/scenarios/ukcipnext/what_is_ukcipnext.asp


Flood Zones in Kent
Flood Zone 3
Flood Zone 2
Flood Zone 2 low to medium risk with an annual probability of flooding of 0.1-1.0% from rivers and 0.1-0.5% from the sea.
Flood Zone 3 - high risk with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.
Kent County Council


All benefit claim rates (IB/SDA, IS and JSA)
at October 2005 as % 16-64 pop. Source: DWP
Joyce Green
27.2% (18)
Northfleet N
23.9% (24)
Riverside
24.2% (22)
Swanley St Mary's
22.6% (28)
Sheerness W
33.6% (5)
Sheerness E
28.5% (12)
Leysdown & Warden
29.3% (9)
Westgate-on-Sea
23.5% (25)
Margate C
44.3 (3)
Cliftonville W
46.3% (1)
Dane Valley
30.6% (7)
Northwood
25.1% (20)
Newington
35.2 (4)
Eastcliff
28.2% (15)
Central Harbour
24.1% (23)
Northgate
26.7% (19)
Shepway S
24.4% (21)
Park Wood
30.8% (6)
Buckland
23.3% (26)
St Radigund's
30.2% (8)
Castle
28.2% (14)
Aylesford Green
27.8% (16)
Stanhope
28.6% (11)
Folkestone E
27.3% (17)
Folkestone Harbour
28.7% (10)
Tower Hamlets
28.5% (13)
Folkestone Foord
22.7% (27)
Folkestone Harvey C
45.8 (2)
Top 10% wards with
claim rate and ranking
% working age pop
claiming benefits
0 - 7.2
7.2 - 10.5
10.5 - 14.3
14.3 - 22.7
22.7 - 46.3
Incapacity Benefit/Severe Disablement Allowance,
Income Support and Jobseekers' Allowance claimants.
All data is ward counts rounded to nearest 5.
Based upon the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office (C) Crown Copyright.
Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
Kent County Council licence No. LA076708. May 5, 2006
KCC Supporting Independence Programme
Source - DWP August 2005
Kent
County
Council

6.10.7 Flooding was the subject of a Select Committee review topic in 2001 and the 2005 Select Committee topic review entitled *"Water and Wastewater, Particularly in Ashford*" considered it necessary to look at flooding as part the water systems considered in that report[99]. This report also commented on the use of Sustainable Urban Drainage Systems ("SUDS")[100] and the Select Committee also received further written evidence on SUDS from Eddy Taylor of Croydon Borough Council. SUDS can be considered a sustainable measure to address the impact of climate change. While the Select Committee welcomes reference to SUDS in the Kent Design guide and other policy documents, it would like to be reassured that rather than simply being 'encouraged' by local planning authorities, it is actually being 'insisted' upon in all possible circumstances.

6.11 Emergency Planning

6.11.1 The Select Committee investigated how climate change could impact on emergency planning. KCC has an Emergency Planning Unit[101] which draws up, maintains and reviews arrangements for dealing with major incidents. It co-ordinates responses across the council, and works closely with the county's emergency services and 12 district councils to ensure that the right people with the right skills are well-briefed and ready to react.

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[99] See the "Water and Wastewater, Particularly in Ashford" Select Committee report, September 2005, Page 53. See: http://www.kent.gov.uk/publications/council-and-democracy/selectcom-water-sep05.htm

[100] For a further explanation of SUDS, please see the Glossary.

[101] See: http://www.kent.gov.uk/Community/community-safety/emergency-planning/

6.11.2 Given that both the probability and severity of extreme weather events are predicted to increase because of the impact of climate change[102], the Select Committee regards it as vital that potential climate related disasters are adequately considered in the emergency planning framework. The Select Committee is concerned that this point is not being adequately considered.

6.11.3 While flooding and water shortages addressed elsewhere in this section are among the most visible potential emergencies which might be addressed by Kent's emergency planning framework, the Select Committee would emphasise that they are not the only ones. For example, planning to protect vulnerable people in the event of more severe and frequent heatwaves might be considered in a similar context. This said, the comments below focus on emergency planning for flood risk as this is the area where the evidence was most forthcoming.

[102] See the UKCIP02 scenarios (page 3 *et seq)*: http://www.ukcip.org.uk/resources/publications/documents/UKCIP02_briefing.pdf

6.11.4 The Select Committee noted that the Environment Agency and KCC's Emergency Planning Unit wish to complete a plan for the evacuation of Romney Marsh in the event of large-scale flooding[103]. This requires support from a number of organisations to be completed. Mr Nick Rowe, KCC's Emergency Planning Officer, also submitted written evidence that as coastal flooding has been identified as a priority risk in the Kent Community Risk Register,[104] it may now be possible to complete the project. Given the points above on the impact of climate change and flooding and the concerns about flooding raised by members of the public at the local board meeting in Romney Marsh referred to in section 6.8.2, the Select Committee calls on all parties to deliver this project as a matter of urgency. We would also encourage a more thorough review of how climate impacts are taken into account in the wider emergency planning framework which might result in further, similar projects being taken forward.

[103] See evidence from Mr Neill Gunn of the Environment Agency at the hearing on 28 April 2006, paragraph 9 and written evidence from Mr Nick Rowe.

[104] See: http://www.kent.gov.uk/publications/community-and-living/kent-community-risk-register.htm

6.11.5 **Recommendation 3**: Ensure climate change impacts on flood risk, water resources and emergency planning are taken into account.

The Select Committee recommends that KCC should:-

1. Strongly support the Environment Agency's efforts to promote sustainable approaches to flood risk management, to restrict building in areas at high risk of flooding and to ensure that flood resilience is built in to new development.

2. Ensure that where development in the indicative flood plain goes ahead it is concentrated in well-defended areas at higher densities.

3. Ensure that development pressure is not simply transferred from high flood risk areas to lower risk areas which may face other constraints, climate-related or otherwise.

4. Adopt a new statement of water policy, emphasising the importance of demand management and reflecting current concerns about water resources and long-term concerns about climate change impacts.

5. Immediately review Kent's emergency planning framework to ensure that the latest evidence on climate change is fully taken into account.

6. Call a high level meeting of the emergency services, local authorities and the Environment Agency to identify potential climate related emergencies and ensure that they are being adequately planned for.

7. Ensure that specific emergency plans for climate related emergencies, such as evacuation plans for those areas of Kent facing high flood risk, are in existence and up to date.

7 Reducing the Risk of Future Climate Change – Mitigation

7.1 Summary of points covered in section

- **Kent's carbon footprint is significant and substantially reducing it is fundamental to reducing the risks of future climate change.**

- **Energy, transport and land use planning are key areas where KCC can influence Kent's carbon footprint.**

ENERGY

- **Energy efficiency measures offer the quickest and cheapest way to reduce emissions, though promotion of a mix of renewable and other low-carbon sources of energy, particularly at a small scale, is also essential. There are existing sources of free, independent energy advice in Kent which should be more strongly supported and promoted by KCC.**

- **KCC must lead by example, using sustainably-sourced biofuels in its vehicle fleet, committing to high standards of sustainable construction and operation for its buildings and setting ambitious targets for carbon reduction and renewable energy use.**

- **The impact of schools on emissions has a major practical and symbolic significance as they make up a large part of KCC's estate. Reducing emissions associated with schools, via support for the Eco-Schools programme and other initiatives, should be a priority.**

TRANSPORT

- **Transport is the fastest growing source of carbon dioxide emissions but current transport policies – national and local – are inadequate to prevent rising emissions.**

- **A new focus on reducing emissions, promoting schemes and policies which will achieve this and avoiding those which will not, is necessary to mount an effective challenge to climate change.**

- **KCC can lead by example by increasing staff commuting by sustainable modes, setting targets to reduce business mileage, and promoting low-emission vehicles via its lease car scheme.**

LAND USE AND PLANNING

- **The South East Plan will have a major impact on greenhouse gas emissions in Kent. KCC's efforts to influence the plan should seek to minimise emissions by focussing on the volume of development facing Kent and standards of sustainable construction.**

- **The Local Development Frameworks being developed by Kent's district councils provide major opportunities to tackle climate change. KCC should work with them to ensure that they make efficient use of land, reinforce high standards of sustainable construction and improve and extend natural habitats both to help wildlife adapt and to act as carbon 'sinks' (see Glossary for definition).**

- **KCC can lead by example by ensuring that it advocates and applies these principles in its own development control and planning functions.**

7.2 Section Introduction

7.2.1 This section covers the following themes:

- Kent's carbon footprint and reducing emissions.
- The case for targets to reduce emissions.
- Mitigation within KCC's estate.
- Mitigation for Kent as a whole.

7.3 Kent's Carbon Footprint and Reducing Carbon Emissions

7.3.1 Reducing the risks of future climate change fundamentally depends on reducing carbon dioxide emissions. To assess the scope of this challenge, the Select Committee agreed it would be useful to identify Kent's "carbon footprint".

7.3.2 The national emissions inventory indicates that 12,628,000 tonnes of carbon dioxide were emitted in Kent in 2003. This represents Kent's 'carbon footprint' for the most recent data available. The main sources of emissions are industrial and commercial (42%), domestic (29.5%), road transport (26.5%) and land use change (2%). Table 7.3.3 details carbon dioxide emissions for each local authority area in Kent[105].

[105] Source: produced on behalf of DEFRA by the National Environmental Technolgy Centre ("Netcen"), (see http://www.netcen.co.uk/index.php) as part of the National Atmospheric Emissions Inventory. The data is compiled using national spatial data and attempts to locate emissions where they occur but excludes domestic aviation, shipping and the off-shore oil industry, which can not be easily allocated to local authority areas. The data do not estimate emissions resulting from the production or transportation of materials or consumables unless the production or transportation occurs with in the defined area boundary. If used as indicators, e.g. by dividing the total or sub totals by the population or GDP, some misleading results can occur due to the over simplification of the emissions allocations and the lack of local knowledge.

7.3.3 **Table 7.3.3:** Carbon Dioxide Emissions by Local Authority Area in Kent

Local Authority Area	Total Emissions (kt 2003)	Population ('000s)	Per Capita (Tonnes Per Person 2003)
Ashford	997	106	9.41
Canterbury	914	140	6.71
Dartford	940	86	10.93
Dover	890	105	8.48
Gravesham	1,574	95	16.57
Maidstone	1,251	142	8.81
Sevenoaks	1,011	110	9.19
Shepway	920	98	9.39
Swale	1,446	125	11.57
Thanet	775	128	6.05
Tonbridge and Malling	1,127	110	10.25
Tunbridge Wells	783	105	7.46
Medway	1,833	251	7.30
KENT TOTAL (excluding Medway)	**12,628**	**1,350**	**9.35**
KENT TOTAL (including Medway)	**15,244**	**1,601**	**9.52**
SOUTH EAST TOTAL	**71,144**	**8,081**	**8.80**
UK TOTAL	**568,105**	**59,537**	**9.54**

7.3.4 Table 7.3.3 demonstrates Kent's emissions are above the south-east regional average on a per capita basis but broadly in line with the national average. Kent is, however, one of the largest and most populous counties in the UK, so our absolute level of emissions - our contribution to climate change - is highly significant in both the regional and national context. The Select Committee concludes that this demonstrates why KCC must play a pivotal strategic role in reducing carbon emissions. The following sections highlight those areas which have a major influence on emissions, and where the Select Committee felt KCC could exert the greatest influence in terms of reducing emissions: energy, transport, land-use and planning.

7.4 Energy

7.4.1 All methods of generating energy - even renewable technologies such as solar panels and windmills - bring some environmental cost and emissions of carbon dioxide, if not during use, then due to manufacture, maintenance or the creation of infrastructure.

7.4.2 For this reason, the most cost-effective and sustainable method of reducing carbon dioxide emissions is to encourage Kent's businesses and residents to reduce energy use across the board.

7.5 Energy Services

7.5.1 The Select Committee received evidence from Creative Environmental Networks ("CEN") that energy efficiency is a quick, cheap and most effective means of reducing carbon emissions in both the domestic and commercial sector[106]. The Select Committee observes that these sectors together account for 71.5% (or 9,029,000 tonnes) of all the carbon emissions in Kent (see section 7.3.2), so any measures targeted here will have a real impact.

[106] See evidence received from Ms Wendy Goddard of CEN at the hearing on 28 April 2006 (paragraphs 2 *et seq)*. The Select Committee also received evidence on a visit to see renewable technologies in action that was organised by CEN on 10 May 2006. The Select Committee also received evidence on energy efficiency within KCC from Mr Andy Morgan, KCC Commercial Services LASER Energy Manager, at the hearing on 15 May 2006 (paragraph 17 *et seq)*.

7.5.2 The Select Committee noted some barriers to delivering energy efficiency measures[107]. Although proven technologies such as loft insulation and cavity wall insulation are readily available, they are not being applied widely enough, due in part to:

- Lack of awareness for many Kent residents as to costs and benefits.
- Lack of impartial advice and support, or lack of awareness of the fact that it is available.
- Lack of resources to put widespread energy efficiency measures into practice.

7.5.3 The Select Committee identified energy efficiency as a key area for KCC to play a leading role in ensuring Kent residents can mitigate the impact of climate change. The Select Committee observes that KCC is well-placed to assist in overcoming the barriers using its own services, resources and partnership influence.

7.5.4 The Select Committee suggests that examples of this include:

7.5.5 Using its communications infrastructure to raise public awareness and to educate Kent's residents on how they can take energy efficiency measures to mitigate the impact of climate change. (See section 8.5).

[107] See note 106 *ibid*.

7.5.6 Working with others in a community leadership role to develop and promote energy advice – see for example evidence from Miss Becky Ribbens in section 8.7 and public feedback in Appendix 1.

7.5.7 **Recommendation 4:** Provide support for better sustainable energy advice to Kent's residents

The Select Committee recommends KCC:-

1. Offer funding to energy advice centres such as Creative Environmental Networks ("CEN") to extend promotion and delivery of their free energy advice service and the projects indicated below.

2. Endorse and advertise this service prominently and aggressively through KCC publications and the kent.gov.uk website.

3. In conjunction with the project provider, consider creating a specific fund for the retro-fitting of domestic energy efficiency measures to achieve carbon dioxide emission reductions, with the wider aim of promoting the impacts of climate change.

4. Partner with the Kent ECO-Schools team and other stakeholders to produce a county-wide "school pack" on climate change[108].

[108] This should be similar to the packs produced by Croydon Borough Council in their schools in conjunction with CEN. Written evidence received from Croydon Borough Council following the hearing on 10 April 2006.

7.6 Renewable and Low-Carbon Sources of Energy

7.6.1 After reducing energy use, the next most effective way of reducing carbon emissions is to make greater use of renewable and low-carbon sources of energy. Kent now has targets for generating renewable energy set via the regional planning process which the Select Committee is happy to endorse[109]. We do start, however, from a very low base, so the scale of this challenge, and the need for proactive approach to meeting those targets, should not be under-estimated. Kent's local authorities, businesses and residents all have a part to play.

7.6.2 The Select Committee does not wish to rehearse the pros and cons of all the renewable energy technologies available. This said, the Select Committee heard evidence to suggest that the issue of biomass in Kent is worth further exploration. This is addressed in more detail in section 7.7. Beyond this, the Select Committee would simply note that our success in mitigating climate change is likely to be greater if we:

[109] See figures cited in *Kent Environment Strategy: 2005 Progress Report, p18*, KCC March 2005. This document can be found at: http://www.kent.gov.uk/NR/rdonlyres/192B4EB8-BDBC-4090-BBD0-F8CEB67AB57E/134/fullprogressreport2006.pdf

- develop a mix of renewable energy technologies - Kent is fortunate in having a large renewable energy potential in the form of wind, solar, biomass, wave and tidal power. Wind, biomass and solar appear to offer the best short term prospects but other options should not be ruled out, particularly as climate change may ironically increase the potential of all the sources mentioned.

- Seek to apply them at a smaller scale - so called 'micro-generation'. This is because some of the inefficiency in our current patterns of energy use arises from a highly centralised generation and distribution process. If this can be addressed through greater use of community scale renewables, domestic installations and the like, then it will help achieve greater security of supply and may address public concerns about larger scale renewable energy developments, as well as tackling climate change.

7.7 Biomass

7.7.1 The Select Committee heard evidence that the economics of different renewable technologies will clearly be influenced by the extent of their application. Some renewable sources of energy may be held back not because they are inherently expensive, but because the market for them needs to be ‘kick-started’ to create the necessary supply chain. This appears to be the case with biomass in Kent with wood fuel being cheap and readily available, but lacking a mature supply chain to match it to potential demand[110].

[110] Evidence received from Ms Wendy Goddard of Creative Environment Networks at the hearing on 28 April 2006 (paragraph 5) and during the Members visit on 10 May 2006 to various projects

7.7.2 This is more likely to happen if KCC or other large organisations were to create a significant corporate demand for a given technology. Evidence was presented to the Select Committee that this could be the case with biomass energy from coppiced woodland[111], of which there is currently an excess of supply over demand in Kent.

7.7.3 The Select Committee strongly believes that further research is necessary to understand the true potential and limitations of the market for biomass in Kent. KCC should also explore the potential for using biomass heating across KCC's estate with a view to installing biomass boilers at suitable sites.

7.7.4 In addition to creating a local supply chain, this would have the added benefit of insulating KCC against rising fossil fuel prices and for the wider community of supporting the coppice industry and the livelihoods, amenity and biodiversity which depend on it. Biomass could be particularly appropriate for high heat users such as care homes, as the greatest efficiencies can be generated when it is operating continually and at maximum capacity[112].

7.7.5 In assessing feasibility, however, it is vital that the connection to *local* sources of wood fuel is maintained and that care is taken to ensure that carbon savings anticipated from reliance on biomass exceed any carbon emissions generated in the production and distribution process.

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organised by CEN, Mr John Archer of the National Farmers Union at the hearing on 12 April 2006 (paragraph 8) and Mr Laurence Tricker, KCC Countryside Partnerships Manager at the hearing on 10 April 2006 (paragraph 10).

[111] See note 110 *ibid.*

7.7.6 As noted in section 7.12.4, the Select Committee believes that there is also great potential for the use of bio-fuel and bio-diesel in KCC where this can be procured from sustainably managed sources. For this reason, the Select Committee includes a recommendation on bio-fuels.

7.7.7 **Recommendation 5:** Complete a feasibility study for use of Biomass in KCC Buildings and replace conventional fuels with Bio-Fuels in KCC vehicles where possible.

The Select Committee recommends KCC:-

1. Undertake feasibility studies for the use of locally-produced biomass across the KCC estate, including schools, care homes and all new build sites.

2. Use Bio-ethanol or Bio-diesel from certified, sustainable sources to fuel its own fleet of vehicles where possible.

3. Consider installing wood-chip or wood-pellet biomass boilers where oil-fired boilers are due for replacement and infrastructure and space can be available for fuel delivery and storage.

[112] Evidence received from Mr John Thorp of the Energy Conservation and Solar Centre (paragraphs 6, 7 and 19).

7.8 Reducing Emissions and Energy Consumption Within KCC

7.8.1 As discussed in sections 7.3 and 8.4, reducing carbon emissions is key to mitigating the impact of climate change. There are a number of pragmatic measures which should help KCC reduce its carbon footprint.

7.8.2 The Select Committee received written evidence from Mr Andy Morgan, Energy Manager in KCC Commercial Services' LASER division estimating that 162,129 tonnes of carbon dioxide were emitted by KCC in 2005. This is indicated in Table 7.8.3. This represents KCC's 'carbon footprint' for the most recent data available. As can be seen, 99.7% of KCC's emissions come from 4 areas - KCC Buildings (47%), KCC Staff Commuting Miles (37%), Street Lighting (11%) and KCC Staff Business Miles (4%).

7.8.3 **Table 7.8.3:** Estimated carbon dioxide emissions by KCC in 2005[113].

Area	Total emissions (Tonnes in 2005)	Percentage of total emissions
Buildings	76,396	47.1%
Streetlighting	17,619	10.9%
Staff Business Miles	6,539	4.0%
Staff Commuter Miles	61,150	37.7%
Waste	425	0.3%
TOTAL	**162,129**	**100.0%**

[113] Source: KCC Carbon Management Programme. Assumptions: Commuter mileage based on County Hall Carbon dioxide emissions average staff mileage a week was 151 miles 6,795 miles a year with a staff total of 30,698. Using same ratio as County Hall staff, we get 208,592,910 miles which is equal to 61,150 tonnes. Assumed petrol car averages 35mpg. 2/3rds of staff work in Education (20,971 staff). Business miles includes fleet and business miles and air miles. Streetlighting based on KCC inventory, not consumption.

7.8.4 The Select Committee noted the work undertaken by KCC's Corporate Environment Performance Group and evidence contained in KCC's Corporate Environmental Performance Report 2004-2005[114]. This details progress and proposes a target of 15% reduction in carbon emissions from its own buildings by 2015 and other activities. In addition, the Select Committee further noted evidence of an Energy Loan Fund Scheme, which is used to invest in appropriate energy savings projects. This £300,000 fund is managed by a team within KCC Commercial Services' LASER division. The Select Committee also noted the production of KCC's Carbon Reduction Plan and the action it proposes to meet these targets[115]. The Select Committee applauds this, but notes that more needs to be done given Kent is atypical in the impact of climate change and its needs. KCC should therefore look to adopt more challenging targets as detailed in Table 8.4.8.

[114] See: http://www.kent.gov.uk/publications/environment/cep-report-2005.htm. Evidence also received from Ms Carolyn McKenzie, KCC Kent Sustainable Business Partnership Co-ordinator at the hearing on 15 May 2006 (paragraph 1 *et seq)*.

[115] See note 114 *ibid.*

7.8.5 The Select Committee also noted evidence that the Building Schools for the Future ("BSF") Programme requires a minimum standard of "Very Good" under the Building Research Establishment Environmental Assessment Method (BREEAM)[116] and that Part L of the Building Regulations were re-issued in April 2006, which require new buildings to meet a 25% improvement in energy efficiency. Clearly, these will have an impact in reducing KCC's emissions[117].

7.8.6 The Select Committee was pleased to note that 46% of the electricity used in KCC's own estate came from renewable sources[118]. However, the Select Committee has subsequently received evidence that from November 2006, this will drop to 0%. The Select Committee understands that changes in the market for energy have currently increased the price of renewable energy to the extent that such contracts are currently considered uneconomic by KCC[119]. The Select Committee also understands that there are concerns about whether the electricity sold under 'green' tariffs delivers any real increase in renewable generation or reductions in carbon dioxide emissions and that some such tariffs may be little more than symbolic[120]. Whilst the Select Committee would not underestimate the importance of symbolism in this area, clearly there are limits to the extent to which KCC could pay for symbolism if there were no clear

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[116] The most widely recognised and used measure of environmental design and management in the construction and property sectors, and increasingly specified in public sector procurement as a minimum standard.

[117] Evidence from Mr Mike Austerberry, KCC Director of Property and Mr Steve Bell, KCC Professional Services Manager, Property Group at the hearing on 28 April 2006 (paragraph 5).

[118] See note 114 *supra*.

[119] Written evidence from Mr Andy Morgan, Commercial Services LASER Energy Manager.

environmental benefit. This said, if we are to tackle climate change effectively, it may be necessary to pay something extra for our electricity, reassured by the knowledge that that this would also encourage us to use less of it.

7.8.7 The Select Committee suggests that it is important to know about the relative costs in terms of both price and carbon dioxide emissions of the options available for KCC's electricity supply contract so that the next time it comes up for renewal, climate change considerations can be taken into account. If KCC has selected a tariff which delivers the same or better performance in terms of emissions for a lower cost then that would clearly be sensible. Either way, the Select Committee would urge KCC to commit to ambitious targets for carbon reduction and for the proportion of its energy coming from renewable sources as suggested in Table 8.4.8. This could be achieved both by procuring an appropriate tariff in future, and by greater reliance on renewable energy generation within KCC's estate which is addressed in the following section.

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[120] For example, please see: http://www.ethicalconsumer.org/magazine/buyers/electricity.pdf and http://www.foe.co.uk/resource/briefing_notes/green_electricity_tariffs.pdf

7.9 The Use of Renewables in KCC's Estate and ECO-Schools Initiative.

7.9.1 81% of energy consumed by KCC is used in schools[121] and 47% of carbon emissions are in KCC buildings[122]. Taking these figures against a backdrop of Government expectation that local authorities adopt targets for energy generation from renewable energy[123], the Select Committee identified potential for micro-renewables in KCC's Estate. This is especially with programs such as Building Schools for the Future (see section 7.8.5) as well as other initiatives, such as Private Finance Initiative projects generally.

7.9.2 The Select Committee urges KCC to take full advantage of opportunities in this area and to consider active policy intervention to ensure that measures to reduce emissions and support renewables are incorporated in Directorate plans or designs, with the KCC Property Group being given sufficient powers to ensure that this is enforced. Although the Select Committee accepts that the costs of achieving the BREEAM 'Excellent' standard may be relatively high at present, the

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[121] Evidence received from Mr Mike Austerberry, KCC Director of Property at the hearing on 28 April 2006 (paragraph 3) and Ms Carolyn McKenzie, KCC Kent Sustainable Business Partnership Co-ordinator at the hearing on 15 May 2006 (paragraph 9).

[122] See Table 7.8.3.

[123] "The Government expects all planning authorities to include policies in their development plans that require a percentage of the energy in new developments to come from on-site renewables, where it is viable". DLCG statement on PPS22 dated 8 June 2006. See: http://www.publications.parliament.uk/pa/cm200506/cmhansrd/cm060608wmstext/60608m0068.htm

Select Committee still believes KCC should commit to a clear timetable for meeting that standard, including in the school building programme[124].

7.9.3 The Select Committee was fortunate enough to visit a number of locations in Kent, including village halls, private houses and tourist attractions, where a range of renewable energy technologies have been installed or were in the process of being installed[125] These visits suggested that there was considerable scope for deploying proven and pragmatic renewable technologies provided they are installed in appropriate settings. These technologies may be especially suited to new-builds or refurbishments in KCC's estate, though the potential for retro-fitting existing buildings should also be explored.

[124] See evidence received from Mr Mike Austerberry and Mr Steve Bell of KCC's Property Group at the hearing on 28 April 2006 (paragraph 11).

[125] Members visit on 10 May 2006 organised by Creative Environmental Networks ("CEN").

7.9.4 Pictures 7.9.4 – Left hand picture: Members of the Select Committee inspecting solar panels with Mr Peter Leutner. Right hand picture: Select Committee chairman Mr Chris Wells inspecting a ground source heat pump at Petham Village Hall with Mr Roger Purnell.

7.9.5 Pictures 7.9.5– Left hand picture: Members of the Select Committee inspecting a woodchip biomass burner being installed and tested on Mr John Leigh-Pemberton's estate. Right hand picture: Members of the Select Committee inspecting a windmill at the Wildwood Trust at Herne.

7.9.6 The Select Committee also noted helpful evidence commenting on the finance of installing renewables from Mr John Thorpe of the Energy Centre for Sustainable Communities[126] based on the experiences of Woking Borough Council.

7.9.7 The Select Committee also noted a particular issue in installing renewables or other low carbon technologies in schools. Whilst the investment costs would be incurred by KCC, as these are capital costs, the benefits would accrue to the schools as the savings would be revenue in nature. This could clearly leave KCC in an adverse financial position. Evidence from Mr Mike Austerberry and Mr Steve Bell suggested that in principle, KCC could enter into a contractual arrangement with the school governors to recoup a portion of the savings[127]. The Select Committee is keen to see this theoretical possibility translated into reality as soon as possible. Mr Thorp of the Energy Conservation and Solar Centre also identified a solution to a similar issue that Woking Borough Council had implemented with the use of power purchase contracts[128] and Mr Thorp and Ms Wendy Goddard of Creative Environmental Networks both noted solutions to this issue using Energy Service Companies ("ESCO's")[129].

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[126] Evidence received at the hearing on 15 May 2006 (paragraph 9 *et seq*).

[127] Evidence received at the hearing on 28 April 2006 (paragraph 11).

[128] Evidence received at the hearing on 15 May 2006 (paragraph 22).

[129] Evidence received from Mr Thorp at the hearing on 15 May 2006 (paragraph 8) and from Ms Goddard at the hearing on 28 April (paragraphs 12 and 13).

7.9.8 The Select Committee also took evidence from Ms Sarah Weston, the KCC Officer responsible for the Kent ECO-Schools initiative and Ms Carolyn McKenzie, KCC's Kent Sustainable Business Partnership co-ordinator[130]. The Eco-schools programme encourages schools to pursue initiatives for sustainable waste, energy and water use, both in the management of the school estate and the behaviour of students, staff and, indirectly, parents.

7.9.9 The Select Committee was very impressed with this exemplary initiative and commends highly the demonstrable success it has had – most notably with Eastchurch Primary School on Sheppey[131], which received a national award (the Ashton Award for Sustainable Energy worth £10,000 to the school) in June 2006.

7.9.10 The Select Committee was therefore particularly concerned to learn about the very limited resources available for promotion of the Eco-Schools initiative. The Select Committee's first concern is that a single KCC officer on a time-limited contract was the sole resource devoted to the initiative. The Select Committee regards this as unacceptable as this initiative must be adequately funded as a long-term commitment.

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[130] Written evidence received from the Kent Eco-Schools Officer and oral evidence received from Ms Carolyn McKenzie, KCC Kent Sustainable Business Partnership Co-ordinator at the hearing on 15 May 2006 (paragraph 2).

[131] See: http://news.bbc.co.uk/1/hi/england/kent/5087500.stm

7.9.11 The second concern was that the practical and symbolic importance of schools becoming more resource-efficient and environmentally aware was left almost to chance or the extra-curricular efforts of willing staff and students. The Select Committee was surprised that some of the initiatives being promoted voluntarily via the Eco-Schools initiative were not compulsory requirements in the construction and operation of all public educational establishments. If these elements could be made compulsory, it would help mitigate the impact of climate change and raise educational awareness among children (see section 8.7).

7.9.12 The Select Committee therefore makes the following recommendation:

7.9.13 **Recommendation 6:** Increase support for energy efficiency and renewable energy, particularly micro-generation, in the KCC Estate and across Kent as a whole.

The Select Committee recommends that KCC:-

1. Commit to the BREEAM “Very Good” standard and adopt a clear timetable to move to the BREEAM “Excellent” standard or its equivalent for all new school and other buildings and major refurbishments.

2. Identify targets to significantly increase the retrofitting of existing school and other buildings with energy efficiency measures and renewable energy installations.

3. Write into procedures governing the management of school estates key energy saving practises.

4. Review the targets for carbon reduction in KCC’s Carbon Management Plan with a view to setting more ambitious targets and ensure that adequate resources are in place for their delivery.

5. Ensure the Kent ECO-Schools initiative is adequately funded and staffed to achieve delivery of this initiative to all Kent schools.

6. Strengthen the focus on sustainable operation in the induction, training and performance regime for school governors and those who manage the KCC estate.

7.10 Transport - Introduction

7.10.1 The Select Committee primarily received oral evidence on Transport from Professor Roger Vickerman of the University of Canterbury and Mr Mick Sutch, KCC's Head of Planning and Transport Strategy. In addition, the Select Committee also received oral and written evidence on Transport from Mr Peter Moore, KCC's Environment Strategy Manager. The following sections draw heavily on this evidence and have been further subdivided into emissions from transport in Kent and emissions from transport by KCC Staff for ease of reference.

7.11 Transport - Emissions from Transport in Kent

7.11.1 De-coupling economic growth from increasing road traffic is one the greatest challenges facing both central and local government today[132]. All forms of motorised transport in operation in Kent today generate carbon dioxide emissions and some are responsible for the emission of other greenhouse gases such as nitrous oxide.

[132] The Select Committee noted that this point was also made by Mr Richard Moyse of the Kent Wildlife Trust at the hearing on 28 April 2006 (paragraph 17).

7.11.2 National figures show that transport is the fastest growing source of carbon dioxide emissions, and that road transport alone currently accounts for over a quarter of Kent's emissions (see section 7.3.2). As the rate of traffic growth in Kent has exceeded the national rate[133], it is safe to assume that transport is probably the fastest growing source of carbon dioxide emissions in Kent - and that it will become more so if the planned extensions to the road network and aviation services take place[134].

7.11.3 The Select Committee recognises that while reducing emissions from traffic is a difficult challenge, it must be given a much higher priority within KCC's other transport policies. As traffic appears to be growing faster than vehicle efficiency is increasing[135], it is unlikely that we will do so unless we adopt the reduction of overall emissions from traffic as a clear and unambiguous objective, put measures in place to achieve this and take the argument to what may initially be a sceptical public without fear of being accused of being 'anti-car'.

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[133] See figures cited in *Kent Environment Strategy: 2005 Progress Report, p24*, KCC March 2005. This document can be found at: http://www.kent.gov.uk/NR/rdonlyres/192B4EB8-BDBC-4090-BBD0-F8CEB67AB57E/134/fullprogressreport2006.pdf

[134] These are detailed in the Kent and Medway Structure Plan ("KMSP") and the Local Transport Plan ("LTP") (2006-2011) policies. The KMSP was adopted in July 2006. Chapter 9 (p 57 *et seq)* considers climate change issues specifically, although policies elsewhere in the KMSP are also relevant. For the KMSP, see: http://www.kmsp.org.uk/pdfs/KMSPAdoptedPolsKDJul06.pdf. The LTP also considers climate change issues and again policies elsewhere in the KMSP are also relevant. See: http://www.kent.gov.uk/static/local-transport-plan/sitemap.html

[135] For example, see: http://news.bbc.co.uk/1/hi/sci/tech/4837174.stm

7.11.4 The Select Committee received evidence from Mr Mick Sutch, KCC's Head of Planning and Transport Strategy on Kent's Local Transport Plan ("LTP")[136]. This LTP emphasises 'providing sustainable alternatives' and 'reducing congestion', but the Select Committee is concerned that both of these objectives could be met without reducing carbon dioxide emissions from transport. While 'promoting alternatives' should in theory deliver carbon savings, there is no guarantee that it will if underlying demand for travel rises unchecked.

7.11.5 It is also possible to reduce congestion, e.g. by expanding roads or speeding up traffic flows etc, in ways which are likely to increase traffic overall or release demand currently suppressed by congestion[137]. In doing so, it is likely that the most pressing air quality problem threatening everyone – that of carbon dioxide emissions – would also rise, even if local air quality problems are addressed.

7.11.6 The Select Committee recognises that there are limits to KCC's ability to affect the sort of change necessary to fundamentally tackle transport emissions. However, in the context of historic levels of traffic growth of between 1-2% in recent years, the Local Transport Plan target of limiting traffic growth to 2% per annum[138] amounts to little more than 'business as usual'. As has become clear from the Select Committee's inquiry, 'business as usual' is not just an inadequate response to climate change, it will turn what is currently the possibility of dangerous climate change into a near certainty.

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[136] See: http://www.kent.gov.uk/static/local-transport-plan/sitemap.html

[137] For example, see evidence from Professor Roger Vickerman of the University of Kent received at then hearing on 15 May 2006 (paragraphs 56 *et seq* and 71).

[138] See: http://www.kent.gov.uk/static/local-transport-plan/section_1321695484.html

7.11.7 Aviation, among the fastest growing sources of carbon emissions, is not immune from climate change impacts. The Kent and Medway Structure Plan and other strategic documents produced by KCC express support for the expansion of air services from Manston and Lydd airports, subject to environmental concerns being addressed[139]. The Select Committee finds it difficult to see how the concern about rising carbon dioxide emissions and their contribution to global warming can be addressed by expanding air services and as such urges KCC to apply the strictest possible tests to any proposals for airport expansion to ensure that the potential contribution to increased carbon emissions is taken into account.

7.12 Transport - Emissions From Transport for KCC Staff and Members

7.12.1 As can be seen in Table 7.8.3, KCC staff transport, especially staff commuting as opposed to business miles, represents one of the largest sources of carbon emissions within the KCC estate - over 40%. The Select Committee recognises the work done under the auspices of KCC's LTP to address these impacts[140]. However, the Select Committee feels that to effectively lead by example, there needs to be a greater focus within the LTP on the achievement of real and significant reductions in the car mileage travelled by KCC staff both in their journeys to work and in the course of their duties.

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[139] See note 134 *supra*.

[140] See note 136 *supra* and http://www.kent.gov.uk/NR/rdonlyres/CB746460-37C4-493E-8EBA-824A191D143D/0/app11smarterchoices.pdf

7.12.2 The Select Committee notes that the Environment Agency has a published target to reduce total emissions from business travel by car by 50% by March 2007 using a 2001/2002 baseline[141]. The Select Committee believes that a comparable statement of intent of this order would be appropriate for KCC.

7.12.3 Second to the amount of travel by KCC staff, the mode of travel offers scope for further reducing emissions. The Select Committee welcomes the achievement of the target in the LTP to increase the proportion of staff travelling to work by sustainable modes to 60%[142], but notes that this can be achieved without necessarily reducing the carbon footprint of KCC staff transport. The Select Committee also notes the large number of KCC events, particularly events which are solely attended by KCC staff, which take place at locations which are difficult to access by modes other than the car. When these events involve external audiences, we must be mindful of the message this sends about where our priorities lie.

7.12.4 The fuels used in KCC vehicles offer further potential to reduce emissions. The Select Committee recognises that there may be limits to the extent to which bio-fuels will provide 'the answer' to transport's contribution to climate change, as the area of land needed to grow the biomass needed to fuel the UK's vehicle fleet would be likely to exceed that on which we currently grow food.

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[141] See the following Environment Agency document at paragraph 1.35 and 4.6 (pp 3 and 7): http://www.environment-agency.gov.uk/commondata/acrobat/travel_rev_v3_200304_925830.pdf

[142] KCC Corporate Environmental Performance Report 2006. See: http://www.kent.gov.uk/NR/rdonlyres/2FD7C424-AE49-4D74-9B61-9595A0F6832E/3831/cepreport2005.pdf

7.12.5 This said, there is clearly some scope for expanding the use of fuels with a lower carbon content, and as bio-diesel is already commercially available, we can see no reason why KCC should not seek to ensure that its diesel vehicles take advantage of this existing source of supply, as long as it comes from certified, sustainable sources.[143] The Select Committee believes that bio-diesel offers great potential to KCC and is the subject of a recommendation in section 7.7.7.

7.12.6 Another way in which KCC can influence emissions of carbon dioxide from its transport operations is via the vehicles it makes available to members of its lease car scheme for essential users. For example, it is possible to encourage take-up of the most efficient vehicles by shifting the balance of any subsidy available within the scheme.

7.12.7 It is also be possible to ensure that the least efficient models are simply not made available as an option to staff. This could be done without significantly reducing the choice of model available to lease car scheme members. It is also worth noting that as lease cars tend to be used for private journeys, and form a major part of the new and second hand car markets, the impact of ensuring that fuel-efficient vehicles are favoured via the lease car scheme would extend far beyond the issue of mileage travelled on KCC business.

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[143] General evidence on biofuels received from Kevin Harlock, KCC Commercial Services Director, at the hearing on 15 May 2006. Bio-deisel available at the pump is typically a 5% blend of bio-diesel with normal diesel. It is understood that higher percentage blends (10-20%) are acceptable in many diesel engines (paragraphs 42 and 50) but the obstacle to their use is the validity of vehicle warranties offered by manufacturers.

7.12.8 **Recommendation 7**: Review Transport Policy to achieve an overall reduction in emissions from transport in the KCC estate and across Kent as a whole.

The Select Committee recommends KCC:-

1. Review its approach to transport policy to put reduction of greenhouse gas emissions from transport as a foremost objective.

2. Re-prioritise transport schemes within its Local Transport Plan to bring forward those which are likely to deliver absolute reductions in emissions.

3. Lead Kent's residents and businesses to a better understanding of the total costs of transport and use its influence as planning and highways authority to deliver real reductions in emissions.

4. Lobby central and regional government about the current and future contribution of road and air transport to climate change and the need for national and regional measures to reduce emissions where local ones alone will not work.

5. Raise the existing target to increase commuting by KCC staff by public transport, walking and cycling, and set a new target to reduce overall business mileage travelled by KCC Members and Staff.

6. Review the lease car scheme for KCC staff to prioritise the use of low carbon dioxide emissions vehicles and eliminate the option to select vehicles with high carbon emissions.

7.13 Land-Use and Planning - Introduction

7.13.1 The Select Committee primarily received oral evidence on these areas from Mr Rob Shaw, Policy Manager at the Town and Country Planning Association and Mr Daniel Salisbury, KCC's Sustainable Construction Advisor. The Select Committee also received written evidence from Dick Feasey, KCC's Development Planning Manager. In addition, the Select Committee also received oral and written evidence on these areas from Mr Peter Moore, KCC's Environment Strategy Manager. The following sections draw heavily on this evidence and have been further subdivided for ease of reference.

7.14 Land-Use and Planning - Making Efficient Use of Land to Tackle Climate Change

7.14.1 Undeveloped land will typically absorb carbon thought the growth of plants more effectively than land which is developed or in agricultural use. Making efficient use of land, and allowing a higher proportion of land to return to a natural state, is as legitimate and desirable a response to climate change as reducing emissions of carbon dioxide from energy use or transport.

7.14.2 This does not mean that planting some trees when we build a housing estate will be an adequate response to the threat of climate change. Rather, it means a relentless focus on making efficient use of land, minimising the loss of undeveloped land, and improving the quality and extent of those habitats which can act as 'carbon sinks[144]'. As well as absorbing carbon, undeveloped land also helps regulate water availability, quality and flood risk and should therefore be regarded as a form of adaptation to future climate change as well as a form of mitigation. The Kent Biodiversity Action Plan[145] sets out targets for habitat creation, and their delivery will serve the dual purpose of enhancing carbon sinks and helping wildlife adapt to climate change.

7.14.3 Making efficient use of land by recycling brownfield sites and building at higher densities will also support more sustainable patterns of transport as existing urban areas tend to be better served by public transport and the viability of public transport services improves in more compact built environments. The Select Committee notes that there is a target of 70% of development to be on Brownfield sites[146], which is being met[147].

[144] Forests and other ecosystems that absorb carbon, thereby removing it from the atmosphere and offsetting carbon dioxide emissions.

[145] See: http://www.kent.gov.uk/publications/environment/biodiversity-action-plan.htm

[146] KMSP policy HP3. See: http://www.kmsp.org.uk/chapter07.html

[147].See:http://www.kent.gov.uk/NR/rdonlyres/2F379FCA-BF35-435F-8347-0074850C0324/6082/2005hlsgreenfieldcompletions.pdf

7.15 Land-Use and Planning - The Volume of New Development Facing Kent and its Impact on Emissions

7.15.1 Projections of household growth, which could see 120,000 new houses built in Kent over the next 20 years[148], must be a cause of serious concern about future emissions, water supply and other factors associated with climate change. Central Government has been pressing strongly for higher levels of growth in the south east. Facing concerns this may be unsustainable, the South East Plan[149], the regional spatial strategy for the South East, is setting housing levels for Kent for the period to 2026.

7.15.2 The volume of new development will continue to be one of the key variables in determining future greenhouse gas emissions arising from Kent. This should form a key part of KCC's representations during the forthcoming examination in public of the South East Plan, which, when adopted, will determine the overall volume of development which Kent will experience over the next 20 years.

[148] See note 46 *supra*.

[149] See: http://www.kent.gov.uk/council-and-democracy/priorities-policies-and-plans/priorities-and-plans/south-east-plan/

7.16 Land-Use and Planning - Standards of Sustainable Construction

7.16.1 The Select Committee noted that, despite there being much talk of 'carbon-neutral' development, the reality of it was some way off[150]. Current efforts to modestly increase the energy efficiency of new buildings and generate a modest proportion of their energy needs from renewable sources would, without demolition of the existing stock of buildings, merely take the edge off an underlying growth in emissions.

7.16.2 The Select Committee notes the over-arching policies covering sustainable construction in the Kent and Medway Structure Plan ("KMSP")[151]. However, as a strategic plan it lacks the detail necessary to set clear minimum standards for energy or water efficiency which must form part of our response to climate change.

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[150] Evidence on carbon-neutrality primarily received from Mr Rob Shaw, Policy Manager at the Town and Country Planning Association and Mr Daniel Salisbury, KCC's Sustainable Construction Adviser, at the hearing on 12 April 2006 (paragraph 13 *et seq)* and Ms Wendy Goddard of Creative Environmental Networks at the hearing on 28 April 2006 (paragraph 9).

[151] Written evidence received from Dick Feasey, KCC Development Planning Manager. The KMSP was adopted in July 2006. Chapter 9 (p 57 *et seq)* considers climate change issues specifically, although policies elsewhere in the KMSP are also relevant.
See: http://www.kmsp.org.uk/pdfs/KMSPAdoptedPolsKDJul06.pdf

7.16.3 The Kent Design Guide[152] may, however, be able to fulfil this role if it sets clear standards of environmental performance and is adopted as a Supplementary Planning Document to the Local Development Frameworks being produced across Kent by district councils. As the volume of development rises over time, it follows that these standards should rise accordingly if we are to avoid cumulative increases in greenhouse gases from development.

7.16.4 Earlier drafts of the South East Plan included a policy requiring the achievement of BREEAM 'very good' standard for new development but this policy was removed in response to consultation in 2005. In view of the high level of development proposed in the South East Plan, it is vital that that which does take place meets the highest standards in terms of greenhouse gas emissions. Without a clear basis in planning policy for insistence on high standards of sustainable construction, local authorities may shy away from rejecting sub-standard development for fear of losing appeals. This can not be allowed to stand in the way of a rigorous approach to raising environmental performance in new buildings.

[152] See: http://www.kent.gov.uk/publications/council-and-democracy/kent-design-guide.htm

7.17 Land-Use and Planning - KCC and Specific Development Proposals

7.17.1 KCC's support is inevitably sought for a wide range of development proposals throughout the county, whether promoted by district councils, private developers or other interests. KCC is also the planning authority for many of its own developments, as well as minerals and waste planning applications. Among the many considerations which KCC must apply before deciding to lend its support, or express concern or opposition, to such proposals, or to reject or approve them when it acts as the planning authority, the Select Committee believes that climate change should feature very high on the list.

7.17.2 It is critical that any development supported by KCC can be shown to have minimal impact in terms of energy use, traffic generation, efficient use of land and materials, waste generation and water use. This should be reflected both in our formal development control decisions and the informal positions we take on proposals for which we are not the ultimate planning authority. It is vital for the credibility of the organisation as it seeks to develop its response to climate change, as well as to the ultimate aim of reducing carbon dioxide emissions. A clear process is required to assess the impact of proposals on emissions before KCC offers its support.

7.17.3 **Recommendation 8:** Make more efficient use of land in the development process and meet higher standards of sustainable construction.

1. Development Control

The Select Committee recommends that KCC's development control function give high priority to climate change specifically to:

A. Ensure that they have considered adaptation to climate change impacts, using the criteria set out in the *Adapting to Climate Change: Checklist for Development* produced by the South East Climate Change Partnership[153].

B. Ensure that these principles and others relating to sustainable construction are reflected in the Kent Minerals and Waste Local Development Framework.

2. South East Plan

The Select Committee recommends that in making representations on the South East Plan KCC:

A. Continue to express concern about the volume of development facing Kent, as it will increase both our contribution to climate change and our exposure to its impacts, most notably in terms of water stress and flood risk.

B. Lobby for the strictest possible tests for new development in respect of greenhouse gas emissions, air quality and resilience to climate impacts.

continued……

[153] A copy of this document can be downloaded from the SECCP web-site, please see: http://www.climatesoutheast.org.uk/downloads/TRCCG%20Checklist%20for%20Development%20Nov%202005.pdf

C. Call for re-insertion of the policy for all new development to meet at least the BREEAM 'very good' standard for sustainable construction and to set a clear policy framework for moving rapidly towards carbon neutral development.

3. Local Development Frameworks

The Select Committee recommends that, in working with Kent's District Councils to develop their Local Development Frameworks, KCC should:

A. Seek to ensure that Kent and Medway Structure Plan policies to build at higher densities and meet brownfield development targets are rigorously observed and improved upon where possible.

B. Insist on new development meeting the BREEAM 'very good' standard as a minimum, and, within this the 'excellent' standard for the energy and water elements of the assessment.

C. Set targets for creating and linking natural habitats based on the Kent Biodiversity Action Plan, along with clear action plans for their delivery.

In addition to all of the above, the Select Committee also notes proposals for measures to minimise emissions, through energy efficiency and the use of renewable energy, in government advice that at least 10% of energy needs should be met from renewable sources[154] and anticipates this policy being reflected in plans and planning decisions at regional, county and district level.

[154] "The Government expects all planning authorities to include policies in their development plans that require a percentage of the energy in new developments to come from on-site renewables, where it is viable". DLCG statement on PPS22 dated 8 June 2006. See: www.publications.parliament.uk/pa/cm200506/cmhansrd/cm060608wmstext/60608m0068.htm .

7.18 Other Areas Where KCC Can Lead by Example on Mitigation

7.18.1 The Select Committee identified 2 other areas where KCC is well-placed to lead by example on mitigation. These are waste efficiency and procurement and these are discussed below.

7.19 Waste Efficiency

7.19.1 Although waste accounts for only 0.3% of KCC emissions, the Select Committee regards a key message used with waste in the wider community – “Reduce, Reuse, Recycle” – as being a message that can be applied in a wider setting to mitigate the impact of climate change.

7.19.2 Waste efficiency is included in the recommendation at 7.9.13. Although this relates to the Kent ECO-Schools initiative, the principles noted in that recommendation can be equally applied throughout KCC and not just schools. These points would back up current KCC initiatives on waste management, such as the ‘War on Waste’ initiative.

7.20 Procurement

7.20.1 Due to its size, KCC as an organisation has considerable strength in procurement terms. The Select Committee noted a good example of this with the use of Green Energy – 46% of KCC’s energy has come from renewable sources since 2005 and this will continue for most of 2006 (see section 7.8.6).

7.20.2 In addition to energy procurement, KCC should take a holistic approach to ensure measures to mitigate the impact of climate change are included in procurement in other areas.

7.20.3 An example could be to continue to support initiatives such as the 'Produced in Kent' initiative to ensure local food is supported, one of the benefit of which is reduced emissions as fewer 'food miles' are incurred[155]. The Select Committee is pleased that Produced in Kent is being supported by KCC to supply food to schools under a new contract as reported in the Local Government Chronicle of 1 June 2006. Contracts like these should be pursued further.

[155] An example of this can be found on Produced in Kent's own website. Please see http://www.producedinkent.co.uk/cgi-local/news.cgi?action=item&newsid=46

8 Responding to Climate Change - Community Leadership

8.1 Summary of Points Covered in Section

- **Kent's response to climate change should be steered by a new Climate Change Action Plan, produced by KCC and the Kent Partnership as a key supporting document to the *Vision for Kent*.**

- **This action plan should incorporate clear and ambitious targets which reflect the fact that Kent has more to lose than most from climate change. These targets should in turn be reflected in future iterations of the Kent Agreement to underline our commitment to achieving them and ensure that they command the focus and resources necessary to do so. The action plan should be accompanied by a high profile communications programme aimed at Kent's residents and businesses to help them reduce their contribution to, and adapt to, climate change.**

- **KCC should review its political and managerial arrangements to ensure that there is clear leadership, co-ordination and lines of accountability for different aspects of the climate change agenda.**

- **Climate change must become a mainstream consideration in KCC's business planning, risk assessment and other corporate plans.**

- **Better climate change education is vital to help adults of tomorrow understand and reduce the risks associated with climate change.**

8.2 Section Introduction

8.2.1 This section covers the following themes:-

- Best practice elsewhere
- Working in Partnership
- Strategic political and managerial leadership

8.3 Best Practice on Climate Change

8.3.1 The Select Committee received evidence of "Best Practice" elsewhere from a variety of witnesses, including SECCP, Carbon**sense,** UKCIP and ECSC, as well as other local authorities[156]. The Select Committee particularly found the evidence received from Mr Steve Waller of I&DeA useful[157] and is pleased to note the wealth of evidence and approaches available to local authorities to address the impact of climate change.

[156] See evidence received as follows: SECCP and Croydon Borough Council at the hearing on 10 April 2006, Carbon**sense** at the hearing on 12 April 2006, Maidstone Borough Council at the hearing on 26 April 2006 and UKCIP at the hearing on 3 May 2006 and ECSC at the hearing on 15 May 2006.

[157] See evidence received from I&DeA at the hearing on 3 May 2006 (paragraph 4 *et seq)*.

8.3.2 A number of witnesses highlighted the need for a strategy or action plan to steer activity on climate change[158]. There is, on paper, already a clear policy basis for action on climate change in Kent in the *Vision for Kent* and *Kent Environment Strategy*. The Select Committee is concerned, however, that while this high level recognition of the issue is welcome, it is not reflected in a detailed plan of action to respond to climate change, nor in the day-to-day decisions and actions of KCC or its partners. The Select Committee agrees with the suggestion from a number of witnesses that the preparation of a Climate Change Action Plan for Kent will be necessary to ensure a concerted and co-ordinated approach, and to identify specific action to support the high-level recognition of the problem referred to above.

8.3.3 The Select Committee debated where such an action plan should 'sit' in relation to other corporate plans and strategies in Kent, and came to the conclusion that the cross-cutting nature of the climate change issue means that it can not be addressed simply as an ‘environmental’ issue. As such, the Select Committee felt that it should be developed as a 'daughter document' to the *Vision for Kent*, which is the over-arching community strategy for Kent, enjoying the support of a wide range of partners. It follows that the Climate Change Action Plan should be produced by the Kent Partnership rather than KCC alone to ensure that it has the involvement and support of a wide range of partners in Kent.

[158] See note 156 *supra*.

8.3.4 It is clear from the lack of progress towards the aspirations and targets in the Kent Environment Strategy[159] that the existence of a strategy or plan alone is not enough. As the Select Committee notes elsewhere, these high level aspirations and targets need to be reflected and reinforced in the mainstream of KCC's corporate planning and performance management regime, and cascaded through the business plans and work programmes of individual service directorates within KCC. The experience of the Kent Agreement, comprising the Kent Public Service Agreement (PSA) and Local Area Agreement (LAA), suggests that the inclusion of specific objectives within such agreements tends to focus the necessary corporate effort and resources on their delivery. In this regard, it would be helpful if future iterations of the Kent Agreement were to address the current absence of targets relating to climate change, reducing energy use, tackling traffic or any of the other main sources of greenhouse gas emissions. The Select Committee was impressed to hear of the experience of other local authorities in Kent, including Medway, which has a PSA target on carbon reduction[160], and urges KCC to emulate this approach in future iterations of the Kent Agreement.

8.3.5 The Select Committee wishes to highlight evidence received from I&DeA about key success factors for local authorities[161]:

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[159] See *Kent Environment Strategy: 2005 Progress Report*, p30 Kent Partnership, March 2005, for a detailed discussion and an assessment of progress against 25 key indicators. See: http://www.kent.gov.uk/NR/rdonlyres/192B4EB8-BDBC-4090-BBD0-F8CEB67AB57E/134/fullprogressreport2006.pdf

[160] Evidence received from Ms Wendy Goddard of Creative Environmental Networks ("CEN") at the hearing on 28 April 2006 (paragraphs 4, 6 and 10).

[161] See note 157 *supra*.

8.3.6 **Diagram 8.3.6**: Key Success Factors for Local Authorities to Adapt and Mitigate the Impact of Climate Change.

8.4 Strategic Targets and Indicators

8.4.1 The Select Committee received evidence from internal sources on strategic targets and indicators, principally from Ms Carolyn McKenzie, KCC Sustainable Business Partnerships Co-ordinator, Mr Andy Morgan, KCC Energy Manager based in the LASER Energy Management Group in KCC Commercial Services and Mr Peter Moore, KCC Environment Strategy Manager.

8.4.2 The Select Committee noted the targets in the KCC Corporate Environmental Performance Report[162], targets contained in documents such as V*ision for Kent* - "to meet the national target of a 20% reduction in carbon dioxide emissions by 2010"[163] - and the *Kent Environment Strategy* on energy use[164].

8.4.3 The Select Committee notes the lack of progress towards these targets[165] and believes that more needs to be done if we are to meet the challenge posed by climate change.

8.4.4 The Select Committee also wishes to focus attention on the key output indicator for mitigating future climate change – i.e. to reduce in *absolute* terms the total carbon dioxide emissions arising within Kent. The targets KCC should adopt must relate to absolute levels of emissions rather than relative levels. It is the absolute level of greenhouse gases that will decide the extent of climate change in the future.

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[162] See http://www.kent.gov.uk/publications/environment/cep-report-2005.htm

[163] *Vision for Kent,* April 2006, p30. See: http://www.kent.gov.uk/NR/rdonlyres/2907E1BF-37D7-4E75-8850-9FE9366BA208/0/VisionlinkedNEW.pdf

[164] *Kent Environment Strategy* 2003 targets: a 25% reduction in carbon emission by 2030; 20% of energy from renewable sources by 2020; all new development to near zero-carbon standards. See: http://www.kent.gov.uk/NR/rdonlyres/192B4EB8-BDBC-4090-BBD0-F8CEB67AB57E/134/fullprogressreport2006.pdf

[165] *The Kent Environment Strategy 2005 Progress Report* cites national figures showing that carbon dioxide emissions are rising again, estimates renewable energy production in Kent as 0.65% of the total and suggests that there has been little progress towards 'near-zero carbon development'. See: http://www.kent.gov.uk/NR/rdonlyres/192B4EB8-BDBC-4090-BBD0-F8CEB67AB57E/134/fullprogressreport2006.pdf

8.4.5 The Select Committee regards clear and ambitious targets as essential and necessary to drive activity, focus and measure progress. Such targets should be a fundamental part of a climate change action plan. (See recommendations at sections 8.4 and 8.6.4.) The Select Committee believes that there is also scope for monitoring climate change indicators at the Kent level to build a Local Climate Profile, adding a layer of local knowledge and detail to the national and regional climate change data made available by UKCIP and others. Indeed, creation of such a Local Climate Profile was recommended by UKCIP[166].

8.4.6 The Select Committee acknowledges the reaction in local government to the proliferation of targets and performance indicators imposed by central government. However, the Select Committee believes climate change is an issue of such profound significance that a clear message supported by clear targets is required.

8.4.7 The Select Committee could not take enough qualified evidence to recommend specific targets in all areas. However, Kent will suffer a greater impact from climate change than the rest of the UK so it follows that targets adopted must at least be as demanding as national targets. Based on the evidence presented, the Select Committee recommends the following as targets for KCC and Kent:

[166] Evidence received from UKCIP at the hearing on 3 May 2006 (paragraph 18).

8.4.8 **Table 8.4.8**: Potential Climate Change Targets for (i) Kent and (ii) KCC

INDICATOR	SIGNIFICANCE	EXISTING TARGET	SOURCE	SELECT COMMITTEE RECOMMENDATION
Targets for Kent				
Kent's ecological footprint	Measures resources consumed according to our share available globally – a fundamental indicator of sustainability and of the resource efficiency of the economy	'Reduce Kent's ecological footprint to sustainable levels'	*Vision for Kent* 2006	**Specify benchmarks and timescales to reduce Kent's ecological footprint**
Kent's carbon footprint	Total carbon dioxide emissions arising within Kent – our main contribution to climate change. The key output indicator for mitigating future climate change.	20% reduction on 1990 level by 2010 25% reduction on 1990 level by 2030	*Vision for Kent* 2006 *Kent Environment Strategy* 2003	**Adopt national target of 60% by 2050 to complement 2010 target and set appropriate milestones**
Carbon dioxide emissions by sector	Total carbon dioxide emissions arising within Kent broken down by sector, indicating carbon-intensity of different types of economic activity.	None	Data available via the National Environmental Technology Centre ("Netcen")[167]	None – but use indicator to identify sectors which might need particular help or advice

[167] See also Table 7.3.3 and note 105. For further information on Netcen, please see: http://www.netcen.co.uk/index.php

INDICATOR	SIGNIFICANCE	EXISTING TARGET	SOURCE	SELECT COMMITTEE RECOMMENDATION
Road traffic volume	Transport is fastest growing source of carbon dioxide emissions. Traffic currently growing faster than vehicle efficiency is improving.	Limit traffic growth to under 2% per annum	*Local Transport Plan for Kent* 2006-11	**Review approach to emissions reduction from traffic and identify measures required to achieve real reductions**
Waste generation	Waste minimisation will directly equate to significant energy savings	Reduce waste growth to zero by 2012	*Kent Environment Strategy*	**Reaffirm Kent Environment Strategy target and supplement with targets to reduce waste arising further beyond 2012**
Renewable energy generation	Low or no-carbon energy sources key to de-couple energy consumption from climate change	20% by 2020 10% by 2010 111 mw installed capacity by 2010; 154 mw by 2016	*Kent Environment Strategy* DCLG planning guidance South East Plan	**Reaffirm Kent Environment Strategy target**

INDICATOR	SIGNIFICANCE	EXISTING TARGET	SOURCE	SELECT COMMITTEE RECOMMENDATION
Efficient use of land	Physical development prevents land performing its natural function of regulating local and global climate; pattern and density of development influences emissions.	70% of development on brownfield sites (minimum) Minimum housing density of 30 dwellings per hectare and 50 in central urban areas.	*Kent and Medway Structure Plan* *Kent and Medway Structure Plan*	**Reaffirm KMSP minimum standards on previously developed land and density, ensure they are reflected in district LDFs and identify potential to exceed them**
Targets for KCC				
KCC's carbon footprint	See above	7.5% per m2 by 2010, 15% per m2 by 2015 (proposed targets)	*Corporate Environmental Performance Report* 2004-05	**Adopt percentage targets for carbon dioxide reduction rather than 'per m2' and ensure these are at least in line with national carbon dioxide reduction targets**

INDICATOR	SIGNIFICANCE	EXISTING TARGET	SOURCE	SELECT COMMITTEE RECOMMENDATION
KCC green energy procurement	Reduces KCC's carbon footprint – currently 46% of KCC electricity supplied from renewable sources - about to fall to 0% following new energy contract	None	N/a	**Adopt a clear and ambitious target for a percentage of electricity needs to be met from renewable sources by 2008**
KCC staff travel	Major element of KCC's carbon footprint	None	N/a	**Raise target for travel to work by sustainable modes and adopt clear target to reduce KCC business mileage**
Use of biodiesel in KCC vehicles	Reduce KCC's carbon footprint and support development of market for bio-diesel	None	N/a	**Procure bio-diesel from sustainable sources for all KCC diesel vehicles as soon as practicable**

8.4.9 The Select Committee therefore makes the following recommendation:

8.4.10 **Recommendation 9:** Introduce a Climate Change Action Plan, supported by clear targets.

The Select Committee recommends:-

1. KCC, with the Kent Partnership, to develop a Climate Change Action Plan for Kent as a key supporting document to the *Vision for Kent*. This will set out how KCC and our partners can reduce our contribution to and prepare for the impacts of climate change. This needs to be consulted upon widely and in a quick timeframe.

2. KCC to adopt and publish clear targets to reduce carbon dioxide emissions in both the wider community and its own estate and reflect these in the Climate Change Action Plan.

3. These targets to be at least as challenging as national targets and reflected in strategic documents and commitments such as Local Area Agreements and Public Service Agreements.

4. KCC's Analysis and Information Team to identify and monitor appropriate climate change indicators for Kent and develop a Kent Local Climate Profile.

8.5 Climate Change Communications

8.5.1 The Select Committee sees effective communications as central to KCC's efforts to lead the community to a deeper understanding and a more concerted response to climate change.

8.5.2 KCC has considerable communications infrastructure, corporate communications staff, publications, presence on the web, relationship with council taxpayers, communities and organisations across Kent. The Select Committee believes we must harness this potential to raise awareness about climate change, and what can be done to tackle it, by using every means and media at our disposal.

8.5.3 Global climate change has had such a high media profile in recent months that many Kent residents are likely to be receptive to more detailed information on what it means for their county, communities and homes and what they can do to respond[168].

[168] An example include the evidence received from Miss Becky Ribbens at the hearing on 26 April 2006, whose opinion was that young people are more likely to respond to radio jingles and "give-aways" but not leaflets.

8.5.4 It is important that messages promoting awareness of climate change also get to people who are difficult to reach, and those who might not respond to communications about traditional environmental issues. KCC should consider using the more familiar socio-economic issues in which people have a self-interest to make links to the wider issue of climate change. For example, Kent's residents will certainly be interested in transport, energy costs, waste management, farming, tourism and food etc – those sectors of society that are affecting, or being affected by, climate change.

8.5.5 **Recommendation 10**: High profile communications programme.

The Select Committee recommends:-

1. KCC to develop a programme which will communicate the positive action that can be taken to reduce the risks of climate change and to prepare for that change which is already inevitable.

2. This must be co-ordinated with the production of a Climate Change Action Plan for Kent.

8.6 Strategic Political and Managerial Leadership

8.6.1 The Select Committee received evidence from various KCC internal officers and Cabinet Members as part of the topic review. The Select Committee formed the following views, which some witnesses may share and recognise, that:

- There is a lack of co-ordination of the activities relating to climate change.

- Although reviewing the whole of KCC's activity was outside the scope of the Select Committee's terms of reference, activity seemed to be initiated or led by middle-ranking officers with rather limited support and involvement from senior officers or politicians. This is not an effective response to climate change given the scale of the challenge.

- Awareness of climate change impacts exists within some directorates but was less evident or apparently absent from others. This is a fundamental issue as climate change will impact on all directorates.

- While there is good work underway to reduce the impact of KCC's own operations, this was not matched by activity to reduce Kent's impact or prepare for impacts as a whole.

- KCC is not visibly leading the community through education, policy and practice as proactively or effectively as it might

8.6.2 The Select Committee concludes that not enough is being done to ensure KCC's compliance with commitments in policy documents, such as the Nottingham Agreement. Potentially, KCC could be criticised for "fine words" not necessarily being translated into "fine actions".

8.6.3 The Select Committee found this is also backed up by evidence received from Mr Steve Waller of I&DeA, UKCIP, Carbonsense, Maidstone and Croydon Borough Councils, who all demonstrated excellent examples of "Best Practice" elsewhere. (See section 8.3 for details).

8.6.4 **Recommendation 11:** Clarify political and managerial leadership and accountability on climate change within KCC.

The Select Committee recommends that KCC should:-

1. Identify a leading member of the Administration to be responsible for climate change policy.

2. Ensure climate change is included in corporate risk planning, business continuity and all directorate plans and policies[169].

3. Challenge management arrangements for addressing climate change within KCC to ensure directorates:-

   - Recognise climate change is an issue for all.
   - Dedicate resources to climate change issues.
   - Co-ordinate climate change activity.
   - Communicate to staff the impact of climate change and the need to adapt and mitigate.

[169] An example of this can be found in the work that Devon County Council has undertaken. See section 5 and Devon CC's climate change strategy report at http://www.devon.gov.uk/climate-change-strategy.pdf

8.7 Climate Change Education

8.7.1 The Select Committee was keen to take evidence from a young Kent resident for their views on climate change education and was fortunate to receive evidence from Miss Becky Ribbens, aged 16 and a member of the Kent Youth County Council. Miss Ribbens evidence had a lasting impact on the Select Committee, dramatically reinforcing the importance of climate change for future generations, who will have to live with the long-term impacts.

8.7.2 Miss Ribbens told the Select Committee that before attending a KCC Local Board meeting in Dartford she was largely unaware of the likely impacts of climate change and the fact that they could have such a direct and significant impact on the future of her community and her generation[170]. The Select Committee was pleased to note Miss Ribbens and the Kent Youth County Council has subsequently set up an awareness campaign[171].

8.7.3 Miss Ribbens commented that she was deeply concerned, as was the Select Committee, at how little time was devoted to the issue within the school environment[172]. Indeed, the Select Committee noted that climate change education currently was part of the PSHE curriculum[173]. Whether or not the issue received any attention seemed entirely down to the preferences of individual teachers and school governors who are responsible for the school curriculum.

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[170] Evidence received at the hearing on 26 April, see paragraph 1 *et seq*.

[171] Evidence received at the hearing on 26 April, see paragraph 11.

[172] Evidence received at the hearing on 26 April, see paragraph 12 *et seq*.

[173] Evidence received at the hearing on 26 April, see paragraph 2 and 12.

8.7.4 The Select Committee appreciates that there will be many interest groups who feel that the issues which concern them should form a more prominent part of the school curriculum. The Select Committee also recognises the constraints on what can and can not be brought into the curriculum. However, the Select Committee makes no apology for proposing that climate change and the issues arising from it take a more prominent position in schools and in learning environments generally.

8.7.5 At the heart of our education system is the need to prepare young people for the future and help them acquire the skills needed to thrive. If, as the Government's chief scientist Sir David King believes, climate change is the greatest threat future generations will face including that of international terrorism[174], it is vital that education gives Kent's children the information and advice they will need to understand the implications and reduce the risks. Indeed, the Select Committee regards it is an essential and logical extension of the widespread desire to integrate schools more effectively into the communities they serve. The Select Committee believes the potential to raise public awareness through educating children on the impact of climate change should not be underestimated.

[174] See: http://www.climatesoutheast.org.uk/viewquotes.php

8.7.6 **Recommendation 12:** Improve education on climate change impacts

The Select Committee recommends that:-

1. KCC raise climate change awareness in young people within and beyond schools to show what they can do to reduce risks to future generations and to adapt to the changes which are coming.

2. The Children, Families and Education directorate produces a report to Cabinet on how climate change education can best be advanced in Kent's schools.

9 Conclusion

9.1 Looking back

9.1.1 At the outset of this topic review, Mr Peter Moore, KCC's Environment Strategy Manager, suggested to the Select Committee that the degree of acceptance of climate change could be likened to the stages of 'the grief cycle'.

9.1.2 This cycle details the stages of emotional response that an individual goes through over time in reaction to bad news[175]. This cycle begins with paralysis, progressing through denial and anger and ultimately to acceptance and the desire to move forward constructively.

9.1.3 Members of the Select Committee each began the inquiry at different stages on this cycle but ended it with clear and unanimous acceptance that climate change above and beyond that which can be explained by natural variation is happening and accelerating and that human activity is, at least in part, responsible. This is matched by a desire to ensure that KCC and Kent as a whole move rapidly towards a constructive, appropriate and adequate response to the many challenges which climate change represents. All Members of the Select Committee hope that the considered recommendations in this report will drive KCC and Kent to achieve this.

[175] This well known cycle was developed by Dr Elizabeth Kübler-Ross, a Swiss Psychiatrist. See: http://changingminds.org/disciplines/change_management/kubler_ross/kubler_ross.htm

9.2 Final Conclusions

9.2.1 In conclusion and presenting the recommendations in this report, the Select Committee strongly emphasises:

- That, as a County, Kent has more to lose than most in the United Kingdom from climate change and thus has a particularly strong incentive to reduce our contribution to it and adapt to its impacts.

- That the costs of responding to climate change will ultimately be marginal compared to the costs of inaction.

- That while KCC's direct influence on climate change may seem limited, we can with our partners exert a massive indirect influence by leading the community to a deeper understanding of risk and a more effective response.

- That the effectiveness of KCC's response to climate change will be greatly enhanced if pursued in partnership with other tiers of government. However, KCC should not shrink from conflict with those tiers if their policies undermine our efforts to combat climate change.

- That the cross-party consensus behind this report demonstrates that climate change is an issue which transcends party politics, and that in responding to this report and implementing its response to climate change, Cabinet and opposition parties must work together to maintain this cross-party consensus.

- That the credibility of KCC's efforts to raise awareness and encourage action depends fundamentally on leading by example in reducing emissions and adapting to climate change, not just within KCC's own estate, but in the decisions that KCC takes and the proposals to which we give our support throughout Kent.

10 Glossary

TERM / ABBREVIATION	DEFINITION
Adaptation	Adaptation can be defined as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. *Climate Change 2001: Impacts, Adaptation and Vulnerability, Annex B,* Intergovernmental Panel on Climate Change, see: http://www.grida.no/climate/ipcc_tar/wg2/index.htm
BSF Programme	The Building Schools for the Future Programme.
BREEAM	Buildings Research Establishment Environmental Assessment Method. (The most widely recognised and used measure of environmental design and management in the construction and property sectors, and increasingly specified in public sector procurement as a minimum standard).
Carbon Sinks	Forests and other ecosystems that absorb carbon, thereby removing it from the atmosphere and offsetting carbon dioxide emissions.

TERM / ABBREVIATION	DEFINITION
Climate Change	Whilst a definitive term for climate change can be found[176], in the course of receiving evidence the Select Committee noted the following evidence:- "*The term 'climate change' is sometimes used to refer to all forms of climatic inconsistency, but because the Earth's climate is never static, the term is more properly used to imply a significant change from one climatic condition to another. In some cases, climate change has been used synonymously with the term 'global warming'. Scientists however, tend to use the term in the wider sense to also include natural changes in the climate"*[177]. The Select Committee found that the evidence in Appendix 2 was important to understand and emphasise the relationship between human activities and climate change.
DCLG	Department for Communities and Local Government
DEFRA	Department for the Environment, Food and Rural Affairs
ECSC	The Energy Conservation and Solar Centre
ERPOC	KCC's Environment and Regeneration Policy Overview Committee.

[176] ""Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. " *United Nations Framework Convention on Climate Change* definition.
See www.unfccc.int/essential_background/convention/background/items/2536.php.

[177] *Climate Change Impacts for Kent, the impacts of climate change on Kent's environment, society and economy*. Report submission to the KCC Select Committee on Climate Change by Mr Peter Moore. KCC Environment Strategy Manager, March 2006.

TERM / ABBREVIATION	DEFINITION
Greenhouse Gases	In the course of receiving evidence the Select Committee noted the following evidence as a definition of Greenhouse Gases[178]: "Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the *greenhouse effect*. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances which are dealt with under the Montreal Protocol. Beside CO_2, N_2O, and CH_4, the *Kyoto Protocol* deals with the greenhouse gases sulphur hexafluoride (SF_6), hydro fluorocarbons (HFCs) and perfluorocarbons (PFCs)".
I&DeA	The Improvement and Development Agency
IPCC	Inter-Governmental Panel on Climate Change.
KCC	Kent County Council

[178] See: *Climate Change 2001: Impacts, Adaptation and Vulnerability, Annex B,* Intergovernmental Panel on Climate Change, see www.grida.no/climate/ipcc_tar/wg2/index.htm.

TERM / ABBREVIATION	DEFINITION
KMSP	Kent and Medway Structure Plan. (This was adopted in July 2006).
LTP	Kent County Council's Local Transport Plan (2006-2011).
Mitigation	Mitigation can be defined as "an intervention to reduce the sources or enhance the sinks of greenhouse gases, *Climate Change 2001: Impacts, Adaptation and Vulnerability, Annex B,* Intergovernmental Panel on Climate Change, see: http://www.grida.no/climate/ipcc_tar/wg2/index.htm
Netcen	The National Environmental Technology Centre[179].
ODPM	Office of the Deputy Prime Minister - now superseded by the Department for Communities and Local Government (DCLG)
SPPOC	Strategic Planning Policy Overview Committee.
UKCIP	United Kingdom Climate Impacts Programme.

[179] For further details, see http://www.netcen.co.uk/index.php

TERM / ABBREVIATION	DEFINITION
UKCIP02 Scenarios	Climate change scenarios for the United Kingdom published by UKCIP in 2002 (for further details, please see: http://www.ukcip.org.uk/resources/publications/documents/UKCIP02_briefing.pdf . These are the latest available scenarios and are due for revision in 2008 (these scenarios are the UKCIPnext scenarios. See: http://www.ukcip.org.uk/scenarios/ukcipnext/what_is_ukcipnext.asp).
SECCP	South East Climate Change Partnership.
SUDS	Sustainable Urban Drainage Systems. (Sustainable drainage is the practice of controlling surface water runoff as close to origin as possible, before it is discharged to a watercourse or to ground. This involves moving away from traditional piped drainage systems to softer engineering solutions that are closer to their natural drainage regimes. This helps to promote wider environmental objectives. As such, SUDS are a system for the process for achieving integrated water drainage design. For further details, please see: http://www.environment-agency.gov.uk/commondata/acrobat/suds_policy.pdf).

11 List of Witnesses

11.1 List of Witnesses Who Submitted Oral Evidence

Date	Name	Position and Organisation
Monday 3 April 2006	Mr Peter Moore	KCC Environment Strategy Manager
Monday 3 April 2006	Mr Keith Ferrin	KCC Cabinet Member for Waste, Highways, Planning and Environment
Monday 3 April 2006	Mr Graham Gibbens	KCC Cabinet Member for Regeneration and Supporting Independence
Monday 10 April 2006	Mr Eddy Taylor	Environment and Sustainability Team Manager, Croydon Council.
Monday 10 April 2006	Mr Laurence Tricker	KCC Countryside Partnerships Manager
Monday 10 April 2006	Mr Mark Goldthorpe	Programme Manager, SE Climate Change Partnership
Wednesday 12 April 2006	Mr Peter Martin	Research Director, Carbon**sense**
Wednesday 12 April 2006	Mr John Archer	Environment and Land Use Adviser, National Farmers Union
Wednesday 12 April 2006	Mr Daniel Salisbury	KCC Sustainable Construction Advisor

Date	Name	Position and Organisation
Wednesday 12 April 2006	Mr Rob Shaw	Policy Manager, Town and Country Planning Association.
Wednesday, 26 April 2006	Mr Nick Rowe	KCC Head of Emergency Planning.
Wednesday, 26 April 2006	Mr Jim Boot	Community Planning Co-Ordinator, Maidstone Borough Council.
Wednesday, 26 April 2006	Miss Becky Ribbens	Member, Kent Youth County Council.
Friday, 28 April 2006	Mr Neil Gunn	Flood Risk Management Team, Environment Agency.
Friday, 28 April 2006	Mr Frank Heeley	Water Resources Team, Environment Agency.
Friday, 28 April 2006	Mr Richard Moyse	Head of Conservation and Policy, Kent Wildlife Trust.
Friday, 28 April 2006	Ms Wendy Goddard	Strategic Support Manager, Creative Environmental Networks.
Friday, 28 April 2006	Mr Mick Sutch	KCC Head of Transport Stragegy and Planning.
Friday, 28 April 2006	Mr Mike Austerberry	KCC Director of Property, Property Group.
Friday, 28 April 2006	Mr Steve Bell	KCC Professional Services Manager, Property Group.

Date	Name	Position and Organisation
Wednesday, 3 May 2006	Mr Peter Jones	Director, Biffa Waste Services.
Wednesday, 3 May 2006	Mr Gerry Metcalf	Knowledge Transfer Manager, UK Climate Impacts Program.
Wednesday, 3 May 2006	Mr Laurie Newton	Local Authority Project Officer, UK Climate Impacts Program.
Wednesday, 3 May 2006	Mr Steve Waller	Principal Consultant, Improvement and Development Agency.
Wednesday 10 May	Mr Neil Turner Select Committee saw various renewable energy projects organised by CEN. The witnesses below demonstrated their projects: Mr and Mrs R Purnell. Mr Peter Leutner. Mr Peter Smith Mr John Leigh – Pemberton.	Creative Environmental Networks. Petham Village Hall - Chief Executive, The Wildwood Trust. -

Date	Name	Position and Organisation
Monday, 15 May 2006	Mrs Carolyn Mckenzie	KCC Corporate Environmental Performance Group
Monday, 15 May 2006	Mr Andy Morgan	LASER Energy Manager, KCC Commercial Services
Monday, 15 May 2006	Mr Kevin Harlock	Director, KCC Commercial Services
Monday, 15 May 2006	Professor Roger Vickerman	Jean Monnet Professor of European Economics, University of Kent.
Monday, 15 May 2006	Mr John Thorp	Managing Director, Energy Conservation and Solar Centre.

11.1.1 Some of the above witnesses also submitted evidence to the Select Committee in response to further follow up questions raised.

11.2 <u>List of Written Evidence Received</u>

11.2.1 The following submitted responses to requests for written evidence:

- Ashford Borough Council.
- Tunbridge Wells Borough Council.
- Tonbridge and Malling Borough Council.
- The Kent Partnership.
- The London Climate Change Agency.
- The Royal Society for the Protection of Birds.
- English Nature.
- Mr Dick Feasey, KCC Development Planning Manager.
- Ms Sarah Weston, KCC Kent Eco-Schools Officer.

12 Appendix 1 – Evidence From the Public

12.1 Background to Evidence

12.1.1 For the first time in a Select Committee process within Kent County Council, the public were able to add their comments directly through Local Board meetings in Dartford, Thanet and Shepway where climate change was the topic of discussion in Spring 2006.

12.1.2 Members of the public were also able to contribute by completing an answer to the question “Name one thing that you think KCC should be doing to tackle climate change”.

12.2 Responses Received from Members of the Public

12.2.1 The Select Committee received the following direct responses:

- *"Encouraging and promoting energy saving projects across Dartford."*
- *"Promoting walking and cycling and informing people about pollution problems."*
- *"Informing people on the actual facts, tackling recycling and having a festival to do with pollution."*
- *"Explaining to people how to save energy and how they are currently wasting energy. Basically making people more aware of how they use and waste energy."*
- *"Encourage environmental changes in schools (e.g. Screensavers on computers, switching lights off when not in use etc) to save energy."*

- *"I personally think that the KCC should lower the bus fares. By doing this, more people will be using the bus, and less car transport will be used. This will help the environment greatly."*

- *"I think one of the main things is the cars and the pollution, the KCC could make some kind of congestion charge locally or something like that."*

- *"Inaugurate a special education programme for both primary and secondary schools to inform and educate all students about global warming."*

- *"Education - early age"*

- *" I personally think that awareness should be raised throughout the community about how life's necessities which produce carbon dioxide e.g. running water, leaving TV/Stereo on standby etc…Also, bus fares should be lowered to encourage members of the community to use public transport and reduce the amount of people using their cars, which is a big contributor to global warming."*

- *"Congestion charging and cheaper transport".*

- *"Buy fruit & veg from England or nearby Europe, especially when it is in season, because that should reduce the number of carbon dioxide emissions produced by airplanes transporting it".*

- *" Talking to Young People! Young people like myself need to know what is happening and how they can help! I did not know the extremes of the problem and many young people still don't. There are approx. 120,000 young people in Kent and a lot of them want to help. Education is the key, if you educate us, we are going to pass it on to others and really make a difference."*

- *"Cut back on planned overcrowding in the South East (1.7 million dwellings) particularly in the Thames Gateway".*

- *"Improve roadside recycling (but also put pressure on companies to reduce the plastic / card packaging!)".*

- *"Pilot renewable energy schemes that people can observe what is achievable and how much can be saved. If people begin to realize that others are paying less than they pay, they will seek change for themselves".*

- *"Require all developers to employ renewable energy, to source their materials locally and to design for collective projects (rainwater harvesting)".*

- *"Maximum use of renewable energy in all new developments"*

13 Appendix 2 – Evidence and Scenarios of Climate Change

13.1 Background and key findings of the Scientific Evidence of Climate Change.

13.1.1 The Select Committee took a wide variety of scientific evidence, primarily from the UK Climate Impacts Program ("UKCIP"), the South East Climate Change Partnership (both of which are government-supported bodies), as well as from Carbon**sense** and from Peter Moore, KCC's Environmental Strategy Manager.

13.1.2 The most striking facts that the Select Committee found from the scientific evidence presented can be summarised as follows:

13.1.3 Climate change is unavoidable over the next 30 to 40 years[180], due to historic emissions of "Greenhouse Gases"[181]. This is why adaptation needs to be considered now.

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[180] See *Climate Change Scenarios for the United Kingdom – The UKCIP02 Briefing Report,* www.ukcip.org.uk

[181] An explanation of the term "Greenhouse Gases" is as follows: "Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the *greenhouse effect*. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances which are dealt with under the Montreal Protocol. Beside CO_2, N_2O, and CH_4. The *Kyoto Protocol* deals with the greenhouse gases sulphur hexafluoride (SF_6), hydro fluorocarbons (HFCs) and perfluorocarbons (PFCs)". *Climate Change 2001: Impacts, Adaptation and Vulnerability, Annex B,* Intergovernmental Panel on Climate Change, see www.grida.no/climate/ipcc_tar/wg2/index.htm.

13.1.4 In addition, the impact of climate change in the period beyond that will be determined by the action taken now to reduce the impact of climate change. This is why mitigation needs to be considered now.

13.2 International Scenarios

13.2.1 International concern on the impact of climate change has existed for some years and as a result of this concern, in 1988 the Inter-governmental Panel on Climate Change was formed under the auspices of the United Nations[182].

13.2.2 Scientific evidence was presented to the Select Committee on trends in global climate and the use of computer models in the formation of international climate change scenarios was noted. The evidence received by the Select Committee showed that it was only when both natural and human factors were included could computer models, such as that used by the IPCC[183] to explain past trends in global climate, accurately reflect the course of global-average temperature since 1860 and especially the warming since the 1970's[184]. As the IPCC noted in their third assessment report:

> *"Most of the warming observed over the last 50 years is likely to have been due to increasing concentrations of greenhouse gases"*[185]

[182] See: www.ipcc.ch/about/about.htm.

[183] The Inter-Governmental Panel on Climate Change. See note 182 *supra.*

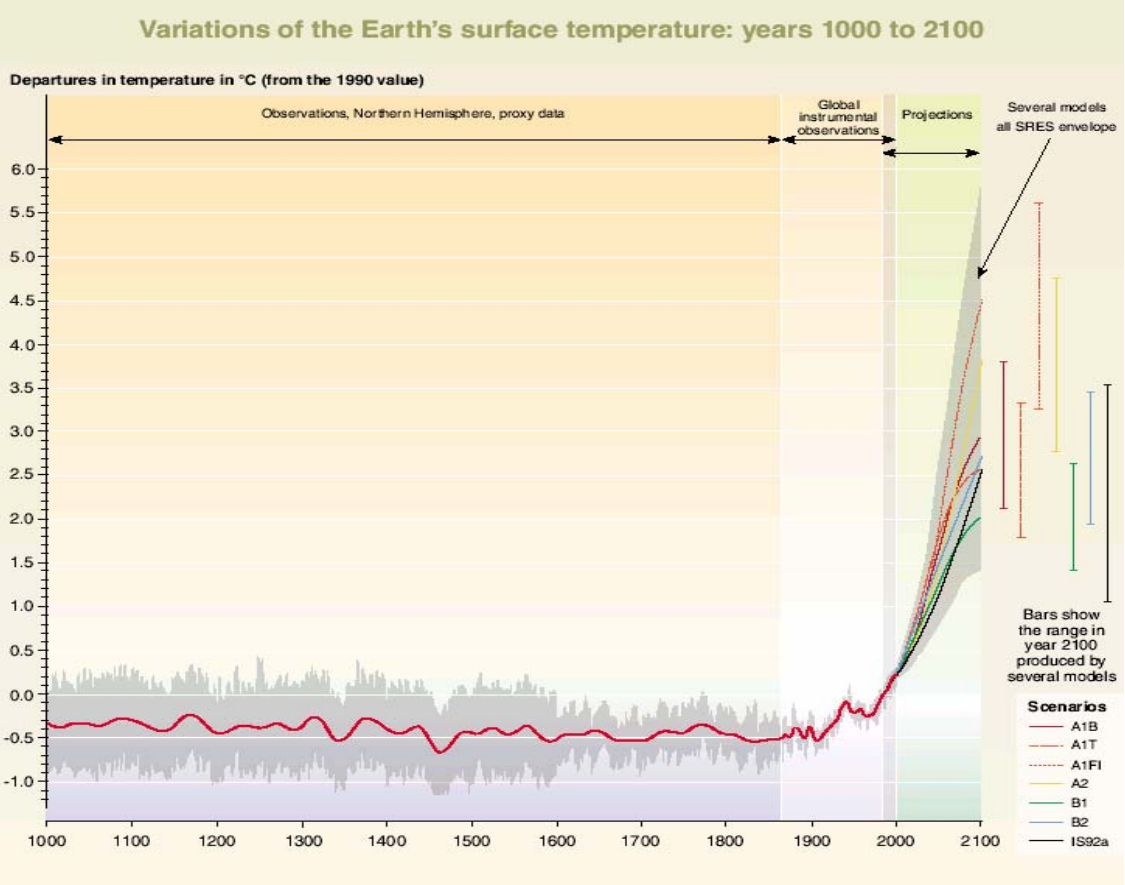
[184] See note 182 *supra*

[185] *Climate Change Scenarios for the United Kingdom – The UKCIP02 Briefing Report*, page 5. See: www.ukcip.org.uk

13.2.3 How climate changes in the future depends on future emissions of greenhouse gases and other pollutants, which in turn depend upon how population, economies, energy technologies and societies develop.

13.2.4 The Select Committee also noted a timeline graph showing an upward curve in global average temperature (usually referred to as the "Hockey Stick" or "J-Curve") demonstrating the impact climate change is having now and is expected to have in the future. This is often referred to in the media in the climate change debate. This is shown in Table 13.2.5[186].

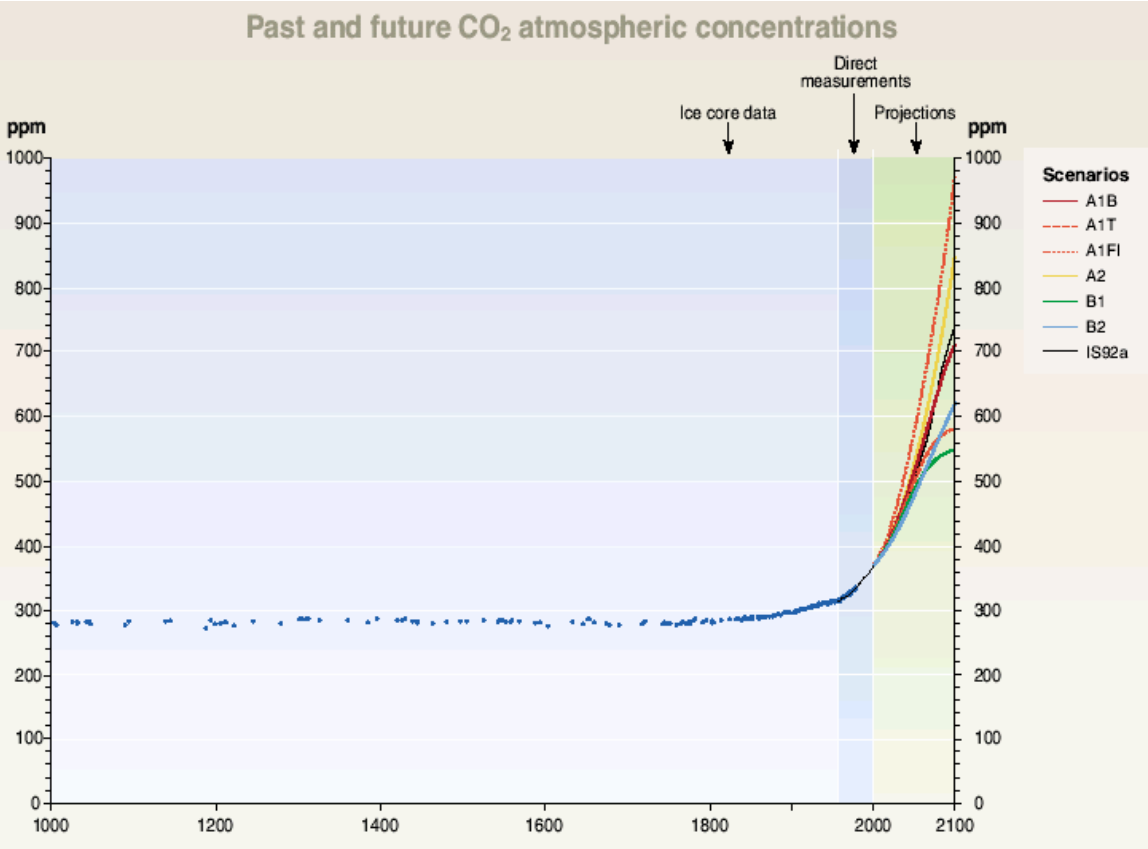
13.2.5 **Table 13.2.5**: "Hockey Stick" graph showing rise in global average temperature



[186] Evidence received from Peter Moore, KCC Environmental Strategy Manager and Mark Goldthorp of the South East Climate Change Partnership at the hearings on 3 April and 10 April 2006 respectively.

13.2.6 In addition, atmospheric concentrations of carbon dioxide show a similar correlation as indicated in Table 13.2.7[187].

13.2.7 **Table 13.2.7**: Graph showing rise in carbon dioxide atmospheric concentrations.



[187] See note 186 *supra*.

13.3 National Scenarios

13.3.1 In the UK, climate change has also been an issue of concern and in 1997 the UK Climates Impacts Programme ("UKCIP") was formed[188].

13.3.2 The UK Climates Impacts Programme has taken some of the range of projections of possible future emissions from the IPCC Special Report on Emissions Scenarios[189] projections and in conjunction with the Hadley Centre[190] global climate model, developed a European regional climate model, which has a resolution of 50km grid squares[191]. From this, 4 UKCIP02 Climate Change Scenarios were developed and are summarised in Table 13.3.3.

[188] See www.ukcip.org.uk.

[189] *Climate Change Scenarios for the United Kingdom – The UKCIP02 Briefing Report*, page 6.

[190] The Hadley Centre for Climate Prediction and Research (part of the Met Office). For further information see www.metoffice.com/research/hadleycentre

[191] The Select Committee noted that the 50km grid square covering parts of East Kent did not have any data. This was because this 50km grid square contained more sea than land. (Squares are classified on the basis of whether land or sea predominates as land and sea squares are calculated differently by the Hadley Centre). However, UKCIP advice is that as a general rule, the land mass reading for these 50km squares can be considered the same as the adjacent land mass square. See *Climate Change Impact for Kent, the impacts of climate change on Kent's environment, society and economy*. Report submission to the KCC Select Committee on Climate Change by Peter Moore. KCC Environmental Strategy Manager, March 2006.

13.3.3 **Table 13.3.3:** UKCIP02 Climate Change Scenarios ("The Scenarios")[192] for the 2080's.

UKCIP02 Climate Change Scenario	**Increase in Global Temperature (ºC)**	**Atmospheric Carbon Dioxide concentration (Parts Per Million (PPM))**
Low Emissions	2.0	525
Medium-Low Emissions	2.3	562
Medium-High Emissions	3.3	715
High Emissions	3.9	810

13.3.4 The Select Committee received evidence that The Scenarios are due to be updated in 2008[193].

13.3.5 The Select Committee received evidence that the European Union regards an increase in Global Temperature of above 2 degrees Celsius as "unsafe" and that when the UK held the chair of the G8, agreement was being sought to aim for Atmospheric Carbon Dioxide concentration of less than 550 PPM[194]. This would indicate that the "Low Emissions" UKCIP02 climate change scenario should be aimed for in order to mitigate the impact of climate change in the future.

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[192] See note 188 *supra*

[193] *Climate Change Impacts for Kent, the impacts of climate change on Kent's environment, society and economy, page 11*. Report submission to the KCC Select Committee on Climate Change by Peter Moore. KCC Environmental Strategy Manager, March 2006.

[194] Evidence from Peter Moore, KCC Environment Strategy Manager at the hearing on 3 April 2006.

13.3.6 There is however an inherent uncertainty in identifying future climate change impacts. The Select Committee in preparing this report accepts that the most robust assessments of future impacts of climate change rely on scenarios that cover a range of possibilities, as detailed in section 13.3.2.

13.3.7 For this reason, the Select Committee regards the resources available to the UK Climate Impacts Program (which is supported by research and resources of the Hadley and Tyndall[195] Centres, as well DEFRA[196]) as such that the evidence presented by it should be relied upon to formulate recommendations at the strategic level, such as in the report. The Select Committee acknowledges that further Kent-specific research may be required to 'fine-tune' the implementation of policy and priorities at local level.

13.3.8 Based on the scenarios in Table 13.3.3, the Select Committee was presented with further evidence on the impact of climate change. These are discussed elsewhere in the main report as appropriate.

13.3.9 The Select Committee accepts the overwhelming scientific consensus that climate change is happening. As a result of this, the Select Committee suggests that tough decisions will have to be taken to deal with the impact of climate change and whilst some of the most dramatic predicted effects may appear some way off in the future these decisions must be taken now.

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[195] The Tyndall Centre for Climate Change Research. For further information, see www.tyndall.ac.uk/index.shtml

[196] The Department for the Environment, Food and Rural Affairs. For further information, see www.defra.gov.uk/environment/climatechange/index.htm.

14 Appendix 3 – Impacts of Climate Change

14.1 National Climate Change Impacts

14.1.1 The scientific evidence on the impact climate change is discussed in Appendix 2.

14.1.2 Based on the 4 UKCIP02 scenarios referred to in Table 13.3.3, the Select Committee received evidence suggesting forecast effects in the 2020's, 2050's and the 2080's as indicated in Table 14.1.3.

14.1.3 **Table 14.1.3** – Key UK climate impacts based on the UKCIP02 scenarios[197]

Item	Year	Climate impact
Warming	2020's	Increase of 0.5 - 1.5ºC
Warming	2050's	Increase of 0.5 - 3.5ºC
Warming	2080's	Increase of 0.5 – 5.0 ºC
Winters	2020's	Up to 10% wetter
Winters	2050's	Up to 20% wetter
Winters	2080's	Up to 40% wetter
Summers	2020's	Up to 20% drier
Summers	2050's	Up to 40% drier
Summers	2080's	Up to 60% drier
Sea levels	2020's	Rise of 4 - 14 cm
Sea levels	2050's	Rise of 7 - 36 cm
Sea levels	2080's	Rise of 9 – 69 cm

[197] See *Climate Change Scenarios for the United Kingdom – The UKCIP02 Briefing Report,* http://www.ukcip.org.uk/resources/publications/pub_dets.asp?ID=14. For sea-level rises, see http://www.ukcip.org.uk/scenarios/ukcip02/documentation/documents/UKCIP02_Ch6.pdf. These impacts were similarly evidenced by Mark Goldthorpe of the South East Climate Change Partnership at the hearing on 10 April 2006 and by Gerry Metcalfe of UKCIP at the hearing on 3 May 2006.

14.1.4 The Select Committee also received similar evidence on key south east climate impacts based on the UKCIP02 Scenarios. This is discussed in section 14.3.3. Further regional variations on the climate impacts above are discussed in section 14.3.

14.2 National Government Policy Context on Climate Change

14.2.1 The UK Government has for some years been involved in climate change policy at the International level, for example through the IPCC[198] and the G8[199].

14.2.2 Within the UK, government policy on climate change involves national government departments (for example the Department for the Environment, Food and Rural Affairs (DEFRA)[200] and the Environment Agency[201]) and through supporting the work of both the South East Climate Change Partnership[202] and UKCIP[203] as well as the Information and Development Agency ("I&DeA")[204].

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[198] The Intergovernmental Panel on Climate Change. See www.ipcc.ch

[199] The G8 is a forum for the leading 7 industrialised nations (including the UK) + Russia that discusses major global issues of the day. The UK had the presidency in 2005. See http://www.g8.gov.uk/servlet/Front?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1078995902703

[200] See http://www.defra.gov.uk/environment/climatechange/index.htm.

[201] See evidence received from the Environment Agency at the hearing on 28 April 2006.

[202] See www.climatesoutheast.org.uk

[203] See www.ukcip.org.uk

[204] See http://www.idea-knowledge.gov.uk/idk/core/page.do?pageId=1

14.3 Regional Climate Change Impacts

14.3.1 The Select Committee received evidence from the South East Climate Change Partnership (SECCP), which is a regional partnership established by stakeholders that works closely with UKCIP to co-ordinate responses to climate change and share experiences. Its work in identifying the impact of Climate Change for the South East region is also based on the UKCIP Scenarios.

14.3.2 The Select Committee also received evidence that the South East of the United Kingdom will suffer the biggest impact of climate change in the United Kingdom[205].

14.3.3 Using the UKCIP02 Scenarios, the Select Committee received evidence suggesting forecast effects on the South East in the 2020's, 2050's and the 2080's as indicated in Table 14.3.4.

[205] Evidence received from UKCIP at the hearing on 3 May 2006.

14.3.4 **Table 14.3.4**– Key South East Climate Impacts Based on the UKCIP02 Scenarios in the 2080's[206]:

Item	**Year**	**Climate impact**
Warming	2020's	Increase of 0.5 – 2.0ºC
Warming	2050's	Increase of 1.0 - 3.0ºC
Warming	2080's	Increase of 2.0 – 5.0 ºC
Winters	2020's	Up to 15% wetter
Winters	2050's	Up to 30% wetter
Winters	2080's	Up to 30% wetter
Summers	2020's	Up to 15% drier
Summers	2050's	Up to 45% drier
Summers	2080's	Up to 60% drier
Sea levels	2020's	Rise of 4 - 14 cm
Sea levels	2050's	Rise of 7 - 36 cm
Sea levels	2080's	Rise of 9 - 69 cm

[206] See note 197 *supra.*

15 Appendix 4 – *"Climate Change Impacts for Kent"* Report.

15.1 This report can be found in a separate document

15.1.1 The full name of this report is "*Climate Change Impacts for Kent, the impacts of climate change on Kent's environment, society and economy*. Report submission to the KCC Select Committee on Climate Change by Peter Moore. KCC Environment Strategy Manager, March 2006.

CLIMATE CHANGE IMPACTS FOR KENT
The impacts of climate change on Kent's environment, society and economy

Submission to the KCC Select Committee on Climate Change by Peter Moore, KCC Environment Strategy Manager, March 2006

CONTENTS

CLIMATE CHANGE IMPACTS FOR KENT
The impacts of climate change on Kent's environment, society and economy

EXECUTIVE SUMMARY

1. Purpose of the report

This report has been prepared to inform the Kent County Council Select Committee inquiry into Climate Change which began in March 2006. It distils findings from national and regional studies into the impacts of climate change as they might relate to Kent, and points to some of the emerging options for mitigating and adapting to these impacts. The report presented to the Select Committee is informed by the following principles:

- It accepts the scientific consensus on climate change and the need for co-ordinated national, regional and local action.
- It promotes the precautionary principle that action which may have significant if uncertain negative consequences should be avoided.
- It reflects the principles of sustainable development and the need to integrate environmental, economic and social objectives in responding to climate change.
- It supports the identification of 'no regret' solutions – actions we should be taking anyway even if the risks of climate change were not as great as they appear.
- The need for community leadership on climate change from local authorities in general and KCC in particular.

Climate change impacts are presented in three formats according to geographical scale (national, regional and local); local authority service areas (key responsibilities and service areas of the County Council); and sector (key economic, social and environmental sectors).

While this inevitably risks a degree of repetition, it is hoped that presenting the impacts in different formats will give the document value as a reference source for the Select Committee and other audiences. The report does not include recommendations to the Select Committee. Rather, it seeks to identify the wide range of possible impacts of climate change and describe some potential responses to them as one of the necessary starting points for the Committee's inquiry.

2. National, regional and Kent impacts

The report presents details of different climate change scenarios identified under the auspices of the UK Climate Impacts Programme in 2002 by the world-renowned Hadley and Tyndall Centres (sections 3-5 of the main report). These scenarios are due to be recalculated and published again in 2007 and are expected to highlight the potential for even more dramatic changes than contained in the 2002 scenarios. Taking the full range represented by all scenarios, in the South East by the 2020s, it is suggested that on average:

- Summers will be hotter by up to 1-1.5°C.
- Summer rainfall will be 5-15% lower.
- Winters will be warmer by 0.5-1.0°C.
- Winter rainfall will be up to 10% higher.

In the South East by the 2080s, it is suggested that:

- Summers will be hotter by 2-6°C.
- Summer rainfall will be 20-60% lower.
- Winters will be warmer by 1.5-3.5°C.
- Winter rainfall will be 10-30% higher.

3. Local authority action on climate change

The report seeks to demonstrate (section 7 of the main report) that local authorities have a clear locus for action on climate change arising from:

- The power to promote 'social, economic and environmental well-being'.
- The threats posed to infrastructure, service provision and service continuity.
- The statutory requirements of the planning system to consider climate change.
- The need to avoid costs in future by investing in mitigation and adaptation now.
- Its responsibilities as an employer with a large estate throughout Kent.

Within KCC and many other local authorities, while climate change is recognised at the strategic policy level, this has not necessarily been translated into a wide-spread understanding of, and a programme of practical measures to reduce and respond to, the impacts.

4. Sectoral impacts

The table on pages 5-6 below summarise key impacts of climate change on different sectors in Kent, as identified in national, regional and local studies. These are described in more detail in section 6 and annex 1 of the main report. The level of detail and analysis applied to each sector does not necessarily reflect its relative exposure to climate change impacts. Sectors like biodiversity and agriculture are familiar with considering environmental impact and thinking long-term – hence more research into the effects of climate change has been done in such areas. Others sectors need to take responsibility for identifying and responding to the impacts for themselves, with local authorities like KCC providing support and advice to enable them to do so.

5. Conclusions from the study of climate change impacts for Kent

It is implicit throughout this report that if efforts to mitigate the effects of climate change by reducing emissions are successful, then the negative risks will be reduced accordingly. It is also clear that there will be a need to avoid counter-productive adaptation to climate change – that is, measures which, in seeking to respond to climate change, are actually likely to make it worse. These might include energy-intensive ‘solutions’ to water scarcity, traffic-generating ‘solutions’ to development pressure, or water-inefficient ‘solutions’ to agricultural change.

The key conclusions to draw from the study are that:

- The full range of risks associated with climate change can best be reduced by taking action now to reduce greenhouse gas emissions.

- The impacts for Kent are so wide-ranging and potentially profound that almost every sector has a stake in reducing its contribution to climate change and adapting to that change which is now inevitable.

SECTOR	KEY CLIMATE CHANGE IMPACTS	OUTLOOK
1.1 Agriculture	• Longer growing season as a result of higher temperatures • Changes in level and timing of water availability • Increased risk of summer drought • Increased soil erosion	Although a relatively small economic sector, agriculture remains a hugely significant influence on Kent's landscape, underpinning the 'Garden of England' brand, influencing Kent's biodiversity and providing the backdrop for much leisure and visitor activity. Agriculture as a sector is inherently adaptable but as climate change affects fundamental inputs to the agricultural process it poses even greater challenges than the many which the sector has had to face in the recent past.
1.2 Forestry	• Increased tree stress and loss through drought • Increased risk of fire damage • Greater yields for commercial forestry • Potential increases in pests and diseases • Changes in species	Woodland is an expanding habitat but care needs to be taken that the species being planted are suitable for the changing climate. Only by reducing emissions to limit climate change can the risks to some treasured woodlands be reduced. Commercial opportunities for growing trees for biomass could increase, though again, species which are more dependent on wet ground may be less suitable for Kent given water scarcity issues.
1.3 Biodiversity	• Sea level rise and erosion squeezing coastal habitats • New sedimentation with implications for habitats • Reduced water availability putting pressure on wetlands • Losses of species at southern edge of their range and gains for those at northern edge • More extreme events increasing risk of local extinctions	The key to protecting Kent's unique coastal biodiversity will be allowing natural processes (e.g. the shift of habitat inland or along coasts) to take place. For all habitats there will be a need to de-fragment and re-link them on a landscape scale to help species adapt over time. The water environment also needs a holistic approach, with environmental limits being understood and respected when considering development.
1.4 Built environment	• Increased risk of flooding • Higher temperatures and increased effect of urban heat island • Increased demand for and reduced supply of water • Increased risk of subsidence • Increased coastal erosion	Climate change will have physical impacts on all forms of development, but will also change the suitability and desirability of some locations for large scale development. There will be significant costs of 'climate proofing' development, but these are likely to be much lower than the costs of not doing so – e.g. the estimated cost of 'climate proofing' new buildings in southern England against subsidence is estimated at £32 million, compared to a possible annual cost of up to £400 million from damage claims if no action is taken. In areas of high development pressure like Kent, high standards of sustainable construction (e.g. energy and water efficiency) will be required to remain within environmental limits.
1.5 Business and economy	• Severe weather affecting buildings/infrastructure • More disruption to distribution, supply, energy and communications networks • Sea level rise will affect coastal business and industry • Manufacturing industry may be affected by costs/availability of raw materials • Impacts on manufacturing/processing techniques (e.g. need for cooling)	The South East has the largest economy after London and thus much to lose from climate change. Increased resource efficiency will be a necessary response to reduced availability of primary resources like water and rising energy costs. As well as considering physical impacts on buildings and infrastructure, business needs to consider climate change in the context of business continuity, risk assessment, supply chains, mitigation (carbon trading and energy efficiency), land holdings, corporate social responsibility and health and safety.
1.6 Flood management and coastal	• Increased frequency of over-topping of coastal defences and risk of breaches due to combined effects of storms, changes in wave direction and sea level rise • Changes in patterns of coastal erosion and deposition • Increased risk of winter flooding • Presumption against development in flood risk areas • Requirement for improved flood forecasting and warning • Threats to coastal habitats, biodiversity and amenity	In the short-term the challenge will be to ensure that communities continue to be protected from flood risk through raising awareness and managing risk as well as maintaining defences. In the longer-term, some communities may simply need to learn to live with increased flood risk and, in some cases, relocate where the costs of defence and risks of flooding become unacceptable.

1.7 Health and care	• Fewer cold-related deaths and illnesses in winter • More heat-related deaths and illnesses in summer • Increased risk of public health emergencies • Increased risk of disruption to services, transport etc • Increased effects of ozone on air quality and health	Some in the health sector take the view that they should 'wait and see' as the dimensions of climate change impacts are 'not possible to quantify'. Others are promoting adaptation responses such as awareness raising of summer health problems and improved advice on handling and preparing food in a warmer climate. Local authorities with ambitions to extend their public health remit will need to develop their understanding of climate change impacts, and articulate preventive and adaptive measures.
1.8 Heritage	• Sea level rise impacts on coastline, landscape etc • Changing water availability affecting parks and gardens • Impact of more extreme weather on buildings/artefacts • Effects of pests and humidity on e.g. fabrics, paintings	The impacts of climate change on natural and cultural heritage are diverse and will need to be reflected in plans and Local Development Frameworks. Coastal heritage needs special consideration in Shoreline Management Planning. Strategies for the management of heritage assets need to prioritise resilience to a range of climate change possibilities.
1.9 Spatial planning	• Changes in character and suitability of locations • Potential increase in planning conflicts • Need for spatial plans and development control decisions to be 'climate proof' – e.g. taking account of flood risk, water and sustainable construction	Some local authorities still do not see climate change as 'a planning issue'. Planning policies (e.g. on flood risk or standards of water efficiency) at national, regional and local level will need to be kept under rolling review to reflect both the current reality and future likelihood of climate change impacts. Knee-jerk responses to climate risks (e.g. abandoning brownfield sites in areas at risk of flooding in favour of greenfield sites in areas with water scarcity issues) should be avoided. Taking account of the range of climate change impacts will have implications for resources and skills of planning authorities.
1.10 Utilities and infrastructure	• Changes in seasonal demand for energy and water • More disruption to infrastructure and services from extreme weather but reduced cold weather damage • Increased investment requirements	Most utilities are already active in climate change mitigation and adaptation, though regional studies suggest that less attention is paid to the issue in highways planning than in rail, energy and water sectors. There is a need to raise awareness among other sectors and co-ordinate activity (e.g. between transport, waste and minerals) where longer term strategies would facilitate adaptation.
1.11 Tourism, recreation, leisure and lifestyle	• Warmer, drier weather will encourage outdoor lifestyles • River navigation may be hard to sustain in dry periods • Beach holidays may become more attractive • increased tourism will bring economic opportunities but also pressures (e.g. transport, demand for water)	Kent's outstanding natural and cultural heritage underpins its tourism and leisure industries. Their future relies on effective planning and transport provision, with tourism development being targeted to support regeneration where it is needed and avoid the development of infrastructure which would demand unsustainable sea defences or put undue pressure on the environmental resources (e.g. water, landscapes) which sustain the sector. These resources are also threatened by climate change.
1.12 Water resources	• Reduced summer rainfall coinciding with peak demand • Increased frequency of dry years and drought • Lower river baseflows during summer • Deterioration in river water quality • Increased evaporation	Climate change will lead to a 'double whammy' of increased demand and reduced supply. Increased winter storage may be part of the solution but not as big a part as in the past due to increased evaporation and higher in-river need for water. Managing demand by extending metering, reducing leakage, harvesting rainwater, re-using 'grey-water' and using water efficient fittings and practises will be increasingly important given the uncertainties over future supply. Projections of up to 60% less rainfall for Kent by the 2080s raise serious questions about the sustainability of high levels of household and commercial development in the coming decades.

1. INTRODUCTION

1.1 What is climate change?

The term ‘climate change’ is sometimes used to refer to all forms of climatic inconsistency, but because the Earth's climate is never static, the term is more properly used to imply a significant change from one climatic condition to another. In some cases, climate change has been used synonymously with the term ‘global warming’. Scientists however, tend to use the term in the wider sense to also include natural changes in climate.

1.2 Is climate change happening?

There is little doubt that our climate is changing. There is also compelling evidence that the phenomenon is at least partly 'man-made' and that most of the warming of the climate system over the last 50 years is attributable to human activities.[1] There is also a political consensus that climate change is an issue of high priority requiring a concerted response from central and local government.[2]

1.3 Policy basis for action on climate change in Kent

Kent subscribes to this consensus with the Kent Partnership, Kent County Council and many District Councils recognising the issue and identifying the need for action in a number of high level plans and strategies, particularly in Kent’s recently revised community strategy, the *Vision for Kent*.[3] Beyond this high level commitment, however, there is:

- Uncertainty and, in some cases, a lack of awareness about the future impacts of climate change on Kent’s economy, communities and the environment which sustains a high quality of life within them.

- Some gaps between the recognition of the problem at a strategic level and action being taken on the ground to mitigate and adapt to these possible impacts.

- Conflicting priorities (including from other tiers of government) which risk undermining the genuine desire to respond effectively to climate change.

- The need for a more co-ordinated programme of action across the County to respond to the threats posed by a changing climate.

[1] See paper on *Climate Change Science and Evidence* submitted to the Select Committee by Peter Moore, March 2006 for a summary of the scientific consensus.
[2] See above also for a summary of the political consensus on the need for action on climate change.
[3] See above also for a summary of the policy basis for action on climate change in Kent.

2. PURPOSE OF THIS REPORT

2.1 The KCC Select Committee on Climate Change

This report is intended to inform the Kent County Council Select Committee inquiry into Climate Change which began in March 2006. It distils findings from national and regional studies into the impacts of climate change as they might relate to Kent, and points to some of the emerging options for mitigating and adapting to these impacts. As such, it is hoped that it will help to:

- Address some of the uncertainties and raise awareness and understanding of the potential impacts on Kent.
- Reduce the 'perception-action' gap which exists on climate change.
- Highlight the potential conflicts which need to be reconciled to enable an effective response to climate change.
- Underline the case for a more concerted, Kent wide response to climate change.

Climate change impacts are presented in three formats according to:

- Geographical scale (national, regional and local).
- Sector (key economic, social and environmental sectors).
- Local authority service areas (key responsibilities and service areas of the County Council).

While this inevitably risks a degree of repetition, it is hoped that presenting the impacts in different formats will give the document value as a reference source for the Select Committee and other audiences.

Box 1: Definitions of climate change adaptation and mitigation[4]

Adaptation: adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (e.g. avoidance of development in areas at risk of flooding)

Mitigation: an intervention to reduce the sources or enhance the sinks of greenhouse gases (e.g. reducing fossil-fuel based energy use, or re-forestation)

This report does not include recommendations to the Select Committee. Rather, it seeks to identify the wide range of possible impacts of climate change and describe some potential adaptations (see box 1 for definition) to them as one of the necessary starting points for the Committee's inquiry. **It is implicit throughout that if efforts to mitigate (see box 1 for definition) the effects of climate change through reducing emissions are successful, then the negative risks will be reduced accordingly.** Conversely, the opportunities (which the report will suggest are far fewer and may often be transient in nature) would also be reduced. This said, a

[4] *Climate Change 2001: Impacts, Adaptation and Vulnerability*, Intergovernmental Panel on Climate Change, Cambridge University Press, 2001.

degree of climate change is inevitable and thus some of these impacts will need to be prepared for regardless of the success of policies to reduce emissions.

2.2 Principles informing this report

There are a number of principles underpinning this report which are widely accepted as central to the debate about climate change:

- **Accepting the scientific consensus:** Kent County Council is not in a position to commission its own scientific research and therefore to significantly add to or question the scientific evidence for climate change and human contribution to it. The report therefore proceeds on the basis that the work of the Intergovernmental Panel on Climate Change[5], and the scenarios developed under the auspices of the UK Climate Impacts Programme and the Hadley and Tyndall Centres, are the most credible and best available basis for policy development in this area. Indeed, we are fortunate to have them to draw upon.

- **Precautionary principle:** this is an accepted principle in the scientific and policy communities, reflected in EU law, that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental damage. This clearly applies in the case of both future emissions causing climate change, and taking action to adapt to the impacts which already seem inevitable.

- **Sustainable development:** the most widely accepted definition of sustainable development is 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'. The UK Government has sought to articulate what this means in the national context through its own sustainable development strategy.[6] The concern for future generations is particularly relevant to the climate change debate, as even some of the benefits we may enjoy in the medium term (e.g. of a warmer climate) may ultimately become costs (e.g. of a climate which is too hot and dry in summer).

- **'No regret' solutions:** although climate change has major economic and social implications, it is often addressed in the context of a broader recognition of the need to protect and enhance the environment (as in our own Kent Environment Strategy). In this context, even if the current scientific consensus were challenged, it is recognised that the measures required to reduce the risk and impacts of climate change (reducing energy use, cutting traffic emissions, using water efficiently, building to better standards) are in any case highly desirable and represent 'no regret' policy choices. Global trends such as rising energy prices reinforce the need for action.

- **Community leadership:** there is growing public awareness and concern about climate change. As such, Kent County Council has a clear locus and

[5] The Intergovernmental Panel on Climate Change (IPCC) was established in 1998 by world leaders, via the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP), to assess the scientific, technical and socio-economic information on climate change, its potential impacts and options for adaptation and mitigation. The IPCC summarises its role as 'to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation'.

[6] *Securing the Future: the UK Strategy for Sustainable Development*, HM Government, May 2005.

responsibility for explaining, reducing and responding to the risks associated with climate change as a key part of its community leadership role.

2.3 Limitations of this report

There are a number of limitations to a report of this nature which need to be highlighted at the outset:

- **No new science:** time and resource constraints mean that this report relies on existing scientific research and evidence. Rather than a weakness, this should be considered a strength as the credibility of the Hadley and Tyndall Centres and the resources available to UK Climate Impacts Programme to provide sound science on climate change is such that they provide an invaluable resource for local authorities which we could not and should not seek to replicate within our own resources. As such it is vital that we should be led by the information and advice they provide to ensure that different tiers of government are pursuing complementary responses to the challenges of climate change.

- **Inherent uncertainty:** the business of identifying future climate change impacts is inherently uncertain, and as such the most credible assessments of future impacts rely on scenarios painting a range of possibilities, rather than making singular 'predictions'. While this makes the task of understanding and describing the impacts more complex, it should be seen as an aid to future planning and policy development by encouraging approaches which will be resilient to a range of outcomes and not reliant on one single prediction. This said, one of the major sources of uncertainty is that future climate change (at least beyond about 2040) will depend on future levels of greenhouse gas emissions. These in turn depend on patterns of socio-economic development across the world, technological changes, the success of mitigation policies etc, all of which are uncertain. Uncertainty about the future is, of course, universal, but this does not stop us planning for it.

- **Statistical bluntness:** resource and time constraints have prevented detailed calculations being developed for many impacts and simple arithmetic has been used in some instances to illustrate some of the potential impacts for Kent. These have been scaled down from national or regional data, rather than producing accurate figures based on Kent's actual demography, topography etc. While more accurate data will be crucial when 'fine-tuning' the implementation of policy and priorities at local level, it is hoped that they are adequate to inform a strategic overview which needs to be taken in developing a Kent-wide response to climate change - i.e. the stage we are at currently.

- **Limited direct stakeholder input:** the report has been prepared in a timescale which has allowed only limited input from the very wide variety of stakeholders in Kent who are likely to be affected by climate change. As such, it should be seen as a starting point for further discussion and a more detailed and ongoing programme of identifying and assessing potential impacts, rather than a definitive statement of those impacts. This said, it draws heavily on UKCIP and SECCP studies which have been strongly stakeholder-led.

3. NATIONAL CLIMATE CHANGE IMPACTS

3.1 The UK Climate Impacts Programme

The UK Climate Impacts Programme (UKCIP) was established in 1997 to provide information to help decision-makers plan their response to the impacts of climate change. Although its focus is on measures to adapt (as opposed to mitigate) climate change (see box 1 for definitions), the scenarios it has produced, in conjunction with the world renowned Hadley Centre (part of the Met Office) and Tyndall Centre, form the basis of climate change policy and planning activity across the UK. It produces a range of guidance, including for local authorities, and tools, such as the 'Adaptation Wizard' to support planning for the impacts of climate change.

3.2 Climate change impacts at national level

In 2002 UKCIP produced scenarios for future climate change for the UK (referred to as UKCIP02). They describe expected climate changes over the 21st century for four different global greenhouse gas emissions scenarios (low, medium-low, medium-high and high) and three future time-slices (the 2020s, 2050s and 2080s). As with earlier scenarios, UKCIP02 demonstrates that the greatest extent of climate change in the UK will be experienced in south eastern areas. The conclusions from the scenarios are summarised in box 2. The UKCIP scenarios are due to be recalculated and published again in 2008 and are expected to highlight the potential for even more dramatic changes than contained in the 2002 scenarios. Until then, however, the 2002 scenarios will continue to be the most appropriate basis for climate change planning.

Box 2: Overview of climate change in the UK[7]

Carbon dioxide levels in the atmosphere have risen by over 30% since the industrial revolution and levels of other greenhouse gases have also increased. Global average temperatures rose by 0.6°C during the 20th century. The Intergovernmental Panel on Climate Change (IPCC) concluded in 2001 that "most of the warming observed over the last 50 years is likely to be attributable to human activities". How climate changes in the future will depend on current and future emissions of greenhouse gases and other pollutants, which in turn depend on how population, economies, technology and societies develop.

In future we may expect:

Higher temperatures, with regional and seasonal variation:

- by the 2020s: annual warming of between 0.5°C and 1.5°C depending on region and scenario;
- by the 2050s: annual warming of between 0.5°C and 3.0°C depending on region and scenario;
- greater summer warming in the south east than the north west of the UK; and
- greater warming in summer and autumn than in winter and spring.

Changing patterns of precipitation:

- wetter winters, by up to 15% by the 2020s (up to 25% by the 2050s) for some regions and scenarios;
- possibly drier summers, by up to 20% by the 2020s (up to 40% by the 2050s) for some regions; and

[7] *Measuring progress: preparing for climate change through the UK Climate Impacts Programme*, UKCIP Technical Report, West C.C and Gawith M.J (Eds) Oxford, 2005.

- significant decreases in snowfall.

Changes in extreme events:

- an increase in frequency and intensity of extreme weather conditions, such as very high temperatures, or heavy downpours of rain.

Changes in sea level:

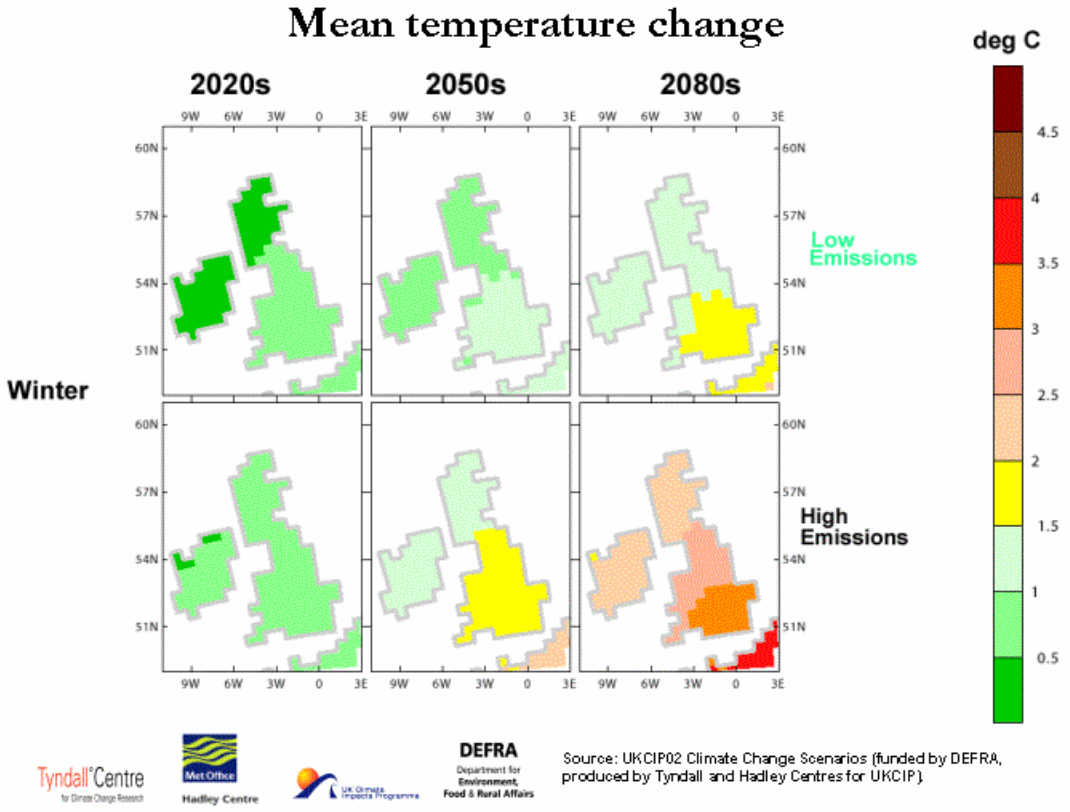
- a rise in global average sea level, due mainly to thermal expansion of ocean water and melting of mountain glaciers, in the range of 4 to 14cm by the 2020s and 7 to 36cm by the 2050s, depending on the emissions scenario;
- historic trends in vertical land movements will introduce significant regional differences in relative sea level rise around the UK, with much of southern Britain sinking and much of northern Britain rising relative to the sea; and
- in addition, extremes of sea level - storm surges and large waves - are expected to increase in height and frequency.

Some of these changes are already being felt. The 1990s was the warmest decade in central England since records began in the 1660s and UK coastal waters have also warmed. As a result:

- the growing season for plants in central England has lengthened by about one month since 1900;
- heatwaves have become more frequent in summer, while there are now fewer frosts and winter cold spells;
- winters over the last 200 years have become much wetter relative to summers throughout the UK;
- a larger proportion of winter precipitation (rain and snow) now falls on heavy rainfall days than was the case 50 years ago; and
- after adjusting for natural land movements, the average sea level around the UK is now about 10cm higher than it was in 1900.

Figures 1 and 2 demonstrates the range of impacts on temperature and rainfall identified in the UKCIP02 scenarios. Even at a glance, it is clear that the impacts could be pronounced for Kent, particularly in terms of higher summer temperatures and lower summer rainfall, both effects being significant even under a ‘low emissions’ scenario.

Figure 1: changes in summer and winter temperature for the UK in the 2020s, 2050s and 2080s under high and low emissions scenarios



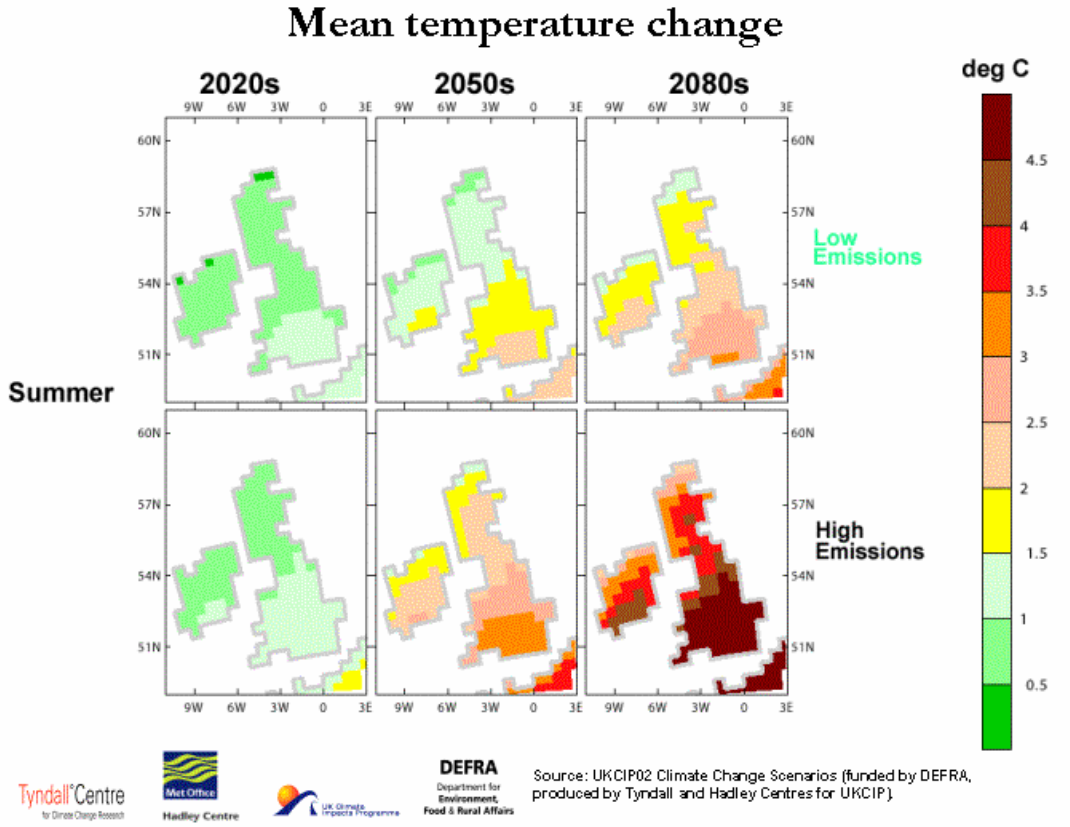
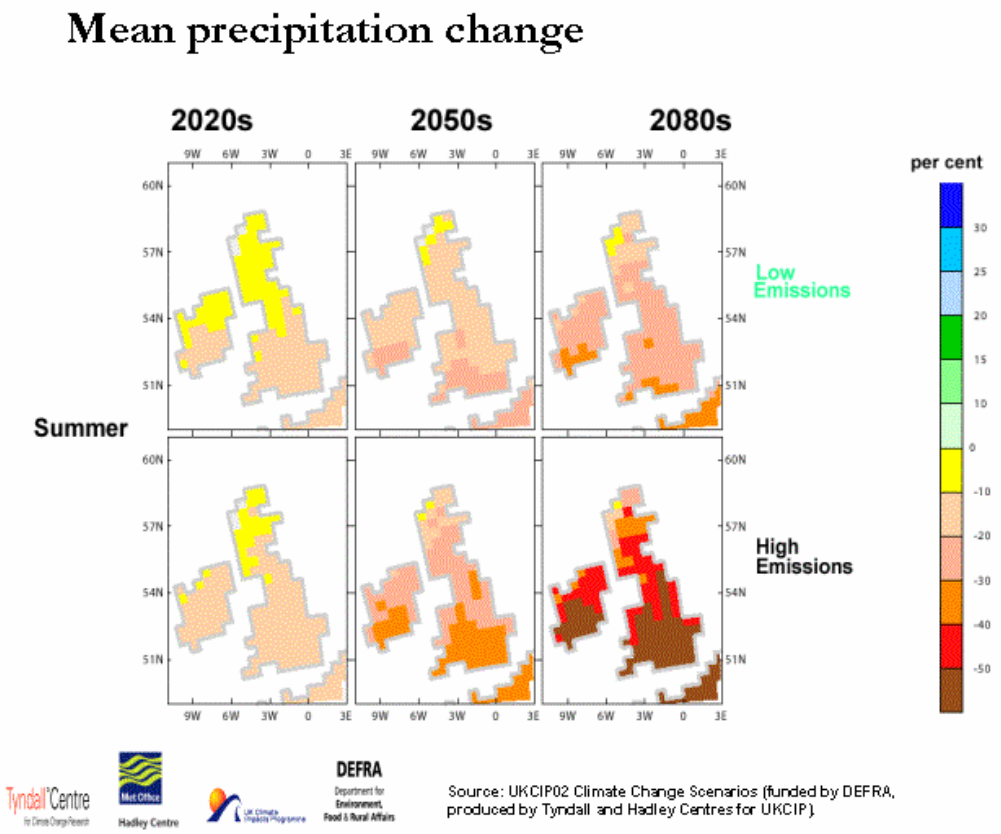
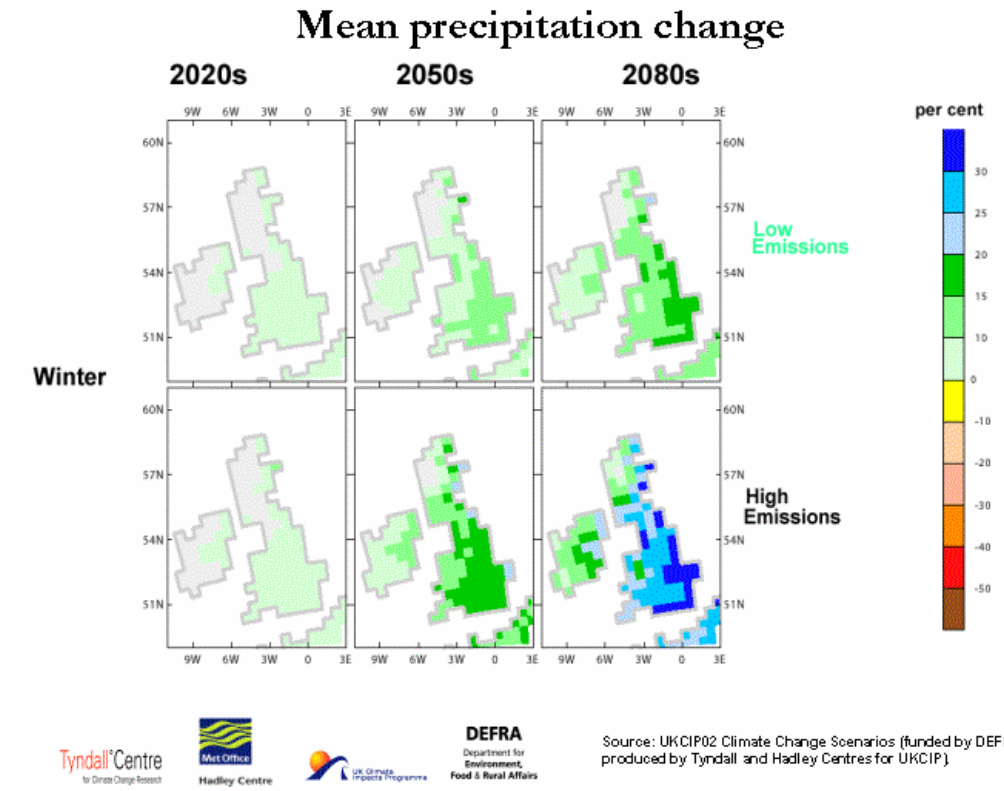


Figure 2: changes in summer and winter rainfall for the UK in the 2020s, 2050s and 2080s under high and low emissions scenarios





4. REGIONAL CLIMATE CHANGE IMPACTS

4.1 The South East Climate Change Partnership

KCC is a member of the South East Climate Change Partnership (SECCP), one of the regional partnerships established by stakeholders and working closely with UKCIP to co-ordinate responses to climate change and share experience. Its work in identifying impacts for the South East region is based on UKCIP02 scenarios, ensuring a consistent basis for regional and local action on climate change. Any assessment of specific impacts for Kent should thus be closely informed by the work of SECCP. It produces practical guidance on climate change adaptation (e.g. it recently published a checklist for development in conjunction with the regional climate change partnerships for London and the East of England.

4.2 Regional impacts for the South East

The maps from the UKCIP02 scenarios in figure 4 show how key aspects of the South East's climate could change by the 2020s, 2050s and 2080s under the high and low emissions scenarios. Although SECCP does not specify which scenario is more likely, as this depends on policy interventions made in the interim, the 'high' emissions scenario assumes that the world continues to experience rapid economic and population growth without reducing its dependency on fossil fuels. Taking the full range represented by all scenarios, in the South East by the 2020s, it is suggested that on average:

- Summers will be hotter by up to 1-1.5°C.
- Summer rainfall will be 5-15% lower.
- Winters will be warmer by 0.5-1.0°C.
- Winter rainfall will be up to 10% higher.

What difference does 1°C make?
Today's climate is 5°C hotter than the last Ice Age - climate models predict a similar rise in the next 100 years alone. A rise of 1°C would extend the growing season for crops and lawns by 2-3 weeks and could see conditions favourable to many species shift north by up to 150km. The EU has adopted 2°C as the target level increase beyond which climate change should be considered 'dangerous'. While the implication is that below this level would be 'safe' at a global level it would not necessarily be 'comfortable', particularly in areas like the South East where the changes are likely to be more acute. As a result, the 'exceptional' 2003 heatwave could become 'normal' by the end of the century.

In the South East by the 2080s, it is suggested that:

- Summers will be hotter by 2-6°C.
- Summer rainfall will be 20-60% lower.
- Winters will be warmer by 1.5-3.5°C.
- Winter rainfall will be 10-30% higher.
- The growing season could be 40-100 days p.a. longer (currently 250 days p.a.).

5. KENT CLIMATE CHANGE IMPACTS

5.1 Evidence of climate change in Kent

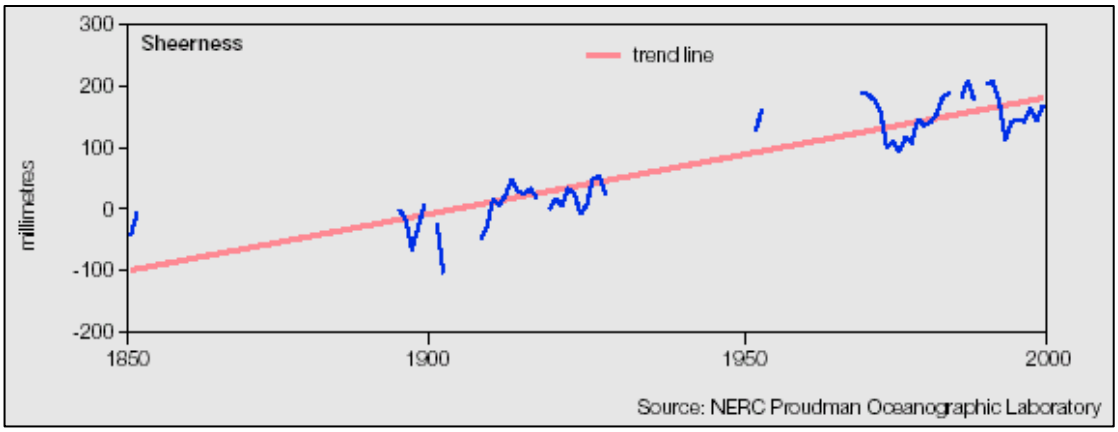
Kent's recent experience of extreme weather has been vividly represented by:

- The great storm of October 1987.
- The River Darent experiencing low flows and running dry in the 1980s and 1990s.
- Extensive and repeated winter flooding in 2000.
- The heatwave of 2003, during which the highest UK temperature since records began was logged in Kent.
- The drought of 2005-06, with hosepipe bans remaining in force through the winter.
- Images of Bewl Water, one of the main reservoirs serving Kent, at a record low of only 35% full in January 2006.

It is impossible to demonstrate a direct link with climate change with any of these events but that does not mean they are not related. Indeed, they clearly fit the predicted pattern of more extreme weather events, and hotter, drier, summers[8]. Other less noticeable changes have been recorded in Kent which similarly suggest that climate change is already having an impact. These include:

- Sea level rise at Sheerness (see figure 3).
- Emergence dates for butterfly species (up to 20 days earlier[9] in the case of the Adonis Blue, symbol of the Kent Wildlife Trust).
- Earlier arrival and breeding success of bird species like the Hobby which require a warmer climate[10].

Figure 3: sea level rise at Sheerness, Isle of Sheppey 1850-2000



[8] The dry winter of 2005-06 might be seen as running counter to predicted trends though the following considerations are relevant: (i) single year events are not indicative of long-term trends (ii) although higher winter rainfall is a predicted climate change impact for Kent, this has yet to be borne out in the historical record with, for example, average winter rainfall at Sandling Park (Folkestone) remaining fairly constant over the period 1901-1998 (iii) predicted increases in winter rainfall for Kent under some scenarios are not as pronounced as for other parts of the UK. Similarly, the floods of winter 2000 might be understood as an example of 'extreme weather', of which we can expect more, rather than 'proof' of wetter winters as a result of a changing climate.

[9] *Millennium Atlas of Butterflies in Britain and Ireland*, Jim Asher et al, Oxford, 2001.

[10] 'Global warming could be expected to help a species on the northern edge of its range in Europe…Hobbies would appear to be arriving back on their breeding territories one or two weeks earlier than was recorded thirty years ago.' Kent Ornithological Society *Kent Bird Report 1999*, 2001.

It is clear from the UKCIP02 scenarios that Kent will face some of the greatest extremes of climate change impact compared to the rest of the UK.

Box 3: examples of climate change impacts on strategic infrastructure in Kent

- **Kent's coastal towns** - many coastal communities will face challenges from climate change impacts such as increased flood risk, sea level rise and extremes of weather. In the long-term, in *some* parts of *some* communities, continuing to maintain sea defences may become economically and environmentally unsustainable.
- **Kent's ports and airports** - increased storminess and wave energy at the coast will pose clear risks to Kent's port infrastructure and services. Work is also underway under the auspices of UKCIP to identify the impacts on the aviation sector of climate change (e.g. turbulent weather, impacts on ground infrastructure), underlining how a sector which is among the fastest growing sources of carbon emissions is not insulated against climate change impacts.
- **Dungeness Nuclear Power Station** - the shingle ridge which protects the power station from coastal flooding is constantly replenished by mechanically moving shingle from elsewhere on the peninsular. The extent and cost of this activity is likely to increase over time as the energy involved in the coastal processes which created the Denge peninsular in the first place will increase. While the power station is more than adequately protected at the moment, surrounding low-lying land on the peninsular could be flooded, leaving the power station isolated from the mainland.
- **The Dover-Folkestone Railway** - the line is only slightly above sea level at some points and its protection from erosion in the long-term will require increasingly expensive maintenance of coastal defences.
- **The A20 at Shakespeare Cliff** - the proximity of the A20 to the cliff edge is striking on the western approach to Dover. If allowed to continue naturally, erosion of the chalk cliff will eventually reach the road. Other trunk roads and minor roads would face similar pressures in future.
- **River Medway flood defences** - the Medway is the largest river in the south east (110km) and is protected upstream of Tonbridge by a flood defence scheme that currently offers protection in events of greater than 1 in 100 years. This calculation is based on historic records but climate change will mean they no longer offer the same level of protection.

5.2 Factors in Kent's exposure to climate change impacts

A number of factors combine to make Kent acutely exposed to climate change impacts:

- A long coastline exposed to erosion, rising sea levels, storm surge and wave damage.
- North, East and South facing coasts exposed to increased storminess from most points of the compass.
- A relatively high proportion of low-lying land.
- A relatively high proportion of the population living in coastal or fluvial floodplain.
- High traffic volumes both in and through the county as a result of our international gateway status, resulting in emissions and air quality problems which may be exacerbated by climate change (e.g. many of the heat-related illnesses of 2003 were linked to air quality episodes triggering respiratory problems).

- A relatively developed landscape (a factor in flood risk as developed land does not perform its natural function of soaking up water slowly).
- Heavy reliance on groundwater sources for public water supply (about 75% of our water comes from this source, making us vulnerable to drought and saline intrusion in coastal aquifers).
- Projections of further housing and commercial development which may exacerbate some of the problems identified above (approximately 120,000 new homes over the next 20 years).
- Proximity to continental Europe which may increase the risks of new, invasive species or diseases arriving in the UK via Kent in the first instance.

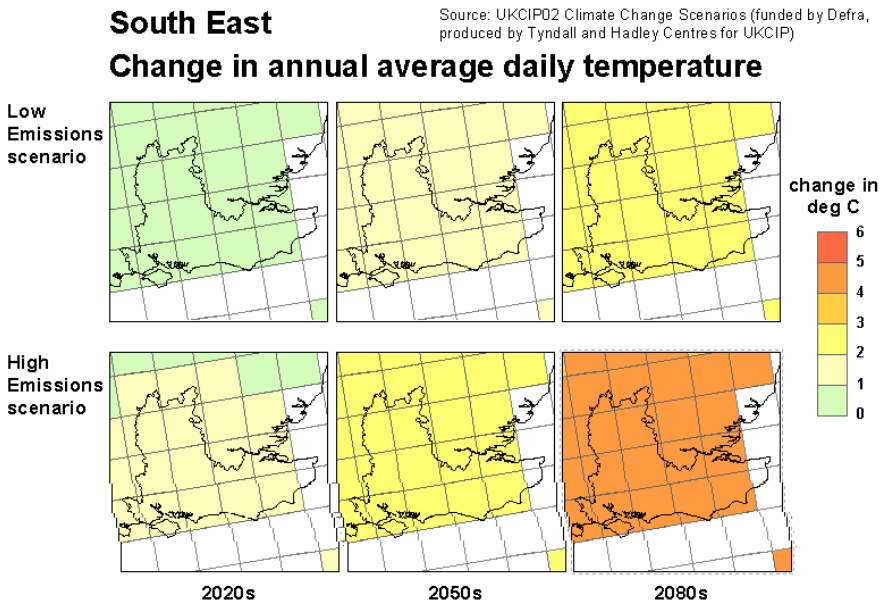
More positively Kent enjoys:

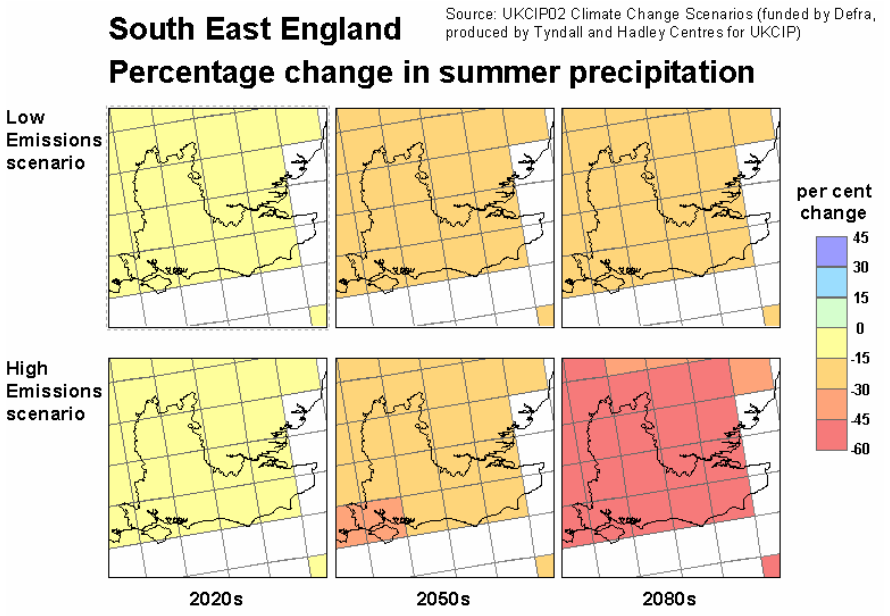
- A relatively high proportion of woodland cover, helping to soak up carbon dioxide and providing a potential renewable energy resource in the form of biomass.
- The potential for development of economic sectors such as tourism and agriculture (at least until beneficial change such as a warmer climate reach the point of becoming uncomfortable or unsustainable due to, for example, water scarcity).
- The potential to capture the increased energy reaching the county and particularly the coast as a result of climate change in the form of renewable energy from solar, wind, wave, and tidal power.
- Proximity to continental Europe which may result in the arrival of new and welcome additions to our native flora and fauna as their 'climate space' moves northwards.

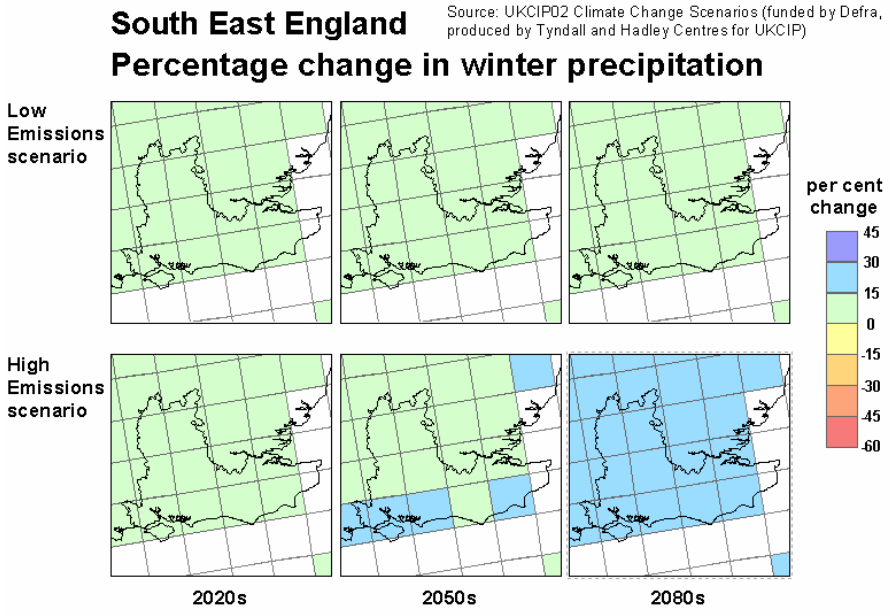
5.3 Future impacts for Kent

The impacts described for the South East region above in section 4 generally apply to Kent. Figure 4 demonstrates key impacts in map form. It should be noted that some of the grid squares covering East Kent are blank. This is because, in the 50Km grid square data supplied by the Hadley Centre, land mass squares and sea squares are calculated differently. Where a grid square contains both land and sea, it has to be classified as one or the other, so some areas of the coast will not be included. UKCIP advice is that, as a general rule, the land mass reading for these squares can be considered to be the same as the adjacent land mass square.

Figure 4: changes in average daily temperature, winter and summer rainfall for the region in 2020s, 2050s and 2080s under low and high emission scenarios







6. SECTORAL CLIMATE CHANGE IMPACTS

6.1 Defining sectors

There are an infinite number of potential ways to identify the impact of climate change on a sector by sector basis. In the interests of consistency, however, this report broadly follows the sector definitions used by UKCIP and the South East Climate Change Partnership in their efforts to describe climate change impacts for the UK and the south east region respectively[11]. While the emphasis within and between sectors may differ between Kent and the rest of the region/country, the overall definition of the range of sectors remains valid. These sectors, and key sub-sectors are (in alphabetical order):

- Agriculture (farming, fisheries, forestry, horticulture)
- Biodiversity
- Built environment
- Business and economy
- Emergency planning
- Flood management and coastal issues
- Health and care
- Heritage
- Spatial planning
- Tourism, recreation, leisure and lifestyle
- Utilities and infrastructure (energy, telecommunications, transport and waste)
- Water resources

The sector summaries at Annex 1 describe key climate change impacts for each of the sectors above in the order listed, with the following exceptions:

- Emergency planning - the implications of climate change can be inferred from the extremes of weather outlined in other sections.
- Fisheries - impacts for river and coastal fishing are described in the 'Biodiversity' and 'Flood Management and Coastal' sector summaries.

Table 1 summarises key climate change impacts for different sectors as identified by stakeholders across the UK in UKCIP studies.

6.2 Conclusions from the sectoral summaries of climate change impacts

The following conclusions can be drawn from the summaries of sectoral impacts in table 1 and at annex 1:

- The negative impacts of climate change outweigh the positive impacts in the over-whelming majority of sectors.
- In sectors where the positives may outweigh the negatives (e.g. tourism), the apparent benefits of climate change may still be transient rather than permanent,

[11] Principally in *Rising to the Challenge: The Impacts of Climate Change in the South East in the 21st Century*, Wade S., Hossell J., Hough M. & Fenn C. (eds), WS Atkins, Epsom, 1999 and *Meeting the Challenge of Climate Change: South East Climate Threats and Opportunities Research Study (SECTORS) Technical Report*, Atkins for South East Climate Change Partnership, 2004. Unless referenced otherwise, these two major research projects underpin the assessment of sectoral climate change impacts made here.

or be cancelled out by other impacts (e.g. water stress might constrain expansion of tourism).

- The uncertainties also outweigh the positives in most sectors.
- Many of the positives identified (e.g. energy efficiency, opportunities for renewable energy) require active intervention by policy makers and stakeholders, and, unlike the main negative impacts, will not happen 'naturally'.

TABLE 1: CLIMATE CHANGE IMPACTS[12] SHOWING BALANCE OF POSITIVE, NEGATIVE AND UNCERTAIN IMPACTS

SECTOR	NEGATIVE	POSITIVE	UNCERTAIN
Agriculture and horticulture	• More/different pests and diseases • Increased need for irrigation • Damage to crops and soils from intense winter rainfall and drought • Difficulty accessing fields • Potential loss of competitive advantage to other regions • Increased soil erosion • Land in floodplain flooded more often or use limited • Heat stress for livestock • Loss of land to sea level rise	• Potential to grow new crops • Longer growing season • Enhanced yields • Reduced problems for livestock grazing in winter	• Higher drought risk may call for more on-farm winter storage reservoirs • Change in timing of planting, harvesting, and ploughing
Forestry	• Increased risk of storm damage • Increased drought risk • Trees suffer from drier conditions, especially in chalk downs • More susceptible to pests and disease • Greater risk of fungal diseases • Increased demand for water resources and increased risk of fires	• Increased growth and productivity • May increase employment/ profitability	• Changes in species
Fisheries	• Reduced stream flow and water quality • Problems for migratory salmon • Loss of indigenous species to the north • Inland fisheries affected if land allowed to flood • Possible increase of algal growth in coastal waters	• New southern species in UK waters	• Change in marine species distributions • Angling affected • Cultured shellfish may spawn
Biodiversity	• Some species and habitats may be lost • Inter-tidal habitats, saltmarshes and mudflats threatened • Local extinction of species that migrate away from nature reserves • Competition from 'exotic' species • Increased stress to wetlands and beechwood from drought • Estuarine and river ecology threatened by tidal flooding • Increased fire risk • Compounded effects of factors such as eutrophication •	• Some species and habitats may be gained • Wetter winters benefit biodiversity in wetland areas	• Gardeners may adapt plantings • Low-water gardening • Phenology changes • Earlier growth of vegetation • Longer breeding season

[12] As identified by stakeholders and reported in *Measuring Progress: Preparing for Climate Change through the UK Climate Impacts Programme (UKCIP Technical Report*), West C.C. and Gawith M.J (Eds), UKCIP, Oxford, June 2005.

Flood management and coastal	• Increased risk of coastal and riverine flooding • Drainage systems overwhelmed • Increased erosion risk and damage to coastal amenities • Loss of natural assets (beaches, dunes, wetlands) • Increased sediment yield and mobilisation and land slipping • Quayside flooding causing ferry transport problems • Sea defences breached/damaged more often • Vulnerability to sea level rise, storm surge, saline intrusion, coastal squeeze • Coastal archaeology vulnerable to erosion • Increased pumping costs for land drainage • Foul water flooding • Increased risk to fisheries, ports, coastal resorts, farming and capital intensive coastal based industries • Risks from contaminated land might increase from former industrial areas • Service disruption	• Managed realignment could benefit environment and reduce risk • Increased winter recharge to reservoirs and groundwater	
Water resources	• Increased risk of summer water shortages • Increase in water quality problems • Increased demand for household, irrigation and industrial uses • Greater risk of saline intrusion into boreholes and river-mouths • More winter flood damage • Increased demand for water from new housing • Pressure on drainage and wastewater management systems • Greater need for pumping from low-lying areas • Increased risk of algal blooms	• Opportunities for water trading between farms	• May require changes to discharge consents
Utilities and infrastructure	• Higher risk of damage to infrastructure and distribution network • Power stations constrained by water availability • Disruption to supply through weather events • Additional cooling may be needed in industrial processes and commercial premises • Increased risk of telecoms infrastructure damage and 'downtime'	• Opportunities for biofuels/renewables • Less fuel poverty • Reduced damage to from frozen weather • Energy efficiency	• Changes in seasonal demand for energy
Built environment	• Increased risk of subsidence • Discomfort in buildings in summer • Increased damage from flooding, storms and intense rainfall • Buildings currently designed for past climates	• Reduced frost damage • Reduced damp related problems	• Adjustments to air conditioning and heating needed to maintain suitable

Built environment (cont)	• Increased urban heat island effect • Increased demand for air conditioning • Increased mould growth • Increased urban drainage problems		indoor temperatures
Heritage	• Increased risk of damage from storms, flooding, light-degradation and fungal damage • Increased maintenance costs • Investment required in shading • Degradation of designated sites	• Increased revenue from tourism	• Historical planting schemes at risk • Character of parks and gardens will change
Transport	• Increased risk of infrastructure damage • Increased disruption to services • Coastal routes vulnerable to sea level rise, high tides and cliff instability • Increased tourism may increase road congestion • Disruption to ferry services from strong wind and wave activity • Insufficient water to maintain canal navigations • Passenger discomfort on all modes of transport without air-conditioning • Increased maintenance of roadside verges • Increased risk of accidents in extreme conditions • Increased susceptibility to landslips on embankments • Speed restrictions on railways • Over-heating of vehicle engines • Increased rail maintenance requirements • Reduced aircraft lift during take-off	• Less cold weather damage and disruption • Reduced need to grit roads in winter • Reduced need for railway point heaters in winter	• Possible changes in ship design
Spatial planning	• More resources/skills needed to understand/address climate change • Need to avoid development in floodplain	• Planning adaptation • Built in resilience	• Need for more holistic planning
Waste management	• Increased rate of degradation and leaching at landfill sites • Increased frequency of waste collections • Increase in pests and vermin • Increased mobilisation of toxic wastes		
Business and economy	• Water supply problems and need for cooling in summer • Water intensive manufacturers (e.g. paper) could become uncompetitive • Problems with safe use of construction equipment due to increased wind • Problems refrigerating food over long distances	• New markets and opportunities • More construction days available	• Changing customer demand/sales patterns • Need for innovation in water use in

Business and economy (cont)	• More difficult working/manufacturing conditions due to higher temperatures • Disruption to supply chains • Increased insurance premiums		manufacturing
Financial and insurance services	• Increase in claims due to extreme weather, subsidence, floods etc • Increased insurance premiums • Increased risk of insurance blight • Banking suffers if customers incur losses • Properties could lose value (e.g in floodplain)	• New insurance products required • Fewer cold-related claims • Carbon trading opportunities	
Tourism, recreation, leisure and lifestyle	• Increased pressure on tourist attractions • Sport and recreational fishing suffer • Heat could deter visitors • Increased transport pressure form increased tourism • Increase in second or holiday home ownership putting pressure on housing supply/affordability	• Increased tourism • More outdoor pursuits • Longer tourist season • More use of environment around buildings • Health benefits from outdoor lifestyle • More walking/cycling for work/leisure	Changes to food/drink consumption patterns Change in character of public parks Changes to beaches
Emergency planning	• Increased risk of extreme weather events and more demand for services • Increased resources for emergency response • Population displacement		
Health and care	• More heat-related illness and death • Increased incidence of food poisoning • Higher risk of skin cancer • Psychological impacts/stress from climate impacts (e.g. flooding) • Risk of contamination of water supplies • Cooling methods required to reduce bacterial build up • Increase in vector-borne and water-borne disease • Reduced air quality and increase respiratory problems • Increased injury from storm events (e.g. road accidents) • Increased health risks from pests and vermin and ‘exotic’ new diseases	• More outdoor activities	

7. CLIMATE CHANGE IMPACTS ON KCC RESPONSIBILITIES AND SERVICES

7.1 The need for a local authority response to climate change

An effective KCC response to climate change is necessary as:

- Climate change will affect the 'social, economic and environmental well-being' of the community which local authorities have duties and powers to address under the Local Government Act 2000.
- Climate change threatens infrastructure, service provision and service continuity and is therefore a key issue in maintaining high levels of customer care.
- The statutory requirements of the planning system to consider climate change impacts (e.g. flood risk) are being strengthened and this is likely to continue.
- Failing to take action now and plan ahead could increase risks and costs in future (e.g. as remedial maintenance and renewal is required).
- KCC will experience the impacts of climate change directly in its capacity as a major employer with a large estate of buildings, land and other assets.
- The new UK Climate Change Programme (publication imminent at the time of writing) and UK National Adaptation Framework) are likely to enhance the role and responsibilities of local authorities in responding to climate change.

Climate change presents acute challenges for policy-makers, service planners, designers and engineers because historic climate variability will no longer be a good guide to future climate. It is therefore imperative for local authorities to act, identifying sustainable ways to reduce the causes of climate change and adapt to the inevitable impacts in ways which do not exacerbate those causes.

7.2 Identifying the scope of impacts relevant to KCC

Guidance produced by UKCIP[13] encourages local authorities to ask themselves a series of questions, answers to which are suggested in box 4 in the case of Kent. The UKCIP guidance warns that if the answer to any of these questions is 'no', ‘your assets and services could suffer form the negative effects of climate change and you may also miss out on any potential benefits'.

7.3 Identifying specific impacts on KCC responsibilities and service areas

Table 2 draws on national and regional efforts to identify climate change impacts for local authorities and supplements them with issues identified within the County itself. While not a comprehensive study, it illustrates the very broad scope of climate change impacts which the Select Committee may wish to explore further, and it is hoped provides the basis for further discussion within and between all Directorates of the County Council. It also focuses on areas where local authorities have *direct* responsibilities, though in terms of leading the community, councils clearly have *indirect* responsibilities for all the sectors addressed in section 6 and annex 1.

7.4 KCC's response to climate change and its impacts

Within KCC, while climate change is recognised at the strategic policy level, this has not necessarily been translated into a wide-spread understanding of, and practical measures to reduce and respond to, the impacts. KCC is far from unique in this position - the same could be said of some district councils in Kent. Indeed, of the

[13] *Climate Change and local communities - how prepared are you? An adaptation guide for local authorities in the UK*, UKCIP, I&DeA, LGA, July 2003.

local authorities in Kent, only KCC and Maidstone Borough Council were among the first 100 signatories of the Nottingham Declaration on Climate Change which commits local authorities to action. Maidstone also has a high profile climate change campaign, the Primrose Promise, which has achieved national acclaim. Some District Councils do not identify climate change as an issue even in high level community strategies, perhaps reflecting a lack of interest (or perceived lack) in the community at large. This said, it will be difficult in future for local authorities developing Local Development Frameworks to ignore climate change given the prominence afforded to the issue in national, regional and county planning policy and guidance.

Box 4: Key questions for local authorities posed by UKCIP – responses for Kent

Do you know what impact climate change could have on your area?
While the UKCIP scenarios are understood by officers who are heavily involved in climate change issues, they are not widely recognised or used within the authority. There is little evidence that the implications of these impacts are routinely considered in service planning[14].

Do your current policies, strategies and plans include provision for the impacts of climate change?
Yes. Some of the key Kent-wide strategies and policy statements - Vision for Kent, Kent and Medway Structure Plan, Kent Environment Strategy and Kent Prospects (economic strategy) all address climate change. However, there is some way to go before the terms in which they address the issue are reflected in action and implementation on the ground.

Can you identify and assess the risks from climate change to your services?
This is clearly possible though has not been done on a systematic basis across KCC, with this report being an important first step.

Are developments with a lifetime of more than 20 years required to factor in climate change?
The Kent and Medway Structure Plan identifies the need for climate change impacts to be taken into account though as a strategic document it does not include details of precisely how. While issues like flood risk are taken into account by KCC's development control function, there is no systematic process for 'climate proofing' development proposals. This said, efforts are being made to address in capital programmes (e.g. Schools for the Future).

Does your emergency planning service take into account climate change?
KCC's emergency planning function has historically been closely involved in weather-related emergencies (e.g. flooding in 2000), but beyond the generic Emergency Plan for the County, there are no specific, climate-related emergency plans in place in the way that there are for, say, a nuclear incident at Dungeness.

Are you addressing climate change in your local Community Strategy or Community Plan?
Yes. The recently revised Vision for Kent identifies climate change as one of seven long-term, cross-cutting challenges facing Kent.

Have you briefed elected members on any key risks arising from climate variability and long-term climate change?
Cabinet deferred a discussion on climate change from its 6 March 2006 meeting pending the conclusion of the Select Committee inquiry but has agreed to a half-day briefing on climate change and related issues such as water resources (currently planned for June 2006). The Select Committee process and associated Local Board meetings will be an important step in the efforts to brief elected members and raise awareness in the wider community.

[14] The author contacted 27 officers across all KCC directorates in December 2005 to identify activity underway to adapt to climate change (which was required to form part of KCC's response to a DEFRA consultation on the UK's National Adaptation Framework). This elicited two responses, relating to biodiversity and international affairs. While this does not mean that such work is definitely not underway, the lack of response suggests that it is either not regarded as a priority, is limited in scope or not readily identifiable.

All this said, the community leadership role performed by the County Council is of special significance and requires a concerted effort to ensure that our high level recognition of climate change is reflected in action and, more importantly, outcomes on the ground. It should also be noted that there is recognition and political acclaim to be gained from responding to climate change - for example, the Kent Environment Strategy is praised in UKCIP guidance for highlighting the issue of climate change.

TABLE 2: POTENTIAL CLIMATE CHANGE IMPACTS FOR KENT COUNTY COUNCIL SERVICE AREAS AND POSSIBLE RESPONSES[15]

Local authority service area	Potential climate change impacts	Possible adaptation responses	Implications for KCC directorate/division
Health and social			
Social services and care	Increased heat stress and related illness among vulnerable people	Ensure adequate shading and cooling available in places where care is delivered, increased need for water for re-hydrating patients/customers	Communities/Children, Families & Education/ Adult Services
	Fewer cold-related deaths but vulnerable survivors requiring extra care in winter	Ensure adequate provision for groups at risk from cold weather/extreme events	Communities/ Children, Families & Education/ Adult Services
	Increase in environmental inequalities (e.g. impact of poor air quality of deprived communities)	Increase support and advice for customers Work with others to tackle problems at source	Communities/ Children, Families & Education/ Adult Services
	Disproportionate impacts of extreme weather events on vulnerable groups	Assistance with costs and provision of advice associated with disruption, repairs, loss of earnings, uninsured property etc	Communities/ Children, Families & Education/ Adult Services
Public health	Increase in air quality episodes exacerbated by hot weather	Ensure transport policy reduces traffic and emissions, implement air quality action plans	Environment & Regeneration/KHS
	Increase in water-borne and vector-borne diseases (e.g. in care homes and hospitals)	Promote preventative measures and ensure treatments available	Communities/Children, Families & Education/ Adult Services
	Increased risk of new diseases reaching UK due to warmer climate	Promote preventative measures and ensure treatments available	Communities/ Children, Families & Education/ Adult Services
	Higher risk of sunburn/skin cancer due to hotter summers and outdoor lifestyles	Raise awareness of dangers, ensure shade in public areas	Communities/ Children, Families & Education/ Adult Services
Environmental health	Higher temperatures likely to increase cases of food poisoning	Raise awareness of food hygiene, revise best practice, increase resources for enforcement	Children, Families & Education/Adult Servs/Property
	Higher levels of dust in the air due to drier summers	May need to hose down streets	KHS

[15] The table is based on the UKCIP/I&DeA/LGA publication *Climate change and local communities - how prepared are you?* July 2003 with additional content added to reflect specific KCC interests and directorate responsibilities. It is not intended to be comprehensive but gives some idea of the scope of the implications for the full range of County Council activities. www.ukcip.org.uk/local_authorities.htm offers a more detailed range of options and advice on how to decide what best fits each community. For decisions involving substantial investments, UKCIP recommends undertaking a detailed risk assessment, for which further advice and tools are available from their website.

Transport and highways			
Transport panning	Increased risk of disruption due to wetter winters (flooding) and extreme weather	Plan to flood-proof or re-site infrastructure and plan routes to minimise disruption	Environment & Regeneration/KHS
	Increased risk to infrastructure from increased flood risk, sea level rise and coastal erosion	Plan to defend, re-route or abandon infrastructure	Environment & Regeneration/KHS
	Increased temperature causing service disruption and heat stress to travelling public	Avoid exposed places and provide shade or cooled waiting areas	Environment & Regeneration/KHS
Highway maintenance	Increased rain intensity affecting embank-ments, bridges, washing debris into gullies	Review maintenance of embankments and bridges, increase gully emptying	KHS
	Drier summers increase road subsidence, higher temperatures lead to surface damage	Review road structure design, implement remedial work for existing roads	KHS
	Longer growing season may lead to increase growth rates for road verges	Revise maintenance schedules, plant slower growing plants in landscaping schemes	KHS
	Warmer winters will reduce risk of frost and ice	Reduced need for gritting and road salting	KHS
Education			
School buildings	Increased risk of heat-stress in educational establishments	Ensure adequate shading and cooling available, ensure additional water available	Children, Families & Education /Property
	Increased risk of structural damage from extreme weather	Ensure high standards of sustainable construction reflect climate change pressures	Children, Families & Education /Property
School transport	Increased temperature causing service disruption and heat stress to pupils	Provide shade or cooled waiting areas, promote Safe Routes to Schools	Children, Families & Education /KHS
School grounds	Longer growing season for plants, need for year-round grass maintenance	Adapt maintenance schedules and resources and minimise energy implications thereof	Children, Families & Education
	Loss of trees and shrubs due to drier summers	Plant drought-tolerant plants, harvest rainwater	Children, Families & Education
Schools in the community	Schools at heart of community affected by extreme weather, flood risk, air quality etc	Raise awareness in and beyond the classroom about 'learning to live' with climate change	Children, Families & Education
Planning			
Spatial planning and development control	Increased risk of flooding from sea level rise and extreme weather	Ensure statutory plan, local development frameworks, area plans and masterplans address flood risk Avoid development in areas at risk Promote sustainable approach to flood risk - emphasis on 'management', less on 'defence' Insist on Sustainable Urban Drainage Systems	Environment & Regeneration

Spatial planning and development control (cont)	Increased coastal erosion	Ensure statutory plans and local development frameworks take account of erosion Avoid developments in areas at risk	Environment & Regeneration
	Hotter, drier summers leading to water stress	Address long-term water supply-demand pressures in plans and when considering development proposals Ensure water demand management is prioritised in plans, policies and proposals If pursuing new resources, ensure sustainable options are promoted (e.g. take into account energy needs of schemes)	All, particularly Environment & Regeneration
	Increased potential for outdoor lifestyles	Reflect changing recreational habits and needs in plans, policies and proposals	All, particularly Environment & Regeneration
	Increased risk of disruption to key services (e.g. energy supply)	Reduce risk through promotion of alternatives and self-sufficiency (e.g. micro-generation from renewable sources, local food) in plans/proposals	Environment & Regeneration
Emergency planning	Increased risk of flooding, drought and extreme weather events	Ensure emergency plans, procedures and resources in place to meet increased risk	Emergency Planning
Buildings and housing			
Management of public buildings	Higher summer temperatures affect thermal comfort	Upgrade energy efficient heating and ventilation and ensure operation to maximum efficiency	All particularly Property
	Wetter winters cause damp, condensation and related problems	Upgrade weather-proofing systems and manage internal environment	All particularly Property
	High risk to buildings in floodplain/coastal areas	Consider flood-proofing or relocation	All particularly Property
Design	Impacts of hotter, drier summers, warmer, wetter winters, increased risk of flooding etc	Revise best practice and supplementary planning guidance according to latest evidence on climate change impacts Use thermal properties of materials to improve cooling Reduce solar heating using recessed windows, roof overhangs and shades	Environment & Regeneration/Property
Housing	Increase risk of subsidence due to soil shrinkage in hotter, drier summers	Plan for preventative and remedial maintenance of existing stock	Environment & Regeneration

Housing (cont)	Higher risk to properties in floodplains or coastal margins	Restrict development in floodplain and instigate flood-proofing, sustainable flood management policies and raise awareness of increased risk	Environment & Regeneration
	Warmer temperatures affect living environment	Use thermal properties of materials to improve cooling, fit energy efficient cooling systems, preferably powered by renewable sources	Environment & Regeneration
Building control	Increased risk of foundation subsidence	Promote changes to procedures and enforcement	Environment & Regeneration
	Increased problems from damp	Promote change to procedures and include measures for wetter conditions	Environment & Regeneration
Environmental Services			
Greenspace management	Longer growing season for plants, year-round grass maintenance	Adapt maintenance schedules and resources and minimise energy implications thereof	Environment & Regeneration
	Loss of trees and shrubs due to drier summers	Plant drought-tolerant species Harvest rainwater	Environment & Regeneration
	Impacts on biodiversity with a squeeze on 'climate space' for some and an expansion for others, including invasive species	Re-link and de-fragment habitats and create green corridors to help species adapt and migrate	Environment & Regeneration
Heritage assets	Increased risks/costs of maintaining historic buildings, changes to character of parks, additional water requirements of historic gardens	Development of new, proactive management approaches	Environment & Regeneration
Watercourse management	Wetter winters and increased rainfall intensity causing local flooding	Increase ditch clearing and gully emptying to remove blockages	Environment & Regeneration/KHS
Waste Services	Waste will decay faster in higher summer temperatures	Review waste storage facilities and collection schedules	Environment & Regeneration
	Higher summer temperatures and higher, more intense winter rainfall may affect landfill	Review design and operation of sites to reflect climate change impacts	Environment & Regeneration
Awareness			
Community awareness	All climate change impacts have implications for communities	Develop climate change communications programme, segmenting audiences/messages	Corporate communications
Business support	All climate change impacts have implications for communities	Raise awareness in business community of risks and costs of impacts/measures to respond	Environment & regeneration
	Some opportunities e.g. tourism, agriculture, green technology, demand for new products	Encourage businesses to adapt to new market conditions and take advantage of opportunities	Environment & regeneration

ANNEX 1: SECTORAL SUMMARIES OF CLIMATE CHANGE IMPACTS

ANNEX 1.1: AGRICULTURE

Key climate change impacts

- Longer growing season as a result of higher temperatures
- Changes in level and timing of water availability
- Increased risk of summer drought
- Increased soil erosion
- Impacts on pests, diseases, livestock and potential for different crop types

Impacts for Kent and possible responses

- **Crop types:** an increase in annual temperature would favour crops preferring warmer conditions (e.g. sunflowers, soya, walnuts, vines). Oilseed rape yields could decline if autumn moisture is too low to allow crop establishment.
- **Horticulture:** benefits from warming (e.g. reduced heating costs for greenhouses, increased demand for salad crops) would be balanced by costs for ventilation, irrigation and packaging to extend product life in warmer conditions.
- **Changing land use potential:** an increase of 2ºC in temperature by the 2050s (possible in the higher emissions scenarios) could see the south east move over to ley grass production as conditions in the west/north will favour cereals.
- **Livestock:** warmer winters may reduce heating costs in intensive operations, but may be outweighed by costs from heat stress (e.g. pig populations decline in warmer years)[16]. A move to outdoor production would be one response, though this could increase water requirements (e.g. by 50-70% for wallowing) and soil erosion. Drought would threaten the carrying capacity of grazing land.
- **Soil erosion:** a major concern is that alternating rainfall and drought conditions could increase soil erosion. Some new crops (e.g. grain maize) could increase the risk. In addition to the loss of essential soil, erosion can affect the quality of watercourses with implications for health and eco-systems.
- **Crop timing:** longer growing seasons and thin soils in arable farmland should encourage autumn planting but this will only be possible if soils are not too wet to work in autumn. The growth stages of some crops (e.g. cereals, peas) will speed up, which may be problematic if there is no capacity to speed up the harvest.
- **Pests:** more crop/livestock pests may over-winter while warmer summers may increase pests such as red spider mite, a serious pest of soft fruit and hops, and soil borne cereal diseases (e.g. take-all). Other pests (e.g. carrot fly) may decline.
- **Water management:** hotter, drier summers will require more irrigation, coinciding with peak demand for water supply. EA is encouraging on-farm winter storage reservoirs but many 'easy' sites (using clay soil as lining) have already been developed. New sites will require investment, as will efficient irrigation. More frequent dry summers could result in loss of crops like hops, vegetables and fruit.
- **Food processing industry:** vulnerable to changes in agricultural output and thus the knock-on impact of e.g. higher yields (positive) or water shortages (negative).

Outlook: although a relatively small economic sector in its own right, agriculture remains a hugely significant influence on Kent's landscape, underpinning the 'Garden of England' brand, influencing Kent's biodiversity (positively and negatively) and providing the backdrop for much leisure and visitor activity. Agriculture as a sector is inherently adaptable but as climate change affects fundamental inputs to the agricultural process - heat, water and soils - it arguably poses even greater challenges than the many which the sector has had to face in the recent past.

[16] Palulutikof *et al*, 1997, cited in *Rising to the Challenge: The Impacts of Climate Change in the South East in the 21st Century*, Wade S. *et al*, WS Atkins, Epsom, 1999

ANNEX 1.2: FORESTRY

Key climate change impacts

- Increased tree stress and loss through drought
- Increased risk of fire damage
- Greater yields for commercial forestry resulting from warmer climate
- Potential increases in pests and diseases
- Changes in species

Impacts for Kent and possible responses

- **Drought:** a major problem for forestry although effects may take some time to become apparent as only prolonged drought will kill trees. Initial impacts include weakening and susceptibility to competition from other species or pathogens. Drier summers may impact on seedling survival which may limit uptake of short-rotation coppice. Continental species like sweet chestnut, which is common in Kent, will be favoured by drier summers and warmer temperatures. Species requiring wetter soils (willow and poplar) may suffer.
- **Pests and disease:** drought stressed tress are more vulnerable to pests and disease (as seen after the 1995 drought). New diseases may reach the UK. Air pollution - episodes of which may increase in warmer temperatures - may also impact on trees.
- **Fire risk:** will inevitably increase, particularly in young plantations which are increasing as a result of incentives to plant new woodland. More outdoor lifestyles could also increase fire risk.
- **Storm damage:** increases in extreme weather events will inevitably increase damage to trees, though drought is thought to be the greater problem in the South East. Increase in wind-throw may encourage shorter rotation coppice to reduce losses.
- **Changes in species:** modelling suggests that increased CO2 levels and warmer temperatures will increase yields[17] but does not include the impacts of storm damage of summer droughts. Coniferous species should be relatively unaffected and broad-leaved species like sweet chestnut should be favoured, offering economic benefits for the sector in Kent. The competitive balance within woodlands will shift, impacting on commercial forestry. The effects will vary depending on soil - e.g. the clay soils of the High Weald should be more drought resilient. Shallow rooted beechwoods are thought to be under particular threat from a changing climate.

Outlook: woodland is an expanding habitat but care needs to be taken that the species being planted are suitable for the changing climate. Only by reducing emissions to limit climate change can the risks to some treasured woodlands be reduced. Commercial opportunities for growing trees for biomass could increase though, again, species which are more dependent on wet ground may be less suitable for Kent given water scarcity issues.

[17] Broadmeadow, Forestry Research, 1999 cited in *Rising to the Challenge: The Impacts of Climate Change in the South East in the 21st Century*, Wade S. *et al*, WS Atkins, Epsom, 1999

ANNEX 1.3: BIODIVERSITY

Key climate change impacts

- Sea level rise and erosion squeezing coastal/inter-tidal habitats and species
- New sedimentation with implications for habitats, estuaries, dunes and harbours
- Reduced water availability putting pressure on wetlands and water quality
- Losses for species at southern edge of their range
- Gains for species at northern edge of their range
- More extreme events (drought, floods, fire) increasing risk of local extinctions

Impacts for Kent and possible responses

- **Coastal habitats:** sea-level rise and erosion mean that coastal and estuarine habitats are most threatened by climate change. These include saltmarsh (e.g. Sheppey, Grain), shingle (e.g. Dungeness), and saline lagoons (e.g. Cliffe). Such habitats will be squeezed against 'hard' sea defences with 'significant losses' of saltmarsh facing North Kent.[18] Cliff faces and cliff top grassland face erosion.
- **Managed realignment:** Kent's highly developed coast limits opportunities for managed realignment to allow landward migration of dynamic habitats. Even where possible, land which would be lost could already be of conservation value (e.g. coastal grazing marsh in North Kent which is protected under the EU Birds Directive). This said, opportunities are being identified (e.g. near Dungeness).
- **Coastal species:** loss of mudflats and eel grass beds reduces the area available for internationally important bird populations (e.g. dunlin, knot, widgeon) which winter in Kent. Loss of saltmarsh threatens breeding birds such as redshank.
- **Marine biodiversity**: catches of warm water fish species may increase off Kent's coasts while cold water species may be lost.
- **Rivers and wetlands:** will suffer from lower river flows and reduced water quality. Warmer waters may damage salmonids, which also suffer from low flows preventing migration. Increased flash floods may scour river beds while breeding waders will be affected by the drying of floodplains, flashes and ditches. New reservoirs may restrict run-off, damaging riverine habitats. Expansion of reservoirs (e.g. Bewl) would require replacement schemes for valuable bank-side habitats. Alien fauna (e.g. bullfrog) may prosper, threatening native amphibians.
- **Calcareous grassland**: Kent's Downs are important for lowland calcareous grassland, for which climate change means both losses and gains. Species such as some orchids currently restricted to Kent may flourish, as may butterflies like the Adonis Blue. This said, drought may have the opposite effect and their spread may be restricted by habitat fragmentation and lack of migration routes.
- **Woodland:** wet woodland is likely to become drier and negative impacts are predicted for the gill woodlands of the Weald where dark, damp conditions are required. See also *Forestry* annex 1.2 above.
- **Farmland:** wildlife could benefit if marginal arable land is withdrawn from cropping and allowed to revert to grassland or other habitats. Increased pesticide use and soil erosion could have the opposite effect.

Outlook: the key to protecting Kent's unique coastal biodiversity will be allowing natural processes (e.g. the shift of habitat inland or along coasts) to take place. For all habitats there will be a need to de-fragment and re-link them on a landscape scale to help species adapt over time. The water environment also needs a holistic approach, with environmental limits understood and respected by development.

[18] Pye and French, 1993, cited in *Rising to the Challenge: The Impacts of Climate Change in the South East in the 21st Century*, Wade S. *et al*, WS Atkins, Epsom, 1999.

ANNEX 1.4: BUILT ENVIRONMENT[19]

Key climate change impacts

- Increased risk of flooding
- Higher temperatures and increased effect of urban heat island
- Increased demand for and reduced supply of water
- Increased risk of subsidence
- Increased coastal erosion

Impacts for Kent and possible responses

- **Location:** development will be affected by increased risk of tidal, fluvial and flash flooding. Developments currently not at risk could become so during their lifetime, and new development will need to avoid increasing flood risk elsewhere.
- **Structures:** higher winds may affect structures, as may higher temperatures, heat loss and gain (with thermal mass affecting how buildings respond).
- **Materials:** the suitability of different materials will change. For example, plastics and roofing felt will be affected by increased ultra-violet, the strength of concrete by higher temperatures, and brick strength by moisture content.
- **Ventilation and cooling**: buildings will need to make best use of natural ventilation, while addressing worsening air quality which may result from hotter, dustier summers. 'Passive design' for cooling (e.g. using shading or appropriate thermal mass) will be preferable to conventional air conditioning, which will increase emissions and may cause problems for neighbouring buildings as heat is simply 'dumped' elsewhere. Opportunities to use renewable energy may increase (e.g. solar energy is most available when cooling is most needed).
- **Drainage:** run-off rates will increase after heavier, 'flashier' rainfall and traditional drainage systems (underground pipes conveying water away as quickly as possible) may cause pollution and flooding downstream. Mimicking 'natural' drainage systems (e.g. ditches, filter strips and swales) will allow water to soak away slowly and may have other benefits (e.g. landscaping, biodiversity).
- **Water:** reduced water availability will affect the viability and desirability of some locations for development. It will also increase the need for water efficient buildings and techniques like rainwater harvester and grey water recycling.
- **Layout:** will need to balance minimising winter heat loss with risk of excessive solar gain in summer.
- **Subsidence:** risk of subsidence will increase, especially on clay soils, with some buildings requiring deeper foundations.

Outlook: climate change will have physical impacts on all forms of development, but will also change the suitability and desirability of some locations for large scale development. There will be significant costs of 'climate proofing' development, but these are likely to be much lower than the costs of no doing so – e.g. the estimated cost of 'climate proofing' new buildings in southern England against subsidence is estimated at £32 million, compared to a possible annual cost of up to £400 million from damage claims if no action is taken.[20] In areas of high development pressure like Kent, high standards of sustainable construction (e.g. energy and water efficiency) will be required to minimise emissions and remain within the limits of the environment, particularly the water environment.

[19] *Adapting to Climate Change: A Checklist for Development*, produced by the Climate Change Partnerships for London, the South East and East of England, and endorsed by UKCIP, November 2005, is the main reference source for this section.

[20] *A Changing Climate for Insurance*, Association of British Insurers, June 2004.

ANNEX 1.5: BUSINESS AND ECONOMY

Key climate change impacts

- Severe weather (storms, floods, heatwaves) affecting buildings/infrastructure
- More disruption to distribution, supply, energy and communications networks
- Sea level rise will affect business and industry in coastal and estuarine locations
- Manufacturing industry may be affected by costs/availability of raw materials
- Impacts on manufacturing/processing techniques (e.g. need for cooling)

Impacts for Kent and possible responses[21]

- **Energy:** lower winter heating requirements should reduce energy demand but demand for cooling in summer will rise. The energy sector is a major consumer of water so is also affected by water availability. The risks of disruption to energy supplies could be reduced by greater reliance on renewable sources and localised generation/distribution networks, which would also have a mitigating effect in reducing emissions (both directly and indirectly by reducing losses in transmission over large distances).
- **Manufacturing**: Kent industries like paper and pharmaceuticals could face higher water costs (e.g. a change from groundwater to surface water abstraction would increase paper industry costs by 1-2% due to salinity of water sources[22]).
- **Construction and development:** better systems for surface water drainage will be required, while warmer summers will require improved ventilation and cooling. Milder winters may extend construction periods but shrinkage of clay sub-soils may increase the cost of foundations in new buildings and increase subsidence risk. Tighter Building Regulations are likely over time unless efforts to reduce emissions (including, crucially, in the construction and development process itself) are successful in mitigating climate change.
- **Distribution, hotels and catering**: disruption from extreme weather could increase costs and affect reliability of distribution, requiring contingency planning and efficiencies in the logistics chain. Changing eating and dining patterns may affect catering and hotels. Increased tourism would bring benefits to the sector.
- **Retail:** retailers are well placed to adapt to changing consumer demand which may include reduced demand for winter clothing, increased fruit and salad vegetable sales in longer, hotter summers.
- **Transport and communications:** see *Utilities and Infrastructure* annex 1.10.

Outlook: the South East has the largest 'ecological footprint'[23] of all English regions except London. It also has the largest economy after London and thus much to lose from climate change. Increased resource efficiency will be a necessary response to reduced availability of primary resources like water and rising energy costs. As well as considering physical impacts on buildings and infrastructure, business needs to consider climate change in the context of business continuity, risk assessment, supply chains, mitigation (carbon trading and energy efficiency), land holdings, corporate social responsibility and health and safety.

[21] Listed according to vulnerability to climate change as in *Rising to the Challenge: The Impacts of Climate Change in the South East in the 21st Century*, Wade S. *et al*, WS Atkins, Epsom, 1999.
[22] Paper manufacturer quoted in *Rising to the Challenge: The Impacts of Climate Change in the South East in the 21st Century*, Wade S. *et al*, WS Atkins, Epsom, 1999.
[23] A measure of resources consumed compared to what is available globally - the Ecological Budget UK programme has calculated that if everyone on earth lived as we do in the south-east, we would need 3.5 planets to sustain us. Population growth and rising affluence/expectations in developing countries make this unsustainable and require reduced consumption and increased resource efficiency.

ANNEX 1.6: FLOOD MANAGEMENT AND COASTAL

Key climate change impacts

- Increased frequency of over-topping of coastal defences and risk of breaches due to combined effects of storms, changes in wave direction and sea level rise
- Changes in patterns and extent of coastal erosion and deposition
- Increased risk of river flooding (e.g. the Upper Medway) during winter months
- Increased cost of maintaining 'hard' sea defences
- Requirement for improved flood forecasting and warning systems
- Threats to coastal habitats, biodiversity and amenity

Impacts for Kent and possible responses

- **Flood defences:** the Environment Agency estimates that the cost of engineered flood defences to respond to climate change in England and Wales will rise from £22 billion to £75 billion by 2080[24]. It therefore advocates a shift in approach from flood 'defence' to flood 'management', making increasing use of 'soft' engineering techniques, natural flood defences and increasing preparedness.
- **Coastal defences:** more off-shore defences might help dissipate wave energy and reduce erosion. On shingle beaches like those at Dungeness, erosion is slowed by engineering of shingle banks. The supply of shingle is limited and may become depleted if the extent (and cost) of this work escalates. The Thames Barrier is now being closed more frequently, increasing the risk of flooding east of the barrier in North Kent.
- **Coastal and flood management planning:** Shoreline Management Plans identify short (0-25 yrs), medium (25-50 yrs) and long-term (50-100 yrs) options for stretches of Kent's coast – either to 'hold, 'advance' or 'retreat' the line or 'do nothing'. There are also Flood Risk Management Plans for Kent's rivers prepared by the Environment Agency. There will be an increasing need for these to inform the spatial planning process, particularly Local Development Frameworks.
- **Coastal communities:** in addition to increased erosion, storms and flood risk, coastal communities may be threatened by more saline intrusion into coastal aquifers (e.g. Denge) and estuaries, affecting scarce water resources. Loss of beach fronts due to sea level rise will reduce amenity and 'natural' flood defence.
- **Coastal biodiversity:** coastal and estuarine habitats are most threatened by climate change as they will be squeezed against 'hard' sea defences. Kent's developed coast limits opportunities for managed realignment (see also *Biodiversity* annex 1.3 above) but some opportunities remain.
- **Coastal industries:** the infrastructure, services and amenity value provided by Kent's ports and harbours will be threatened by more frequent storms, strong winds and sea level rise. Agricultural land on the coast will also be threatened.
- **Flood risk awareness:** communities and their leaders need to be made aware that flood risk can not be eliminated. Current flood defences are based on historical flood conditions and will not offer sufficient protection in future. The area at risk of flooding will also increase, underlining the need to make residents and businesses aware of the risks and help them to prepare for them.

Outlook: in the short-term the challenge will be to ensure that communities continue to be protected from flood risk through raising awareness and managing risk as well as maintaining defences. In the longer-term, some communities may simply need to learn to live with increased flood risk and, in some cases, relocate where the costs of defence and risks of flooding become unacceptable.

[24] *The Climate is Changing: Time to Get Ready*, Environment Agency, March 2005, p9.

ANNEX 1.7: HEALTH AND CARE[25]

Key climate change impacts

- Fewer cold-related deaths in winter and more heat-related deaths in summer
- Increased risk of public health emergencies e.g. arising from floods, heatwaves
- Increased risk of skin cancer (est. 5,000 new cases p.a. by 2050)
- Increased incidence of food poisoning (est.10,000 new cases p.a. by 2050)
- Physical impacts on NHS estate, care facilities etc and disruption to services
- Increased risk of health problems associated with effects of ozone

Impacts for Kent and possible responses

- **Service planning:** more predictable climate change impacts (e.g. hotter, drier summers, water scarcity) will need to be reflected in planning and resource allocation within health and care services. Less predictable impacts (e.g. extreme weather) will need to be considered in contingency and emergency plans.
- **Heat related death and illness**: it is estimated that hotter summers as a result of climate change could result in 2,000 additional heat-related deaths nationally per annum by 2050. The number for Kent proportionately would be about 50 (the actual number would be much higher as Kent is one of the hottest parts of the UK). Heat-related illnesses (heat-stroke, de-hydration, food poisoning, sunburn) may increase hospitalisations and have implications for care services. In vulnerable groups, such illnesses may trigger other health problems.
- **Reduced cold-related death and illness**: it is estimated that warmer winters as a result of climate change could result in 20,000 fewer cold-related deaths per annum nationally by 2050. The number for Kent proportionately (based on population) would be about 400 (the actual number is likely to be lower given the already warmer climate). Cold winters will still occur, however, and there will be a continuing need to avoid being caught out by them.
- **New disease:** although the impact of new water and vector borne diseases (e.g. malaria, Lyme disease) may be small, they could present local problems.
- **Air quality:** Kent's air quality is affected by continental sources of pollution as well as its own traffic emissions and those of through traffic (notably around the M25). 1 in 7 children in Kent already has respiratory illness (six times more than 25 years ago)[26]. Department of Health studies on climate change impacts assume that air quality will improve over time (due to cleaner, more efficient vehicles) but there is little in current transport policy to support this assumption or counter the risk that traffic growth will outweigh any gains. This said, the Department recognises that climate change will increase the effects of ozone.
- **Operational impacts:** disruption or damage to services or assets could increase as a result of extreme weather impacts on transport, power and communications.

Outlook: some in the health sector take the view that they should 'wait and see' as the dimensions of climate change impacts are 'not possible to quantify'.[27] Others are promoting adaptation responses such as awareness raising of summer health problems and improved advice on handling and preparing food in a warmer climate. Local authorities with ambitions to extend their public health remit will need to develop their understanding of, and articulate preventive and adaptive measures to respond to, climate change impacts.

[25] *Health effects of Climate Change in the UK*, Department of Health, 2001 is the main source.
[26] *Kent Environment Strategy*, Kent Partnership, 2003.
[27] *Meeting the Challenge of Climate Change: South East Climate Threats and Opportunities Research Study (SECTORS)* Summary, Atkins for South East Climate Change Partnership, 2004, p14.

ANNEX 1.8: HERITAGE

Key climate change impacts

- Sea level rise impacts on coastline, landscape and coastal features
- Changing water availability affecting character of parks and gardens
- Impact of more extreme weather on buildings and artefacts
- Effects of pests and humidity on e.g. fabrics, paintings, furniture
- Need for features like shelter-belts and shading to protect buildings

Impacts on Kent and possible responses

- **Landscapes:** Kent has two Areas of Outstanding Natural Beauty (the Kent Downs and High Weald which extends into Sussex), a number of other landscapes of designated importance and many other un-designated landscapes which are important to those who live in and visit them. Climate change will influence these through agricultural change and changes in vegetation. Historic landscapes such as ancient woodland and parklands are common in Kent and will be affected by the changing climate.
- **Parks and gardens:** increased temperatures and reduced summer water availability may threaten the integrity of some plant collections and historic garden designs. Important water features would also be threatened by water scarcity and fire risk would increase on heathland such as Ashdown Forest - outside Kent but much-visited and loved by many Kent residents.
- **Historic buildings:** changes in extreme weather, rainfall and humidity will damage the structure of buildings, and alter the severity and distribution of fungal and insect attack on historic artefacts. Material subject to thermal movement (e.g. timber-framed buildings) and masonry could be affected by alternating extremes of temperature and moisture. Increased risk of subsidence from lower ground water and clay soil shrinkage will affect building foundations. Repair and underpinning may be required, increasing costs.
- **Archaeology:** archaeologists are concerned about the impacts of a potential drop in groundwater levels on the preservation of buried sites and artefacts. The impacts of changes in farming practise as a result of climate change also pose threats. Greater scouring of the land and rivers may accelerate the erosion of archaeological sites, while some coastal sites may be lost altogether.
- **Potential benefits for heritage sites:** these depend on progressive management that considers the likely impacts of climate change - for example, if coastal land is abandoned to natural processes there may be opportunities for land acquisition where new landscapes are allowed to develop. Frost damage to buildings could reduce, and appropriate planting of shelter belts could help protect buildings and provide shade for them and visitors to them.
- **Heritage interests:** are already leading the way in adapting to climate change, with the National Trust, one of the largest membership organisations in the county, managing some of our finest visitor attractions, leading the way. The Trust is promoting planning policies to reflect heritage interests, changing its own management practises to adapt to climate change, and reducing water use within its estate through, for example, waterless urinals in its visitor facilities.

Outlook: the impacts of climate change on natural and cultural heritage are diverse and will need to be reflected in plans and Local Development Frameworks. Coastal heritage needs special consideration in Shoreline Management Planning. Strategies for the management of heritage assets need to priorities resilience to a range of climate change possibilities.

ANNEX 1.9: SPATIAL PLANNING

Key climate change impacts

- Changes in character and suitability of development locations
- Potential increase in planning conflicts
- Need for spatial plans and development control decisions to be 'climate proof' – e.g. taking account of flood risk, water resources and sustainable construction

- **Development locations:** climate change impacts may make sites currently thought of as having development potential less suitable (e.g. due to increased flood risk). Economic factors may reinforce this and lead to blight (e.g. areas which may become uninsurable against climate-related risks).
- **Planning conflicts:** conflicts could increase if climate impacts become a pretext for transferring development pressure from, say, brownfield sites in the Thames Gateway to greenfield sites which may be subject to other climate-related or planning constraints (e.g. water scarcity, importance for landscape, wildlife etc), or which would increase traffic and thus accelerate climate change. This emphasises the need to make efficient use of land where development is permitted as there will be less suitable land available as a result of climate change, and more of if may be need to be allocated and managed for adaptation (e.g. for natural flood defence or for 'green corridors' to help wildlife adapt).
- **Flood risk:** increased risk of flooding is already rising up the planning agenda with a revision of national planning policy underway. Many development sites are in areas at risk of flooding (e.g. 45% of new development planned for Kent Thameside and 65% of that in the rest of the Kent Thames Gateway by 2016-21 will be in the indicative flood zone)[28].
- **Water resources:** potentially a constraint on development which will need to be reflected in land use and water resource planning, which may need to be geared more to delivering water efficiency measures than continually expanding new resources (e.g. reservoirs). These may in any case be less reliable sources of supply as a result of reduced summer rainfall and increased evaporation.
- **Sustainable construction:** climate change impacts will increase the need for planning authorities to consider whether development proposals are 'climate proof' and to ensure that building design is resilient to the full range of climate impacts, as well as not unduly adding to those impacts. This represents an opportunity to deliver high quality development, which Kent has been promoting.
- **Landscape, biodiversity and heritage:** other sections address these issues in detail but planning policies and decisions will need to address their protection and enhancement in the face of climate change impacts.

Outlook: some local authorities still do not see climate change as 'a planning issue'[29]. Planning policies (e.g. on flood risk or standards of water efficiency) at national, regional and local level will need to be kept under rolling review to reflect both the current reality and future likelihood of climate change impacts. Knee-jerk responses to climate risks (e.g. abandoning brownfield sites in areas at risk of flooding in favour of greenfield sites in areas with water scarcity issues) should be avoided. Taking account of the range of climate change impacts will have implications for resources and skills in a sector already experiencing skills shortages.

[28] Association of British Insurers data, cited in *Managing Water Resources and Flood Risk in the South East*, 4th working paper of the IPPR's Commission for Sustainable Development in the South East (Chaired by Sir Sandy Bruce-Lockhart), 2005, p37.

[29] *Meeting the Challenge of Climate Change: South East Climate Threats and Opportunities Research Study (SECTORS)* Technical Report, Atkins for the South East Climate Change Partnership, 2004, p52.

ANNEX 1.10: UTILITIES AND INFRASTRUCTURE

Key climate change impacts

- Changes in seasonal demand for energy and water
- Increased disruption to infrastructure and services from extreme weather
- Reduced damage from cold weather
- Increased investment requirements
- Some opportunities for increased revenues

- **Energy:** in addition to higher risk of damage to infrastructure and distribution networks, conventional power stations, which are major users of water, may be constrained by reduced water availability. Demand for energy will be affected by reduced heating requirements in winter and increased cooling in summer. The cost of defending coastal power stations (e.g. Dungeness) is likely to increase over time. The opportunity to develop renewable technologies will be significant.
- **Railways:** infrastructure and services would be affected by more subsidence, coastal erosion (e.g. Folkestone-Dover line), storms and flooding (e.g. Medway Valley line). Increased leaf-fall from storms will require vegetation clearance and emergency time-tables will be needed to cope with increased disruption.
- **Highways:** reduced risks from frost and ice need and reduced need for gritting in winter would contrast with increased maintenance costs from the effects of extreme weather and temperatures. Increased rain intensity may affect embankments (e.g. more risk of landslips), bridges, and wash more debris into gullies. Drier summers will increase road subsidence and higher temperatures will lead to surface damage. The longer growing season may lead to increase growth rates for road verges with maintenance implications.
- **Ports and airports**: increased storminess and wave energy at the coast will pose clear risks to Kent's port infrastructure and services. Work is also underway under the auspices of UKCIP to identify the impacts on the aviation sector of climate change (e.g. turbulent weather, impacts on ground infrastructure). Long-range impacts of climate change such as significant population movements (temporary and permanent) could have practical implications for ports of entry (e.g. security, immigration control).
- **Waste:** waste authorities and operators will need to take account of the impact of changing climate conditions on landfill (leachate, reduced composting, gas yields, litter blow). Waste collection authorities may need to review the frequency of collections in light of hotter summer which may cause waste (e.g. kitchen waste) to decay faster, thus increasing smell and potentially attracting vermin.
- **Investment:** most utilities could face increased investment needs to respond to climate change impacts.
- **Water:** see *Water Resources* annex 1.12 below.

Outlook: most utilities are already active in climate change mitigation and adaptation, though regional studies suggest that less attention is paid to the issue in highways planning than in rail, energy and water sectors. There is a need to raise awareness among other sectors and co-ordinate activity (e.g. between transport, waste and minerals sectors) where longer term strategies would facilitate adaptation.

ANNEX 1.11: TOURISM, RECREATION, LEISURE AND LIFESTYLE

Key climate change impacts

- Warmer, drier weather will encourage more outdoor lifestyles
- River navigation may be difficult to sustain during dry periods
- Beach holidays may become more attractive - though some beaches themselves may be among the coastal habitats threatened by climate change
- increased tourism will bring economic opportunities but also pressures (e.g. transport bottlenecks, demand for water during peak periods)

Impacts for Kent and possible responses

- **Visitor attractions:** a warmer climate may allow some attractions to extend their opening seasons to encourage visitors. Increased costs (see *Heritage* annex 1.8 above), however, will require increased income and possibly investment in sustainable transport links and new marketing techniques to support this.
- **Coastal resorts:** increased tourism is central to the regeneration of Kent's coastal towns but their success depends on maintaining high environmental quality (e.g. bathing water quality, attractive landscapes, maintenance of coastal habitats between developed areas) which may be threatened by climate change.
- **Rights of way:** coastal trails and other rights of way may require re-routing.
- **Beaches:** beaches may need to be maintained by increased 'feeding' from offshore sediment to maintain their recreational value as natural coastal process will be accelerated by climate change. The high and escalating cost of coastal engineering may make some defences unsustainable in the long-term.
- **Sustainable tourism:** regional stakeholder surveys have identified the quality of the environment (e.g. Kent's Garden of England') as the mainstay of the tourism industry in the region. Tourism development must therefore avoid 'killing the goose which lays to golden egg', maintaining environmental quality while accommodating increased visitor numbers sustainably.
- **Water-based activities:** while pursuits like yachting are expected to increase in a milder climate, some harbours are under threat from sea level rise and will need additional defences. Increased marine recreation, increased wind speeds and more frequent storms will have implications for maritime safety. Inland water sports may be threatened by reduced water levels and poor water quality.
- **Predictability of weather:** research for tourist boards has identified the perception of the predictability of English weather as a key factor in decisions to holiday abroad.[30] Whether climate change challenges this perception (as opposed to the reality) remains to be seen. A shift from overseas to domestic holidays would offer mitigation benefits (e.g. by reducing emissions from international aviation).

Outlook: Kent's outstanding natural and cultural heritage underpins its tourism and leisure industries. Their future relies on effective planning and transport provision, with tourism development being targeted to avoid the development of infrastructure which would demand unsustainable sea defences or put undue pressure on the environmental resources (e.g .water, landscapes) which sustain the sector. Pressures such as litter, overcrowding, erosion (physical and in terms of character and amenity) and fire risk will also need to be managed through public education and other means.

[30] *Attitudes to domestic and abroad holidays*, English Tourist Board, 1998, cited in *Rising to the Challenge: The Impacts of Climate Change in the South East in the 21st Century*, Wade S. *et al*, WS Atkins, Epsom, 1999.

ANNEX 1.12: WATER RESOURCES

Key climate change impacts

- Reduced summer rainfall coinciding with peak demand increasing water stress
- Increased frequency of dry years and drought
- Lower river baseflows during summer
- Deterioration in river water quality due to lower flows, soil erosion etc
- Increased evaporation as a result of warmer temperatures

Impacts for Kent and possible responses

- **Groundwater:** 75% of Kent's water supply comes from groundwater, making us vulnerable to drought. The Environment Agency regards some aquifers as already over-abstracted and Kent is already vulnerable to 'back to back' drought years. Lower summer rainfall, higher evaporation, and more frequent droughts will extend the period when soil moisture deficits are above zero and reduce the opportunity for groundwater recharge.
- **Water demand:** demand for water peaks when supply is most constrained as farmers, gardeners and households increase their water use in summer. Longer, hotter summers will exaggerate these 'spikes' of demand.
- **Water resource planning:** assumptions underlying well-established methodologies for calculating groundwater and surface water yields (based on historic patterns) are being challenged by climate change. The traditional approach to reducing the risk of supply shortfall – providing new resources like reservoirs – may become less fruitful as climate change will reduce summer rainfall, evaporation will increase and more water will be required to meet in-river needs, and thus not be available for diversion to reservoirs. The EU Water Framework Directive may also set more demanding standards for the water environment, making it more difficult to divert river water into reservoirs should they become depleted.
- **Water quality:** water quality may be threatened by lower river flows, higher temperatures and soil erosion causing elevated levels of turbidity. Run-off from extreme rainfall may also increase nutrient and pesticide levels.
- **Wastewater management:** loss of baseflow during warmer summers would reduce dilution of effluent from sewage treatment works. This is of particular concern in areas where streams fed by groundwater derived from the chalk (e.g. the Stour) and where abstractions are already having an impact on river flow.
- **Conflicts between mitigation and adaptation:** increased pressure on water supplies may increase demand for processes like de-salination of sea water while tighter standards for effluent may require additional treatment. Such processes are energy intensive and it is vital that they do not increase emissions and thus increase the problem they are designed to solve.

Outlook: climate change will lead to a 'double whammy' of increased demand and reduced supply. Increased winter storage may be part of the solution but not as big a part as in the past due to increased evaporation and higher in-river need for water. Managing demand by extending metering, reducing leakage, harvesting rainwater, re-using 'greywater' and using water efficient fittings and practises will be increasingly important given the uncertainties over future supply. Projections of up to 60% less rainfall for Kent by the 2080s raise serious questions about the sustainability of household and commercial development in the coming decades.