Cambridgeshire Green infrastructure Strategy Appendix 6
Climate Change

Contents

This Appendix identifies the baseline information used for developing the Climate Change Theme and supporting of the Strategy Objective. This information together with the spatial analysis enabled mapping of the opportunities that exist for Climate Change Green Infrastructure Theme. This map was combined with the other six Theme maps to inform and develop the Strategic Network of Green Infrastructure.

For the purpose of this work the term climate change is used for the short and long-term affects on our climate as a result of human activities such as fossil fuel combustion and vegetation clearing and burning.

1 Baseline information

The information in this section will cover:

- Policy
- Strategies and Guidance
- Data and Baseline Map

Policy

A range of climate related policy has been established to help limit the degree of future climate change, and to ensure that communities are adequately prepared for the anticipated impacts. The key climate-related policies relating to Planning and Green Infrastructure are outlined below in Table 6.1.

Table 6.1 Key climate related policies relating to Green Infrastructure

Policy	Explanation
Climate Change Act	The UK introduced a long-term legally binding framework to tackle the dangers of climate change. The Climate Change Act received Royal Assent on 26 November 2008. The Act requires that emissions are reduced by at least 80% by 2050, compared to 1990 levels and that adaptation to climate change is reported.
Planning Policy Statement 1 (PPS1): Delivering Sustainable Development	Regional planning bodies and local planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and potential impact of climate change.
Planning Policy Statement: Planning and Climate Change: Supplement to PPS1	This supplements PPS1 by setting out how planning should contribute to reducing carbon emissions and stabilising the impacts of climate change taking into account the unavoidable consequences.
Planning Policy Statement 25 (PPS25): Development and Flood Risk	PPS25 uses opportunities offered by new development to reduce the causes and impacts of flooding, (e.g. surface water management plans, making the most out of the benefits of green infrastructure for flood storage, conveyance and SuDs; re-creating functional floodplains; and setting back defences).
Planning Policy Statement: Planning for a Low Carbon Future *(Consultation Draft)*	• *Policy LCF5: Local Planning Approach for Adapting to Climate Change:* plan green infrastructure so as to maximise its benefits, as part of wider green infrastructure networks, in order to support local biodiversity and healthy, living environments, • *Policy LCF6: Local Planning Approach for Selecting Sites for Development:* where developing the site would provide opportunities to help the existing community adapt to impacts arising from changes in the climate, including sustainable drainage systems and green infrastructure. • *Policy LCF13: Designing for a Low Carbon Future in a Changing Climate:* provide public or private open space as appropriate so that accessible choice of shade and shelter is offered, recognising the opportunities for people, biodiversity, flood storage and carbon management provided by multi - functional greenspaces and green infrastructure networks.

Strategies and Guidance

Green Infrastructure by design**:** adding value to development' (June 2010) published by Natural England and the Environment Agency. This guide illustrates how incorporating Green Infrastructure into the very core of spatial planning and urban design can deliver countless benefits for new communities including climate change adaptation and mitigation.

The Environment Agency's Climate Change Adaptation Strategy (2008-11) sets out a systematic approach for embedding climate change adaptation providing a strategic framework for assessing climate risk, building adaptive capacity, identifying adaptation options and ensuring coordinated delivery.

Local Authority Climate Change Strategies including:

- Climate Change and Environment Strategy 2008 Cambridgeshire County Council formally adopted as part of the Council's policy framework.
- Cambridge Climate change strategy, 2008, Cambridge City Council.
- Huntingdonshire Sustainable Community Strategy 2008 – 2028, Huntingdonshire District Council
- A Climate Change Strategy Framework, July 2007, Fenland District Council

Forestry Commission England A Wood fuel Strategy for England (2007): This indicates significant CO_2 savings and fiscal benefits are associated with substituting wood fuel for fossil fuels. A series of interventions are recommended, which if implemented, could utilise an extra 2 million tonnes of wood fuel, saving 400,000 tonnes of carbon, equivalent to supplying 250,000 homes with energy by 2020. Additional benefits of the Strategy include conserving woodland resources and reversing the decline in woodland diversity by increasing the number of sustainably managed woods, and creating economic opportunities through developing a viable biomass industry.

Green Infrastructure: How and where it can help the Northwest mitigate and adapt to climate change?[1]

As an example of good practice guidance on Green Infrastructure specifically for climate change mitigation and adaptation[2] has been produced through the green infrastructure strand of the Northwest Climate Change Action Plan. Published in June 2010, the report "sets out how and where Green Infrastructure can help the Northwest to mitigate and adapt to climate change. It is intended to raise awareness in the Northwest of the climate change services that Green Infrastructure can provide, and to start to target where these may be considered to be the most important; highlighting that it may be possible to get multiple services from the same piece of land and the need to take opportunities as they arise to do this." (Green Infrastructure: How and where it can help the Northwest mitigate and adapt to climate change? 2010. P4).

Data & Baseline Maps

[1] http://www.greeninfrastructurenw.co.uk/html/index.php?page=resources&NorthWestRegion=true
[2] http://www.greeninfrastructurenw.co.uk/climate change/

- Cambridgeshire CO2 emissions
- UK Climate Change Impacts Programme & Projections
- Woodland/Ancient Woodland + English Woodland grant Scheme (EWGS) Target and Priority Areas
- Landscape Character Areas
- Strategic Flood Risk Maps
- Biodiversity Reservoirs
- Main Urban Areas
- Air Quality Management Areas

Cambridgeshire CO2 emissions

On average, each Cambridgeshire resident was responsible for an estimated 10 tonnes of CO_2, representing a total of 6.2 million tonnes for the County (in 2007). Of this total, around 473,000 tonnes were emitted as a result of land use change or from agricultural production[3].

[3] Department of Energy and Climate Change (DECC) (2010) Local and Regional CO2 emissions estimates 2005-2007
http://www.decc.gov.uk/en/content/cms/statistics/climate_change/gg_emissions/uk_emissions/2007_local/2007_local.aspx

UK Climate Impact Programme & Projections

The UK Climate Impacts Programme (UKCIP) helps organisations to adapt to inevitable climate change. UKCIP is about getting a better understanding of the science of climate change to make it easier to consider the possible impacts, manage climate risks and make better decisions about planning for the future.

The UK Climate Projections (UKCP09) provides climate information designed to help those needing to plan how they will adapt to a changing climate. UKCP09 offer projections of the future climate using climate model simulations that are based on the current understanding of the climate system.

The Projections provide information up to the end of the century based on three different future scenarios (High, Medium and Low greenhouse gas emissions). They allow the user to develop projections for a range of climate variables (including temperature, precipitation and sea level rise) for a specific location or region, to help improve knowledge and planning in adapting to climate change.

A broad range of anticipated changes up to the end of the century is in Figure 6.1. Figure 6.2 shows the percentage change in summer/winter precipitation relative to the 1961-1990 baselines under the medium emissions scenario for 2020, 2050 and 2080. Followed by the change in annual mean temperature (°C) relative to the 1961-1990 baselines under the medium emissions scenario for 2020, 2050 and 2080.

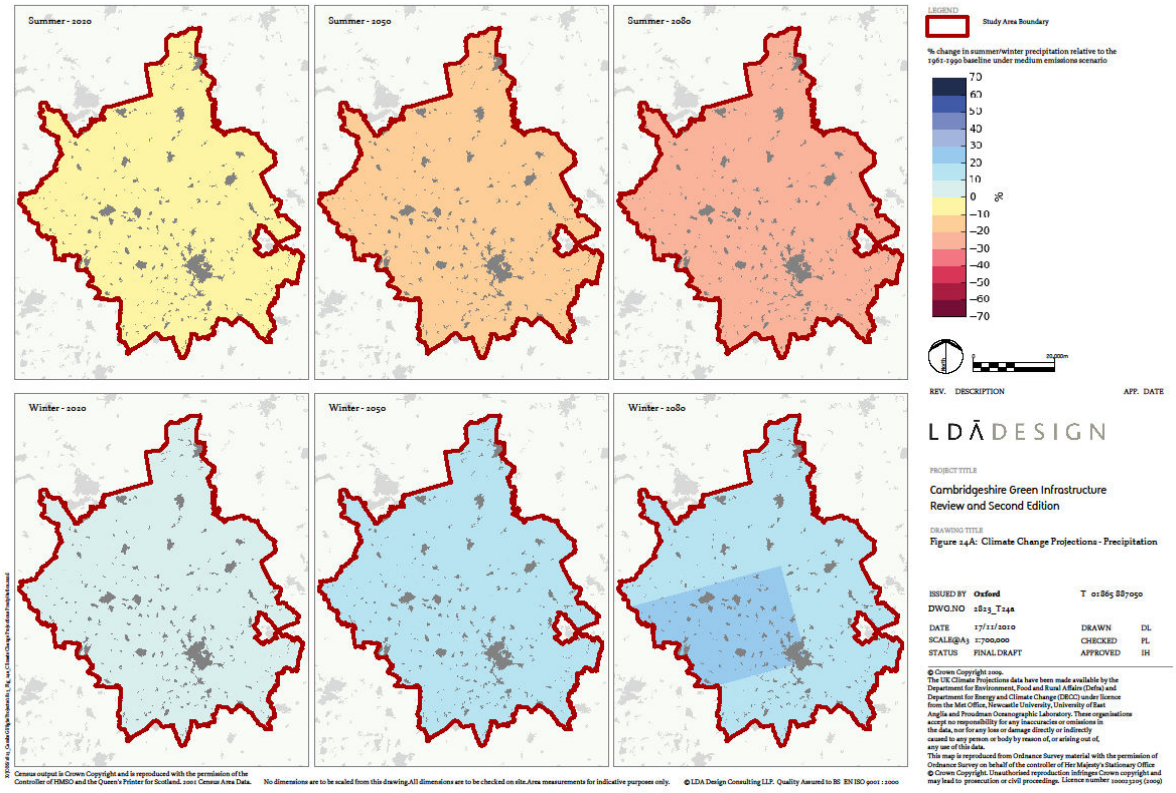

Figure 6.1 Climate Change projections - precipitation

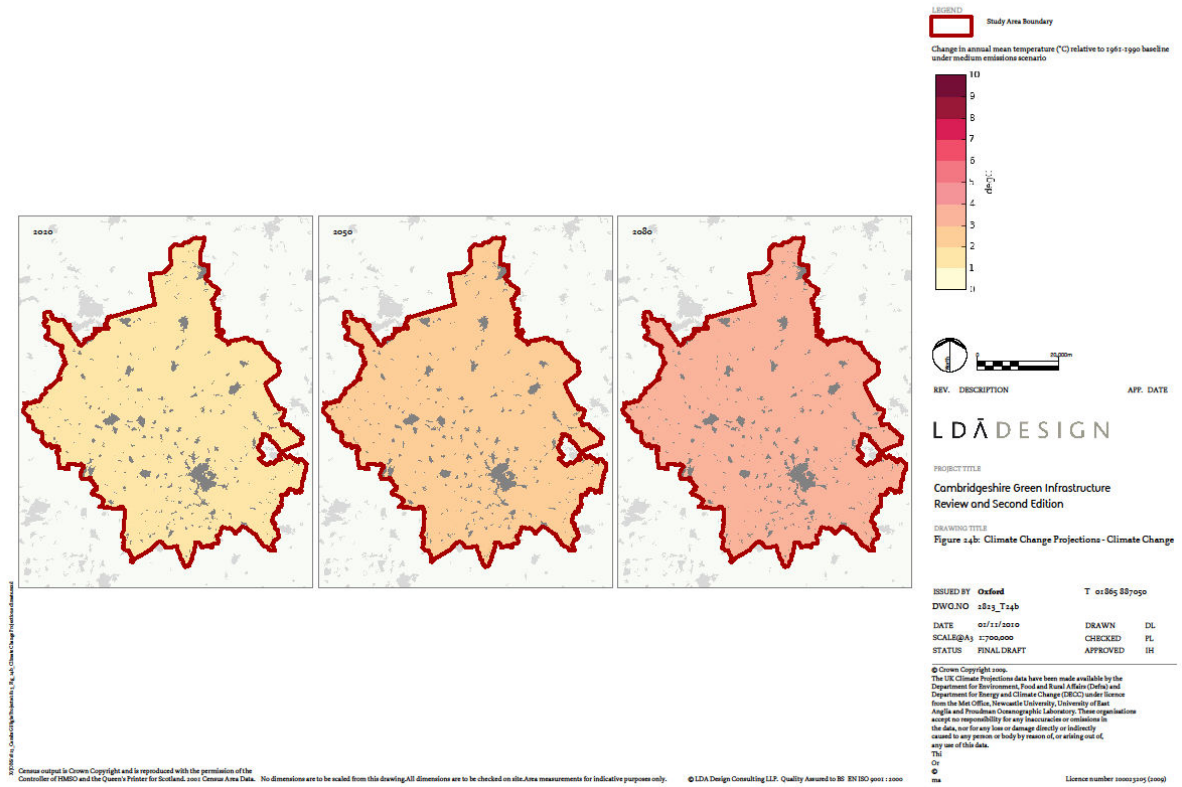

Figure 6.2 Climate Change projections – Climate Change

The level of future climate impacts will ultimately vary according to the success of global efforts to reduce greenhouse gas emissions[4]. However, the national UK Climate Projections database can highlight some of the likely anticipated changes to help inform future decision making. Within the East of England, the following scenarios can be expected (data shown in Table 6.2 at end of Appendix):

- **Hotter, drier summers**: average summer temperatures are likely to increase by around 2.5 degrees centigrade (ranging between 1.2 and 4.3 degrees), whilst summer rainfall will reduce by around 17% (ranging from -38% to +6%)
- **Milder, wetter winters**: average winter temperatures will increase by around 2.2 degrees centigrade (ranging from 1.1 to 4.1 degrees) whilst average winter rainfall will increase by around 14% (but may range from 3 to 31%)
- **More frequent extreme weather events:** temperatures on the warmest day of the year may increase by around 2.2 degrees centigrade (although could increase by up to 6.9 degrees). Rainfall on the wettest day of the year may increase by around 14% (although this may range between 2% and 30%)
- **Rising sea levels:** mean sea level is expected to rise by around 22cm by the 2050s

[4] Carbon dioxide equivalents: Emissions of other greenhouse gases (e.g. Nitrous oxide and Methane) are often expressed in terms of CO_2 equivalent. This is the number of tonnes of CO_2 that would have the equivalent warming effect. Use of CO_2equivalents allows a measure of consistency when comparing emissions of varying greenhouse gases.

Woodland/Ancient Woodland & English Woodland Grant Scheme (EWGS)[5] Target/Priority Areas:

Woodland is an important component of Green Infrastructure, providing biodiversity, habitat, landscape and recreational benefits. Woodland can also help with mitigating and adapting to climate change. The creation of new woodland and appropriate management of existing woods can capture and store carbon, albeit not as effectively as other forms of carbon capture, such as peat creation. Well-managed woodland can also provided a more renewable source of energy through wood-fuel production.

The English Woodland Grant Scheme (EWGS) provides grant support for landowners wanting to create new woodland and carry out sustainable woodland management, particularly where it protects and enhances the woodland's environmental or social value.

Figure 6.3 tells us where there are current opportunities to manage woodland more effectively and grow more woodland to secure carbon reductions and for fuel supply in Cambridgeshire. The distribution of woodlands is also important their role storing and slowing down water run off as part of the adaptation to climate change.

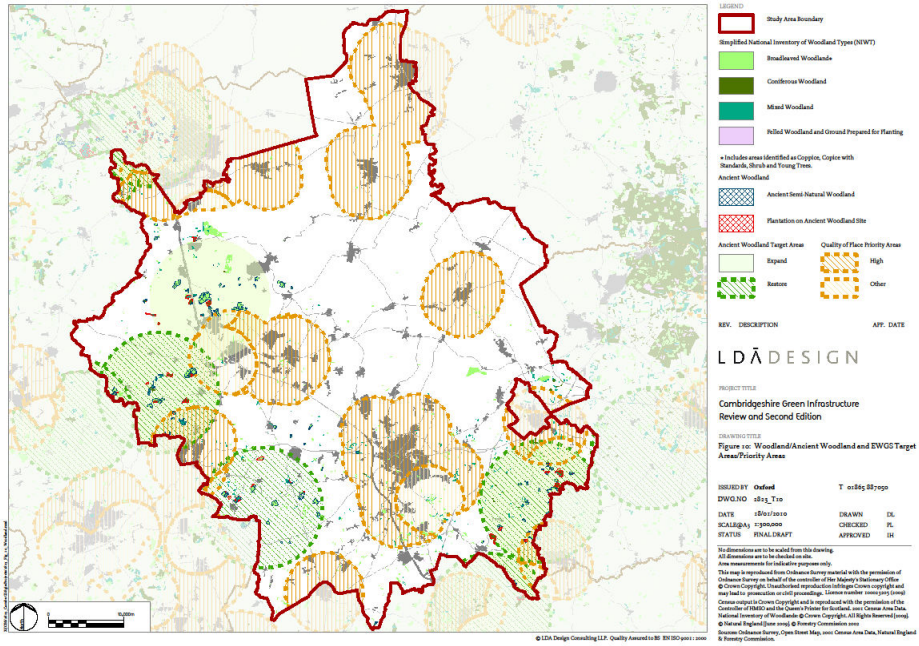

Figure 6.3 Woodland/Ancient Woodland and EWGS Target Areas/Priority Areas

[5] http://www.forestry.gov.uk/ewgs

Landscape Character Areas

Broad landscape areas can help indicate where peat restoration could take place e.g. Fenlands. These are likely to be the most appropriate locations for land uses that can capture and store carbon. Peat restoration can provide significant capture and storage benefits.

Figure 6.4 identifies for Cambridgeshire where peat restoration and carbon capture and storage can be considered.

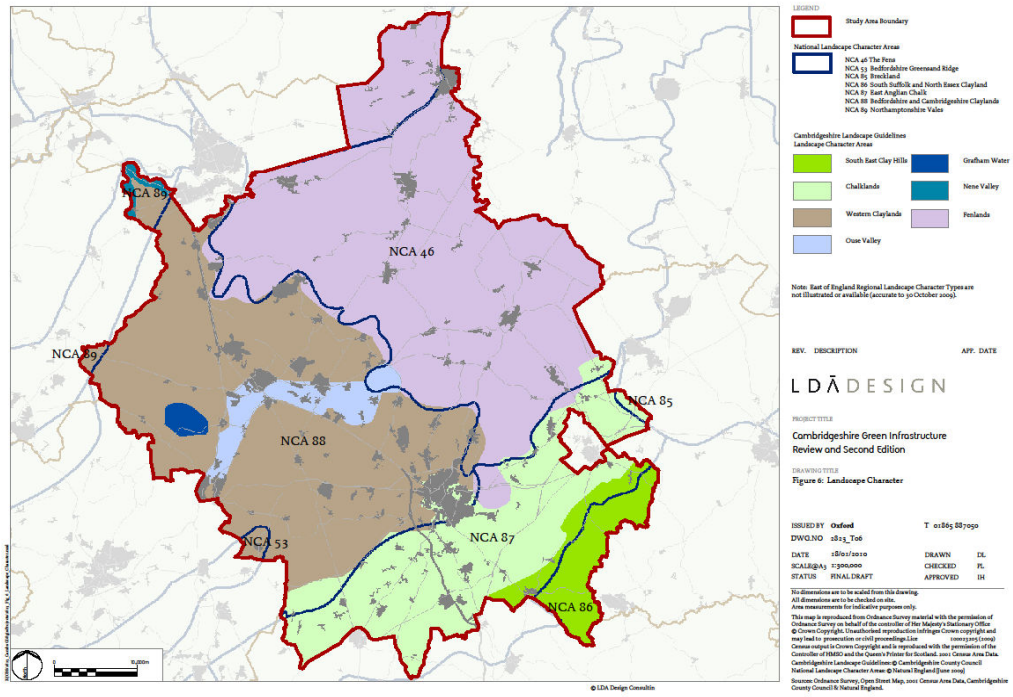

Figure 6.4 Landscape Character

Strategic Flood Risk Maps

Climate change predictions indicate an increase in flood risk and flooding. Much of the north of county is low lying and it is estimated by the Environment Agency, that 23% of the area of Cambridgeshire is at risk of 1 in 100 year flood events from rivers in the absence of flood defences.

Habitats such as flood meadows, water bodies such as old gravel workings, wet woodland and wet grassland can help store water and reduce flood risk and the severity of flood events. Figure 6.5 shows the areas most at risk from flooding and where these habitats may already exist or new habitats could be created.

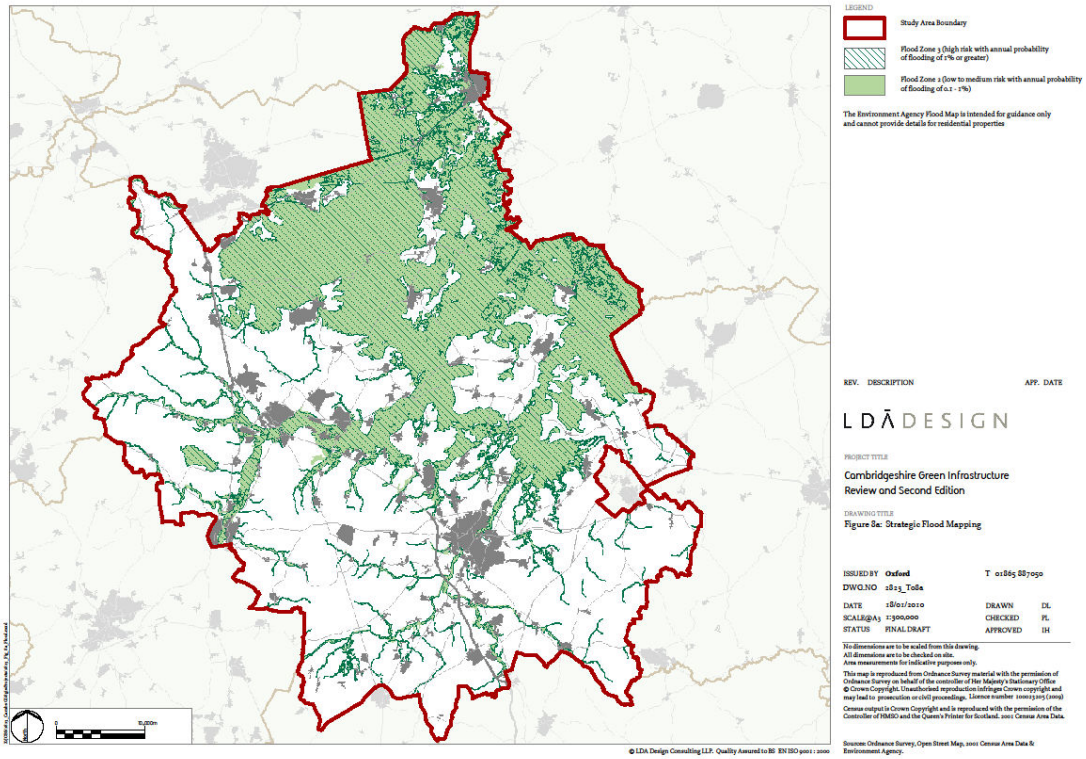

Figure 6.5 Strategic flood mapping

Woodland and fen habitat sites and Biodiversity Reservoirs

Figures 6.6 and 6.7 identify the location of existing habitats and show where it would be more appropriate to undertake woodland planting and management, and peat restoration to link to and enhance these existing habitats.

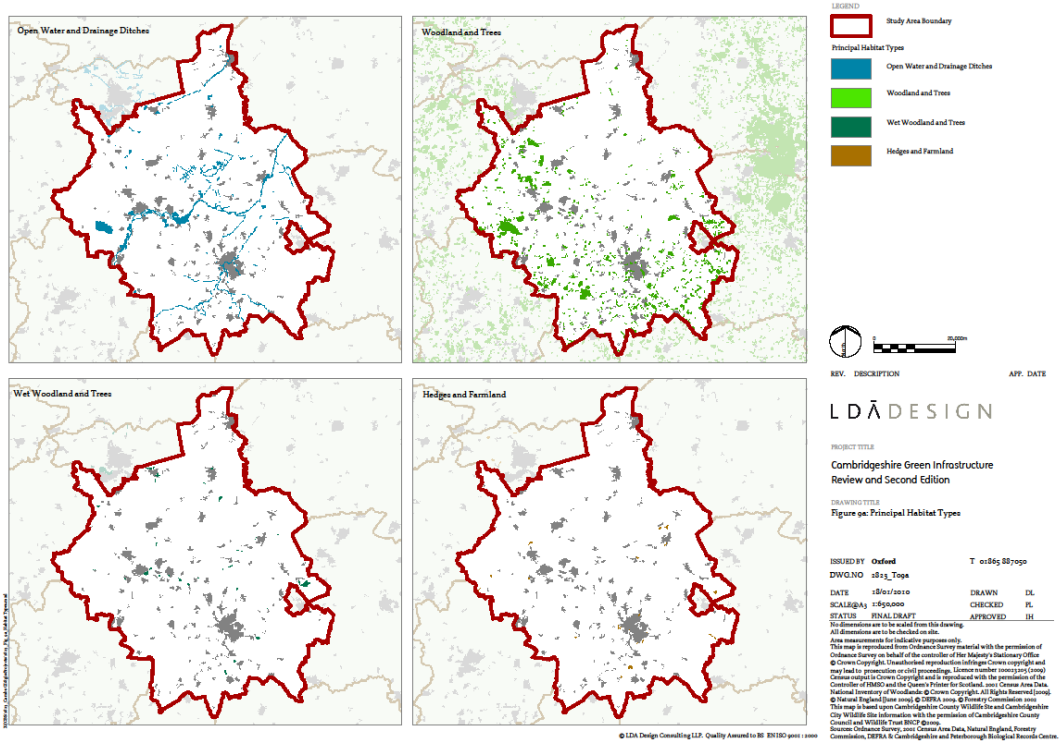

Figure 6.6 Principle habitat types

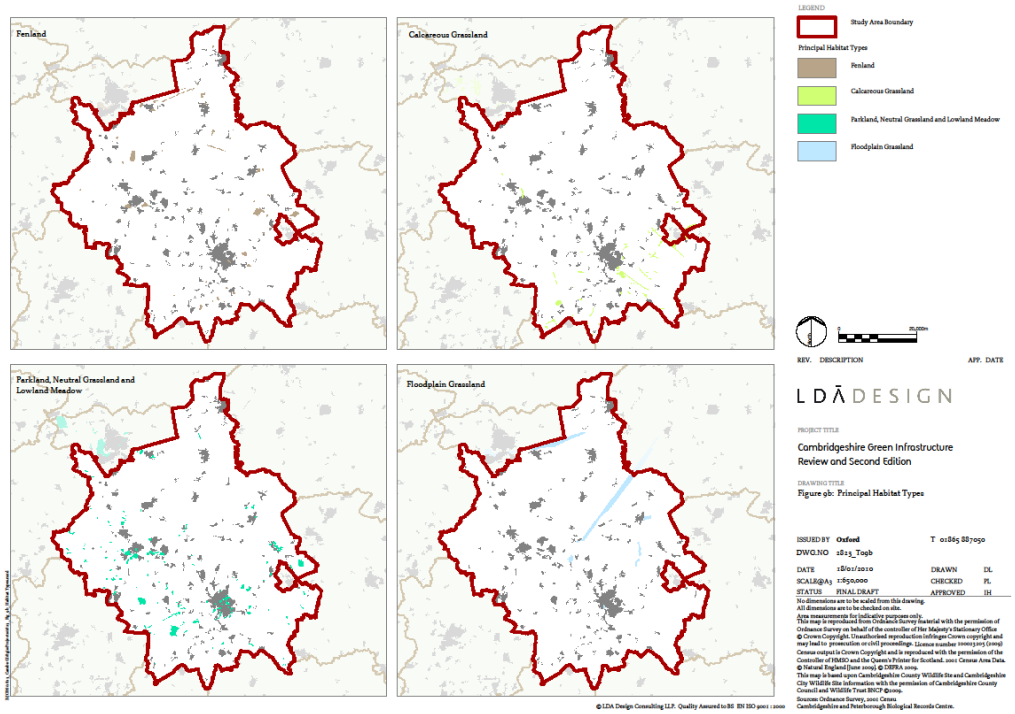

Figure 6.7 Principle habitat types

The Cambridgeshire and Peterborough Biodiversity Partnership have identified areas for large-scale habitat creation to support Biodiversity Action Plan habitats and species – reflecting in part the location of existing habitats. The Wildlife Trust has also identified similar areas called 'living landscapes'. Figure 6.8 highlights areas for woodland creation and peat restoration and allows the identification of broad areas for carbon capture and storage and wood fuel production

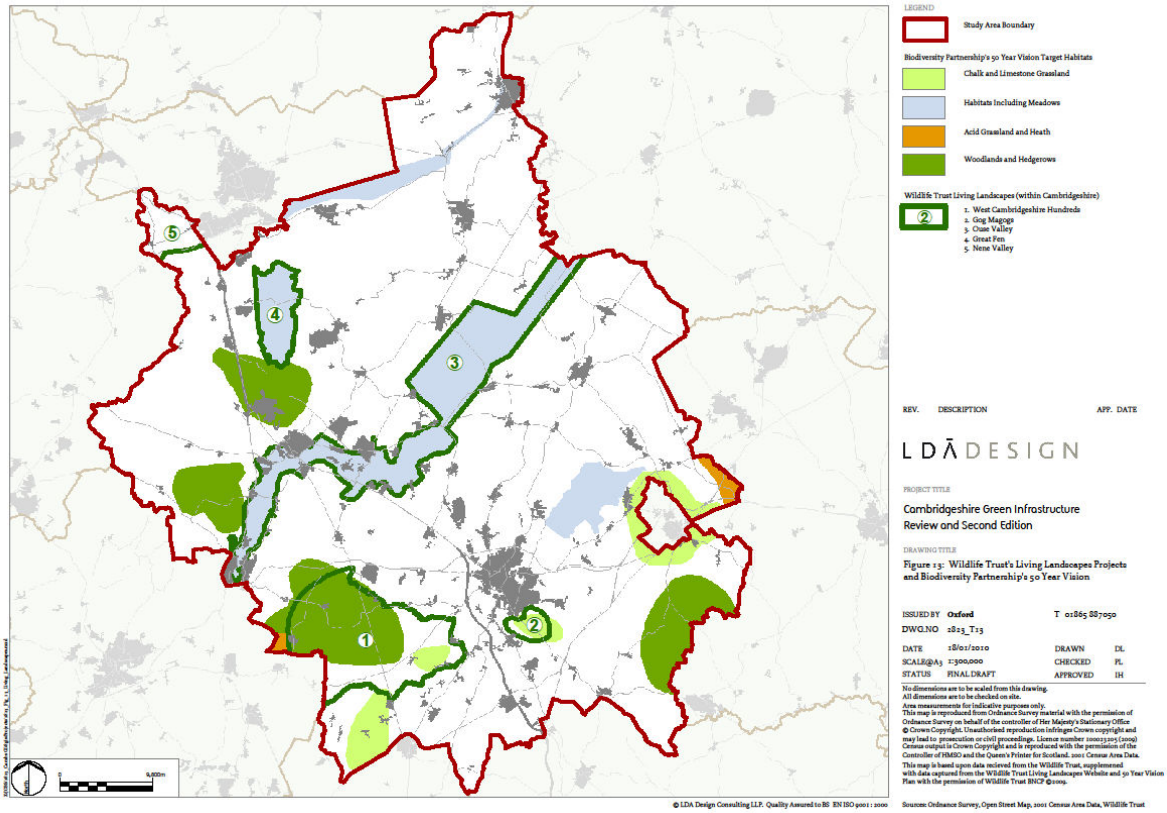

Figure 6.8 Wildlife Trust's Living Landscape projects and Biodiversity Partnership's 50 Year Vision

Main Urban Areas

Climate change predictions indicate an increase in summer temperatures. These can be particularly noticeable in urban areas, where the built environment increases temperatures and hold heat for longer than in rural/natural areas. This 'urban heat island' effect can have significant impacts of people's health and wellbeing.

Figure 6.9 shows the larger settlements within Cambridgeshire and the main urban centres where the heat island effect is likely to be most significant.

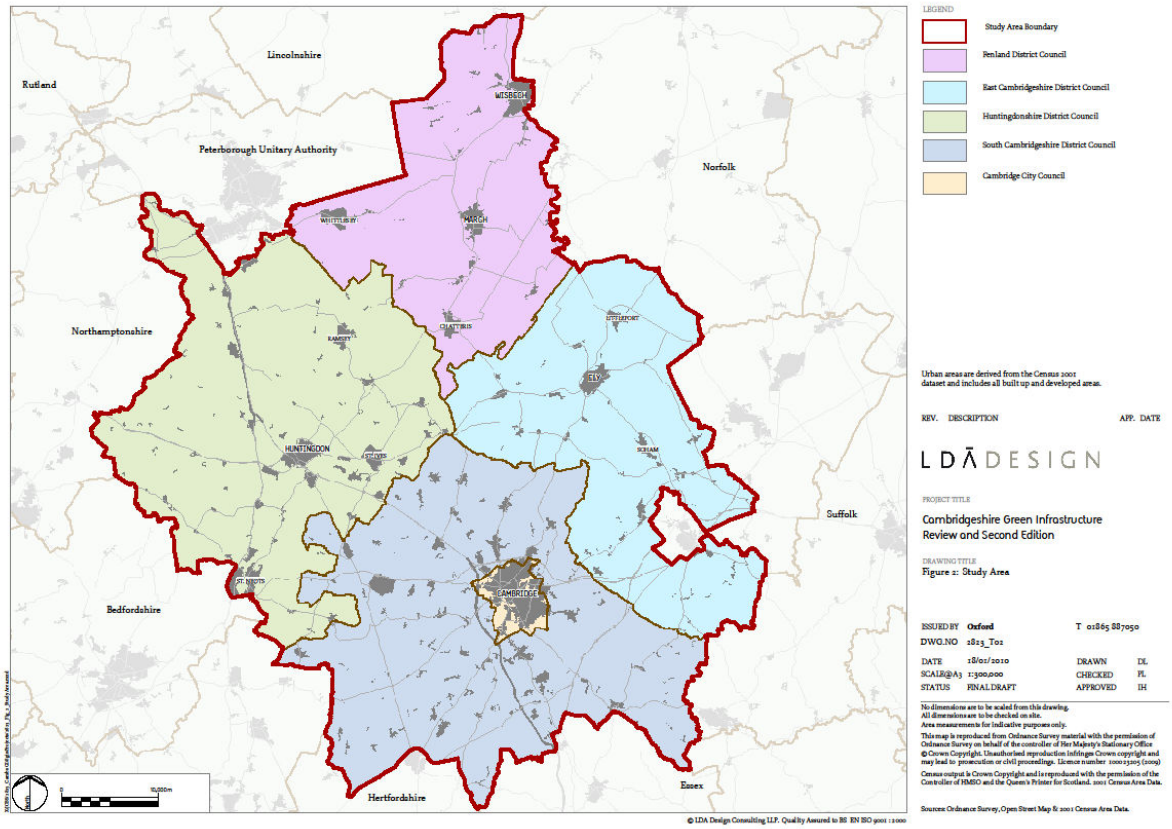

Figure 6.9 Study Areas within Cambridgeshire

Air Quality Management Areas

Poor air quality affects people's health and can be exacerbated by the impacts of climate change – in particular, extreme summer events such as heat waves.

Air quality management areas (AQMAs) are designated where air quality is poor to enable action to be taken to improve air quality. Those living and working within AQMAs may be detrimentally affected by the impacts of poor air quality. Green Infrastructure, particularly tree planting, can help alleviate air pollution. AQMAs can be used to identify areas where Green Infrastructure can help mitigate the impacts of air pollution. Figure 6.10 presents environmental quality data (surface water quality and air quality).

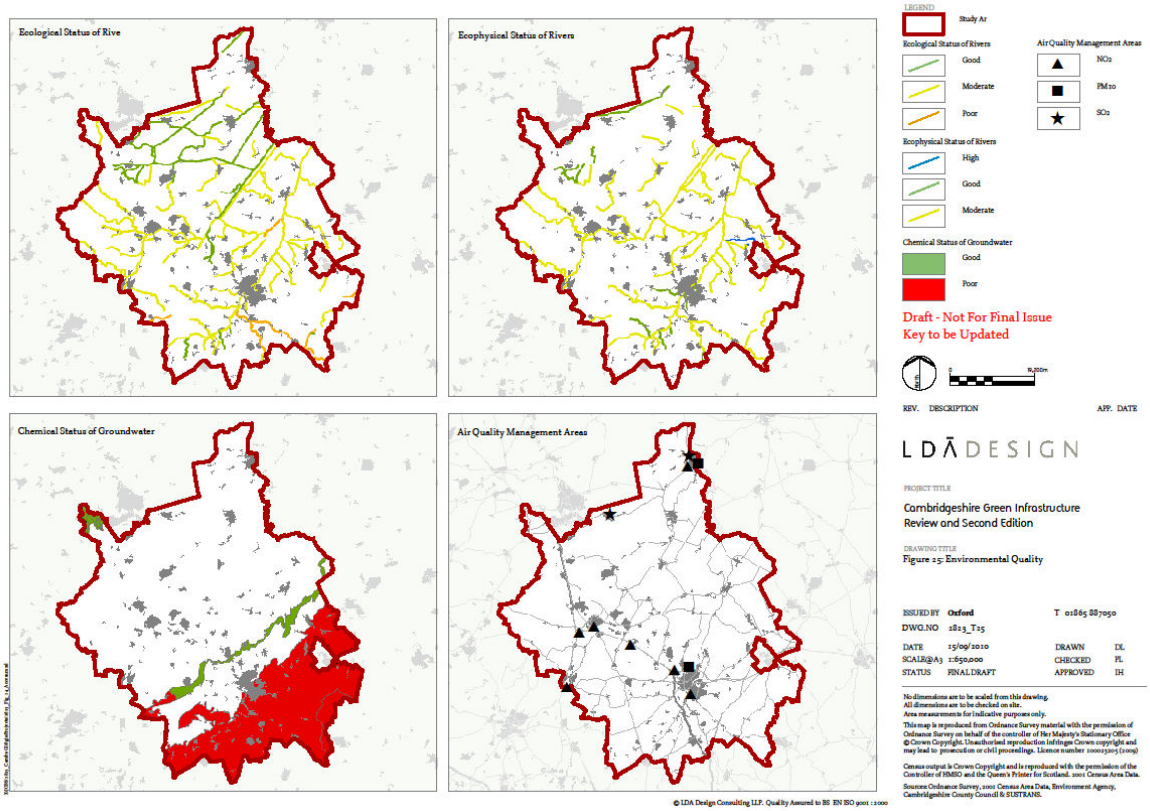

Figure 6.10 Environmental Quality

2 What this information tells us

Cambridgeshire is within a particularly dry part of the country.

Changes in weather patterns such as summer conditions are likely to exacerbate potential drought problems with widespread impacts on native woodlands, habitat persistence and agricultural productivity. By contrast, much of the north of county is low lying and is at risk of flooding.

Changes as small as a 2°C global temperature rise will have serious impacts:

- Rising sea levels
- Extreme events such as droughts and heavy rainfall, leading to disruption to natural and man-made habitats.
- Communities across the UK may struggle to cope with the effects of warmer summers and wetter winters.

Growth and development will serve to further exacerbate the potential human and economic impacts.

There are opportunities to:

- undertake woodland planting and management (including ancient woodland) with potential for wood fuel production,
- provide existing large-scale peat restoration or appropriate habitat creation schemes, which could help to further research into the costs and benefits of carbon capture and storage through peat restoration;
- mitigate against increased flood risk through appropriate habitat creation or management;
- Provide areas for woodland creation and woodland habitats;
- to reduce heat island effect
- to help mitigate air pollution

3 Spatial Analysis

Further mapping enables identification of these opportunities and the development of one climate change theme map. Figures 6.11 and 6.12 indicate areas where Green Infrastructure could

- Militate against increased flood risk through appropriate habitat creation or management.
- Could provide large-scale peat restoration or appropriate habitat creation schemes.
- Enable woodland creation and enhance principle woodland habitats (including ancient woodland) including through management and potential wood fuel production
- Reduce heat island effect in urban areas.
- Help improve air quality

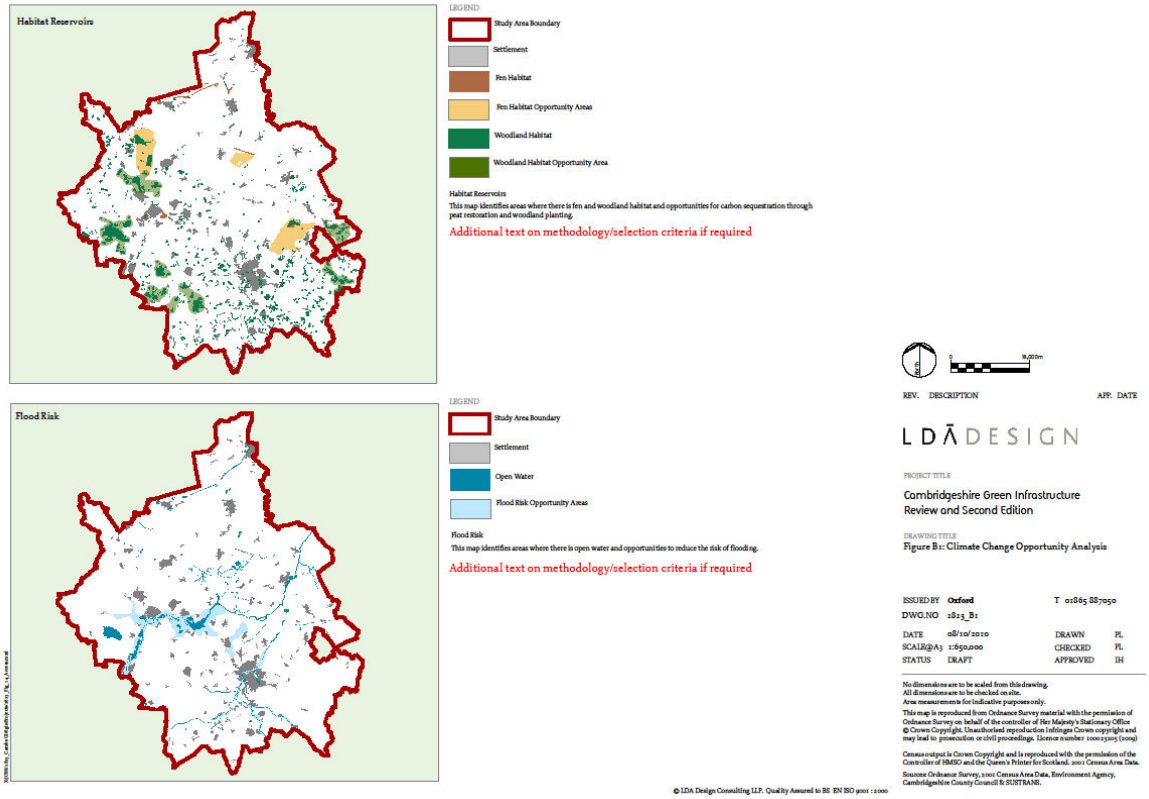

Figure 6.11 Climate Change opportunity analysis

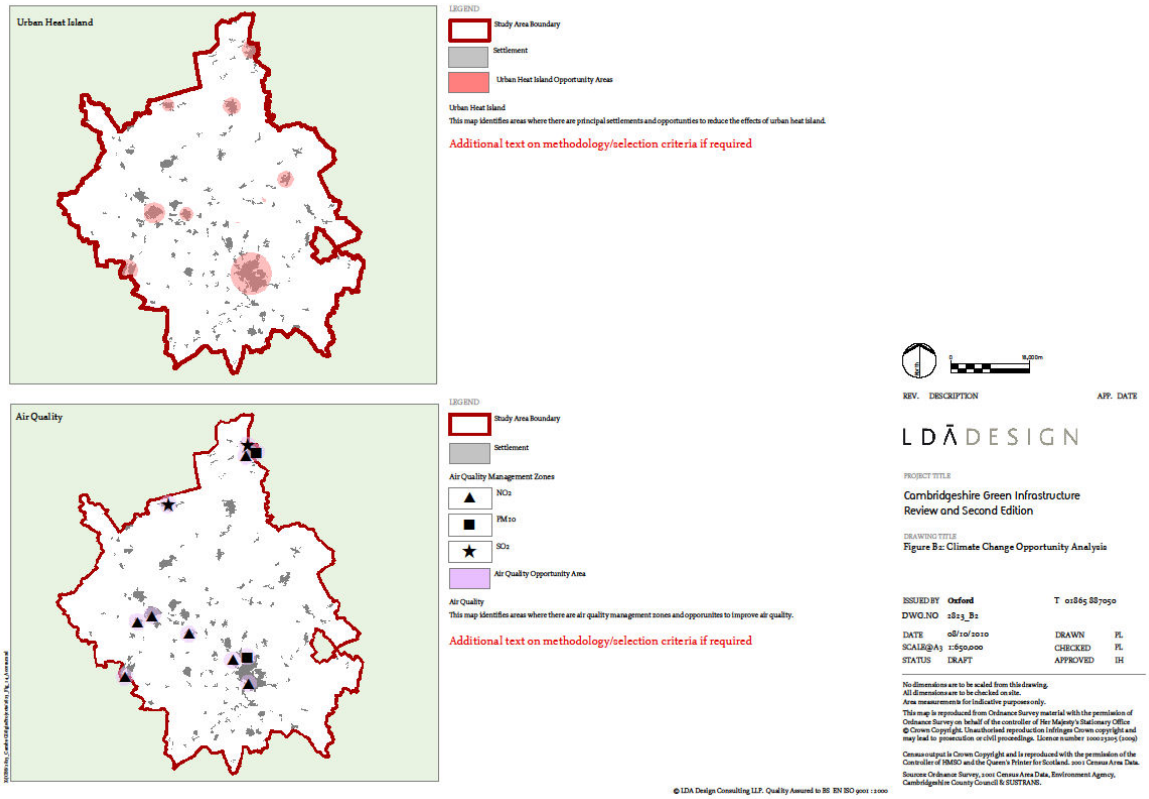

Figure 6.12 Climate change opportunity analysis

By bringing all these together the Climate Change Theme Figure 6.13 was developed.

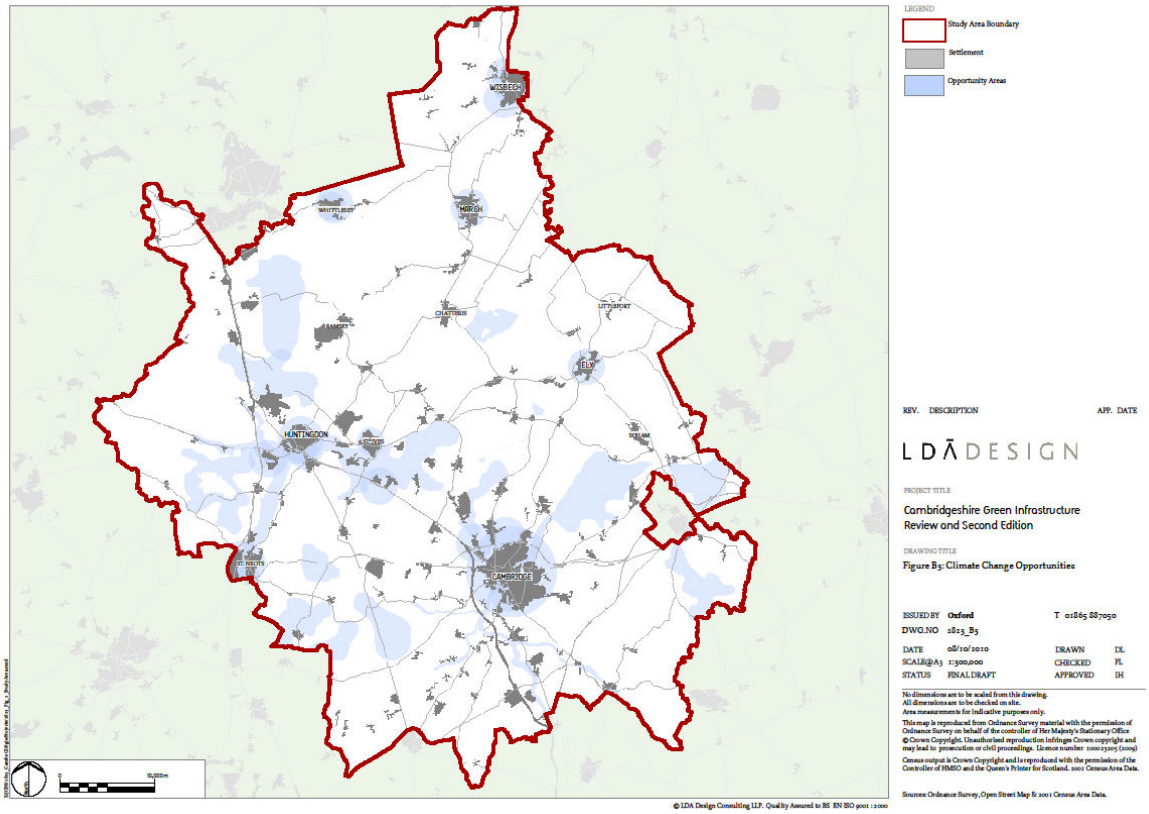

Figure 6.13 Climate change opportunities

4 Green Infrastructure and Climate Change opportunities

This section will identify:

- The Issues and Opportunities for Climate Change Mitigation
- The Issues and Opportunities for Climate Change Adaptation

The Issues and Opportunities for Climate Change Mitigation

Climate Change mitigation is the reduction of CO2 emissions and greenhouse gases into the atmosphere. The mitigation measures considered for Cambridgeshire include:

- Carbon sequestration
- Supply of wood fuel
- Sustainable transport and reducing the need to travel

Carbon Sequestration

This is the capture and storage of carbon emissions through woodland and peat.
The Cambridgeshire GI Strategy can help ensure that the release of carbon is minimised and that carbon 'sinks' are created in areas where natural geography and land use allows. The continued management of land uses so they continue to act as carbon stores should be protected and enhanced where appropriate. There is also potential to explore opportunities for "offsetting" the carbon emissions of new developments by increasing carbon stored through Green Infrastructure in key opportunity areas identified in Cambridgeshire.

In the U.K. soils contain more carbon than vegetation, and different soil types have different carbon components (for example peat stores more carbon than sand). Different types of vegetation also store different amounts of carbon, with, for example, forests generally having significantly higher above ground carbon reservoirs than other vegetation types. Depending on their nature, land use change and/or management practices can lead to increases or decreases in the amount of carbon stored in both soils and vegetation.

Peat bogs act as an important carbon sink – and are deemed the single most important soil type for carbon storage.[6] Within the UK, peat lands contain more than half of total UK soil carbon, but many are under threat from activities including cultivation, drainage, burning and extraction (for use in horticulture or for fuel). Within East Anglia, the average rates of peat loss in the Fens are around 1.5 cm per year. Natural England estimates that in their current state, English peat lands are responsible for the emission of ~3 million tonnes of CO_2-equivalent a year, which is a similar to emissions from around a third of a million British households.

[6] Natural England (2010) England's peat lands: Carbon storage and greenhouse gases
http://naturalengland.etraderstores.com/NaturalEnglandShop/NE257

Trees and woodlands play an important role in balancing the cycle of greenhouse gases, particularly carbon dioxide, by acting as carbon reservoirs (storing carbon in biomass, litter and soils). The Read Report (2009)[7], produced on behalf of the Forestry Commission, suggests that actively growing woodland in the UK sequester on average three tonnes of carbon (equivalent to 11 tonnes of CO_2) per hectare, per year. Various activities can be employed to influence the uptake of CO_2 in woodlands, including sustainable harvesting; increasing the forest carbon stored per unit area through forestry management measures (such as longer rotations and increased tree stocking densities), and extending the time over which harvested wood remains in use.

Supply of Wood fuel

Substituting fossil fuels for renewable wood fuel supply will support the reduction of CO_2 emitted. Establishing sources of renewable energy such as wood fuel in appropriate locations should also be a priority of Green Infrastructure.

Sustainable transport and reducing the need to travel

Promoting the opportunities to walk, cycle and use public transport to move around Cambridgeshire through a green and sustainable transport network will help reduce carbon emissions. This includes identifying gaps in the existing rights of way network to ensure people can get to where they want to go. The protection of high quality recreational assets close to where people live the creation of new assets as part of new development that reduce the need to travel by car.

In addition, helping to reduce 'food miles' through supporting initiatives that promote local food production/ markets such as farm shops, community gardens and/or orchards close to where people live. Green Infrastructure provision should seek to ensure that the best and most versatile land is protected and maintained in agricultural land uses. It may also be possible, through advice and guidance, to promote soil management and farming practices that reduce greenhouse gas emissions, such as organic/ low tillage.

Climate Change Adaptation

Adaptation recognises that there are now some inevitable climate change implications, which need to be addressed. The role Green Infrastructure in climate change adaptation is perhaps more significant that it is in mitigation.
The key areas of adaptation include:

- Urban Heat Island Effect
- Flood risk management
- Habitat creation

Urban Heat Island Effect

[7] Read Report (2009) http://www.forestry.gov.uk/forestry/infd-7y4gn9

The GI Strategy has the potential to moderate urban heat island effects, especially in densely built up areas such as Cambridge, through the protection, management and planning of green and blue space and sensitive tree planting. Consideration should also be given to maintaining Green Infrastructure assets, such as river corridors or Sustainable Urban Drainage (SUDS), that encourage air flow into and through urban areas, and woodland that can filter out air pollutants.

Flood Risk management

The GI Strategy can reduce the impacts of flood risk through the restoration of natural flood plains along river valleys, creating strategic flood storage areas, and delivering Sustainable Drainage Systems (SUDS) as part of development proposals. Such an approach will support the Governments strategy 'Making Space for Water'[8], which proposes a whole catchment approach in order to take better account of the environmental and social consequences of flood risk. Within this, the promotion of green roofs planting of trees, permeable paving and rainwater harvesting also have a role in reducing flood risk and making the most of available water.[9]

Habitat creation

Due to changing weather patterns, there is evidence that certain flora and fauna will need to move northwards to find suitable alternative habitat. The GI Strategy will need to identify opportunities where existing habitats and wildlife sites can be connected to new habitats to fill the gaps in the existing habitat networks. Priority should be given to enhancing north-south habitat connectivity.

Certain flora will also not be able to tolerate changing climatic conditions. The design of new and existing open spaces will need to consider the types of trees and plants that are resilient to a changing climate.

[8] Defra, Making Space for Water: Taking forward a new Government strategy for flood and coastal erosion risk management in England, 2005
[9] Shaw R et. al. Climate Change Adaptation by Design, Town and Country Planning Association, 2007

Table 6.2: Projected changes in climate in the East of England up to the 2080s (relative to the 1961-1990 baselines)

Variable	Emissions Scenario	Range of Change - 2020s			Range of Change - 2050s			Range of Change - 2080s		
		Lower (10%)	Central (50%)	Upper (90%)	Lower (10%)	Central (50%)	Upper (90%)	Lower (10%)	Central (50%)	Upper (90%)
Average Summer Temperature	Low	+1.0°C	+2.4°C	+4.0°C	+1.0°C	+2.4°C	+4.0°C	+1.3°C	+2.7°C	+4.7°C
	Medium	+1.2°C	+2.5°C	+4.3°C	+1.2°C	+2.5°C	+4.3°C	+1.9°C	+3.6°C	+5.9°C
	High	+1.3°C	+2.9°C	+4.8°C	+1.3°C	+2.9°C	+4.8°C	+2.4°C	+4.5°C	+7.5°C
Average Winter Temperature	Low	+0.5°C	+1.3°C	+2.1°C	+0.9°C	+2.0°C	+3.1°C	+1.4°C	+2.6°C	+4.0°C
	Medium	+0.6°C	+1.3°C	+2.2°C	+1.1°C	+2.2°C	3.4°C	+1.6°C	+3.0°C	+4.7°C
	High	+1.0°C	+1.0°C	+2.0°C	+1.4°C	+2.5°C	+3.8°C	+2.0°C	3.7°C	+5.7°C
Temperature on the warmest day of the year	Low	-2.0°C	+1.1°C	+4.3°C	-1.6°C	+2.3°C	+6.7°C	-2.3°C	+2.3°C	+7.7°C
	Medium	-1.9°C	+1.1°C	+4.3°C	-1.6°C	+2.2°C	+6.9°C	-2.1°C	+2.9°C	+9.3°C
	High	-1.7°C	+1.4°C	+4.7°C	-2.0°C	+2.6°C	+8.0°C	-2.2°C	+3.8°C	+11.5°C
Average Summer Precipitation	Low	-21%	-5%	+11%	-33%	-12%	+14%	-35%	-13%	+11%
	Medium	-23%	+6%	+12%	-37%	-16%	+6%	-44%	-20%	+6%
	High	-15%	-3%	+20%	-39%	-17%	+8%	-52%	-26%	+4%
Average Winter Precipitation	Low	-2%	+6%	+16%	+1%	+12%	+26%	-4%	+16%	+34%
	Medium	-2%	+6%	+16%	+3%	+14%	+31%	+4%	+20%	+44%
	High	-1%	+7%	+16%	+3%	+16%	+35%	+52%	+26%	+4%
Rainfall on the wettest day of the year	Low	-6%	+6%	+19%	-0.5%	+12%	+26%	+2%	+16%	+33%
	Medium	-4%	+6%	+17%	+2%	+14%	+30%	+5%	+20%	+41%
	High	-4%	+7%	+21%	+2%	+16%	+33%	+7%	+26%	+53%

Figures quoted in Section in this Appendix.