National Character Area profile:

88. Bedfordshire and Cambridgeshire Claylands

NATURAL ENGLAND

www.naturalengland.org.uk

Introduction

As part of Natural England's responsibilities as set out in the Natural Environment White Paper,[1] Biodiversity 2020[2] and the European Landscape Convention,[3] we are revising profiles for England's 159 National Character Areas (NCAs). These are areas that share similar landscape characteristics, and which follow natural lines in the landscape rather than administrative boundaries, making them a good decision-making framework for the natural environment.

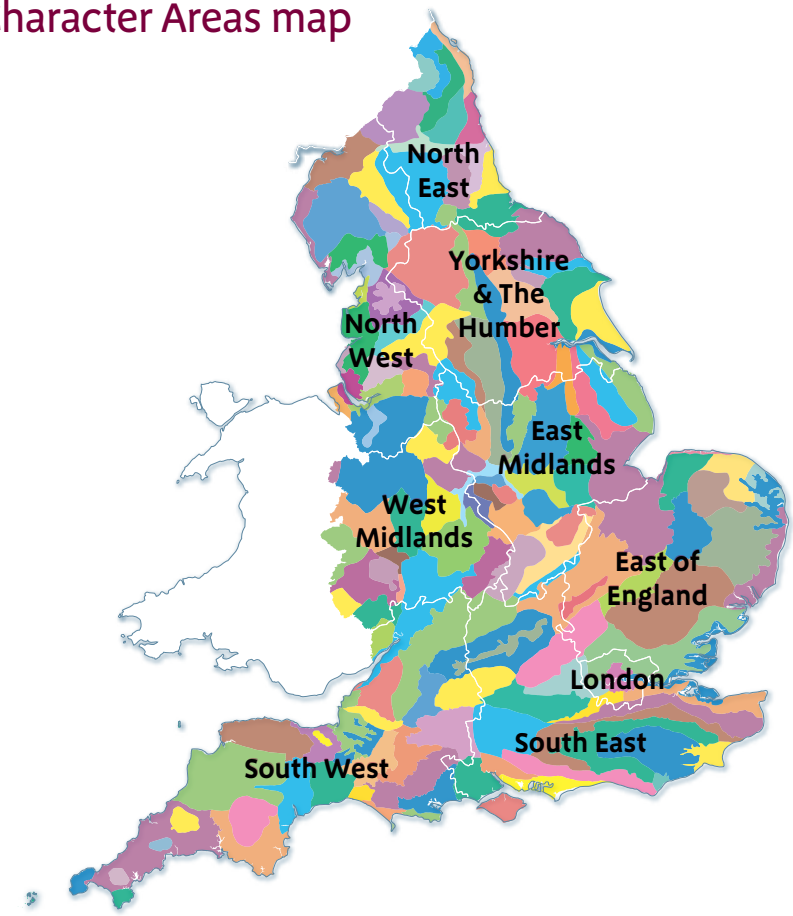
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and encourage broader partnership working through Local Nature Partnerships. The profiles will also help to inform choices about how land is managed and can change.

Each profile includes a description of the natural and cultural features that shape our landscapes, how the landscape has changed over time, the current key drivers for ongoing change, and a broad analysis of each area's characteristics and ecosystem services. Statements of Environmental Opportunity (SEOs) are suggested, which draw on this integrated information. The SEOs offer guidance on the critical issues, which could help to achieve sustainable growth and a more secure environmental future.

NCA profiles are working documents which draw on current evidence and knowledge. We will aim to refresh and update them periodically as new information becomes available to us.

We would like to hear how useful the NCA profiles are to you. You can contact the NCA team by emailing**ncaprofiles@naturalengland.org.uk**.

National Character Areas map



[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: **www.official-documents.gov.uk/document/cm80/8082/8082.pdf**)
[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: **www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf**)
[3] European Landscape Convention, Council of Europe (2000; **URL: http://conventions.coe.int/Treaty/en/Treaties/Html/176.htm**)

Summary

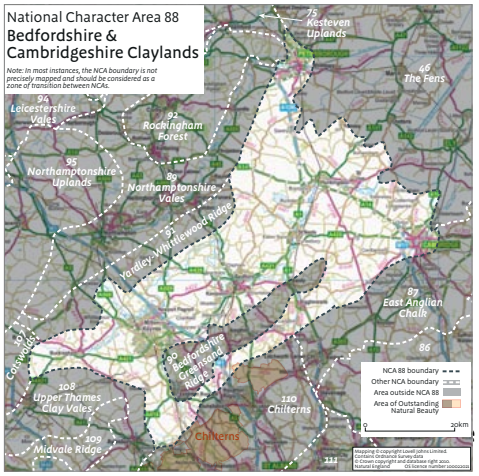
The Bedfordshire and Cambridgeshire Claylands National Character Area (NCA) is a broad, gently undulating, lowland plateau dissected by shallow river valleys that gradually widen as they approach The Fens NCA in the east. Within it, but distinct from it, is the Bedfordshire Greensand Ridge, a contrasting narrow and elevated outcrop of Greensand, with its associated habitats on acidic soils such as grassland, heathland and woodland. Views of the Bedfordshire and Cambridgeshire Claylands NCA and its large-scale arable farmland can be seen in most directions, from the elevated ground of the Yardley Whittlewood Ridge, Bedfordshire Greensand Ridge, East Anglian Chalk and Chilterns NCAs.

The NCA contains the Forest of Marston Vale – one of 12 Community Forests in England – and to the south, around Luton, a small proportion of the Chilterns Area of Outstanding Natural Beauty (AONB). While predominantly an arable and commercially farmed landscape, a wide diversity of semi-natural habitats are also present within the NCA, including a number of internationally important and designated sites that support a range of species – some rare and scarce – and offer opportunities for people to have contact with the natural environment. The River Great Ouse and its tributaries meander slowly and gently across the landscape.

The Marston Vale and Peterborough areas have been subject to extensive clay extraction for brick making. Subsequent restoration has provided opportunities for recreation and biodiversity aided by new woodland planting and other green infrastructure initiatives. Extensive quarrying of sand and gravel within the river valleys has also left its mark with a series of restored and flooded waterbodies that benefit biodiversity and recreation.

The majority of the Bedfordshire and Cambridgeshire Claylands NCA is sparsely populated. Settlements are generally located along the river valleys and more recently along major road and rail corridors. A feeling of urbanisation is brought by the numerous large towns, including Milton Keynes, Bedford, Cambridge, Huntingdon and Peterborough, and major transport routes, including the M1, A1 and A14 and the Midlands and East Coast mainline railways.

Tranquillity within the NCA has declined, affected by visual intrusion, noise and light pollution from agriculture, settlement expansion and improvements in road infrastructure. Mineral extraction and landfill activities, particularly within the Marston Vale and around Peterborough, have affected local tranquillity. Many areas, however, retain a rural feel and there are numerous opportunities for nearby urban communities to enjoy quiet, informal recreation. A sense of place and history provided by the area's rich geology and archaeology as well as historic features such as Stowe House, Wimpole Hall, Wrest Park, Bletchley Park, the Cardington Hangars, the Grand Union Canal and the post-industrial landscapes of the brickfields.



Click map to enlarge; click again to reduce

Key ecosystem services include food provision, including unique genetic diversity found in local varieties of fruit; and the ability of the area's rivers and wetlands to provide water, regulate water quality and flow, as well as providing benefits for biodiversity and recreation. The NCA faces significant challenges around accommodating levels of future growth and managing water resources, both within the NCA and the impacts that this can have further downstream in other NCAs while, at the same time, protecting and enhancing its character and increased demand for leisure and recreation.

View of the Bedfordshire Claylands with Bedfordshire Greensand Ridge in the distance.

Statements of Environmental Opportunities:

- **SEO 1:** Maintain and manage a sustainable and productive claylands arable landscape, while managing, expanding and linking woodlands, hedgerows and other semi-natural habitats to benefit biodiversity, improve soil and water quality, and ameliorate climate change by promoting good agricultural practice.

- **SEO 2:** Protect aquifers and enhance the quality, state and structure of the River Great Ouse, its valley and tributaries, habitats, waterbodies and flood plain by seeking to enhance their ecological, historical and recreational importance while taking into account their contribution to sense of place and regulating water flow, quality and availability.

- **SEO 3:** Plan and create high-quality green infrastructure to help accommodate growth and expansion, linking and enhancing existing semi-natural habitats. Regenerate the post-industrial landscapes of the Marston Vale and Peterborough to improve and create new opportunities for biodiversity, recreation, timber and biomass provision while strengthening sense of place, tranquillity, resilience to climate change, and people's health and wellbeing.

- **SEO 4:** Protect, conserve and enhance the cultural heritage and tranquillity of the Bedfordshire and Cambridgeshire Claylands NCA, including its important geodiversity, archaeology, historic houses, parkland, and Second World War and industrial heritage, by improving interpretation and educational opportunities to increase people's enjoyment and understanding of the landscape.

Description

Physical and functional links to other National Character Areas

The Bedfordshire and Cambridgeshire Claylands National Character Area (NCA) covers most of north and mid Bedfordshire and western Cambridgeshire, and part of east Buckinghamshire and Northamptonshire. The underlying clay geology (shared with the adjacent Upper Thames Clay Vales NCA in the south-west) gives a gently undulating topography that is divided by broad, shallow river valleys that gradually widen as they approach The Fens NCA in the east. These lower-lying claylands completely enclose the Bedfordshire Greensand Ridge NCA. A distinct boundary exists in the east where the Bedfordshire and Cambridgeshire Claylands NCA meets The Fens NCA and to the south where it meets both the elevated East Anglian Chalk NCA and Chilterns NCA. There is more of a gradual transition towards the Upper Thames Clay Vales NCA and Midvale Ridge NCA in the south-west, Yardley Whittlewood Ridge NCA to the north, and Northamptonshire Vales NCA and Leicestershire Vales NCA in the north-west where the River Nene marks the boundary.

The Bedfordshire and Cambridgeshire Claylands NCA contains the nationally designated Forest of Marston Vale Community Forest and a small proportion of the Chilterns Area of Outstanding Natural Beauty (AONB), which lies predominantly in the adjacent Chilterns NCA. Similarly, the NCA partially hosts several internationally and nationally important sites for nature conservation: the Nene Washes, the Ouse Washes and Woodwalton Fen – three Ramsar sites, two Special Protection Areas (SPA) and five Special Areas of Conservation (SAC) that straddle the boundary with The Fens NCA, providing ecological and functional connectivity between these NCAs.

Water is shed to the River Great Ouse and River Nene: both rise in adjacent NCAs, their tributaries passing through the Bedfordshire and Cambridgeshire Claylands NCA to The Fens NCA and out into the Wash estuary. There are several aquifers supplying water for public, agricultural, horticultural, commercial and industrial uses both within the NCA and in adjacent NCAs. Grafham Water, a large manmade reservoir, supplies water to the nearby urban populations of Milton Keynes, Bedford and Northampton. The Grand Union Canal, located in the west of the NCA, flows north–south through Milton Keynes and links the Yardley Whittlewood Ridge, Bedfordshire Greensand Ridge and the Chilterns NCAs.

There are views of large-scale arable farmland across the lowland plateau in most directions and particularly from the elevated ground of the Yardley Whittlewood Ridge, Bedfordshire Greensand Ridge, East Anglian Chalk and Chilterns NCAs. Equally, the lower-lying claylands provide reciprocating views.

The NCA contains several major towns, including Milton Keynes, Bedford, Cambridge, Huntingdon and Peterborough, and is crossed by numerous roads. Major transport routes include the M1, M11, A1 and A14, and the Midlands and East Coast mainline railways. The NCA offers numerous quiet recreational opportunities for nearby urban communities, including site-based woodland and water-based activities, two National Cycle Routes and an extensive rights-of-way network.

Distinct areas

- Post-industrial landscapes of the Marston Vale and Peterborough brickfields
- Great Ouse river valley

Key characteristics

- Gently undulating, lowland plateau divided by shallow river valleys that gradually widen as they approach The Fens NCA in the east.
- Underlying geology of Jurassic and Cretaceous clays overlain by more recent Quaternary glacial deposits of chalky boulder clay (till) and sand and gravel river terrace deposits within the river valleys. Lime-rich, loamy and clayey soils with impeded drainage predominate, with better-drained soils in the river valleys.
- The River Great Ouse and its tributaries meander slowly across the landscape, and the River Nene and the Grand Union Canal are also features. Three aquifers underlie the NCA and a large manmade reservoir, Grafham Water, supplies water within and outside the NCA.
- Brickfields of the Marston Vale and Peterborough area form distinctive post-industrial landscapes with man-made waterbodies and landfill sites. Restoration of sand and gravel workings has left a series of flooded and restored waterbodies within the river valleys.
- Variable, scattered woodland cover comprising smaller plantations, secondary woodland, pollarded willows and poplar along river valleys, and clusters of ancient woodland, particularly on higher ground to the north-west representing remnant ancient deer parks and Royal Hunting Forests.
- Predominantly open, arable landscape of planned and regular fields bounded by open ditches and trimmed, often species-poor hedgerows which contrast with those fields that are irregular and piecemeal.
- Wide variety of semi-natural habitats supporting a range of species – some notably rare and scarce – including sites designated for species associated with ancient woodland, wetland sites important for birds, great crested newt and species of stonewort, and traditional orchards and unimproved grassland supporting a rich diversity of wild flowers.
- Rich geological and archaeological history evident in fossils, medieval earthworks, deserted villages and Roman roads. A number of historic parklands, designed landscapes and country houses – including Stowe House and Park, Kimbolton Park, Croxton Park, Wimpole Hall and Wrest Park – combine with Bletchley Park, Second World War airfields, the Cardington Airship Hangars and brickfields to provide a strong sense of history and place.
- Diversity of building materials including brick, render, thatch and stone. Locally quarried limestone features in villages such as Lavendon, Harrold and Turvey on the upper stretches of the River Great Ouse.
- Settlements cluster around major road and rail corridors, with smaller towns, villages and linear settlements widely dispersed throughout, giving a more rural feel. Small villages are usually nucleated around a church or village green, while fen-edge villages are often in a linear form along roads.
- Major transport routes cross the area, including the M1, M11, A1, A6, A5 and A14 roads, the East Coast and Midlands mainline railways, and the Grand Union Canal.
- Recreational assets include Grafham Water, the Grand Union Canal, Forest of Marston Vale Community Forest, Chilterns AONB, woodland and wetland sites, an extensive rights-of-way network and two National Cycle Routes. The cities of Cambridge and Peterborough and several of the historic market towns in the NCA are popular tourist destinations.

Bedfordshire and Cambridgeshire Claylands today

The Bedfordshire and Cambridgeshire Claylands NCA is a broad, gently undulating, lowland plateau dissected by shallow river valleys. Within it is the Bedfordshire Greensand Ridge NCA, a contrasting narrow and elevated outcrop of Greensand that supports habitats associated with acidic soils. The Bedfordshire Greensand Ridge and other higher ground offer views of the large-scale arable farmland of the Bedfordshire and Cambridgeshire Claylands NCA in all directions.

The claylands are underlain by flat to very gently dipping Jurassic (including Oxford Clay) and Cretaceous clay sediments. These are predominantly clay with occasional locally prominent limestones such as Blisworth Limestone and Cornbrash Limestone, and more sandy sediments such as Kellaways Sand. Throughout much of the NCA this underlying geology is covered by Quaternary glacial and fluvial deposits, including boulder clay or till and river terrace sands and gravels. The sediments and deposits are rich in fossils and the Oxford Clay is renowned for being the local source of clay for the brick-making industries of Peterborough and the Marston Vale. The soils are moderately fertile and permeable, and the majority are lime-rich, loamy and clayey. More fertile and free-draining soils occur in the river valleys.

The clay plateau is slightly elevated in the west and dissected by the upper reaches of the River Great Ouse, giving rise to better-drained soils derived from the underlying Jurassic limestone of the adjacent Yardley Whittlewood Ridge NCA. Many of the river valleys have well-drained soils over alluvium and river terrace gravels that have been extracted by the aggregate industry as source material for the construction industry. The brick-making properties of the Jurassic Oxford Clay in the Peterborough and Marston Vale areas have created a distinct post-industrial landscape of waterbodies ranging in size from small field ponds and marshy areas to huge lakes that are important for birds, amphibians, invertebrates and stoneworts.

The source of the River Great Ouse is located to the north of Brackley (just within the adjacent Yardley Whittlewood Ridge NCA). Flowing in an easterly direction, the Great Ouse meanders gently in characteristic broad loops through Buckinghamshire, around the northern edge of Milton Keynes and onwards

The River Great Ouse meanders slowly and gently across the landscape in a broad shallow floodplain.

through an enclosed landscape of watermeadows and attractive limestone villages towards Bedford and on into Cambridgeshire. The River Ouzel joins at Newport Pagnell, the River Ivel near Sandy, and the River Kym upstream of Huntingdon. The valley is lined by riparian habitats and trees such as alder, poplar and willow. The surrounding area is predominantly arable farmland with some pasture grazed by sheep and cattle. The river valleys feel enclosed in their upper reaches and broaden gradually as they approach The Fens NCA.

The rivers are generally slow flowing, in shallow, broad valleys of significant ecological value containing distinctive vegetation not common in, and in contrast to, the surrounding arable landscape, including flood plain grazing marsh, lowland meadow, wet woodland, fens and reedbeds. These habitats are important for rare and scarce flora and fauna such as wetland birds and invertebrates. Portholme Meadow Site of Special Scientific Interest (SSSI) and SAC, Cambridgeshire, for example, represents one of the largest remaining areas of lowland flood plain meadow in the country.

Along much of its length, the valley is flanked by large areas of open water, a legacy of mineral extraction (sand, gravel and, in parts of its upper reaches, limestone). The natural regeneration and restoration of mineral extraction sites have created new landscape features that are important recreational and biodiversity resources. Examples include Emberton Country Park in Buckinghamshire; Harrold-Odell Country Park, Felmersham Gravel Pits SSSI, and Priory Country Park in Bedfordshire; and Little Paxton Pits and Fen Drayton Lakes in Cambridgeshire.

In the south the Grand Union Canal, with its mills (for example, at Wolverton), series of locks, weirs and pollarded trees, provides distinctive character. It continues southwards through Milton Keynes alongside the River Ouzel as it passes through a series of linear parks and amenity lakes. Grafham Water, to the south-west of Huntingdon, is one of the largest manmade reservoirs in England. Surrounded by arable fields and scattered woodland, it is important for strategic water supply, water-based recreation and nature conservation.

Woodland cover is generally scattered and sparse. There is a concentration of ancient semi-natural woodland in a band to the north of the NCA between Salcey Forest and Grafham Water on the Northamptonshire/Bedfordshire border – representing remnants of Royal Hunting Forest – and south-west of

Remaining semi-natural ancient woodland supports a range of species.

Locally quarried limestone is used in village buildings like this church in Odell.

Cambridge. Elsewhere woodland survives in numerous, but small and isolated, fragments. Secondary woodland and plantation is evident in the river valleys and as screening for mineral extraction and built development. There are a number of important ancient woodlands designated for their biodiversity interest – such as Marston Thrift, Brampton Wood and Monks Wood – and a significant amount of new woodland planting, particularly within the Forest of Marston Vale, to regenerate the landscape following clay extraction and landfill activities.

The Bedfordshire and Cambridgeshire Claylands NCA has a predominantly arable and intensively farmed landscape, with main crops of winter cereals and oilseed rape. Fields are generally large and rectilinear, typically increasing in size further eastwards. In the west, hedgerows are predominantly of hawthorn, generally intact, with few hedgerow trees of oak and ash. Further east, hedgerows are more species-rich and gappy. Open ditches with infrequent trees also bound some fields and are often under-managed. Within the river valleys, willow and poplar help to emphasise local distinctiveness.

The NCA contains many important sites for nature conservation, although in terms of area it is only a small proportion. There are three Ramsar sites, two SPA, five SAC, three National Nature Reserves (NNRs) and 61 SSSI wholly or partly within the NCA. In addition, a variety of semi-natural, priority habitats support a range of species – some rare and scarce. Those associated with ancient woodland include oxlip, butterflies such as the white admiral and purple and black hairstreaks, the dormouse (re-introduced) and the barbastelle bat. Ancient trees and remaining traditional orchards support specialist invertebrates. Remnant fragments of unimproved grassland support a rich diversity of flora such as the sulphur clover, crested cow-wheat and green-winged orchid. Riparian and wetland habitats provide valuable

habitat and connectivity within the landscape and support populations of breeding and overwintering birds, water vole, otter, great crested newt and rare species of stonewort. The extensive arable landscape supports farmland birds such as the skylark and grey partridge, and the brown hare.

Pre-Roman archaeological remains are concentrated in the Ivel and Great Ouse river valleys. Across the whole NCA, historic features include Roman and medieval settlements, moated manor sites, deserted villages, pockets of ridge and furrow, and ruined or isolated churches – for example, Bushmead Priory. A sense of history is provided by a number of historic houses and parkland estates such as Stowe House, Wrest Park, Kimbolton Park and Croxton Park; the Cardington Hangars (also known as Sheds), the only grouping of extant airship hangars in the UK dating from 1915; Second World War airfields; and the former code-breaking centre at Bletchley Park, which developed within a medieval and Victorian park.

The majority of the NCA is sparsely populated. Settlements are generally located along the river valleys and more recently along road and rail corridors. Small villages are usually nucleated around a church or village green, while fen-edge villages are often in a linear form along roads. A feeling of urbanisation is brought by the numerous large towns and cities (such as Milton Keynes, Cambridge and Peterborough), recent growth and development, and associated road and rail infrastructure improvements. Traditional building materials vary considerably, with localised pockets of materials and styles used. Locally quarried limestone is used in the buildings in villages north of the River Great Ouse whereas clay tile and brick is commonly found to the south and east. Surviving examples of timber-frame buildings and thatch and the occasional use of colour-washed render add to the eclectic nature of the area's building stock.

Tranquillity within the NCA has declined significantly – affected by visual intrusion, noise and light pollution from commercial agriculture, settlement expansion, and improvements in road infrastructure – but it is also variable across the NCA. Strong contrasts exist between greater tranquillity in more rural, inaccessible areas (including sections of the river valleys) and lower tranquillity in areas with a settled, urban and developed feel. Mineral extraction and landfill activities, particularly within the Marston Vale and around Peterborough, have further affected local tranquillity. Once very active, these areas have declined, although there are still some active and worked clay pits, brickworks, landfill sites and large waterbodies – comprising a mosaic of despoiled and restored land among agricultural uses. Four chimney stacks still punctuate the skyline, and landfill in the Marston Vale has left prominent 'domed' landforms. The full extent of these industrial areas is often concealed from public roads, but is more visible from elevated land such as the Greensand Ridge.

Many recreational facilities such as country parks, nature reserves, woodland and wetland sites and Community Forest are located close to the main urban populations. The large towns and cities such as Milton Keynes, Bedford, Huntingdon, Cambridge and Peterborough have green spaces within them and some recently improved green infrastructure links to the wider countryside. The historic cities of Cambridge and Peterborough are popular tourist destinations. The area also offers many opportunities for water-based recreation such as sailing and fishing – for example, at Grafham Water. The Grand Union Canal and the river valley offer opportunities for quiet, informal recreation and facilities for boating, walking, fishing and watching nature. An extensive rights-of-way network and two National Cycle Routes (Routes 51 and 6) provide additional quiet recreation opportunities.

The landscape through time

During the Jurassic and Cretaceous Periods the Bedfordshire and Cambridgeshire Claylands NCA was dominated by marine environments. The oldest rocks, which follow the western margin of the NCA, belong to the shallow marine Blisworth Limestone and are overlain by the estuarine Blisworth Clay. The overlying Cornbrash Limestone (particularly noted for its shallow marine, shelly fossils and corals), Kellaways Clays and Sands show a gradual rise in sea level, leading to the deeper sea that deposited the Oxford Clay which dominates much of the NCA. The Oxford Clay is particularly noted for its fossil marine reptiles, many of which have been found in the brick pits during clay extraction and are today displayed in local museums. Marine environments continued through the Upper Jurassic Period into the Lower Cretaceous (Greensand and Gault Clay) Period. The advance and retreat of ice sheets during the Quaternary Period (over the last 2 million years) has left thick deposits of boulder clay over much of the NCA, influencing the development of the rivers that cross the area and depositing a sequence of sand and gravel river terraces. These contain vertebrate fossils such as mammoth and woolly rhinoceros associated with colder periods, and hippopotamus and elephant linked to warmer interglacial periods.

Prehistoric farmers and Roman settlers farmed the lighter soils in the river valleys of the Great Ouse and Ivel, deterred by the dense woodland and the heavy soils of the clay plateau. Archaeological evidence is abundant in these valleys. Settlements along the river valleys have subsequently grown in size, including the expansion of the first Roman settlements that were at the river crossings at Huntingdon, Godmanchester, St Ives and St Neots. Small villages and historic market towns exist, some tourist destinations in themselves as they contain attractive buildings, including mills and bridges, reflecting the use of the rivers and their valleys as important transport corridors.

During the medieval period improved agricultural practice and a rising population put pressure on the higher, heavier claylands and settlement was extensive, with available land organised into nucleated settlements of hamlets and small villages surrounded by communal fields and common grazing unless run by manorial or ecclesiastical estates. Areas less favourable to arable production remained as woodland. The decline of this farming system accelerated after the Black Death, continued with the increase in the value of sheep pasture and enforced depopulations in the 15th and 16th centuries, and concluded with Parliamentary enclosure in the late 18th and early 19th centuries. Abandoned medieval settlements and structures such as moated sites remain a feature of the landscape, some now protected as Scheduled Monuments. A few pre-1750 farmstead buildings, farmhouses and aisled barns still survive.

Enclosure during the late 18th to mid-19th centuries resulted in the creation of numerous isolated farmsteads, including a significant proportion of brick-built estate farms belonging to wealthy landowners such as the Duke of Bedford. The characteristic, ruler-straight boundaries and medium-scale fields still exist across the area, although many were subsequently subsumed through farm amalgamation and field boundary loss in the late 20th century by commercial arable farming. Several notable historic houses and estates, including Kimbolton Park and Croxton Park, remain. The grandest example is at Wrest Park, Silsoe – the estate of the de Grey family. The French baroque/rococo-style house, built around 1835, is unique in England. The formal gardens comprise canals, pavilions and radiating vistas set within woodland.

Military airfields developed across the plateau from the First World War, some such as Alconbury developing as significant Cold War sites. The hangars at Cardington, dating from the First World War, provide a uniquely important testimony to airship technology in Europe although they are best known for their association with the R101 airship disaster of 1930. They remain a significant and prominent landmark of the Bedfordshire landscape and are still used as a movie set. Bletchley Park developed as a government code-breaking centre in the Second World War, at the centre of a local and international network of other intercept and data-processing stations. Many of the airfields have now naturalised back into the landscape, but others either await further development or thrive today as important technological and military centres and business airports – for example, Alconbury, Cranfield and Thurleigh.

The late 20th century witnessed further landscape change with continued commercial agricultural use and the industrial activity within the brickfields of the Marston Vale and Peterborough. Clay extraction for brick making and associated infrastructure further altered the landscape. Significant landfill took place within the Marston Vale, leaving a restored 'domed' landscape among water-filled pits. New woodland planting, especially within the Forest of Marston Vale, and other regenerative green infrastructure initiatives have created a number of new opportunities for recreation and biodiversity. Extensive quarrying of sand and gravel within the river valleys, not exclusively but especially in Cambridgeshire, has also left its mark with a series of restored and flooded waterbodies also benefiting biodiversity and recreation.

Cultural influences include John Bunyan, who wrote Pilgrim's Progress while imprisoned in Bedford jail; fictitious locations in the novel are thought to be drawn from the Marston Vale, Greensand Ridge, the Great Ouse river valley and the Chilterns. Oliver Cromwell, a contemporary of Bunyan, was born in Huntingdon in 1599, and in the 18th century Olney was home to the reformed slave trader Rev. John Newton and the poet William Cowper whose association led to the writing of the Olney Hymns.

There has been significant development (residential, commercial and infrastructure, road and rail improvements) within the NCA and it continues to be the focus for new growth and development. There are growth plans for all of the main towns and cities in the NCA, including Milton Keynes which has a large geographic sphere of influence and continues to expand. Transport infrastructure, business and commercial development are now major components of the NCA's character, with good transport links north and south and particular nodes along the corridors of the A1, M1 and A14. As renewable energy technology has developed, the area has witnessed the establishment of a number of wind energy schemes.

The Cardington Hangars or Sheds are a prominent feature of the landscape near Bedford.

Ecosystem services

The Bedfordshire and Cambridgeshire Claylands NCA provides a wide range of benefits to society. Each is derived from the attributes and processes (both natural and cultural features) within the area. These benefits are known collectively as 'ecosystem services'. The predominant services are summarised below. Further information on ecosystem services provided in the Bedfordshire and Cambridgeshire Claylands NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** Seventy per cent of the area is in agricultural use, although statistics indicate that there has been an overall decrease in the area of land in agricultural use, total farm size and area of land held. Soils are moderately fertile and classified as Grade 2 and Grade 3. The arable landscape is important for food production, is a major industry within the area and provides a significant food resource. It is likely to be influenced by changes in the market. Multiple benefits could be gained in terms of maintaining levels of food production, preserving historic character and enhancing biodiversity, although there are pressures on soil and water resources, especially water availability.

- **Water availability:** The River Great Ouse is the main river in this NCA, with many others feeding in as tributaries. A small part of the River Nene also passes through the NCA, supplying Rutland Water (outside the NCA) which is internationally important for nature conservation and provides drinking water to Kettering, Northampton, Peterborough and surrounding areas. Grafham Water near Huntingdon, constructed in the 1960s, supplies water to Milton Keynes and towns in Bedfordshire and Northamptonshire. There are also several aquifers. Water availability within the NCA is considered to be restricted, with many waterbodies listed as having no water available. Water is abstracted for a number of different purposes, including agriculture, spray irrigation, industrial use, power generation and public water supply. Any new development is likely to put additional pressure on water resources. Careful management of water resources will be required.

Regulating services (water purification, air quality maintenance and climate regulation)

- **Regulating water quality:** The soils covering the majority of the NCA have a degree of impeded drainage and are at risk of compaction and erosion – requiring careful management to maintain a good soil structure and avoid increasing vulnerability to run-off under high precipitation conditions that can cause localised soil erosion and affect water quality. The whole of the NCA is a nitrate vulnerable zone (NVZ). Water quality improvements could be gained by reducing sediment, nutrient and run-off from agricultural land as well as controlling damage caused to the soil by vehicles or stock. The semi-natural habitats present – including woodland, hedgerows, semi-improved and unimproved grassland, flood plain grazing marsh, fen and reedbed – help to filter out any pollutants and sediments, thereby regulating water quality. This ability could be greatly strengthened by linking or expanding existing fragmented habitat.

- **Regulating water flow:** The soils covering the majority of the NCA have some degree of impeded drainage which, if damaged, can increase the likelihood of run-off under high precipitation conditions. Flood risk occurs along the course of the River Great Ouse. Many of the rivers are heavily modified, embanked or re-sectioned rivers, with weirs and flood defence structures in place to manage water flows. The numerous lakes and other waterbodies within river valleys are also used in some cases for water storage and management purposes. The River Great Ouse catchment is known for its quick response during periods of heavy rainfall. Therefore measures taken in this NCA to reinstate the natural functionality of the flood plain will help to regulate and manage flows further downstream in other NCAs and help protect sites that are important for nature conservation and which are known to have issues with water quality and flow, such as the Nene and Ouse Washes.

Cultural services (inspiration, education and wellbeing)

- **Recreation:** Recreation is a significant service in the NCA. It is generally low key, close to the main urban populations and associated with the river valleys, existing sites and restored post-industrial landscapes, particularly within the Forest of Marston Vale. There are numerous country parks and nature reserves available for local residents and

Grafham Water supplies water within and outside of the NCA and is an important recreational resource.

visitors. Large towns and cities – including Milton Keynes, Bedford, Cambridge and Peterborough – have a good network of parks and green spaces within them and recently improved links to allow access to adjacent countryside. With the high development pressures in the NCA, it is likely that demand for leisure and recreation will increase with subsequent pressures on biodiversity, soil and water resources. Opportunities exist to cater for increased demand without significant effects on other services as long as the assets are positively managed.

- **Biodiversity:** Although only a small proportion of the NCA is designated for its biodiversity interest, the NCA contains a diverse range of habitats of importance. These include coastal and flood plain grazing marsh, lowland mixed deciduous woodland, fen, lowland meadow, reedbed, traditional orchards, wood pasture and parkland with ancient and veteran trees. These support a range of species – some rare and scarce. Many are associated with the remnant ancient woodland – including butterflies such as the white admiral and purple and black hairstreaks, dormouse, barbastelle bat and specialist invertebrates. Riparian and wetland habitats provide valuable habitat connectivity within the landscape and support populations of breeding and overwintering birds, water vole, otter, great crested newt and species of stonewort. The farmscape supports farmland birds such as skylark and grey partridge, and brown hare. The biodiversity of the area is under pressure from land use change, development and infrastructure improvements, and demand for resources (especially water). However, there are also opportunities to benefit biodiversity and recreation by creating new green infrastructure. The management and extension of semi-natural habitats within the NCA will bring benefits for biodiversity, soil and water quality, climate regulation and recreation.

- **Geodiversity:** Geodiversity has significantly influenced the landscape character of the NCA and development within the NCA. Oxford Clay has been a major source of material for the brick-making industry since the early 19th century, providing the dominant building material for many of the towns and villages of the NCA. Jurassic limestone from the west of the NCA has also been used as a building stone. The brick pits are particularly noted for their Jurassic marine reptiles and have yielded the most important collections of marine reptiles of this age, many of which are on display at local museums. There are five geological SSSI and 19 Local Geological Sites across the NCA, many of which are found in active and disused clay, sand and gravel workings. This reflects the importance of these extraction sites for accessing and understanding the area's geodiversity, which is otherwise poorly exposed. The restoration of these sites provides opportunities for retaining geodiversity, developing a range of habitats, enhancing landscape character and offering new leisure and recreation opportunities.

Statements of Environmental Opportunity

SEO 1: Maintain and manage a sustainable and productive claylands arable landscape, while managing, expanding and linking woodlands, hedgerows and other semi-natural habitats to benefit biodiversity, improve soil and water quality, and ameliorate climate change by promoting good agricultural practice.

For example, by:

- Managing the arable landscape to retain the value of food provision through employing sustainable farming practices.
- Working with local farmers, landowners and managers to promote best practice such as the appropriate management of hedgerows, reducing herbicide and pesticide use, buffering field margins and woodland edges, and retaining winter stubble to support farmland birds and pollinators.
- Promoting good soil management to avoid compaction and maintain good soil structure.
- Encouraging the conservation and management of existing woodlands and the replacing of introduced species with native species, as well as undertaking new tree and woodland planting to link existing sites in order to enhance biodiversity and recreational opportunities.
- Seeking opportunities to develop biomass production through active woodland management and promote and stimulate local markets for wood products, biomass and wood fuel to support sustainable timber production.
- Ensuring that populations of wild deer are managed to reduce damage caused to the natural regeneration of trees and woodland.
- Preparing and implementing plans to control or limit the spread of new pests or disease – for example, ash die-back.
- Extending where appropriate the semi-natural vegetation cover, especially on steeper slopes where the Bedfordshire and Cambridgeshire Claylands National Character Area (NCA) meets the Bedfordshire Greensand Ridge, Chilterns, and East Anglian Chalk NCAs, to improve soil quality and reduce run-off and erosion.
- Enhancing and expanding the network of semi-natural habitats through targeted environmental enhancements, including ponds, hedgerows, hedgerow trees and species-rich grasslands (such as areas found along road verges, green lanes and field margins) to support biodiversity.
- Encouraging the appropriate management and expansion of traditional orchards, bringing them back into active management to conserve their genetic diversity, biodiversity value and cultural heritage; and promoting and encouraging local markets for locally grown orchard produce.

Species-rich roadside verges and hedges.

SEO 2: Protect aquifers and enhance the quality, state and structure of the River Great Ouse, its valley and tributaries, habitats, waterbodies and flood plain by seeking to enhance their ecological, historical and recreational importance while taking into account their contribution to sense of place and regulating water flow, quality and availability.

For example, by:

- Promoting and encouraging the sustainable use of local water resources by agricultural, commercial and domestic users to reduce the pressure on water resources in this NCA.
- Ensuring that water abstraction and poor water quality do not threaten important wetland habitats and archaeological features.
- Monitoring and managing water abstraction licences, with new applications for groundwater abstraction considered on a case-by-case basis to reduce the pressure on the aquifers.
- Incorporating and encouraging the use of water efficiency measures in new developments.
- Implementing catchment-wide water management plans to ensure a co-ordinated approach to reducing the impacts of pollution on water quality.
- Encouraging the use of sustainable drainage schemes, especially within urban areas to reduce run-off.
- Promoting and encouraging different remedies to improve water quality (for example, increasing on-farm water storage to reduce water abstraction levels, increasing flow rates and water levels in rivers, and continuing to make improvements to wastewater treatment works), to benefit aquatic biodiversity.
- Encouraging landowners and managers to increase and link areas of semi-natural habitat –such as flood plain grazing marsh, lowland meadow, ponds, fen and reedbed – to help slow water passage and filter out pollutants and support biodiversity.
- Working to reduce surface and groundwater pollution at a catchment scale by managing farmland under the principles established by the Catchment Sensitive Farming Programme.
- Expanding buffer strips along watercourses to help filter out sediments and pollution and provide benefits for landscape character and biodiversity.
- Working with landowners and managers to encourage the appropriate management of rivers, streams, waterbodies and riparian habitats to support biodiversity.
- Managing vegetation within the catchment to help to bind the soil, thus reducing the risk of erosion and slowing the passage of water.
- Seeking opportunities to extend and link areas of woodland, hedgerows, grassland and other semi-natural habitats to assist in absorbing water flow and provide benefits for biodiversity.
- Seeking opportunities to increase the capacity of the flood plain, conserve and extend riparian habitats to retain water, and bring benefit to the river environment.
- Promoting green infrastructure to help mitigate the impact of flooding.
- Encouraging the use of sustainable urban drainage systems such as permeable surfacing within urban areas to help reduce run-off.
- Controlling, monitoring and managing invasive non-native species to prevent or reduce damage to native species populations and habitats.

SEO 3: Plan and create high-quality green infrastructure to help accommodate growth and expansion, linking and enhancing existing semi-natural habitats. Regenerate the post-industrial landscapes of the Forest of Marston Vale and Peterborough to improve and create new opportunities for biodiversity, recreation, timber and biomass provision while strengthening sense of place, tranquillity, resilience to climate change, and people's health and wellbeing.

For example, by:

- Supporting the creation and expansion of native woodlands, orchard, parkland, grasslands, and hedgerows to improve habitat connectivity within the landscape and provide increased benefits for biodiversity and recreation.
- Ensuring that areas of designated land remain in favourable condition, and improving their condition where possible.
- Promoting awareness of, and providing advice to landowners and managers on, managing habitats of biodiversity interest.
- Supporting initiatives that include well-planned green infrastructure that will increase people's access to and contact with the natural environment to benefit their health and wellbeing.
- Creating new woodland as appropriate on urban fringes to help screen and integrate new developments, and provide biodiversity and green infrastructure benefits.
- Managing recreational sites to accommodate visitor pressure and demand without conflict between different users, and without causing adverse effects on the natural environment.
- Maintaining, extending and promoting the use of the National Cycle Routes and the rights-of-way network.
- Conserving and managing traditional orchards, hedgerows, parkland, and ancient and veteran trees for the benefit of fauna (such as specialist invertebrates dependent on dead or decaying wood, pollinators and pest regulators).
- Protecting and conserving existing traditional orchards from inappropriate development and changes in land use.
- Retaining and enhancing the contrast in landscape character between the clay plateau and river valleys, aiming to maintain and enhance the balance between urban and rural landscapes.
- Preventing inappropriate development and promoting the use of local building stone to maintain the character of villages and historic buildings.
- Ensuring that any new developments incorporate well-designed green infrastructure, to include improved access and recreation opportunities for local communities and visitors.
- Supporting the work of the Forest of Marston Vale Community Forest to regenerate the area and repair the landscape, using trees and woodland to provide social, economic and environmental benefits.
- Supporting the work of the Chilterns Area of Outstanding Natural Beauty (AONB) to conserve and enhance the landscape and special qualities of the AONB.
- Ensuring that geodiversity sites continue to be protected, monitored and managed.
- Ensuring that mineral extraction sites are restored to contribute to local landscape character and offer opportunities to enrich people's understanding of landscape, and enhance biodiversity, recreation and geodiversity.

SEO 4: Protect, conserve and enhance the cultural heritage and tranquillity of the Bedfordshire and Cambridgeshire Claylands NCA, including its important geodiversity, archaeology, historic houses, parkland, and Second World War and industrial heritage, by improving interpretation and educational opportunities to increase people's enjoyment and understanding of the landscape.

For example, by:

- Promoting awareness and understanding of the area's rich geological heritage and the impact it has on the landscape, local distinctiveness and human activity – for example, in brick making.
- Ensuring that new development is in keeping with the local character of the area by using local stone in buildings to enhance sense of place and history.
- Promoting the restoration and good management of historic buildings and features, including those that are listed and 'at risk'.
- Using an understanding of the area's historic settlements and buildings to promote high-quality design in new development.
- Protecting, managing and promoting important archaeological features and landscapes such as ridge and furrow to increase people's understanding.
- Conserving and enhancing the cultural heritage of the brick-making industry, the Grand Union Canal and 20th-century military sites by promoting and improving access to increase awareness and understanding.
- Increasing tranquillity by conserving, managing and extending areas of semi-natural habitat, particularly woodlands and hedgerows, to benefit wildlife and people.
- Promoting existing sites that offer opportunities for people to enjoy the local landscape and providing improved interpretation and educational opportunities to increase people's understanding of the natural and built environments.
- Offering high-quality interpretation at key sites, and providing improved interpretation and educational opportunities to increase people's understanding and enjoyment of the key attributes of the area such as the history of brick making and jam making.
- Encouraging the restoration and sustainable management of historic parklands.
- Seeking opportunities to protect more tranquil parts of the area to reduce light and noise pollution and seeking opportunities to remove obtrusive features such as signage, lighting and poles.
- Working with local planning authorities to ensure that development is well designed to enhance landscape character and sense of place and to minimise the impacts of noise and light pollution.

Supporting document 1: Key facts and data

Bedfordshire and Cambridgeshire Claylands National Character Area (NCA): 260,560 ha

1. Landscape and nature conservation designations

The Bedfordshire and Cambridgeshire Claylands NCA contains 139 ha of the Chilterns Area of Outstanding Natural Beauty (<1 per cent of the NCA).

Management plans for the protected landscape can be found at:

- www.chilternsaonb.org/

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Designated site(s)	Area (ha)	% of NCA
International	Ramsar	Nene Washes, Ouse Washes, Woodwalton Fen	130	<1
European	Special Protection Area (SPA)	Nene Washes SPA, Ouse Washes SPA	126	<1
	Special Area of Conservation (SAC)	Orton Pit SAC, Portholme SAC, Eversden and Wimpole Woods SAC, Ouse Washes SAC, Fenland SAC	313	<1
National	National Nature Reserve (NNR)	Monkswood NNR, Upwood Meadows NNR, Woodwalton Fen NNR	126	<1
National	Site of Special Scientific Interest (SSSI)	A total of 61 sites wholly or partly within the NCA	2,699	1

Source: Natural England (2011)

Please note: (i) Designated areas may overlap (ii) all figures are cut to Mean High Water Line, designations that span coastal areas/views below this line will not be included.

There are 491 local sites in Bedfordshire and Cambridgeshire Claylands covering 7,939 ha which is 3 per cent of the NCA.

Source: Natural England (2011)

- Details of individual Sites of Special Scientific Interest can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm
- Details of Local Nature Reserves (LNR) can be searched at: http://www.lnr.naturalengland.org.uk/Special/lnr/lnr_search.asp
- Maps showing locations of Statutory sites can be found at: http://magic.defra.gov.uk/website/magic/ – select 'Rural Designations Statutory'

1.1.1 Condition of designated sites

Condition category	Area (ha)	% of SSSI land in category condition
Unfavourable declining	242	9
Favourable	973	36
Unfavourable no change	147	5
Unfavourable recovering	1,330	49

Source: Natural England (March 2011)

- Details of SSSI condition can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/reportIndex.cfm

2. Landform, geology and soils

2.1 Elevation

The highest part of this NCA is around 158 m above sea level and the lowest area is at -0.02 m below sea level.

Source: Natural England (2010)

2.2 Landform and process

The area comprises a broad sweep of lowland plateau, dissected by a number of shallow valleys, including the rivers Great Ouse and Ivel. It is typically an empty gently undulating lowland landscape.

Source: Bedfordshire and Cambridgeshire Claylands Countryside Character Area Description

2.3 Bedrock geology

The Claylands are underlain by flat to very gently dipping Jurassic (including Oxford Clay) and Cretaceous clay sediments. These are predominantly clay with occasional locally prominent limestones such as Blisworth Limestone and Cornbrash, and more sandy sediments such as the Kellaways Sands.

Source: Bedfordshire and Cambridgeshire Claylands Countryside Character Area Description

2.4 Superficial deposits

Throughout much of the area the underlying clay geology is covered by Quaternary glacial and fluvial deposits including boulder clay or till and river terrace sands and gravels.

Source: Bedfordshire and Cambridgeshire Claylands Countryside Character Area Description

2.5 Designated geological sites

Designation	Number
Geological Site of Special Scientific Interest (SSSI)	5
Mixed interest SSSI	0

There are 19 Local Geological Sites within the NCA.

Source: Natural England 2011

- Details of individual Sites of Special Scientific Interest can be searched at: **http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm**

2.6 Soils and Agricultural Land Classification

Soils in the area are dominated by a variety of moderately permeable, calcareous, clayey soils. To the north these overlie a chalky glacial till, whereas to the south they overlie Jurassic and Cretaceous clays. The elevated clayland plateau to the west is dissected by the upper reaches of the Great Ouse which have better drained soils due to the underlying local Jurassic limestone. To the east of Bedford and north of Shefford, the broader river valley of the river Ivel and its tributaries have well drained soils over alluvium and river terrace gravels.

Source: Bedfordshire and Cambridgeshire Claylands Countryside Character Area Description

The main grades of agricultural land in the NCA are broken down as follows (as a proportion of total land area):

Agricultural Land Classification	Area (ha)	% of NCA
Grade 1	5,386	2
Grade 2	90,690	35
Grade 3	124,851	48
Grade 4	14,504	6
Grade 5	0	0
Non-agricultural	11,932	5
Urban	13,198	5

Source: Natural England (2010)

- Maps showing locations of statutory sites can be found at: http://magic.defra.gov.uk/website/magic/ - Select 'Landscape' (shows ALC and 27 types of soils)

3. Key water bodies and catchments

3.1 Major rivers/canals

The following major rivers/canals (by length) have been identified in this NCA.

Name	Length in NCA (km)	Name	Length in NCA (km)
River Great Ouse	167	River Cam	10
Grand Union Canal	51	River Flit	10
River Ouzel or Lovat	24	River Nene	10
River Ivel	20	River Thame	6
River Kym	18	River Glyme	4
River Tove	12	King's Dyke	2
River Cam or Rhee	11	River Til	2

Source: Natural England (2010)

Please note: other significant rivers (by volume) may also occur. These are not listed where the length within the NCA is short. Rivers less than 2 km are not included.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 260,560 ha, 100 per cent of NCA.

Source: Natural England (2010)

3.3 Water Framework Directive

Maps are available from the Environment Agency showing current and projected future status of water bodies at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 11,947 ha of woodland (5 per cent of the total area), of which 3,068 ha is ancient woodland. The Forest of Marston Vale, one of twelve Community Forests established to demonstrate the contribution of environmental improvement to economic and social regeneration, covers 13,711 ha of this NCA, which is 5 per cent (within the programme area, not all woodland).

Source: Natural England (2010), Forestry Commission (2011)

4.2 Distribution and size of woodland and trees in the landscape

There are scattered ancient woodlands which tend to be clustered most noticeably in a band to the north of the area. Elsewhere the woods are more isolated, yet form important visual and wildlife features. Dutch elm disease in 1970s and 1980s had a major impact on woodland and hedgerow trees. The maturing of other trees has reduced this impact over time although the disease continues to affect the ability of young elm to reach maturity.

Source: West Anglian Plain Natural Area Profile

4.3 Woodland types

A statistical breakdown of the area and type of woodland found across the NCA is detailed below.

Area and proportion of different woodland types in the NCA (over 2 ha).

Woodland type	Area (ha)	% of NCA
Broadleaved	10,193	4
Coniferous	767	<1
Mixed	140	<1
Other	847	<1

Source: Forestry Commission (2011)

Area and proportion of Ancient Woodland and Planted Ancient Woodland within the NCA:

Type	Area (ha)	% of NCA
Ancient semi-natural woodland	3,068	1
Ancient re-planted woodland (PAWS)	923	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Fields are bounded by either open ditches or sparse closely trimmed hedgerows, both containing a variable number and quality of hedgerow trees. River corridors of the Great Ouse and Ivel compose cohesive sub-areas characterised by flood plain grassland, riverine willows and larger hedgerows. This is predominantly an open and intensive arable landscape.

Source: Bedfordshire and Cambridgeshire Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

Fields to the east of the Ivel/Great Ouse divide form a notably large rectilinear pattern. To the east of the NCA the hedgerows are typically mixed but in poor repair and gappy. Further to the west hedgerows are predominantly hawthorn but the quality and integrity improves together with a greater, though still limited, number of hedgerow trees, mainly oak and ash. Clustered around many of the urban villages and settlements are smaller but significant areas of paddocks and pasture where a pony paddock culture creates a distinct local character of mixed fencing, sheds and jumps. Agricultural intensification and farm amalgamation has changed the landscape to create larger arable fields.

Source: Bedfordshire and Cambridgeshire Countryside Character Area description; Countryside Quality Counts (2003)

6. Agriculture

The following data has been taken from the Agricultural Census linked to this NCA.

6.1 Farm type

In 2009, 70 per cent of the NCA was in agricultural use with the total farmed area being 181,916 ha, comprising 1,798 holdings. In 2009 farm holdings in this NCA were recorded as follows: 886 commercial holdings, or 49 per cent, grew cereals (84,922 ha) and 15 per cent of the land was used for oilseeds (27,717 ha). Other arable crops were grown across 7 per cent of the land area (12,643 ha).

Source: Agricultural Census, Defra (2010)

6.2 Farm size

In 2009, farms over 100 ha were the most common in the NCA (571 accounting for 32 per cent of holdings). The next most common number of holdings was in the category of 5 ha to 20 ha (424 or 24 per cent of holdings), farms between 20 and 50 ha (347 or 19 per cent of holdings) and farms between 50 and 100 ha (294 or 16 per cent of holdings). The least common farm size in this NCA is holdings less than 5ha (162 or 9 per cent of holdings). The largest holdings (those over 100 ha) made up 79 per cent of the total farmed area, compared to those under 5 ha which covered less than <1 per cent of the farmed area. Between 2000 and 2009 the numbers of farms in all size categories had decreased. The number of farms under 5 ha had the largest reduction in number, decreasing by 21 per cent (204 to 162) This was followed by the number of farms over 100 ha which decreased by 12 per cent (647 to 571), farms between 5 and 20 ha by 10 per cent (471 to 424), farms between 20 and 50 ha by 7 per cent (373 to 347) and farms between 50 and 100 ha by 5 per cent (309 to 294).

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 181,916 ha; owned land = 122,745 ha
2000: Total farm area = 198,160 ha; owned land = 128,360ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

In 2009 the dominant agricultural land use was cereals accounting for 84,922 ha (47 per cent of the total farmed area) and grass and uncropped land which accounted for 45,045 ha (25 per cent). These were followed by oilseeds which covered 27,717 ha (15 per cent) and 'other' arable crops which accounted for 12,643 ha (7 per cent). Other agricultural land uses each represented 1 per cent or less of the total farmed area. Between 2000 and 2009 the area of cereals decreased by 16 per cent, the area of grass and uncropped land decreased by 9,835 ha or 18 per cent). The area under arable crops increased by 1,580 ha (14 per cent). There were also increases in the area of land used for growing stock feed (up by 263 ha or 560 per cent). The area of land used for hardy nursery stock decreased by 50 ha or 56 per cent, the area of land growing vegetables decreased by 877 ha or 53 per cent, fruit down by 181 ha or 45 per cent, glasshouses down by 12 ha or 34 per cent, and cash roots down by 312 ha or 18 per cent.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

In 2009, sheep were the most numerous livestock with 104,200 recorded. Cattle at 39,900 were the next most numerous and the number pigs were recorded as 38,300.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

The majority of holdings were run by principal farmers (2,553) compared with salaried managers (211). Together, employed full-time and part-time workers (679 full-time and 422 part-time) are more numerous than casual/gang workers (637). Between 2000 and 2009 the number of farmers recorded as principal farmers decreased by 417 and salaried managers increased by 52. All other farm workers were recorded to have decreased with full time workers down by 345, part-time workers down by 31 and causal/gang workers down by 35.

Source: Agricultural Census, Defra (2010)

Please note: (i) Some of the Census data is estimated by Defra so will not be accurate for every holding (ii) Data refers to Commercial Holdings only (iii) Data includes land outside of the NCA belonging to holdings whose centre point is within the NCA listed.

Little Paxton Pits.

7. Key habitats and species

7.1 Habitat distribution/coverage

The major feature of the area is the man-made reservoir at Grafham Water, which is important for biodiversity and recreation. Old flooded and restored clay and gravel pits along the river Ouse and Nene (gravel pits) and around Peterborough and the Marston Vale south of Bedford (clay pits) are of importance for overwintering birds, great crested newts and scarce species of stonecrop. Flood plain grazing marsh occurs mainly on permanently wet mineral soil and seasonally flooded (winter and spring) alluvium in the valleys of the major watercourses in the area.

The river corridors of the rivers Great Ouse, Nene, Ivel, Tove and Ouzel, along with a multitude of smaller watercourses down to small ditches and drains, provide valuable habitat 'highways' through an otherwise arable landscape and support many species including otter and kingfisher. Pollarded trees, mainly willows and flood plain grazing marsh, create a distinctive riverine landscape. Reedbed, swamp and fen tend to be localised and found at the margins of the major rivers and associated with old clay and gravel pits.

River corridors of the Great Ouse and Ivel compose cohesive sub-areas characterised by flood plain grassland, riverine willows and larger hedges.

Ancient woodland is scattered in a band to the north-west of the area on the higher plateau area between Salcey and Grafham Water. Elsewhere the woods are more isolated. Most woodlands occur on heavy, ill-draining calcareous clays and have a coppice-with-standards structure. Characteristic species are ash, pedunculate oak and field maple with local concentrations

of alder, aspen, birch, wych elm and in Cambridgeshire particularly, other elms. The shrub layer is typically composed of hazel, hawthorn, Midland hawthorn, dogwood, wild privet, guelder rose, wayfaring-tree and spindle. Some of the woodlands have a rich ride flora, in places resembling lowland meadow grassland.

Fenlands tend to be localised and found at the margins of the major rivers and associated with old clay and gravel pits. Typical species are reed sweet-grass, lesser pond-sedge, greater tussock-sedge, giant horsetail and lesser bulrush, marsh valerians, marsh pennywort, marsh marigold and ragged robin. Lowland meadow is found on poorly draining till and on alluvium, often with ridge-and-furrow topography and managed for a hay crop.

Farmed land is an important habitat containing features such as hedgerows and mature trees, field margins, ponds, ditches and small watercourses. These support nationally important assemblages of arable birds. Semi-improved grassland is found alongside tracks and on road verges.

Source: West Anglian Plain Natural Area Profile

7.2 Priority habitats

The Government's new strategy for biodiversity in England, Biodiversity 2020, replaces the previous Biodiversity Action Plan (BAP) led approach. Priority habitats and species are identified in Biodiversity 2020, but references to BAP priority habitats and species, and previous national targets have been removed. Biodiversity Action Plans remain a useful source of guidance and information. More information about Biodiversity 2020 can be found at; http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/englandsbiodiversitystrategy2011.aspx

The NCA contains the following areas of mapped priority habitats (as mapped by National Inventories). Footnotes denote local/expert interpretation. This will be used to inform future national inventory updates.

Priority habitat	Area (ha)	% of NCA
Coastal and flood plain grazing marsh	4,187	2
Broadleaved mixed and yew woodland (broad habitat)	3,939	2
Fens	1,653	1
Lowland meadows	1,028	<1
Reedbeds	894	<1
Purple moor grass and rush pasture	124	<1
Lowland calcareous grassland	112	<1
Lowland dry acid grassland	1	<1

Source: Natural England (2011)

Maps showing locations of priority habitats are available at

- http://magic.defra.gov.uk/website/magic/ select 'Habitat Inventories'

7.3 Key species and assemblages of species

- Maps showing locations of priority habitats are available at: http://magic.defra.gov.uk/website/magic/
- Maps showing locations of S41 species are available at: http://data.nbn.org.uk/

8. Settlement and development patterns

8.1 Settlement pattern

The majority of the arable claylands are uniformly but sparsely populated. Small villages nestle in gentle valleys while isolated hamlets and farmsteads are widely dispersed, particularly north of Bedford. Linear settlements, such as Riseley, are common in the area. Notable houses and grounds include Kimbolton Park and Croxton Park. Settlement in the 20th century has continued from its historic pattern along the rivers and major road and rail corridors (A1 and M1). Expansion of towns such as Bedford, St Neots, Biggleswade and Huntingdon has been extensive. To the west of the area adjacent to the M1, Milton Keynes has developed since the 1960s. The accessibility of the area to major commuting routes has led to the expansion of all towns and most of the larger villages, gradually submerging the character of historic settlement. Development along transport and infrastructure corridors and in association with the key major growth areas around Milton Keynes and the M11 corridor has impacted on local character.

Source: Bedfordshire and Cambridgeshire Claylands Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main settlements within the Bedfordshire and Cambridgeshire Claylands are Milton Keynes, Peterborough, Bedford, Cambridge, Huntingdon. The total estimated population for this NCA (derived from ONS 2001 census data) is 1,028,236.

Source: Bedfordshire and Cambridgeshire Claylands Countryside Character Area description; Countryside Quality Counts (2003)

8.3 Local vernacular and building materials

Traditional building materials in the villages comprise a mix of brick, thatch, render and stone but there is no over-riding cohesion to the area. Notable localised pockets of style or material include the warm limestone villages of the upper Great Ouse at Olney, Harrold, Odell, Turvey and Felmersham, many of which contain elegant Northamptonshire-style church spires and distinctive multi-arched stone bridges, for example at Harrold, Turvey and Bromham. The towns along the lower Great Ouse contain a notable range of buildings including the High Street at Godmanchester which has many fine Georgian town houses. Along the river, causeways and medieval bridges, including the rare bridge chapel at St Ives, are distinctive features. Historic coaching towns along the Great North Road, for example at Stilton and Buckden, are now bypassed. Kimbolton with its red tiled town houses is a small, yet distinguished, model settlement. Milton Keynes, with its grid-iron road pattern, extensive open spaces, tree planting and modern buildings, is both a showcase new town and major regional shopping centre.

Source: Bedfordshire and Cambridgeshire Claylands Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

Early settlement in the area tends to follow the lighter soils of the Ivel and Ouse valleys, where important prehistoric complexes have been recorded from cropmarks and excavation. There has been a high survival of moats, generally associated with high-status sites and of 12-13th century date. Medieval earthworks including deserted villages are key historic landscape features.

Wimpole Hall.

Abandoned medieval settlements remain a feature of the landscape. There has been a medium survival of pre-1750 farmstead buildings, particularly farmhouses but also including medieval and later aisled barns. Notable houses and grounds include Kimbolton Park and Croxton Park. The grandest example is at Wrest Park, Silsoe, the estate of the de Grey family. The French Baroque/ Rococo style house, built in around 1835, is unique in England. Most woodland occurs on heavy, ill-draining calcareous clays. Some have ancient peripheral woodbanks and others have clearly developed over earlier farmland or land-abandoned settlements as ridge-and-furrow or other earthworks occur on the wooded ground. There is a man-made reservoir at Grafham Water. Restored gravel working lakes adjacent to River Ouse, and waterbodies in the Marston Vale have resulted from clay extraction. River corridors of the Great Ouse and Ivel compose cohesive sub-areas characterised by flood plain grassland, riverine willows and larger hedgerows.

Source: Countryside Quality Counts Draft Historic Profile, Countryside Character Area description

9.2 Designated historic assets

This NCA has the following historic designations:

- 39 Registered Parks and Gardens covering 2,688 ha
- 0 Registered Battlefields
- 324 Scheduled Monuments
- 8,102 Listed Buildings

Source: Natural England (2010)

- More information is available at the following address: www.english-heritage.org.uk/caring/heritage-at-risk/
- www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/

10. Recreation and access

10.1 Public access

- 1.5 per cent of the NCA 3,834 ha is classified as being publically accessible.
- There are 3,998 km of public rights of way at a density of 1.5 km per km2.
- There are no National Trails within the Bedfordshire and Cambridgeshire Claylands NCA.

Source: Natural England (2010)

Danish Camp, Willington - a popular place to stop for walkers and cyclists on National Cycle Route 51.

The following table shows the breakdown of land which is publically accessible in perpetuity:

Access designation	Area (ha)	% of NCA
National Trust (accessible all year)	209	<1
Common Land	663	<1
Country Parks	641	<1
CROW Access Land (Section 4 and 16)	929	<1
CROW Section 15	415	<1
Village Greens	76	<1
Doorstep Greens	1	<1
Forestry Commission Walkers Welcome Grants	780	<1
Local Nature Reserves (LNR)	266	<1
Millennium Greens	22	<1
Accessible National Nature Reserves (NNR)	167	<1
Agri-environment Scheme Access	199	<1
Woods for People	1,793	1

Sources: Natural England (2011)

Please note: Common Land refers to land included in the 1965 commons register; CROW = Countryside and Rights of Way Act 2000; OC and RCL = Open Country and Registered Common Land.

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of tranquillity (2006), the most tranquil area of this NCA is in the north-west of the area, west between Huntingdon and Bedford, particularly around Grafham Water. The least tranquil area is in Cambridge. Other low scores are found around Milton Keynes, as well as the main transport links of the A1, A14 and M1.

A breakdown of tranquillity values for this NCA are detailed in the table below:

Category of tranquillity	Score
Highest	42
Lowest	-90
Mean	-4

Sources: CPRE (2006)

More information is available at the following address: **www.cpre.org.uk/what-we-do/countryside/tranquil-places/in-depth/item/1688-how-we-mapped-tranquillity**

11.2 Intrusion

The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows that Milton Keynes and Cambridge, the most highly urbanised areas, are the most highly disturbed areas of this NCA. A breakdown of intrusion values for this NCA is detailed in the following table.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	27	48	54	26
Undisturbed	69	47	38	-31
Urban	4	5	9	5

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are light pollution resulting from intensive agriculture, growth of settlements and road infrastructure improvements, particularly apparent in the low-lying areas. Notably, disturbed or intruded land has increased by nearly 26 per cent during the period between 1960 and 2007. At the same time there was a reduction of around -31 per cent of undisturbed or un-intruded land.

- More information is available at the following address: **www.cpre.org.uk/resources/countryside/tranquil-places**

12. Data sources

- British Geological Survey (2006)
- Natural Area Profiles, Natural England (published by English Nature 1993-1998)
- Countryside Character Descriptions, Natural England (regional volumes published by Countryside Commission/Countryside Agency 1998/1999)
- Joint Character Area GIS boundaries, Natural England (data created 2001)
- National Parks and AONBs GIS boundaries, Natural England (2006)
- Heritage Coast Boundaries, Natural England (2006)
- Agricultural Census June Survey, Defra (2000,2009)
- National Forest Inventory, Forestry Commission (2011)
- Countryside Quality Counts Draft Historic Profiles, English Heritage (2004)*
- Ancient Woodland Inventory, Natural England (2003)
- Priority Habitats GIS data, Natural England (March 2011)
- Special Areas of Conservation data, Natural England (data accessed in March 2011)
- Special Protection Areas data, Natural England (data accessed in March 2011)
- Ramsar sites data, Natural England (data accessed in March 2011)
- Sites of Special Scientific Interest, Natural England (data accessed in March 2011)
- Detailed River Network, Environment Agency (2008)
- Source protection zones, Environment Agency (2005)
- Registered Common Land GIS data, Natural England (2004)
- Open Country GIS data, Natural England (2004)
- Public Rights of Way Density, Defra (2011)
- National Trails, Natural England (2006)
- National Tranquillity Mapping data, CPRE (2007)
- Intrusion map data, CPRE (2007)
- Registered Battlefields, English Heritage (2005)
- Record of Scheduled Monuments, English Heritage (2006)
- Registered Parks and Gardens, English Heritage (2006)
- World Heritage Sites, English Heritage (2006)
- Incorporates Historic Landscape Characterisation and work for preliminary Historic Farmstead Character Statements (English Heritage/Countryside Agency 2006)

Please note all figures contained within the report have been rounded to the nearest unit. For this reason proportion figures will not (in all) cases add up to 100 per cent. The convention <1 has been used to denote values less than a whole unit.

Supporting document 2: Landscape change

Recent changes and trends

Trees and woodlands

- Between 1999 and 2003 the area of woodland covered by a Woodland Grant Scheme in the NCA rose from 15 per cent to 23 per cent. Four hundred and fifty-five hectares was approved for new planting through the Woodland Grant Scheme and the proportion of ancient woodland sites covered by a Woodland Grant Scheme agreement rose from 16 per cent to 38 per cent. Agreements included the expansion of wet woodland and lowland broadleaved woodland. Along river valleys some willow pollarding and planting of native black poplar has taken place grant-aided by various means including agri-environment schemes and landfill tax, as well as by local authorities, environmental charities and statutory agencies.

- New woodland planting can be found throughout the NCA in small scattered blocks and corners of arable fields. Woodland cover has increased through the ongoing creation of the Forest of Marston Vale Community Forest in Bedfordshire. This is one of 12 Community Forests set up in England in 1990/91. In 1995 woodland cover in the Marston Vale was 3 per cent which had risen to 9 per cent in 2009/10 as a result of new planting. The target set by Government is for 30 per cent tree/woodland cover within the Community Forest area by 2031. In Cambridgeshire the Wildlife Trust is undertaking work with landowners to link some of the remaining ancient woodlands around Gamlingay, Gransden and Waresley.

Boundary features

- The predominance of commercial arable production, farm amalgamation and a need to accommodate modern agricultural equipment has led to the removal of some hedgerows and an increase in field size. Neglect and inappropriate management of hedgerows are key issues with many becoming gappy, overly-trimmed and species-poor. Where hedgerows are absent, particularly in parts of the NCA in Cambridgeshire, the fields may be bounded by open ditches, which may also be similarly neglected or inappropriately managed.

- In 2003 only a small proportion (3 per cent or 410 km) of the estimated boundary length for this NCA (13,663 km) was under Countryside Stewardship agreements. This included 76 km of fencing, 96 km of hedgerow management, 146 km of hedgerow planting and restoration, and 37 km of restored-boundary protection. Similarly there were limited agreements for ditches (4 km). Data suggests that uptake of boundary options significantly increased with Environmental Stewardship; Entry Level and Higher Level Stewardship options taken since 2005 include 945 km of hedgerow management, 24 km of hedgerow restoration, 9.4 km of hedgerow planting and 156 km of ditch management and restoration.

- Dutch elm disease had a dramatic effect on hedgerow trees in the NCA resulting in the loss of many. Remaining hedgerow trees and those located by ditches are mainly oak and ash. A small-scale project has begun to reintroduce English elm to the Marston Vale using potentially disease-resistant plants.

Agriculture

- Farm amalgamation associated with an increase in agricultural productivity has created an intensively farmed landscape consisting of medium and large arable fields. This has resulted in the loss of hedgerows, fragmentation and loss of semi-natural habitats, particularly grasslands, and damage to underground archaeology and historic features.

- A subtle change in land use has occurred around small villages and settlements where small grass paddocks for keeping of horses and ponies have been accommodated, impacting on local landscape character.

- The NCA remains predominantly agricultural in nature; however, between 2000 and 2009 the area of land under livestock, arable, horticulture and mixed cropping fell as land was converted to other uses or developed. The area under grass remained fairly static, although total farm size and the area of land held by farms also fell.

- In 2003, Countryside Stewardship agreements were based on arable options and followed the national average. These included overwintered stubble followed by a spring/summer fallow (102 ha), overwintered stubble followed by a low input spring cereal crop (29 ha), overwintered stubble followed by a spring crop (26 ha), wild bird seed mixture (58 ha), creation of permanent grass margins > 6 m (852 km), creation of 2 m wide arable margins (218 km), creation of 2 m wide grass margins or beetle banks (242 km), and buffer strips (4 km). The area of lowland pastures on neutral/acid soils and lowland hay meadows under agreement was 1,454 ha and 800 ha respectively. Environmental Stewardship (Entry Level and Higher Level) options taken (2005 to 2011) include 271 ha of overwintered stubble, 44 ha of wild bird seed mixture and 376 ha of buffer strips to cultivated land, grassland and watercourses.

Settlement and development

- Development pressure in the NCA is high. There has been significant development, both residential and commercial, around many of the major towns and within villages. Development around Milton Keynes, Bedford, Biggleswade, St Neots, Huntingdon, Peterborough and Cambridge, in particular, has been extensive. There are growth plans for all of the main towns and cities and Milton Keynes continues to expand.

- A large proportion of development has taken place within growth areas around Milton Keynes, Cambridge and Peterborough, and along major transport corridors such as the A1, M1 and M11. This includes transport infrastructure improvements such as widening of sections of the A1 and M1, a new section of the A421 between Junction 13 of the M1 and the A1, and duelling of the A428 between Caxton Gibbett and Cambridge impacting on local landscape character.

- Airfields built in the Second World War have been given a new lease of life as business hubs and local airports or are awaiting a second phase of development often including residential development.

- As renewable energy technology, particularly wind energy, has developed the area has been subject to proposals for generating renewable energy with pressure to accommodate wind turbines. A number have been given permission most notably near Gravely, Biggleswade, St Neots and Olney.

Semi-natural habitat

- The main semi-natural habitats within the NCA include flood plain grazing marsh, lowland mixed deciduous woodland, wood pasture and parkland, fen, lowland meadow and reedbed. All have become reduced in size and more fragmented.

- Around Somersham and Bluntisham in Cambridgeshire some good examples of traditional orchard remain. The area of remaining traditional orchard in the county is thought to be 20 per cent of what the total area was in 1950 with losses still occurring due to development, neglect and land use change such as conversion to arable or paddocks.

- Countryside Stewardship uptake for the area followed the national average. Agreements included pastures on neutral/acid soils (1,454 ha), lowland hay meadows (800 ha) and grassland/semi-natural vegetation regeneration (567 ha). Environmental Stewardship (Entry Level and Higher Level) options taken between 2005 and 2011 included 328 ha of wood pasture and parkland management and restoration, 11 ha of orchard management and 340 ha of species-rich grassland management and restoration.

Historic features

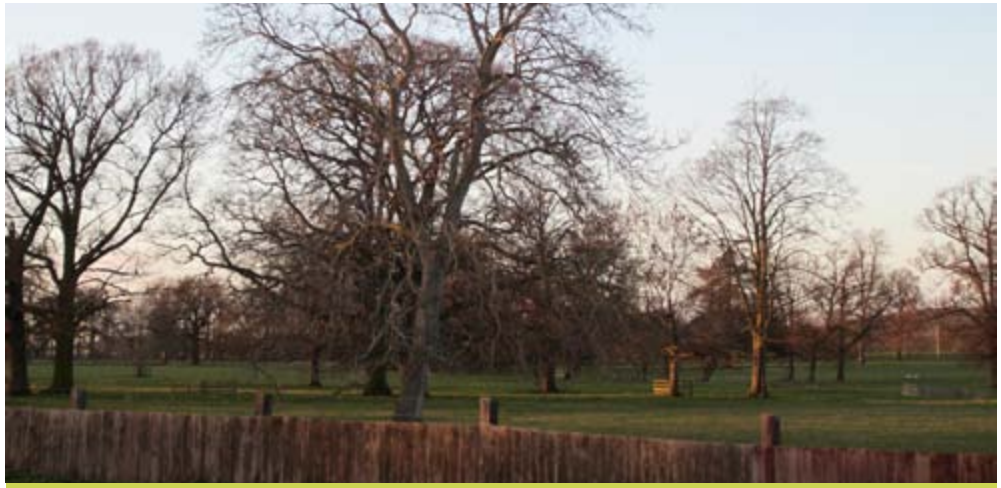
- A small proportion of the NCA is historic parkland, much of which is included on the Register of Historic Parks and Gardens (39 sites). The resource is considerably smaller in extent than it was in 1918. By 1995 it is estimated that 53 per cent of parkland had been lost. About 35 per cent of the remaining parkland is covered by a Historic Parkland Grant, and about 18 per cent of this is included within an agri-environment scheme.

- Approximately 67 per cent of historic farm buildings remain unconverted.

- One of the Cardington Hangars, a local landmark and historic feature which was registered by English Heritage as being at risk, is currently undergoing restoration work.

Rivers

- The whole of the NCA area has been identified as a nitrate vulnerable zone (NVZ) with measures in place to improve water quality. The potential ecological status of the majority of the waterbodies in the NCA has been recorded as 'moderate'. The groundwater status in the majority of the NCA has been recorded as 'poor'. The Cam and Ely Woburn Sands and Secondary Upper Bedford Ouse Oolite aquifers have 'good' status.



A small proportion of historic parkland and wood pasture remains in the NCA.

- Water resources have come increasingly pressured due to demands for water for agriculture, spray irrigation, industrial use, power generation and public water supply. Water availability within the NCA is restricted with many waterbodies currently listed as having no water available.

- Flood risk occurs along the course of the River Great Ouse and within the catchment. Many rivers have been heavily modified, embanked or re-sectioned with weirs and flood defence structures in place to manage water flows. The catchment is known for its quick response during periods of heavy rainfall and for water quality and flow issues further downstream that affect important sites of nature conservation interest for example Nene and Ouse Washes.

The River Great Ouse through Bedford.

- Grafham Water near Huntingdon was constructed in the 1960s to meet the demand for water from the new town of Milton Keynes and the rapid expansion of Bedfordshire's and Northamptonshire's existing towns. It is one of the largest man-made reservoirs in England and an important location for water-based recreation and nature conservation.

- Some invasive species, such as signal crayfish and Himalayan balsam, thrive in the River Great Ouse catchment at the expense of native species. Dikerogammarus villosus, an invasive freshwater shrimp, has been found at Grafham Water. Measures are in place to help control its spread.

Minerals

- The extensive extraction of clay in the Marston Vale, Bedfordshire and in the brickfields of Peterborough has created a distinct landscape of deep excavations and man-made waterbodies. Many have been restored for recreation, biodiversity as well as being used for landfill, particularly within the Marston Vale, creating a unique 'domed' landscape within the gently undulating arable plateau.

- Sand and gravel extraction within the river valleys, especially along the River Great Ouse, has left a series of restored and flooded waterbodies important for biodiversity, recreation and in some cases water management for the catchment.

- While economic factors have slowed the rate of mineral extraction some continues and the area has rich deposits of clay, sand and gravel which could be exploited in future.

Drivers of change

Climate change

- Current agricultural practices may need to adapt to likely changes in weather patterns and water availability. Greater demands on agriculture to produce higher yields could put pressure on the remaining areas of semi-natural grassland, woodland, wetland and other semi-natural habitats.

- Changing temperatures and weather conditions such as warmer, drier summers could lead to a longer growing season and the ability to grow different types of crops. However, a reduction in winter cropping and winter stubbles could reduce available food sources for farmland birds. There may be an increased demand for energy crops that changes cropping patterns and impacts on landscape character. Careful management may be required to ensure this does not lead to a deterioration in soil and water quality, through the run-off of soil nutrients, sediment and diffuse pollution from herbicides and pesticides.

- An increase in extreme weather events – hotter, drier summers and heavier winter rainfall –could result in an increase in the incidence of grassland and woodland fires during dry summers with impacts on soil and water quality and flooding following heavier rainfall. Flood plain grazing marsh may benefit from wetter winters, but suffer from summer droughts. Periods of drought may alter the species composition of semi-natural habitats, particularly woodland and grassland, so that species more tolerant of drought conditions dominate those that are not. Increases in sediment loads and run-off may affect water quality and have adverse effects on habitats, species and designated sites along river valleys, especially those further downstream.

- Wind blow and drought may lead to the loss of ancient and veteran trees in hedgerows and parkland landscapes impacting on landscape character. There may even be a decline in the amount of woodland cover and changes in species abundance including those that specialise in decaying and dead wood.

- Climate change may make some tree species more vulnerable to pests and disease, or vulnerable to competition from invasive species. Warmer winters may allow new pests and diseases to become a potential threat. Changes in climate may also make it easier for non-native and other invasive species to move within the landscape to the detriment of native ones.

- With warmer weather it is likely that there will be an increase in demand for outdoor recreation during the summer adding further pressure on popular recreation sites. Additional path and visitor facility maintenance may be required. Ground conditions and storm damage in the winter may hinder access or detract from the user experience. Where habitats are fragmented they are likely to be more vulnerable to degradation and damage, and sensitive species more likely to be disturbed.

Other key drivers

- Development pressure in this NCA is high and continues to grow due to expanding populations and proximity to London. Further growth and infrastructure improvements are planned, such as upgrading the A14 and a new waterway link between Milton Keynes and Bedford. The need to accommodate this further growth and expansion will present a challenge in ensuring that the character and tranquility of the area are not adversely affected. Opportunities exist to improve multi-functional green infrastructure links and the design of the urban fringes in ways that respect landscape character and improve access to the countryside for local communities.

- There are significant pressures on the water resources within the NCA which are likely to intensify with the impact of growth and development, recreational and agricultural demands, and climate change. Water management will be an increasingly major challenge. The NCA is in one of the driest parts of the UK with low rainfall. It contains a number of important wildlife sites reliant on a good supply of water of high quality and it suffers from high flood risk in some areas which impacts on water quality. Opportunities exist to address some of these challenges and bring wider benefits by reconnecting the river with its flood plain and increasing its water storage capacity.

- Within the Marston Vale the work of the Community Forest to regenerate the landscape affected by the brick-making industry will continue to 2031. Trees and woodlands are being used to regenerate the landscape and provide social, economic and environmental benefits. Partnership projects and initiatives such as Bedford River Valley Park, on the eastern side of Bedford, offer multiple benefits for recreation, biodiversity, education, protection of heritage assets, climate regulation and an opportunity to restore a functioning flood plain. The impact of ash die-back in the NCA caused by the fungus Chalara fraxinea is currently unknown; however, it could have a potentially significant impact as ash is a common and characteristic tree species of the area.

New road infrastructure includes this new section of the A421 linking Junction 13 of the M1 to the A1.

Supporting document 3: Analysis supporting Statements of Environmental Opportunity

The following analysis section focuses on a selection of the key provisioning, regulating and cultural ecosystem goods and services for this NCA. These are underpinned by supporting services such as photosynthesis, nutrient cycling, soil formation and evapo-transpiration. Supporting services perform an essential role in ensuring the availability of all ecosystem services.

Biodiversity and geodiversity are crucial in supporting the full range of ecosystem services provided by this landscape. Wildlife and geologically-rich landscapes are also of cultural value and are included in this section of the analysis. This analysis shows the projected impact of Statements of Environmental Opportunity on the value of nominated ecosystem services within this landscape.

Stewartby Lake, Bedfordshire, an important recreational resource with remaining brickwork chimneys in the background.

Statement of Environmental Opportunity	Ecosystem Service																		
	Food provision	Timber provision	Water availability	Genetic diversity	Biomass provision	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place / Inspiration	Sense of history	Tranquillity	Recreation	Biodiversity	Geodiversity
SEO 1: Maintain and manage a sustainable and productive claylands arable landscape, while managing, expanding and linking woodlands, hedgerows and other semi-natural habitats to benefit biodiversity, improve soil and water quality, and ameliorate climate change by promoting good agricultural practice.	↑ **	↔ *	↗ *	↗ *	↔ *	↗ **	↗ **	↗ **	↗ **	↗ **	↗ *	↗ *	n/a	↔ *	↔ *	↔ *	↔ *	↗ *	↔ *
SEO 2: Protect aquifers and enhance the quality, state and structure of the River Great Ouse, its valley and tributaries, habitats, waterbodies and flood plain by seeking to enhance their ecological, historical and recreational importance while taking into account their contribution to sense of place and regulating water flow, quality and availability.	↔ *	↔ *	↗ *	↔ *	↔ *	↗ **	↗ **	↗ **	↗ *	↗ *	↗ *	↗ *	n/a	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **
SEO 3: Plan and create high-quality green infrastructure to help accommodate growth and expansion, linking and enhancing existing semi-natural habitats. Regenerate the post-industrial landscapes of the Marston Vale and Peterborough to improve and create new opportunities for biodiversity, recreation, timber and biomass provision while strengthening sense of place, tranquillity, resilience to climate change, and people's health and wellbeing.	↔ **	↗ **	↗ *	↗ **	↗ *	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **	n/a	↗ **	↗ **	↗ **	↗ **	↗ **	↗ *
SEO 4: Protect, conserve and enhance the cultural heritage and tranquillity of the Bedfordshire and Cambridgeshire Claylands NCA, including its important geodiversity, archaeology, historic houses, parkland, and Second World War and industrial heritage, by improving interpretation and educational opportunities to increase people's enjoyment and understanding of the landscape.	↔ **	↔ *	↔ *	↔ *	↔ *	↗ *	↔ *	↗ *	↗ *	↗ *	↔ *	↔ *	n/a	↗ **	↗ **	↗ **	↗ **	↗ *	↗ **

Note: Arrows shown in the table above indicate anticipated impact on service delivery: ↑ = Increase ↗ = Slight Increase ↔ = No change ↘ = Slight Decrease ↓ = Decrease. Asterisks denote confidence in projection (*low **medium***high) ° symbol denotes where insufficient information on the likely impact is available.

National Importance; Regional Importance; Local Importance

Landscape attributes

Landscape attribute	Justification for selection
A gently undulating lowland plateau with an underlying clay geology and sand and gravel deposits within broad, shallow river valleys.	■ The Bedfordshire and Cambridgeshire Claylands NCA comprises most of north and mid Bedfordshire, western Cambridgeshire, and parts of east Buckinghamshire and Northamptonshire. The underlying geology (shared with the adjacent Upper Thames Clay Vales NCA) gives a gently undulating topography that is divided by broad, shallow river valleys of the River Great Ouse and its tributaries that gradually widen as they approach The Fens NCA. ■ Soils are moderately fertile, permeable, and the majority are lime-rich, loamy and clayey. More fertile and free-draining soils occur in the river valleys. ■ The Jurassic Oxford clay has been extensively extracted and used in the brick-making industry based in the Marston Vale and around Peterborough. ■ Extensive sand and gravel deposits exist within the river valleys. A significant amount of quarrying has taken place within the river valleys leaving a series of restored and flooded waterbodies.
Slow-flowing rivers in broad, shallow flood plains.	■ The River Great Ouse and its tributaries including the rivers Ivel, Kym, Til, Tove, Cam, Ouzel and Flit meander slowly and gently across the landscape. A small section of the River Nene dissects the NCA at Peterborough. ■ The river valleys feel more enclosed in their upper reaches, but broaden gradually as they approach the Fens. As they widen the landscape and views become more open. ■ Flood plain grazing marsh, fen, reedbeds, open waterbodies and pollarded willows within the flood plain provide a contrast to the character of the surrounding intensive arable landscape and support a range of species. Remaining fragments of unimproved grassland support a rich diversity of flora such as sulphur clover, crested cow-wheat and green-winged orchid while riparian and other wetland habitats support populations of breeding and overwintering birds, water vole, otter, great crested newt and species of stonewort. ■ Grafham Water provides a strategic water supply and is important for recreation and biodiversity. ■ The Grand Union Canal with its series of locks and distinctive canal-side vegetation, including pollard willows, dissects the NCA in the south-west within the River Ouzel valley. ■ The rivers and the Grand Union Canal and other man-made waterbodies offer numerous opportunities for quiet, informal recreation.
Brickfields of the Marston Vale and Peterborough form distinctive post-industrial landscapes.	■ The properties of the Jurassic Oxford Clay have made it valuable for brick making. ■ In the Marston Vale and south of Peterborough clay extraction for brick making has created a distinct post-industrial landscape of man-made waterbodies, brickworks, chimney stacks and restored land, including landfill sites. ■ Waterbodies range in size from small field ponds and marshy areas to huge lakes that support important breeding and overwintering birdlife. They are also important for stoneworts, amphibians and their invertebrate fauna. ■ New woodland planting, especially within the Forest of Marston Vale, and other green infrastructure initiatives have created new opportunities for recreation and biodiversity.

Landscape attribute	Justification for selection
Scattered woodland cover including ancient semi-natural woodland, parkland, plantations and secondary woodland within the river valleys, and new tree and woodland planting.	■ Woodland cover is variable and generally scattered and sparse. Small areas of remnant parkland remain. Smaller plantations and secondary woodland exist within the river valleys and as screening for mineral extraction and development schemes. ■ Woodland survives in numerous small and isolated fragments on the clay plateau and within river corridors. ■ Clusters of ancient semi-natural woodland remain, most notably located on higher ground to the north-west of the NCA between Salcey Forest and Grafham Water where remnants of Royal Hunting Forests exist on the Northamptonshire-Bedfordshire border, and south-west of Cambridge. ■ A number of ancient woodlands are designated for their biodiversity interest such as Marston Thrift (Bedfordshire), Brampton Wood and Monks Wood (Cambridgeshire). These sites are important for butterflies, ground flora such as bluebells and oxlip, and bats, as well as supporting an introduced population of dormice. ■ Traditional orchards exist in a triangle between Cambridge, Huntingdon and Ely, containing some ancient and veteran trees that support specialist invertebrate species and a range of local varieties of plum, apples and gage. ■ A significant amount of new woodland planting has been carried out within the Marston Vale as part of the creation of the Forest of Marston Vale, to regenerate the landscape following clay extraction and landfill activities. In Cambridgeshire work is underway to link the ancient woodlands around Gamlingay, Gransden and Waresley.
An open, arable landscape with large rectilinear fields bounded by hedgerows and open ditches.	■ A predominantly open and intensively-farmed arable landscape with typical crops of cereals and oilseed rape. The better-drained soils of the river valleys, especially those of the Ivel Valley, support vegetable and horticultural crops. ■ Views of the claylands and its large-scale arable farmland can be seen from the elevated ground of the Bedfordshire Greensand Ridge, East Anglian Chalk and Chilterns NCAs as well as from the Yardley Whittlewood Ridge NCA. ■ The large rectilinear fields are bounded by open ditches or trimmed hedgerows that are often species-poor and contain variable numbers of hedgerow trees. The hedgerows typically increase in size towards the east. Open ditches with infrequent trees also bound some fields and are often under-managed. ■ Arable farmland and associated habitats are important for farmland birds such as skylark and grey partridge, and brown hare.

Landscape attribute	Justification for selection
Rich archaeological, geological and heritage resource contributing to a strong sense of place and history.	■ The underlying clay sediments and glacial deposits of the NCA are rich in fossil remains. The Oxford Clay is renowned for being the source of the clay for the brick-making industries of Peterborough and the Marston Vale. ■ Abundant early archaeological remains and evidence concentrated along the Ivel and Great Ouse river valleys including Roman settlements at the river crossings of Huntingdon, Godmanchester, St Ives and St Neots, medieval settlements and moated manor sites, deserted villages, pockets of ridge and furrow, and ruined and isolated churches such as Bushmead Priory. ■ There are several notable houses, historic parklands and estates including Stowe House, Wrest Park, Kimbolton Park, Wimpole Hall and Croxton Park. ■ World War history includes Bletchley Park and military airfields, some of which have merged back into the landscape while others await further development or thrive as important technological and military centres and business airports (for example, Alconbury, Cranfield and Thurleigh). The Cardington Hangars, built in 1915, remain a significant landmark and form part of the cultural heritage of the area. ■ Traditional building materials vary considerably across the NCA with a diversity of building materials used including brick, render, thatch and stone resulting in pockets of localised materials and styles. ■ Locally quarried limestone is commonly used in village buildings on the upper stretches of the River Great Ouse. Clay tile and brick is commonly found in the south and east of the NCA. ■ There are several cultural and literary associations such as John Bunyan, who wrote Pilgrim's Progress,, and Oliver Cromwell, born in Huntingdon in 1599. In the 18th century Olney was home both to the reformed slave trader Rev. John Newton and the poet William Cowper.
Urban centres and settlements clustered around major road and rail corridors.	■ The majority of the Bedfordshire and Cambridgeshire Claylands NCA is uniformly, but sparsely populated. ■ Larger settlements are generally located along the river valleys and more recently around the major road and rail corridors. Smaller towns and villages are dispersed throughout the NCA with a more rural feel to them. ■ Major transport infrastructure crosses the area including the M1, M11, A1, A5, A6, A14, A421, A422, and A428 roads, two main railway lines, and Grand Union Canal. ■ Recreational facilities are concentrated close to the main urban populations. Large towns and cities such as Milton Keynes, Bedford, Cambridge and Peterborough have urban green spaces within them and improved green infrastructure links to the wider countryside. There is a Community Forest, a small part of an Area of Outstanding Natural Beauty, an extensive rights-of-way network, three National Nature Reserves, open access land, two National Cycle Routes, and numerous opportunities for quiet, informal recreation.

Landscape opportunities

- Support sustainable farming practices that promote food production, protect and improve soil quality, improve water quality and help to regulate water flow.
- Strengthen the mosaic of semi-natural habitats within the farmed landscape to benefit landscape character and habitat connectivity and support farmland biodiversity.
- Appropriately manage semi-natural habitats including woodland, grassland, hedgerows, field margins, road verges and green lanes to provide structural diversity and a variety of flowering plants, and improve habitat extent, quality and connectivity in the landscape.
- Encourage the reconnection of the rivers with their flood plains, seeking to link and extend existing habitats and restore or create new grasslands, fens, reedbeds and wet woodland for their contribution to riverine character, biodiversity and sense of place. Reinstate traditional management practices such as willow pollarding.
- Conserve ancient and veteran trees in river valleys, hedgerows, historic parklands and traditional orchards for their biodiversity and heritage value, planning for the provision of replacement stock and veteran trees in the future.
- Appropriately manage mineral extraction activities to limit damage to archaeology, geodiversity and biodiversity interests.
- Seek opportunities to enhance landscape character and biodiversity through the creation of new habitats and recreational and educational opportunities to increase people's understanding and enjoyment of local archaeology and geodiversity and its contribution to the landscape.
- Plan for and manage the impact of new development by ensuring that high-quality design secures biodiversity enhancements and access and green infrastructure provision which strengthen sense of place and landscape character.
- Conserve the character and pattern of the distinctive limestone villages of upper reaches of the River Great Ouse. Encourage new development that respects the distinctive character of the villages using traditional local building materials and limiting visual impact by ensuring it is sensitively designed and located.
- Manage visitor access and recreational activities to ensure that demand can be accommodated without conflict between different users, local communities and the historic, built and natural environments.
- Protect the tranquillity of areas that remain undisturbed, for example around Grafham Water, north of Bedford, from intrusive communication and utility infrastructure, noisy recreational pursuits, air traffic and light pollution.
- Support the work of the Forest of Marston Vale Community Forest to regenerate the area and restore the landscape using trees and woodland to provide social, economic and environmental benefits.
- Support the work of the Chilterns AONB to conserve and enhance the landscape and special qualities of the AONB. Conserve and manage distinctive elements of the Chilterns landscape such as its woodlands, grasslands, streams and rural character to improve sense of place and tranquillity, particularly near to settlements.

Ecosystem service analysis

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Arable farmland Soils Traditional orchards	Seventy per cent of the character area is in agricultural use. Of this cereals (wheat, winter and spring barley) account for 47 per cent of the total farmed area. Other crops include oilseed rape, linseed, field beans and beet. Statistics indicate there has been a decrease in the area of land in agricultural use, farm size and area of land held. Soils are variable but the majority are moderately fertile and classified as Grade 2 (35 per cent) and Grade 3 (48 per cent). Lime-rich loamy and clayey soils with impeded drainage cover 65 per cent of the NCA with more fertile and free-draining soils in the Ivel river valley and its tributaries.	Regional	The area is important for food production which is a major industry. It is likely to be influenced by changes in the market. However, the area in agricultural use has decreased as land has been converted into other uses and lost to development. Multiple benefits could be gained in terms of maintaining or increasing levels of food production, preserving historic character and enhancing biodiversity, however, there are pressures on soil and water resources, especially water availability. Demand for potable water in the area is high. Extraction of water for irrigating crops adds to pressure on this limited resource. Crop type and the cultivation techniques may need to be modified in coming years to accommodate changes in climate, increase drought resilience and reduce diffuse pollution.	Manage the arable landscape to retain the value of food provision, employing sustainable farming practices to benefit biodiversity, water availability, and soil and water quality, for example, by reducing the use of herbicides and pesticides, buffering field margins, and retaining winter stubble. Encourage farmers to use techniques such as establishing break crops to manage land and protect soil. Work with local farmers, landowners and managers to promote best practice through agri-environment schemes such as the establishment of buffer strips and margins, and the appropriate management of hedgerows to promote biodiversity, address soil erosion and improve soil and water quality to continue the important service of food provision by sustainable means.	**Food provision** **Regulating soil quality** **Regulating water quality** **Regulating soil erosion** **Biodiversity** **Sense of place/ inspiration** **Climate regulation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Lowland mixed broadleaved woodland	The NCA has a low proportion of woodland: 11,947 ha which is 5 per cent of the total NCA area. Of this 3,068 ha is ancient semi-natural woodland. Woodland cover is scattered and there is limited commercial plantation forestry. Since 1990/91 the Forest of Marston Vale Community Forest has been planting new woodlands for environmental, economic and social benefit in the Marston Vale. In 1995 woodland cover in the Community Forest area was 3 per cent and in 2009/10 it had risen to 9 per cent.	Local	Although lowland mixed broadleaved woodland cover is a small proportion of the total NCA area it is the second largest priority habitat, important for biodiversity. Woodland also provides a sense of tranquillity and landscape character. Commercial timber provision is currently limited, but the existing woodland area and new planting provides an important role for carbon sequestration and is an important recreational resource. There is scope for low grade woodland products in the short- to medium-term and higher-value timber production in the longer term with active woodland management. Increases in timber production need careful consideration and planning against the impacts on food production, landscape and biodiversity. Benefits include increased biodiversity and carbon sequestration, improvements in water and soil quality, reduced soil erosion and stimulating local markets in wood products and fuel. With climate change, the species composition of woodlands may change, affecting timber production over time. New pests and diseases are a potential threat.	Encourage the conservation and management of existing woodlands and the replacement of introduced species with native species, as well as undertaking new woodland planting that enhances the biodiversity and recreational value of the woodlands along with benefits for water quality, soil erosion and adaptation to climate change. Link and expand woodland areas to improve habitat connectivity where appropriate. Promote and stimulate local markets for wood products, biomass and wood fuel to support sustainable timber production. Explore opportunities to bring unmanaged woodland into management and promote the benefits for biodiversity, landscape and contribution to climate regulation. Prepare and implement plans to control or limit the spread of new pests or disease ñ for example, ash dieback disease.	**Timber provision** **Biodiversity** **Climate regulation** **Regulating water quality** **Regulating soil quality** **Biomass energy** **Recreation** **Sense of place/ inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Rivers and streams Aquifers Reservoirs Grand Union Canal Semi-natural habitats	The River Great Ouse is the main river in this NCA. Others include the rivers Tove, Til, Kym, Ouzel, Ivel, Flit and Cam which are all tributaries of the River Great Ouse. A small part of the River Nene also passes through the NCA; it supplies Rutland Water (outside of the NCA) and provides drinking water to Kettering, Northampton, Peterborough and surrounding areas. The Great Oolite limestone aquifer underlies much of this NCA while part of the Woburn Sands aquifer underlies the NCA in the south-west (the majority of this aquifer underlies the Bedfordshire Greensand Ridge NCA). There is also a small chalk aquifer in the south-east of the NCA.[4] In the north of the NCA there are alluvial sand and gravel aquifers, following the course of the River Great Ouse and its tributaries. The majority of these groundwater resources have a ëno water availableí status. Surface water is abstracted for a number of different purposes in this NCA including agriculture, spray irrigation, industrial use, power generation and public water supply. The rivers Tove, Til, Kym, Great Ouse, Ivel, Flit, and Ouzel have a ëno water availableí status.[5] The River Cam flowing north through Cambridge in the north-east of the NCA has an ëover licensedí status.[6] Grafham Water near Huntingdon was constructed in the 1960s to meet the demand for water from the new town of Milton Keynes and the rapid expansion of Bedfordshireís and Northamptonshireís existing towns. Anglian Water Services abstract water from the Great Ouse at Offord to maintain levels. The Grand Union Canal dissects the NCA at Milton Keynes following the line of the River Ouzel and relies on some water abstraction to maintain canal water levels.	Regional	Water availability is a significant challenge in the NCA and is restricted. Any new development or change in agricultural practice is likely to put additional pressure on water resources. Over-abstraction for agricultural and domestic supply can have an impact on wildlife and natural features in the NCA. Future changes in climate are likely to impact on water resources and the riparian habitats of the NCA. Seasonal changes in water availability may lead to changes in species composition and habitat succession. Reduced river flows due to low rainfall and drought could lead to reduced water quality, with diffuse pollution becoming more of an issue. Increased flood risk at certain times of the year may impact on biodiversity and water quality. Meeting the large demand for potable and irrigation water in this area as well as the needs of an expanding population and the impacts of climate change are a big challenge.	Promote and encourage the sustainable use of local water resources by agricultural, commercial and domestic users to reduce the pressure on water resources in this NCA. Monitor and manage water abstraction licences with new applications for groundwater abstraction considered on a case-by-case basis to reduce the pressure on the aquifers. Incorporate and encourage the use of water efficiency measures in new developments. Manage and encourage the extension and improved connectivity of semi-natural habitats, especially riparian habitats, to increase resilience to water shortages and to help regulate water flows by either slowing down the passage of water, adding storage capacity to the catchment, or feeding water to the aquifers. Support measures to maintain and improve soil structure to increase permeability and water retention by the soil.	**Water availability** **Regulating water flow** **Climate regulation** **Biodiversity** **Food production** **Sense of place/ inspiration** **Tranquillity**

[4] The Upper Ouse Bedford and Ouse Catchment Abstraction Management Strategy, Environment Agency (March 2005)
[5] *Ibid*
[6] The Cam and Ely Ouse Catchment Abstraction Management Strategy, Environment Agency

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	Traditional orchards	A small number of traditional orchards supporting a range of local varieties of plum for jam making, apples and gage exist in a triangle between Cambridge, Huntingdon and Ely. Plum orchards are most notable around Bluntisham. The decline in the extent of orchards in Cambridgeshire is significant from around 5,000 ha in 1950 to approximately 1,000 ha in 2000, with many more neglected or under-managed.	Local	Many orchards have been lost or destroyed through change in land use and development and many more are neglected. Local efforts exist to protect these habitats and prevent further losses. Many of the trees are old and support a variety of specialist species of invertebrate, lower plants and lichens. The preservation and management of the different types of orchard fruit is important to retain the genetic diversity of food crops. Increased genetic diversity affords an increased ability to respond to climate change and disease. Some locally grown varieties are available on a small scale at farmersí markets, roadside stalls and farm shops.	Protect and conserve existing orchards from inappropriate development and changes in land use, where possible. Encourage the appropriate management of traditional orchards, bringing them back into active management to conserve their genetic diversity, biodiversity value and cultural heritage. Plant and establish new orchards using traditional varieties of fruit trees. Promote and encourage local markets for locally grown orchard produce.	**Genetic diversity** **Biodiversity** **Pollination** **Sense of place/ inspiration** **Sense of history** **Food provision**
Biomass energy	Energy crops Existing woodland New woodland planting	There is a low level of biomass provision in the NCA at present, but potential for energy crops such as miscanthus or short rotation coppice (SRC) exists. The existing low woodland cover (5 per cent) offers limited potential for the provision of biomass through bringing unmanaged woodland under management as a by-product of commercial timber production.	Local	Opportunities exist for sensitive energy crop planting with either miscanthus or SRC. The potential for miscanthus is high. The potential for SRC is medium, with the highest areas of potential to the west of Cambridge, north-west of Huntingdon, north of Bedford and the outskirts of Milton Keynes. This has the potential to aid climate regulation and help regulate soil quality and erosion, but would need careful siting to avoid landscape and biodiversity impacts, in particular in the main river valleys and clusters of ancient woodland. Increasing biomass by bringing woodland back under management, as a by-product of commercial timber production, and from new planting has the potential to bring biodiversity and landscape benefits, aid climate regulation and soil erosion, and stimulate local markets in wood products. New woodland planting such as that in the Marston Vale offers potential in the future.	Encourage, where suitable, short rotation coppice and miscanthus, ensuring this does not have an adverse impact on historical assets, biodiversity or landscape character. Seek opportunities to develop biomass production through active woodland management, for example through coppicing, or as a by-product of commercial timber operations Stimulate local markets for biomass and wood fuel to support sustainable woodland management.	**Biomass energy** **Climate regulation** **Regulating soil erosion** **Regulating soil quality** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Arable farmland Woodland Semi-natural habitats Soils	Being predominantly arable (70 per cent of the NCA area) the potential for carbon sequestration in this NCA is limited due to regular soil disturbance. However, existing woodland, new woodland planting and other semi-natural habitats act as a carbon store. The soils over much of the NCA have low carbon content (0 to 5 per cent) although there is a band of soils within the vicinity of the River Great Ouse and its tributaries where the carbon content is between 5 and 20 per cent. These are flood plain soils with naturally high groundwater, some of which are peaty at depth or include small areas of peaty soils.	Local	Carbon sequestration and storage in the NCA is currently low. Arable cultivation techniques such as regular ploughing deplete stored soil carbon levels. Careful cropping techniques, the use of cover crops and measures to actively increase the organic content of soils can increase carbon sequestration. Woodland has a role to play in the sequestration and storage of carbon, especially where woodland is under active management. Other semi-natural habitats have the ability to store carbon and this capacity can be increased by improving habitat condition. There is potential for increasing carbon sequestration by increasing the organic matter inputs to the soil and by reducing the frequency and area of cultivation. Keeping some soils wet, especially those with peat content will be important to help retain their carbon content.	Work with farmers and landowners to encourage the adoption of sustainable farming practices to support carbon storage of soils, for example by reducing ploughing and increasing soil organic matter to help carbon storage and retention. Maintain and increase levels of carbon sequestration through sustainably managing existing woodland, actively managing it for multiple benefits including recreation as well as for climate regulation. Support new woodland and tree planting and promote the planting of trees and hedgerows within new developments. Enhance the hedgerow network to strengthen landscape character and improve carbon sequestration, for example by linking areas of existing woodland and reinstating hedgerow field boundaries. Extend where possible and improve the condition of semi-natural habitats such as grassland through management to increase their capacity to sequester carbon.	**Climate regulation** **Regulating soil quality** **Biodiversity** **Regulating soil erosion** **Regulating water quality** **Regulating water flow** **Sense of place/ inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Soils Aquifers Waterbodies including reservoirs and rivers Semi-natural habitats including woodland, flood plain grazing marsh, reedbeds and hedgerows	The whole of the NCA area is a nitrate vulnerable zone (NVZ). The lime-rich loamy and clayey soils with impeded drainage that cover the majority of the NCA are at risk from compaction and poaching, requiring careful management to maintain a good soil structure and avoid increasing vulnerability to run-off under high precipitation conditions that can quickly cause localised soil erosion impacting on water quality. The groundwater status in the majority of the NCA is ëpoorí. The Cam and Ely Woburn Sands and Secondary Upper Bedford Ouse Oolite aquifers have ëgoodí status. The potential ecological status of the majority of the waterbodies and rivers in the NCA is ëmoderateí. In some cases the potential ecological status is ëgoodí on upper reaches reducing to ëmoderate' further downstream. The semi-natural habitats present in the area including woodland, hedgerows, semi-improved and unimproved grassland, flood plain grazing marsh, fen and reedbed help to filter out pollutants and sediments, helping regulate water quality.	Regional	To address issues within the NVZ, surface water quality improvements could be gained by reducing sediment, nutrient and run-off from agricultural land as well as controlling damage caused to the soil by vehicles or stock. Water quality within the NCA is affected by: ■ Diffuse agricultural pollution including nitrates and pesticides such as metaldehyde that threaten public water supplies. ■ Solvents. ■ Sediment which causes siltation. ■ Pollution from wastewater discharges introducing nutrients and chemicals such as phosphate, ammonia and organic matter in treated sewage. ■ General poor quality surface run-off in urban areas. Slow flows and low dissolved oxygen levels, limited habitat diversity, and nutrient enrichment encouraging excessive weed and algal growth impairs quality further. Semi-natural habitats have the potential to filter out pollutants and sediment. This ability could be greatly strengthened by linking or expanding existing fragmented habitat. Climate change may bring drier summers leading to lower water levels and a concentration of pollutants. Flooding can increase problems of silt and other contaminants to watercourses. Increased run-off following intense rainfall may also increase the concentration of pollutants in water supplies.	Implement catchment-wide water management plans to ensure a co-ordinated approach to reducing the impacts of pollution on water quality. Encourage the use of sustainable drainage schemes especially within urban areas to reduce run-off. Promote and encourage different remedies to improve water quality (for example increasing on-farm water storage to reduce water abstraction levels, increasing flow rates and water levels in rivers, and continuing to make improvements to wastewater treatment works) to benefit aquatic biodiversity. Encourage landowners and managers to increase and link areas of semi-natural habitat such as flood plain grazing marsh and reedbed to help slow water passage and filter out pollutants. Work to reduce surface and groundwater pollution at a catchment scale by managing farmland under the principles established by the Catchment Sensitive Farming programme. Encourage adoption of sustainable land management practices to improve the soil structure through increasing organic matter, reducing compaction and promoting sustainable management to minimise the loss of sediments. Where possible expand buffer strips along watercourses to help filter out sediments and pollution, and provide benefits for landscape character and biodiversity.	**Regulating water quality** **Regulating water flow** **Biodiversity** **Regulating soil erosion** **Climate regulation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Soils Aquifers Waterbodies and river valleys Semi-natural habitats including woodland, flood plain grazing marsh, reedbed and hedgerows	The lime-rich loamy and clayey soils with impeded drainage that cover the majority of the NCA can increase the likelihood of run-off under high precipitation conditions if damaged. Many of the rivers in this NCA are heavily modified, embanked or re-sectioned rivers, with weirs and flood defence structures to manage water flows. The numerous lakes and other waterbodies within river valleys are also used in some cases for water storage and management purposes. Flood risk occurs along the course of the River Great Ouse, however water management and increased flood storage within the flood plain has helped to protect major settlements. Areas at risk of flooding include Kempston, Bedford, St Neots, Godmanchester, Huntingdon and St Ives. The approach to managing flood risk set out in the Catchment Flood Management Plan[7] is to maximise the potential of the undeveloped flood plain to retain water. Flood risk also exists at Newport Pagnell and Milton Keynes from the River Ouzel, from the River Cam in Cambridge and from the River Flit in Shefford.	Regional	Careful soil management to reduce soil damage and increase organic matter content will help improve infiltration aiding aquifer recharge, reduce run-off and slow flows. The River Great Ouse catchment is known for its quick response during periods of heavy rainfall, therefore measures taken in this NCA will help to regulate and manage flows further downstream in other NCAs and sites of nature conservation importance that are known to have issues with water quality and flow such as the Nene and Ouse Washes. River and flood plain modifications including development have decreased habitat diversity and created obstacles to fish passage. Reinstating the natural functionality of the flood plain, where possible, could assist in water flow management with added benefits for biodiversity. Restoring river channels and creating and managing riparian habitats as well as engineered schemes that store floodwater can provide long-term benefits for the river environment and wetland habitats. Increasing woodland cover and the networks of grassland, hedgerows and other semi-natural habitats will help with the interception of water, reducing run-off and minimising soil erosion. Potential changes in climate with more rainfall in winter and more intense rainfall in summer could exacerbate flood risk. High development pressures in the NCA will impact on flood risk and necessitate additional management.	Work with landowners and managers to encourage and adopt good land, soil and water management to reduce poaching and soil compaction. Manage vegetation within the catchment to help to bind the soil, reducing the risk of erosion and slowing the passage of water. Seek opportunities to extend and link areas of woodland, hedgerow, grassland and other semi-natural habitats to aid infiltration and slow water flow, and provide benefits for biodiversity. Seek opportunities to increase the water storage capacity of the flood plains, conserving and extending riparian habitats to retain water, and bring benefit to the river environment. Promote green infrastructure to help mitigate the impact of flooding. Encourage the use of sustainable drainage systems (SuDS) such as permeable surfacing within urban areas to help reduce run-off.	**Regulating water flow** **Regulating water quality** **Regulating soil quality** **Regulating soil erosion** **Biodiversity** **Climate regulation** **Sense of place/ inspiration**

[7] Draft Great Ouse Catchment Flood Management Plan Summary Report: Consultation Draft, Environment Agency (April 2010)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Soils Semi-natural habitats	There are eight main soilscape types in this NCA: ■ Lime-rich loamy and clayey soils with impeded drainage covering 65 per cent of the NCA. ■ Slowly permeable seasonally wet slightly acid, but base-rich loamy and clayey soils (7 per cent). ■ Freely draining lime-rich loamy soils (6 per cent). ■ Slightly acid loamy and clayey soils with impeded drainage (6 per cent). ■ Freely draining slightly acid loamy soils (5 per cent). ■ Loamy and clayey flood plain soils with naturally high groundwater (4 per cent). ■ Freely draining slightly acid, but base-rich soils (2 per cent). ■ Shallow lime-rich soils over chalk (2 per cent). The lime-rich loamy and clayey soils with impeded drainage (65 per cent) are calcareous soils with some natural resilience and enhanced workability. These soils are at risk from topsoil compaction and poaching, requiring careful management to maintain good soil structure and avoid increasing vulnerability to run-off under high precipitation conditions.	Local	Management that helps to maintain good soil structure, such as increasing soil organic matter levels and the use of minimum tillage will help improve soil quality, as well as reduce the potential for soil erosion in freely-draining soils. Maintaining good structural conditions will aid water infiltration, aquifer recharge, reduce run-off and prevent pollution of groundwater. Keeping some soils wet is important to the retention of their carbon content especially those with high peat content in the river valleys. There is the potential to increase organic matter content by management interventions. Much of the NCA is in agricultural use where maintaining and improving the soil quality will safeguard and retain food production in the long-term and increase the resilience of soils to climatic change and extreme weather events. Retaining and increasing the amount of semi-natural habitat and tree cover in this NCA would help maintain and improve soil condition.	Promote management techniques that prevent compaction and improve water infiltration such as the careful use of machinery. Add organic matter where appropriate to improve the soil structure. Promote the minimal use of tillage operations where possible. Encourage the use of crops which break up the soil such as rape or beans and winter cover to increase organic matter. Increase where possible the areas under woodland or permanent vegetation to stabilise the soil and increase quality with organic matter and soil fauna. Manage localised compaction and erosion in areas of recreational pressure, for example at popular woodland sites and along green lanes.	**Regulating soil quality** **Regulating water quality** **Regulating water flow** **Regulating soil erosion** **Food provision** **Biodiversity** **Climate regulation** **Recreation** **Sense of place/ inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Soils Woodland Semi-natural habitats (grassland, hedgerow network)	The dominant soils in the NCA, the lime-rich loamy and clayey soils with impeded drainage, are easily compacted by machinery or livestock if accessed when wet, increasing the risk of soil erosion by surface water run-off. This is a characteristic shared with the slightly acid loamy and clayey soils with impeded drainage (6 per cent) and the freely draining slightly acid, but base-rich soils (2 per cent). Some lighter-textured/ shallow variants of the freely draining lime-rich loamy soils, the freely draining slightly acid loamy soils, and the shallow lime-rich soils over chalk (together covering 13 per cent of the NCA) are at risk of erosion on sloping land where cultivated or where bare soil is exposed. The slowly permeable seasonally wet slightly acid, but base-rich loamy and clayey soils and the loamy and clayey flood plain soils with naturally high groundwater (which together cover 10 per cent of the NCA) are at low risk of erosion.	Local	Soil erosion in this NCA could be exacerbated where organic matter levels are low or where soils are compacted. There is potential for wind erosion on some coarse-textured cultivated soils on sloping land. Appropriate soil management measures such as careful timing of cultivations and maintenance of vegetation cover, especially over winter, can reduce the risk and help increase water infiltration aiding aquifer recharge. Increasing the areas of semi-natural habitat, for example extending hedgerows, establishing grassland and planting more woodland, is likely to help to bind the soils together, aid water penetration reducing erosion, and improve soil quality by incorporating organic matter.	Extend where appropriate the semi-natural vegetation cover, especially on steeper slopes where the claylands meet the Bedfordshire Greensand Ridge, Chilterns and East Anglian Chalk NCAs, in particular by planting more trees and woodland, establishing grassland and buffering hedgerows. This will help to increase the organic matter content of soils, reduce run-off and erosion, benefit biodiversity, and help to regulate water quality and flow. Encourage sustainable land management practices to reduce soil erosion, for example through types of crop rotations, use of machinery and timing of cropping. Work with farmers and landowners to choose options within agri-environment schemes or adopt best practice that will help to regulate soil erosion by avoiding leaving surfaces exposed (for example by introducing and incorporating green cover crops, fallow rotations, overwintering stubble or reversion to permanent grassland). Manage localised compaction and erosion in areas of concentrated recreational pressure for example within wooded areas and along green lanes in north Bedfordshire.	**Regulating soil erosion** **Regulating soil quality** **Regulating water flow** **Regulating water quality** **Biodiversity** **Climate regulation** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Areas of semi-natural habitat such as flood plain grazing marsh, hedgerows, unimproved and semi-improved grassland Traditional orchards	The area of flood plain grazing marsh, lowland calcareous grassland and lowland meadow in the NCA is relatively small (5,327 ha). However, many remaining examples are species-rich and designated as SSSI, such as Portholme Meadow SAC. Semi-improved and unimproved grassland also occurs along woodland rides, roadside verges and green lanes. Hedgerows are variable, some more species-rich than others, gappy and with variable numbers of hedgerow trees. The extent of traditional orchards has reduced; however, good examples exist around Bluntisham and Somersham in Cambridgeshire.	Local	The areas of semi-natural habitat found in the NCA are highly likely to support a variety of pollinators although the quality and extent of this habitat has reduced and become more fragmented. The grassland and hedgerows, in particular, provide good corridors and habitats for pollinators. Appropriate management of these habitats to create a structurally-diverse and nectar-rich network will enable pollinating invertebrates to move through the landscape. Maintaining a healthy population of pollinators is important for food provision in this NCA as well as biodiversity. Managing and enhancing the provision of flower-rich grasslands/pasture, field margins and headlands through agri-environment schemes will be of great benefit to many pollinating insects including bumblebees.	Seek opportunities to restore, recreate and manage areas for pollinators, for example by promoting agri-environment options with pollen and nectar mixes. Manage semi-natural habitats including hedgerows, parkland, road verges and green lanes to provide structural diversity and a variety of flowering plants that can provide breeding sites and food sources for pollinators. Encourage the active management of traditional orchards and seek to increase their extent. Encourage the minimum use of herbicides and pesticides to minimise impacts on pollinators.	**Pollination** **Food production** **Biodiversity** **Pest regulation** **Sense of place/ inspiration** **Sense of history**
Pest regulation	Areas of semi-natural habitat such as hedgerows, unimproved and semi-improved grassland and woodland Traditional orchards	Semi-natural habitats in the NCA support a variety of predatory species such as beetles that can contribute to the regulation of populations of pest species. Ancient semi-natural woodland and remaining areas of traditional orchard and parkland containing ancient and veteran trees support specialist deadwood invertebrates.	Local	The NCA provides a range of habitats for species that contribute to the regulation of pests; however, these are highly fragmented. Breaks in the ecological network and connectivity of habitats may limit the movement and effectiveness of predatory species.	Enhance and expand the network of semi-natural habitats particularly hedgerows, grasslands along road verges, green lanes and field margins that aid the movement of predatory species through the landscape and bring benefits for pest regulation, as well as pollination and biodiversity. Encourage the use of field margins, beetle banks and headlands in arable land to encourage pest-regulating species. Improve the diversity and condition of semi-natural habitats and where possible seek to expand and link them to provide a range of suitable conditions to support pest-regulating species. Conserve and manage traditional orchards, parkland and ancient and veteran trees for the benefit of fauna.	**Pest regulation** **Biodiversity** **Pollination** **Food production** **Sense of place/ inspiration** **Sense of history**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Underlying clay geology and clay soils River valleys Semi-natural habitats Arable landscape Scattered woodland cover Rural villages Restored landscapes Second World War airfields and Cardington Hangars Forest of Marston Vale Community Forest Chilterns AONB Historic cities of Cambridge and Peterborough, and market towns	The underlying clay geology gives the NCA an open, gently undulating topography. This is dissected by broad, shallow river valleys containing a mix of semi-natural habitats including flood plain grazing marsh, wet woodland, flooded pits and lines of pollarded willows, which contribute to sense of place. Scattered woodland, especially ancient woodlands, parkland and hedgerows are important features in a predominantly arable landscape. Small settlements are dispersed and larger settlements clustered along river valleys and major road networks. The limestone villages of the upper River Great Ouse are particularly distinctive for their use of local materials. The distinctive history of the industrial landscapes and associated infrastructure such as chimneys, clay pits and landfill of the Marston Vale and Peterborough areas give a strong sense of place to parts of the NCA. Literary associations include John Bunyan, who wrote Pilgrimís Progress, and the poet William Cowper who lived in Olney. The Second World War airfields and Cardington Hangars provide a sense of history. The NCA contains the Forest of Marston Vale Community Forest. A small extent of the Chilterns AONB occurs in the south of the NCA. Cambridge, Peterborough and some of the market towns are popular tourist destinations.	Regional	A sense of place and inspiration is associated with the areaís ancient woodlands and remnant parklands, as well as the river valleys that provide the contrast to the surrounding arable landscape, and where locally quarried limestone has been used in village buildings along the Upper Great Ouse. This NCA has been significantly influenced by a history of clay extraction for brick making and subsequent landfill. Sand and gravel extraction has also influenced landscape character, particularly of the river valleys. Increasing pressure on sense of place comes from development, especially around the main urban areas of Milton Keynes, Bedford, Huntingdon, Cambridge and Peterborough, and from transport infrastructure improvements. Promoting and maintaining landscape character where possible will help to integrate new development into the existing landscape. Managing and promoting locally distinctive features such as the woodland, parkland, historic houses and associations with the author John Bunyan and poet William Cowper are likely to increase the sense of place and have the potential to increase the attractiveness of the area to visitors. Conserving and managing distinctive elements of the Chilterns landscape such as its woodlands, grassland, streams and rural character will help improve a sense of place and tranquillity, particularly near to settlements and Luton in the south of the NCA.	Retain and enhance the contrast in landscape character between the clay plateau and river valleys, aiming to maintain and enhance the balance between urban and rural landscapes. Protect and enhance positive landscape attributes such as woodland, hedgerows, parkland and grassland that help to define landscape character. Resist inappropriate development and promote the use of local building stone to maintain the character of villages and historic buildings. Offer high quality interpretation at important sites, and provide opportunities for education about the positive attributes of the area, such as the history of brick making and jam making. Strengthen the character of the landscape by bringing neglected woodlands into appropriate management and replanting hedgerows and hedgerow trees. Create new woodland as appropriate on urban fringes to help screen and integrate new developments, provide biodiversity and green infrastructure benefits. Support the creation of a new ëForestí landscape in the Marston Vale, defining a new sense of place for the future. Support the work of the Chilterns AONB to conserve and enhance the landscape and special qualities of the designated landscape.	**Sense of place/ inspiration** **Tranquillity** **Sense of history** **Biodiversity** **Recreation** **Climate regulation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Geodiversity Brick-making industry Historic houses and parkland Archaeology Grand Union Canal Second World War airfields and Bletchley Park Historic cities of Cambridge and Peterborough, and market towns	The underlying clay sediments and glacial deposits are rich in fossils. Clay extraction for the brick-making industry in the Marston Vale and south of Peterborough has been extensive, leaving a series of man-made waterbodies, many now restored for biodiversity and recreational use. The NCA has 39 registered parks and gardens covering 2,688 ha, 324 Scheduled Monuments and 8,102 Listed Buildings. Examples include Stowe House, Wrest Park, Kimbolton Park Wimpole Hall and Croxton Park. The history of the landscape is evident in early archaeological remains from the Ivel and Great Ouse river valleys, including Roman and medieval settlements, moated manor sites, deserted villages, pockets of ridge and furrow and ruined or isolated churches such as Bushmead Priory. The Grand Union Canal dissects the NCA in the south-west within the River Ouzel valley. Bletchley Park and several airfields built across the clay plateau during the Second World War have an important military history. Cambridge, Peterborough and some of the market towns are popular tourist destinations.	Regional	Maintaining, conserving and enhancing the sense of history provided by numerous assets and attributes in the NCA ñ in particular the geodiversity, industrial and cultural heritage of the brick-making industry, archaeology, historic houses and parkland ñ through increased interpretation and access opportunities has the potential to increase the service. This may lead to increased recreation and tourism to parts of the area which would require careful management to ensure it is sustainable and does not have a negative impact on the assets themselves. The reinforced sense of history could contribute strongly to sense of place in the landscape.	Promote awareness and understanding of the areaís rich geodiversity heritage and the impact it has on the landscape and human activity, for example, in brick making. Promote the restoration and positive management of historic buildings and features, especially those that are Scheduled Monuments, or Listed Buildings and that are at risk. Protect, manage and promote important archaeological features to increase peopleís understanding. Where possible, use agri-environment agreements to protect historic farmsteads, buildings and other features such as ridge and furrow. Encourage the restoration and sustainable management of historic parks and gardens. Restrict inappropriate development to help maintain landscape character and promote the use of local building materials. Conserve and enhance the cultural heritage of the brick-making industry, the Grand Union Canal and Second World War assets by promoting and improving access, to increase awareness and understanding.	**Sense of history** **Sense of place/ inspiration** **Geodiversity** **Biodiversity** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Ancient woodlands Grafham Water River valleys Restored landscapes	Tranquillity within the NCA has declined significantly; undisturbed areas have decreased from 69 per cent in the 1960s to 38 per cent in 2007, primarily due to visual intrusion, noise and light pollution resulting from agriculture, settlement expansion and improvements in road infrastructure. Mineral extraction and landfill activities, particularly within the Marston Vale and around Peterborough, have impacted on local tranquillity. The most tranquil area of the NCA is in the north-west between Bedford and Huntingdon, particularly around Grafham Water. The least tranquil areas are the urban centres of Milton Keynes, Bedford Huntingdon, Cambridge and Peterborough, and along the main transport routes of the M1, M11, A14 and A1(M).	Local	Tranquillity is variable across the NCA and highly localised. Feelings of tranquillity are more likely to be associated with the more remote, inaccessible and rural areas of the NCA, particularly north-west of Bedford. Tranquillity is also associated with areas where ancient woodland is clustered, in less developed stretches of the river valleys, around Grafham Water, and in areas where post-industrial landscapes have been restored for biodiversity and recreational uses following mineral extraction, especially within river valleys, in the Marston Vale and around Peterborough.	Work with local planning authorities to ensure that development is well designed to minimise impacts on the landscape and reduce noise and light pollution. Prevent inappropriate development and promote the use of design statements to retain the character of rural villages within the NCA, particularly those north-west of Bedford. Enhance the wooded peripheries of settlements and increase tree planting around new developments to help filter out noise and light pollution. Seek opportunities to protect more tranquil parts of the area, to reduce light and noise pollution, and seek opportunities to remove obtrusive features such as signage, lighting and poles. Increase tranquillity by conserving, managing and extending areas of semi-natural habitat, particularly woodlands and hedgerows, to benefit wildlife and people.	**Tranquillity** **Sense of place/ inspiration** **Recreation** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Rights-of-way network National Cycle Routes National Nature Reserves Country parks and nature reserves River valleys Grafham Water Grand Union Canal Restored landscapes Woodland Forest of Marston Vale Community Forest Chilterns AONB	Recreation is supported by 3,998 km of public rights of way (at a density of 1.53 km per km2). There are three NNR in the NCA and two National Cycle Routes that pass through the area (Routes 6 and 51). Many recreational facilities are concentrated close to the main urban populations. There are numerous country parks and nature reserves available for local residents and visitors. Large towns and cities have a good network of parks and green spaces within them and improved links to allow access to adjacent countryside via canals, river corridors and green infrastructure links. Grafham Water (one of the largest man-made reservoirs in the country) provides opportunities for sailing and other activities. The Grand Union Canal provides opportunities for informal recreation and the river valleys offer important areas for walking, fishing and watching nature. Restoration after mineral extraction has left numerous waterbodies available for recreation, often water-based activities such as sailing, boating and fishing, but also for bird watching. Woodland planting, especially within the Forest of Marston Vale as part of environmental regeneration, has created a number of new sites available for recreation. Other recreational facilities include a small extent of the Chilterns AONB, golf courses, historic houses, parks and museums.	Regional	Recreation is generally low-key, close to the main urban populations and associated with the river valleys, Community Forest, existing sites, woodland and restored landscapes. With high development pressure in the NCA it is likely that demand for leisure and recreation opportunities will increase with subsequent pressures on biodiversity, soil and water resources. Opportunities exist to accommodate increased demand for leisure and recreation without significant effects on other ecosystem services. Managing potential conflicts between users of the area will be needed as well as practical considerations such as access issues with heavy clay soils. There are a number of opportunities to link and provide new green infrastructure, benefitting people and wildlife through initiatives such as the Milton Keynes to Bedford Waterway, Bedford River Valley Park, Community Forest and AONB activities, green infrastructure improvements around Peterborough and Cambridge, and the restoration of mineral extraction sites.	Maintain, extend and promote the use of the rights-of-way network. Promote existing sites that offer opportunities for people to enjoy the local landscape, and provide improved interpretation and educational material to increase peopleís understanding of the natural environment. Manage recreational sites to accommodate visitor pressure and demand, without conflict between different users, and without causing adverse effects on the natural environment. Ensure that any new developments incorporate well-designed green infrastructure, to include improved access and recreation opportunities for local communities and visitors. Support initiatives that include well-planned green infrastructure that will increase peopleís access to and contact with the natural environment to benefit their health and wellbeing.	**Recreation** **Sense of place/ inspiration** **Sense of history** **Tranquillity** **Biodiversity** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Designated sites Ancient woodland Parkland Traditional orchards Unimproved and semi-improved grassland Rivers, streams, waterbodies and riparian habitats Fen and reedbed Arable farmland and associated habitats such as hedgerows, ponds, ditches and field margins	There are three Ramsar sites, two Special Protection Areas (SPA), five Special Areas of Conservation (SAC), three National Nature Reserves (NNR) and 61 Sites of Special Scientific Interest (SSSI) wholly or partly within the area, totalling 3,394 ha. There are also 491 local sites totalling 7,939 ha (3 per cent of the NCA). There are 11,938 ha of priority habitat within the NCA including 4,187 ha of flood plain grazing marsh, 3,939 ha of broadleaved, mixed and yew woodland, 1,653 ha of fen, 1,028 ha of lowland meadow and 894 ha of reedbed. Other priority habitats include lowland calcareous and dry acid grassland, traditional orchards and wood pasture and parkland. The diversity of semi-natural habitats present supports a range of species, some rare and scarce, including white admiral, purple and black hairstreak butterflies, dormouse, barbastelle bat, specialist invertebrates associated with dead and decaying wood, sulphur clover, crested cow-wheat and green-winged orchid. Also present are important populations of breeding and overwintering birds, water vole, otter, great crested newt and species of stonewort. Arable habitats support farmland birds such as skylark and grey partridge, brown hare and pollinators.	Regional	Due to the nature of the heavy clay soils, areas less favourable for arable cultivation have retained semi-natural habitats. There is a high degree of habitat fragmentation across the NCA and the importance of the agricultural land for biodiversity may be under-represented. Riparian and wetland habitats, hedgerows, road verges and green lanes provide valuable habitat connectivity within an intensively arable and increasingly urban landscape. Over-browsing by wild deer is having a damaging impact on woodland biodiversity. Some non-native invasive species such as signal crayfish and Himalayan balsam thrive in the main river catchment at the expense of native species. Dikerogammarus villosus, an invasive freshwater shrimp has been found at Grafham Water, competing with native species. Increasing pressure from land-use change, development, infrastructure improvements and demand for water resources is having a detrimental impact on biodiversity; however, there are also opportunities to benefit biodiversity and recreation by creating new green infrastructure. The management and extension of semi-natural habitats within the NCA will bring benefits for soil and water quality, regulating water flow, climate regulation, biodiversity and recreation.	Ensure areas of designated land remain in favourable condition, and improve condition where possible. Promote awareness of, and provide advice to landowners and managers on, managing habitats of biodiversity interest. Support the creation and expansion of native woodlands, orchards, parklands, grasslands, and hedgerows to improve habitat connectivity within the landscape and provide increased benefits for biodiversity and recreation. Seek opportunities to increase woodland management and bring existing woodland into active management, including managing woodland and hedgerows for species such as dormouse and barbastelle bat. Ensure that populations of wild deer are managed to reduce damage caused to the natural regeneration of trees and woodland. Ensure that water abstraction and poor water quality does not threaten important wetland habitats. Work with landowners and managers to encourage the appropriate management and restoration of semi-natural habitats such as rivers, streams, waterbodies, flood plain grazing marsh, lowland meadows and other riparian habitats to support biodiversity. Control, monitor and manage invasive non-native species to prevent or reduce damage to native speciesí populations and habitats. Secure opportunities to encourage sustainable farming practices that enhance biodiversity, such as reducing herbicide and pesticide use, buffering field margins, and retaining winter stubble to support farmland birds and pollinators. Manage visitor pressure and recreational use at popular and sensitive sites to accommodate demand while avoiding adverse effects on the natural environment.	**Biodiversity** **Regulating water quality** **Regulating water flow** **Climate regulation** **Sense of place/ inspiration** **Recreation** **Tranquillity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Underlying geology Soils Fossils Designated sites Local building materials	The claylands are underlain by Jurassic and Cretaceous clay sediments, occasional locally-prominent limestone and more sandy sediments. Much of this is covered by Quaternary glacial and fluvial deposits including boulder clay or till and river terrace sands and gravels. Soils are moderately fertile, permeable, and the majority are lime-rich, loamy and clayey and in agricultural use. More fertile and free-draining soils occur in the river valleys. Unfavourable areas have retained important and distinctive semi-natural habitats important for biodiversity. Extensive extraction of Oxford clay for brick making in the Marston Vale and near Peterborough, and significant extraction of sand and gravel within the River Great Ouse and Ivel valleys, has left a patchwork of flooded and restored waterbodies important for biodiversity and recreation. The exposure of deposits in the river valleys and quarries provides access to a rich variety of fossils. There are five geological Sites of Special Scientific Interest (SSSI) and 19 Local Geological Sites. Locally quarried limestone (to the west of the NCA and in the Yardley Whittlewood Ridge NCA) is a commonly used building material in the villages along the upper reaches of the River Great Ouse, giving them a distinctive character. Bricks made from local clay have been widely used particularly in villages built to house the brick industryís workers, for example Stewartby, Bedfordshire.	Regional	Geodiversity has significantly influenced the landscape character of the NCA and its social and economic history including industry, development and settlement patterns. Exposures of deposits, especially those now designated as SSSI or Local Geological Sites, are important for the geology and geological processes they reveal, with some of the fossil fauna discovered being of national importance. The extensive mineral extraction in the NCA offers many opportunities to uncover geological processes and study fossil remains. Some clay is still extracted and sand and gravel is being quarried for use in the construction industry. The restoration of river valley sand and gravel quarries provides opportunities for wetland biodiversity as well as recreation as sites generally become flooded and quickly naturalise. Inactive and restored sites yield valuable geological information and examples of relic and active landform features.	Promote awareness and understanding of the areaís rich geodiversity heritage and the impact it has on the landscape and human activity. Promote existing geological sites as an educational tool, emphasising the integral role of geodiversity in underpinning the landscape character of the NCA. Ensure that geodiversity sites continue to be protected, monitored and managed. Ensure that new development is in keeping with the local character of the area by using local stone in buildings to enhance senses of place and history. Ensure that mineral extraction sites are restored to contribute to local landscape character and opportunities are taken to enhance biodiversity, recreation and geodiversity.	**Geodiversity** **Sense of history** **Biodiversity** **Recreation** **Sense of place/ inspiration**

Photo credits

Cover photo: Farmed claylands landscape © Michelle Russell/Natural England

All photos © Michelle Russell/Natural England except:

Page 8 © James Russell

Page 11 © Don Morris/Forest of Marston Vale

Pages 25, 29 & 37 © Jim Stevenson

Page 28 © Andrew Butler/National Trust Images

Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

Catalogue Code: NE555 ISBN: 978-78367-115-1

Should an alternative format of this publication be required, please contact our enquiries line for more information: 0845 600 3078 or email enquiries@naturalengland.org.uk

www.naturalengland.org.uk