National Character Area profile:

110. Chilterns

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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.

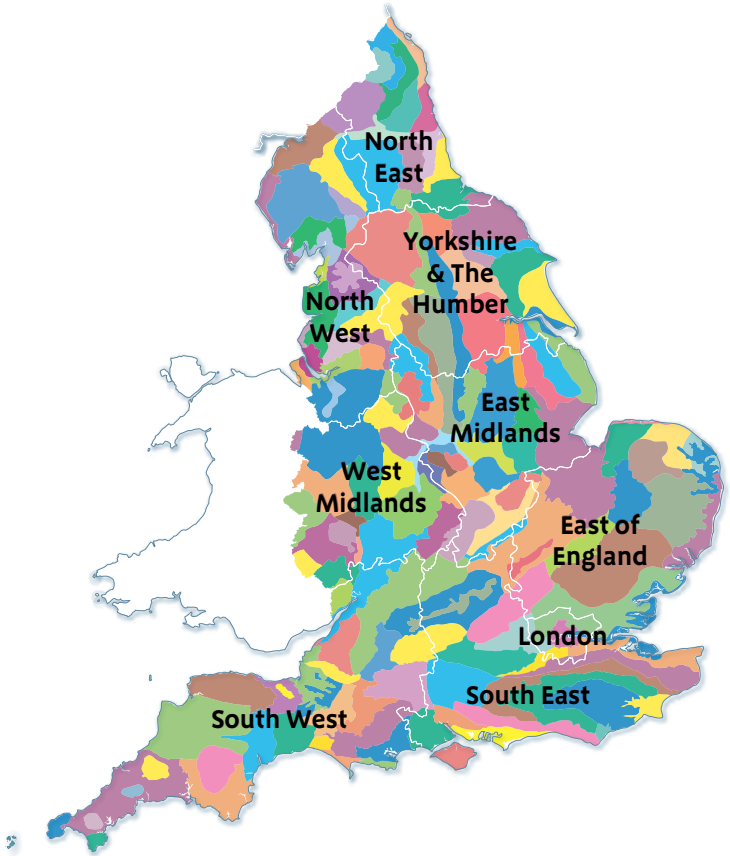
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and 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**)

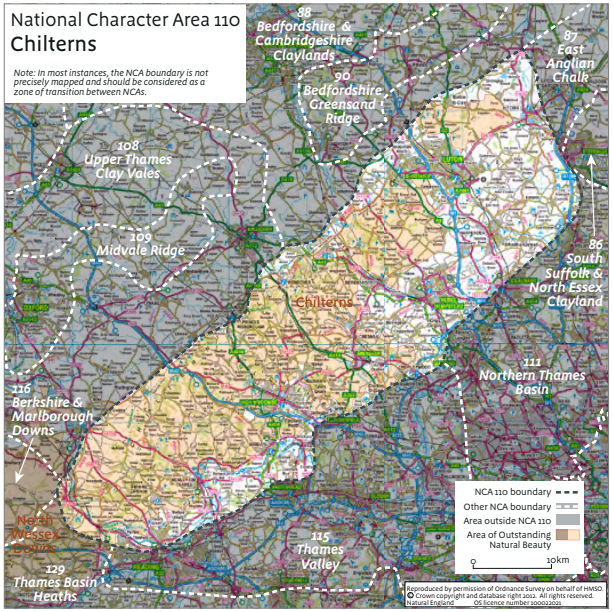
[3] European Landscape Convention, Council of Europe (2000; **URL: http://conventions.coe.int/Treaty/en/Treaties/Html/176.htm**)

Summary

The extensively wooded and farmed Chilterns landscape is underlain by chalk bedrock that rises up from the London Basin to form a north-west-facing escarpment offering long views over the adjacent vales. From the vales, the River Thames breaches the escarpment in the south at the Goring Gap and flows on past riverside towns such as Henley. Small streams flow on chalk down some of the dip slope valleys or from the scarp foot, passing through numerous settlements. The major sources of public water supply for the Chilterns and the London area are the chalk aquifer and the Thames.

The countryside is a patchwork of mixed agriculture with woodland, set within hedged boundaries. Furthest from London, the natural and built features of the countryside are recognised as special and attractive in approximately half the National Character Area (NCA) by the designation of the Chilterns Area of Outstanding Natural Beauty (AONB) and, in a small area south of the River Thames, by the North Wessex Downs AONB. Outside the AONBs there are major settlements that incorporate extensive urban fringe and growth areas, including Luton, Hemel Hempstead and High Wycombe. Motorways and railways make the area very accessible to visitors and connect the Chilterns to nearby London. Opportunities for residents and visitors to enjoy the outdoors are wide-ranging, including extensive rights of way; open access commons, woods and downland; Registered Parks and Gardens open to the public; golf courses; shooting estates; and urban green spaces. The Ridgeway and the Thames Path National Trails pass through the Chilterns, and the River Thames and Grand Union Canal are major water-based recreation corridors.

Human history dates back to the Palaeolithic, as evidenced by flint scatters. Farming of the valleys and escarpment began in the Neolithic and continues to this day as a major land use. Arable farming is concentrated on deep, well-drained soils found in the valleys, along the scarp foot and beneath the hills in the north. Nucleated settlements, often featuring historic buildings dating back to medieval times, are found in the valleys and along the scarp foot, as are the major routes. Chalk streams are found only in the main valleys and can be dry in their upper reaches.



Click map to enlarge; click again to reduce.

Above the valley floors, cultivation is made difficult by steep slopes, convoluted terrain and extensive clay-with-flint soils on the dip slope ridges. This has given rise to a diversity of land management practices throughout history, including mixed farming, woodland, extensively grazed downland and common land. Settlement on the plateau is characterised by dispersed farmsteads and villages linked by historic, small-scale routes including sunken lanes.

Walkers can enjoy an extensive rights of way network across farmland and woodland.

Today, common land and downland exist as fragments of their former extents. Commons are numerous across the plateau, providing green space near to people's homes. Historic downland is largely confined to the scarp and is strongly associated with prehistoric archaeology; its species-rich grassland and scrub include areas designated as a National Nature Reserve (NNR) and Special Areas of Conservation (SAC). Woodland cover accounts for 14 per cent of the NCA and makes the Chilterns one of the most wooded lowland landscapes in the country. Woods are found on poor agricultural soils, on commons and 'hanging' on steep slopes. A long history of a wood-based economy has helped to maintain many woodlands on ancient sites and generate rich woodland archaeology. More recently, local demand for wood fuel is helping to maintain the woodland resource. Chilterns NCA is renowned for its native beechwoods, a number of which are designated as SAC for their ecological interest.

Throughout the area, historic buildings and also some more recent constructions display locally distinctive uses of local materials, particularly brick and flint. Large mansions and follies are frequent in the countryside, many relating to Registered Parks and Gardens.

Statements of Environmental Opportunity

- **SEO 1**: Manage the wooded landscape, the woodlands (including internationally important Chilterns beechwoods), hedgerows, commons and parklands with the aims of conserving and enhancing biodiversity and the historic landscape and its significant features; maximising the potential for recreation; and securing sustainable production of biomass and timber.

- **SEO 2**: In pockets of historic land use where natural and cultural heritage are both particularly rich, aim to restore and strengthen the historic landscape, ecological resilience and heterogeneity, and to conserve soils. Ensure that species-rich habitats are conserved and extended, including internationally important species-rich Chiltern downland. Secure environmentally and economically sustainable management to ensure conservation in the long term.

- **SEO 3**: Conserve the Chilterns' groundwater resource, River Thames and chalk streams by working in partnership to tackle inter-related issues at a catchment scale and also across the water supply network area. Seek to secure, now and in the future, sustainable water use and thriving flood plain landscapes that are valued by the public.

- **SEO 4**: Enhance local distinctiveness and create or enhance green infrastructure within existing settlements and through new development, particularly in relation to the urban fringe and growth areas such as Luton. Ensure that communities can enjoy good access to the countryside.

Remnant downland is rich with orchids and other flowering plants.

Description

Physical and functional links to other National Character Areas

Chilterns is one of several NCAs that make up an outcrop of the Chalk stretching from East Anglia to Dorset and to the South Downs. To the north-east, the Chiltern escarpment lowers into the East Anglian Chalk. In the south-west, the neighbouring escarpments of the Chilterns and the Berkshire and Marlborough Downs face each other across the Thames at the Goring Gap. From the north-west-facing escarpment, the Chilterns dip slope descends to the south-east into the London Basin, where the Chalk is overlain by younger bedrock.

The escarpment offers panoramic views across the vales and hills to the north-west.

Adjacent to the low-lying NCAs of Bedfordshire and Cambridgeshire Claylands and Upper Thames Clay Vales, the Chilterns scarp is prominent and offers panoramic views of the adjacent vales, principally Aylesbury Vale, from viewpoints such as Ivinghoe Beacon. Across the vales there is inter-visibility between Chilterns and other elevated NCAs such as Midvale Ridge and Bedfordshire Greensand Ridge.

From the northern end of the scarp, the rivers Flit and Ouzel (also known as Lovat) flow north onto the Bedfordshire and Cambridgeshire Claylands as part of the Anglian catchment. Along the remainder of the scarp, watercourses flow into the Upper Thames Clay Vales to feed the Thames catchment. The Thames flows from the Upper Thames Clay Vales through the Chiltern ridge at the Goring Gap to enter the London Basin.

Within the London Basin, the Chilterns' natural groundwater and surface water flows are linked to those of the wider basin which centres upon London and the Thames. These links are significant since the Chilterns function as the larger of the two principal aquifers in the basin (the other being the North Downs). Infiltration in the Chilterns supports groundwater levels and quality in London's confined aquifer and base flow in the Thames, which passes through the Thames Valley and inner London.

The Chilterns are linked into a modern transport network of motorways and railways radiating from nearby London. Outside London, major roads around Reading, Maidenhead, Slough and Aylesbury also link to the Chilterns. Long-distance historic routes that now function as key recreation corridors pass through the Chilterns: the Grand Union Canal, the Thames and the Ridgeway.

Distinct areas

- Thames Valley

Key characteristics

- The chalk plateau is incised by parallel branching valleys gently shelving to the south-east into the London Basin. The large chalk aquifer is abstracted for water to supply London and its surrounds and also supports flows of springs, chalk streams and the River Thames.
- There are several chalk streams. Features associated with a history of modification include historic mills, watercress beds, culverts and habitat enhancements.
- The north-west-facing escarpment is an abrupt relief feature beside low-lying vales, breached notably by the Thames at the Goring Gap. The escarpment lowers northwards, terminating as distinct hills. The Chiltern ridge offers panoramic views.
- Within the Chilterns, views are enclosed within branching valleys, sunken routeways and extensive woodland and hedgerow-enclosed fields. There are hidden, tranquil pockets along single track lanes and rights of way.
- A mixture of arable, grassland and woodland and the numerous commons reflects the dominance of Grade 3 agricultural land. Ancient woodland has remained on extensive clay-with-flint deposits, while very steep slopes are rarely cultivated. There are, however, not inconsiderable areas of Grade 1 and 2 land that are associated with lower-lying areas and river valleys.
- The Chilterns are one of the most wooded lowland landscapes in England. The area is particularly renowned for its extensive native beechwoods, several of which are designated as part of the Chilterns Beechwoods Special Area of Conservation (SAC). Other distinctive features include rare box woods, 'hanging' woods on steep slopes and rare yew woods, including Hartslock Wood SAC.

The River Thames offers a variety of recreation opportunities, particularly as it passes through towns fronting the river such as Marlow shown here.

Key characteristics continued

- Pre-18th-century fields defined by ancient, often sinuous hedged boundaries are scattered throughout, including co-axial fields. Parliamentary enclosure fields are limited. Large modern fields, usually with ancient boundaries, cover the better agricultural land, most notably in the north-east.
- Remnants of various historic land use types can combine rich and diverse habitats and archaeology. Many key places are publicly accessible, including Registered Parks and Gardens, historic downland and common land. Traditional flood plain landscapes and orchards are the most restricted in extent. Historic routeways, hedged boundaries and watercourses provide connectivity.
- Historic downland preserves prehistoric archaeology and supports high numbers of rare and scarce chalk grassland vascular plants, mosses and liverworts. Diversity is enhanced by a mosaic of chalk grassland, scrub and woodland, with Hartslock Wood SAC being one example.
- Species strongly associated with the Chilterns include the red kite, pasque flower, stag beetle, Chiltern gentian, shepherd's needle, chalkhill blue butterfly and native box. Aston Rowant SAC protects an internationally important juniper scrub population. Farmland birds and deer are a feature of the wider countryside.
- Nucleated settlements of medieval origin and land farmed since prehistory are found alongside watercourses and springs in the through-valleys and at the foot of the scarp. Elsewhere, dispersed farmsteads dating from the medieval period and mid-19th-century development around commons are characteristic of the plateau.
- The River Thames and its flood plain mark a distinctive area in the south. The river is a focus for settlement, abstraction and recreation.
- Major transport routes, including motorways, radiate from adjacent Greater London, associated with significant 20th-century development and extensive urban fringe areas.
- Brick and flint are the dominant traditional building materials, with Totternhoe Stone (clunch) being less common, but still a distinctive
- Numerous parkland landscapes define large, historic estates. Designs by Humphry Repton and Lancelot 'Capability' Brown are represented, and the houses, follies and wooded features provide local landmarks.
- Extensive rights of way, commons, open access downland, woodland and some parklands provide access to the countryside. The Thames Path, the Ridgeway and the Grand Union Canal are high-profile recreation routes; locally promoted routes include the Chilterns Cycleway. Private leisure land uses, including golf courses and horse paddocks, are common near urban centres.

Chilterns today

The Chilterns are a distinctive outcrop of the Chalk, with a dramatic scarp forming the north-western boundary. From the long, north-west-facing scarp there are extensive, panoramic views over the adjacent vales. The dip slope, with the character of a plateau, falls gently to the south-east, cut by a series of branching valleys. The enclosed character of the valleys contrasts with the open plateau and long views from the scarp. Rising to just above 260 m, the hills stretch from the Thames in Oxfordshire at their south-western point, across Buckinghamshire and Hertfordshire to Bedfordshire in the north-east. The area includes the lower-lying substantial settlements of Luton, Dunstable, Hemel Hempstead, Berkhamsted, Chesham, Amersham and High Wycombe, as well as sections of the M40 and M1 motorway corridors. The south-western boundary is formed by the River Thames as it flows past Wallingford, Reading, Henley and Marlow. Although part of the Chilterns, this belt of countryside is dominated by the river and its flood plain rather than by the hills.

While many of the dip slope valleys are dry, there are several chalk rivers flowing through others, such as the Chess. Springs and watercourses also issue from the foot of the scarp, such as the Ewelme Brook. Many of the watercourses are 'bournes' or 'winterbournes', which dry up near their source when groundwater levels are low. Many chalk streams receive treated discharges, often to counter low flows caused by abstraction. The presence of accessible and reliable water sources has determined, in large part, the location of settlement, including major urban centres. Canalisation, relict watercress beds, mills, sewage treatment works, habitat enhancements and riverside green spaces catalogue a history of use and modification and the significance of water in a chalk landscape.

The countryside of the Chilterns combines mixed agriculture with numerous woodlands and hedgerow boundaries that are often ancient. Steeper ground is often characterised by small fields, and there is a notable concentration of pre-18th-century fields, including assarts and co-axial fields, in the Buckinghamshire and Oxfordshire parts of the NCA. There are localised concentrations of arable production in the north, around Luton, and in the 'Ipsden prairie' of Oxfordshire. Livestock farming is dominated by sheep and cattle and, across the remaining fragments of historic downland, grazing

The nucleated village of Fingest lies in a valley. Woodland cover is considerable and sheep graze the grasslands.

Large flocks of red kites are common.

animals help to conserve open grassland. Meadows remain alongside watercourses but are rarely traditionally managed. Cherry orchards, once a widespread feature of the central part of the NCA, are now encountered only occasionally. Farmland supports a wide range of birds, including corn bunting, yellow hammer and grey partridge, and also arable weeds, such as prickly poppy and shepherd's needle.

Woodland cover is extensive, making the Chilterns one of the most wooded lowland landscapes in England. Large woods, dominated by beech, are found on the plateau and as 'hanging' woods above the valleys; there are also small farm woodlands. Secondary woodland can be found on once-open common land and downland but, elsewhere, many woods are ancient. Chilterns beechwoods are renowned for 'cathedral-like' qualities and bright autumn colours, and their importance is recognised through SAC designation. Local variations include the very rare natural box woods that occur on the scarp, as well as mosaics of habitats such as at Hartslock Wood SAC, which includes a species-rich area of chalk downland within a mosaic of beech and yew woodland. Soaring above the woods and valleys, the distinctive forked tail of the red kite is now a common sight. Deer are often glimpsed in woodlands and fields.

Remnant areas of heathland, acid grassland and wood pasture are scattered across the plateau, often associated with common land and parkland on low-fertility agricultural soils. The scarp and some dry valley slopes are characterised by fragmented areas of species-rich chalk grassland with scrub. Colourful flowers are a feature of these grasslands during spring and summer and include the rare Chiltern gentian, pasque flower and a number of orchids. Butterflies, including the restricted Duke of Burgundy and chalkhill blue, can also be spotted. There are also a few small areas of rare chalk heath.

Aston Rowant SAC features an internationally important juniper population. Dispersed farmsteads and hamlets are found on the high plateau, with nucleated towns and villages in valleys and at the foot of the scarp. Some linear villages dating from the mid-19th century occur on the plateau, usually associated with common land. Many lower-lying settlements contain historic centres, often dating back to the medieval period. St Albans contains remains of the major Roman town of Verulamium. Historic, and some modern, buildings use local, traditional materials, including flint, brick, clay tiles and occasionally thatch. Clunch, an impure and harder form of chalk, is sometimes used as a highly distinctive building material. Designed parklands and gardens make a dramatic contribution to the area, with follies and grand houses often located in prominent positions and featuring other distinctive attributes such as tree avenues and gatehouses. A number of landscaped parklands and gardens are the work of famous 18th-century designers such as Bridgeman, Brown and Repton.

Major roads and railway lines follow the valleys cutting through the escarpment, linking London and the Midlands. Settlements along main routes have expanded considerably during the 20th century, with major urban centres found near motorways at Luton and High Wycombe. There is also an airport near Luton. Business and industrial parks adjacent to watercourses are often located on the sites of former mills. Ancient, often sunken lanes can be found beyond the network of major routes, some running straight along valley bottoms or ridgetops and others winding up the scarp or valley sides. Away from main settlements, roads and railways are areas with high levels of tranquillity, many associated with concentrations of well-preserved prehistoric monuments, including bronze-age burial mounds and iron-age hill forts and dykes.

With a large population in or near the area, demand for recreation has generated a considerable number of golf courses, horse paddocks and managed public green spaces near settlements. Numerous parklands and woodlands are also open to the public, alongside the designated open access commons and downland. The Thames Path and the Ridgeway National Trails pass through the area. Boating is popular on the River Thames, and horse riding, walking and cycling are supported by an extensive rights of way network that includes locally promoted routes such as the Grand Union Canal, the Chilterns Cycleway and the Icknield Way Riders' Route. Easy access has resulted in some busy 'honeypot' sites, such as Ashridge, with accompanying, prominent visitor facilities – car parks, information panels and signage.

Overall, the countryside has a predominantly quiet and prosperous farming and estate character, and the scenic qualities in the half of the NCA furthest from London are recognised by their Area of Outstanding Natural Beauty (AONB) designations.

The landscape through time

The NCA is defined by a Chalk outcrop that formed between 95 and 70 million years ago during the Upper Cretaceous. Deposits on the bed of warm, shallow, lime-rich seas built up over Upper Greensand and Gault Clay to create distinct bands of chalk recording changing conditions. They contain marine fossils, including ammonites. Massive earth movements 60 to 40 million years ago during the Palaeogene tilted the Chilterns and the wider area into a downfold to form the London Basin. High on the northern rim of the London Basin, the Chilterns were exposed to erosion, causing a reduction in the height and westward extent of the Chalk. During the Quaternary, ice sheets overrode the outcrop in the north, lowering the escarpment and blocking the passage of the Thames through the Vale of St Albans. The Thames, forced southwards, carved its gorge through the escarpment at Goring and shaped its gravel deposits into terraces. Upon the frozen ground of the dip slope, water could not percolate into the Chalk and so carved branching valleys down into the London Basin, eroding as deep as the Melbourn Rock in the main valleys. Various Quaternary deposits were laid down on the Chalk, the most extensive being clay-with-flint deposits, which were created through disintegration of upper chalk bedrock by freeze–thaw action.

Quaternary deposits are associated with the earliest humans in the Chilterns. Extensive flint-working sites at Caddington and the largest Palaeolithic hand axe in Britain – and probably Europe – have been dated to the early Palaeolithic. Finds of Mesolithic flint implements are widespread.

Monuments, boundaries and tracks remain visible today as tangible evidence of prehistoric people in the Chilterns. The oldest monuments, for example the long barrow overlooking Princes Risborough, date from the Neolithic. The Bronze Age is largely represented by burial mounds, while iron-age monuments consist of simple hill forts, such as Pulpit Hill, and dykes – earth boundaries – including Grim's Dyke. There is a notable concentration of iron-age defensive features commanding prominent hills overlooking key routes such as the Thames, the Ridgeway and the Icknield Way.

Country mansions, follies and parkland are frequent across the Chilterns. West Wycombe mausoleum occupies a prominent position in the valley.

The management of woodland for a range of products or to release land for agriculture defines much of this landscape. Farming in the Chilterns began in the Neolithic when woods were cleared along the scarp and river valleys. Favourable farmland in the valleys and along the springline attracted late iron-age settlers. Existing farmsteads were later adapted into Roman villas. Thriving Roman markets, such as Verulamium (now St Albans), and a growing population encouraged farmers onto marginal soils, evidenced by the remains of Roman farmsteads and fields, many of which are now preserved under woodland. Verulamium was connected to London by Watling Street through the Ver Valley – now the modern A5 – and to the west by Akeman Street following the Bulbourne Valley – now the A41. Charcoal produced from the extensive woodlands was an important resource for the Roman iron smelting industry in the area.

In contrast to the more productive valley and scarp foot soils, the marginal agricultural land of the plateau lent itself to woodland and rough grazing. Minor droveways developed linking the vales to the plateau. Saxon estate boundaries, many still discernable today, indicate the equal apportionment and distribution of resources of clay vale, springline, chalk escarpment and wooded plateau. The marginal nature of growing conditions on the plateau made farming sensitive to phases of reclamation and abandonment. Population declines and a collapse in agricultural markets in the 5th and 6th centuries led to abandonment to rough grazing and woodland. By the time of Domesday in 1085–86, woodland had spread to exceed today's cover.

'Manorial wastes' were established between the 10th and 13th centuries across the plateau, often linked together by thin tracts of land. Commons developed providing small centres for industry, producing bricks, tiles and lime, and were used for occasional grazing, providing firewood and places for local gatherings.

The 12th century saw another period of population growth and 'land hunger' driving renewed woodland clearance to allow cultivation, and the establishment of farms and settlement. Some steeper slopes were cultivated for the first time. Medieval assarts and strip lynchets provide evidence of intense agricultural activity in the Chilterns during this period. Monasteries, such as Missenden Abbey, were also accumulating land into large estates and establishing priories. Clearance of common woods slowed towards the end of the 13th century.

Sunken routeway through beech woodland.

Despite increased demands for farmland, the value of woodland produce and the low fertility of some areas were sufficient to ensure the retention of substantial areas of woodland. In the 13th century, the demand from the adjacent vales for timber and firewood made Chilterns woodlands valuable and stemmed the steady clearance that had begun in the preceding century. Many wooded commons were enclosed as private property, and further woodland was enclosed in parks.

Tudor population increases instigated resurgence in clearance for agriculture, which included enclosing common heaths. Woodlands in the south were saved from clearance by London's demand for firewood and timber, combined with their proximity to the Thames shipping route.

Since 1600, approximately 12,000 ha have remained under continuous woodland cover, assisted in the 18th and 19th centuries by the demand from the local furniture industry for beech timber. This grew from its 'cottage industry' beginnings to a nationally recognised, large-scale industry known for the 'Windsor' chair. This industry drove widespread planting of beech and the conversion of many semi-natural mixed woods into beech woodland. Coppice for charcoal was devalued by the opening of the Grand Union Canal, which made coal more readily available. Secondary woodland cover also increased. Ancient woodlands were extended, particularly in Oxfordshire, and the agricultural depression of 1880 to 1940 led to the scrubbing up of downland and commons, including Totternhoe and Naphill.

Further change in the 18th and 19th centuries was associated with agricultural improvements involving Parliamentary enclosure of commons and the re-organisation of farm and older boundaries. Some commons were lost entirely, including Wycombe, while others, such as Berkhamsted, survived intact. The Chilterns, within easy travelling distance of London, also became a focus for the wealthy, who established grand houses and fashionable parks and gardens. Many had earlier antecedents as hunting parks but were substantially remodelled or expanded. Designed landscapes include examples by Lancelot 'Capability' Brown and Humphry Repton. Many large estates survive, having diversified to include schools, tourist attractions and shooting estates.

Water-powered mills, which first appeared during medieval times, gradually increased in number, but it was not until the 19th century that the paper industry reached an industrial scale along the Wye and Gade. At a similar time the Chilterns became famous for their apples and soft fruit, with orchards surviving, particularly around the 'cherry pie villages' of Seer Green and Holmer Green.

The 19th century saw the first deliberate construction of transport networks since Roman times. Turnpike trusts improved all the main routes running along the through-valleys. The Grand Union Canal, railways (including three London mainlines) and motorways followed. The effect of improved connections with the capital was dramatic, leading to development of light industry and suburbs. This is most clearly seen in the 'Metroland' suburbs along the Metropolitan Line, which were promoted to commuters as accessible rural retreats away from the city. With suburbanisation came an increase in recreational land use, with areas of downland converted to golf courses, such as near Luton and Dunstable.

Many towns and villages have retained their historic core, with notable medieval buildings and Norman churches, but many have expanded substantially. Settlements on the plateau have more recent origins in the

19th century. Luton was targeted for growth as an early 'new town' and remains a focus for growth. Old mill sites along chalk streams have been redeveloped as business and industrial estates. Three industrial-scale cement works extracted material from the scarp in the 20th century but have subsequently closed.

In the countryside there has also been recent change. Post-war enlargement of fields by hedgerow removal saw the creation of some prairie fields, particularly concentrated in Hertfordshire and Bedfordshire. Across the commons and downs, the continuing decline of livestock farming led to further significant areas of open land being lost to scrub and woodland. Traditional grazing and clearance of scrub became a conservation activity. The woodland resource also fell out of management with the demise of the local furniture industry, although increasing local demand for wood fuel in recent years has incentivised management in some woods. Farms have evolved to include increasing numbers of 'hobby' farms and historic farm buildings converted to dwellings and offices. In the face of change, the scenic qualities and natural beauty of the countryside furthest from London have been conserved by AONB designations: the Chilterns AONB to the north of the Thames (designated in 1965) and the North Wessex Downs AONB to the south of the Thames (designated in 1972).

Ecosystem services

The Chilterns 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 Chilterns NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision**: As a result of the predominance of Grade 3 agricultural land, farming is mixed, with average levels of productivity. There is a concentration of arable production on Grade 1 and 2 land along the Thames Valley, beneath the hills in the north and along the scarp foot. Cereals dominate arable production, with wheat being a predominant crop. There are limited but well-established sheep farms and localised areas of dairy and beef production.

- **Water availability**: The Chalk is the most significant aquifer of southern England and is of national importance in terms of abstracted volume and development for abstraction. Groundwater abstraction volumes far outweigh those from surface waters in the Chilterns, with much of it being for public water supply. A large and growing population combined with high consumption rates per person put significant demands on the resource. Chilterns water resources also support London's groundwater supplies in the confined aquifer and the Thames river system downstream of the Chilterns. Unsustainable abstraction currently takes place in the north of the Chilterns, where the rivers Ver, Misbourne, Mimram and Lee are considered to be over-

abstracted and hence experience low flows exacerbated by abstraction pressures. There is hydraulic continuity between the aquifer and watercourses, which means that changes in groundwater levels directly affect surface water levels. The Thames is relatively resilient to abstraction but alleviation schemes and monitoring have been required for the Chilterns' small chalk streams to address negative impacts of low flows on valued biodiversity.

- **Biomass energy**: The extensive woodland cover represents a source of wood fuel, particularly since timber quality is limited in the immediate future. The market for firewood is growing significantly in parts of the Chilterns. The potential for miscanthus is limited and there have been very few plantings. Short rotation coppice coverage is minimal and is discouraged in areas such as the Chilterns where there are water availability concerns.

The Chilterns countryside is accessible to many people along major road and rail links radiating out from London. The M40 passes through Aston Rowant National Nature Reserve.

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

- **Climate regulation**: Across most of the NCA, carbon stored in the topsoil horizon is typically in the range of 0–5 per cent, which is good for mineral soils in agricultural use. The considerable area of undisturbed soils beneath remnant historic land uses such as ancient woodlands and downland represents a large, longstanding carbon store with maximised storage capacity. The extensive tree cover also sequesters carbon, although trees make a greater contribution to carbon reduction by providing alternatives to fossil fuels.

- **Regulating water quality**: Since the Chalk aquifer is nationally important for water supplies and chalk stream biodiversity is influenced by water quality, pollution is a concern across the NCA. Nitrate concentrations in groundwater exceed drinking water standards at points across the Chilterns and appear to be rising in some areas. Steep slopes increase rates of run-off, potentially increasing the movement of sediment and chemicals from cultivated or damaged soils into watercourses. Catchment sensitive farming measures are being promoted across some catchments, with a particular focus in the north. A dense hedgerow network, extensive woodlands and permanent grasslands will contribute to trapping mobile soils and pollutants and to slowing rapid run-off. Point sources of pollution are also associated with settlements and highways, such as High Wycombe, Luton and Dunstable. Extensive settlement entails numerous sewage treatment works, which pose pollution risks.

- **Regulating water flow (flooding)**: The Thames Valley has a fairly high risk of flooding, with riverside settlements including Reading, Henley and Marlow susceptible. The Thames Valley also offers potential floodwater storage areas. Smaller-scale flooding may also affect those settlements adjacent to chalk streams in the dip slope valleys but, historically, low flows have been a more significant issue, with natural flows needing to be artificially supplemented in many cases. Natural river processes are often constrained by channel modifications in urban and developed areas, for example canalisation in Luton and High Wycombe.

- **Regulating soil quality**: Agricultural opportunities are optimal across the Grade 1 and 2 land found in valley bottoms, along the scarp foot and in other lower-lying areas. Historic land uses with a long history of low or zero chemical input and limited or no cultivation, including traditionally managed downland, parkland and ancient woodland, represent areas of soil that have benefited from a long continuity of conservation practices and natural soil processes. Soil quality is at risk across much of the NCA due to compaction. The role of soil quality in water filtration to the aquifer and water pollution is of significance to groundwater quality in the Chilterns' principal aquifer and to the biodiversity of chalk streams.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration**: Landscape character ranges from enclosed and intimate folded valley landforms to the exposed plateau tops and scarp that afford extensive views, with the separate character of the Thames flood plain to the south. The unifying elements include sunken lanes, woodland, downland, chalk streams, parkland and a distinctive vernacular architecture. Red kites are now a common sight adding to sense of place. Prominent landmarks include grand houses and follies (as at West Wycombe), chalk figures (such as Whiteleaf Cross) and monuments (such as Coombe Hill Monument). The undeveloped commons and dry valleys evoke a sense of rural endurance, particularly when contrasted with nearby London and its fringe. The Chilterns landscape inspired John Milton, Stanley Spencer[4], John Nash[5] and Roald Dahl. Properties owned by key historic figures include Benjamin Disraeli's country estate, Hughenden Manor, and the Rothschild family's Natural History Museum at Tring.

- **Sense of history**: Extensive flint-working sites and finds date from the early Palaeolithic Period. The prehistoric routeways of the Ridgeway and the Icknield Way and associated prehistoric monuments create a particularly strong sense of prehistory along the escarpment. Roman influence on the landscape is still evident, primarily through the communications network and settlement pattern. Many villages, farmsteads and field patterns are of medieval origin, including rare co-axial fields. Commons and woodlands rich with archaeology are widespread. Historic buildings and more recent constructions make use of traditional materials such as flint, brick, and tiles and, in places, weatherboard and thatch. Designed parklands and large gardens are prominent, covering 3 per cent of the area, and many are included on the national Register of Historic Parks and Gardens. There are examples by key landscape designers such as Brown and Repton. More recent heritage features include the Grand Union Canal and the 'Metroland' towns along the London Underground Metropolitan Line.

[4] URL: www.chilternsaonb.org/about-chilterns/people-and-history.html#1325
[5] URL: www.chilternsaonb.org/about-chilterns/people-and-history.html#1345

- **Tranquillity**: Contrasting with nearby London, this area offers relative tranquillity. Tranquillity is found along parts of the escarpment but the largest area is found in the remote and sparsely settled dip slope in Oxfordshire. Transport corridors, such as the motorways, and aircraft impact negatively on tranquillity in localised areas.

- **Recreation**: A variety of green spaces and an extensive rights of way network offer a range of recreation opportunities suitable for walkers, horse riders and cyclists, as well as for those who enjoy less common pursuits, such as carriage drivers and paragliders. Improvements have also been made to increase accessibility for disabled users. Long-distance trails include the Ridgeway and the Thames Path National Trails, and the Chiltern Way. There are more than 3,500 ha of open access land, around 2.5 per cent of the NCA, including significant tracts of common land close to settlement. There are three National Nature Reserves (NNRs) that provide access to some of the best examples of semi-natural habitats in the country and a particularly large area of accessible woodlands. Green space is well distributed except in the north, where Luton, for example, is noticeably lacking.

- **Biodiversity:** The approximate area of priority habitat amounts to just over 16,000 ha, of which the huge majority is woodland and includes the Chilterns Beechwoods SAC. Fragments of lowland calcareous grassland total more than 700 ha[6] and include Barton Hills and Knocking Hoe NNRs. Chiltern chalk grasslands are distinctive for their large number of rare and scarce vascular plant species such as the Chiltern gentian. At Hartslock Wood SAC and Aston Rowant SAC, there are important examples of the Chilterns' mosaic of chalk grassland, scrub and woodland. Site of Special Scientific Interest (SSSI) designation protects more than 3,600 ha of habitat and Local Wildlife Sites a further 12,647 ha. In addition, there are undesignated chalk streams and parklands. The area is popularly known for its numerous red kites.

- **Geodiversity:** The Chalk outcrop of the Chilterns filters and stores large quantities of high-quality potable water, making it a principal aquifer. The Chalk produces water that is naturally mineral rich, sediment free and of a stable temperature and as such supports specialised chalk stream ecology. In the Thames Valley, large flood plain terraces create a distinct landform and comprise a valuable aggregate resource. Buildings have made use of Chiltern flint; a particular form of hard chalk called 'clunch' or Totternhoe; a conglomeration of flint and pebble called puddingstone; and red brick made from local clays[7]. Of the 14 SSSI designated for their geological interest, many are small-scale historical sites of mineral extraction, including brickworks, sand pits, gravel pits and chalk pits. There are 33 Local Geological Sites.

[6] *Chilterns Area of Outstanding Natural Beauty: Management Plan 2008 - 2013 – A Framework for Action,* Chilterns Conservation Board (undated)
[7] *Chilterns Building Design Guide, Chilterns Area of Outstanding Natural Beauty* (February 2010, second edition)

Statements of Environmental Opportunity

SEO 1: Manage the wooded landscape, the woodlands (including internationally important Chilterns beechwoods), hedgerows, commons and parklands with the aims of conserving and enhancing biodiversity and the historic landscape and its significant features; maximising the potential for recreation; and securing sustainable production of biomass and timber.

For example, by:

- Planning for landscape restoration, creation and enhancement activities with reference to the special qualities of the Chilterns Area of Outstanding Natural Beauty (AONB) and North Wessex Downs AONB.
- Building on existing stakeholder groups and strategies involved in woodland conservation including, for example, AONB management plans and county green infrastructure strategies.
- Working across administrative boundaries to develop a resilient ecological network that supports wooded habitat and species.
- Bringing as many wooded features as possible into appropriate management, drawing support from woodland grant schemes and agri-environment schemes. Restore management to those woodlands that have fallen out of management, particularly those with already poor woodland structure, declining timber prospects and deteriorating visitor infrastructure. Secure sustainable management in all cases.
- Seeking to secure woodland and tree health in the long term. Maintain and enhance a heterogeneous woodland resource to ensure that it is resilient to climate change and to pests and diseases such as ash dieback. In existing woodlands and in new plantings, allow for positive species composition changes and maintain woodland on varying terrain, soils and aspect. Conserve the genetic diversity of the woodland resource.
- Co-ordinating deer population management across ownership boundaries. Protect woodlands and trees from deer damage as appropriate. Restore key woodlands and other wooded features that have been severely damaged by deer and squirrels, including important beech woodlands.
- Monitoring impacts of climate change, pests and diseases on native beechwoods, including the Chilterns Beechwoods Special Area of Conservation (SAC), and implementing appropriate adaptation and mitigation strategies. Recognise and conserve all habitats and species of principal importance, including those within SAC, Sites of Special Scientific Interest (SSSI) and Local Wildlife Sites. Restore and conserve all native beechwood types and conserve other semi-natural woodland types that are less extensive than the beechwoods.
- Identifying current and future threats to wooded features in the Chilterns and reviewing ecological, historic and landscape designations to ensure that there is appropriate protection of the range of wooded features. Consider ecological designations for parklands, orchards and hedgerows in particular. Consider Tree Preservation Orders in relation to 'landmark' and veteran trees.

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SEO 1: Manage the wooded landscape, the woodlands (including internationally important Chilterns beechwoods), hedgerows, commons and parklands with the aims of conserving and enhancing biodiversity and the historic landscape and its significant features; maximising the potential for recreation; and securing sustainable production of biomass and timber.

For example, by:

- Maintaining woodland on ancient woodland sites and conserving ancient hedgerow boundaries. Conserve ancient trees and veteran trees, planting or identifying nearby successors in order to secure the deadwood resource and associated biodiversity in the long term. Continue restoration of Plantations on Ancient Woodland Sites.
- Conserving the diverse arrangements and particular species compositions of wooded features in designed landscapes, incorporating native and exotic species in avenues, groves, belts, shrubberies and so on. Carry out historic landscape character assessments and devise management plans to inform conservation efforts. Ensure that succession planting respects the original plantings and seeks to maintain the historical continuity and sense of place. Target Registered Parks and Gardens, particularly those 'at risk', but also consider parklands of local importance and 'landmark trees'.
- Managing all wooded features to benefit biodiversity, considering the needs of woodland species including woodland butterflies, birds and deadwood invertebrates.
- Conserving and recording archaeology in ancient and secondary woodland. Draw on best practice developed by, for example, the Chilterns AONB and North Wessex Downs AONB.
- Using historic landscape information to engage the public in discussion about change in the landscape, particularly in relation to tree clearance and scrub management on once-open common land and downland.
- Drawing on best practice developed by, for example, the Chiltern Woodlands Project, to ensure appropriate management of woodlands across the Chilterns.
- Drawing on the best practice example of the Chilterns Special Trees and Woods Project to engage the public in recording and celebrating wooded features beyond the Chilterns AONB. Focus such efforts in green spaces and along routes that are publicly accessible. Manage and enhance field boundaries and small woodlands as connections in the woodland network and also as part of a diverse habitat mosaic. Plant hedgerows where there is poor connectivity, particularly where this will also restore historic boundaries. Manage large, species-rich woodlands, such as the Chilterns Beechwoods SAC, as core areas in the ecological network. Focus particularly on conservation of ancient hedged boundaries and ancient woodlands in order to secure their high species richness.
- Conserving historic boundary features, including veteran trees, and creating optimal edge habitat along the woodland or boundary edge.

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SEO 1: Manage the wooded landscape, the woodlands (including internationally important Chilterns beechwoods), hedgerows, commons and parklands with the aims of conserving and enhancing biodiversity and the historic landscape and its significant features; maximising the potential for recreation; and securing sustainable production of biomass and timber.

For example, by:

- Planning clearance of secondary woodland where it would restore species-rich and fragmented open habitats and restoring key views and historic landscapes. Due to the sensitivities of tree clearance and major landscape change, undertake this work in partnership with local stakeholders. Ensure that historic features are not negatively impacted by clearance. (Open habitats include grassland and heathland in downland, common land, farmland and flood plain settings.)
- Strengthening and developing new local markets for 'local', 'sustainable', 'traditional' woodland products, including wood fuel, which delivers climate regulation benefits.
- Managing the woodland resource to accommodate and drive appropriate woodland-based recreation activities that generate an income to support suitable woodland management. Draw from existing successful examples such as the visitor attractions at Wendover Woods and at Aston Hill Bike Park, the mountain bike course at Halton. Promote and manage demand for recreation to avoid unsustainable visitor numbers, recognising that recreational uses are not appropriate in some woodlands.
- Managing visitor pressure and forestry impacts on the woodland's ecological and historic environment features.
- Strengthening and enhancing multi-user access links between settlements and woodlands, facilitating greater community stewardship of local green spaces. Prioritise access to woodlands near to people's homes and workplaces, creating new woodlands where appropriate.
- Managing small woods associated with farmland as part of the wider ecological network and as a resource that can be managed to provide small-scale products of value to the farmer. Secure buffers in farmland adjacent to woodlands, veteran trees and hedgerow boundaries, particularly where high chemical input and deep ploughing is undertaken.
- Creating new forestry infrastructure that makes sustainable woodland management more viable, such as rides and sawmills.

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SEO 2: In pockets of historic land use where natural and cultural heritage are both particularly rich, aim to restore and strengthen the historic landscape, ecological resilience and heterogeneity, and to conserve soils. Ensure that species-rich habitats are conserved and extended, including internationally important species-rich Chiltern downland. Secure environmentally and economically sustainable management to ensure conservation in the long term.

For example, by:

- Building on existing stakeholder groups and strategies involved in landscape conservation including, for example, AONB management plans and county green infrastructure strategies.
- Designing any new development to accommodate and sustainably conserve the historic and ecological features and functions of historic land uses and their setting. Avoid negative impacts upon historic setting and the ecological network, working across administrative boundaries within and adjacent to the NCA.
- Using understanding of the area's traditional and historic architecture, and its distinct patterns of settlement, to inform appropriate conservation of historic buildings and settings, and planning for and inspiring any new development so that it makes a positive contribution to local character. Where an existing structure is negatively impacting on a historic setting, consider removal or concealment where it is not possible to improve the structure.
- Identifying and conserving semi-natural habitats that are often associated with historic land uses in the Chilterns, such as chalk grassland, heathland, species-rich scrub, lowland meadow, species-rich hedgerow, traditional orchards, chalk streams and acid grassland. Recognise and conserve all habitats and species of principal importance, including those within SAC, SSSI and Local Wildlife Sites.
- Managing the landscape around pockets of habitat to provide buffers, connections and food for wildlife, for example by locating field margins, field corners and low-input grassland where they will most benefit the ecological network and nearby species populations.
- Identifying where bats, owls and other species are making use of historical structures such as barns, and manage structures and the surrounding ecological network accordingly. Prioritise management of protected species and species of principal importance.
- Confirming the specialist species associated with historic land uses and establishing management that reflects the requirements of specialist species; that is, niche management, or traditional management. Develop management strategies for species with restricted distributions, particularly in light of climate change.
- Restoring historic features associated with chalk streams, such as mills, ponds, watercress beds and watermeadows, particularly where restoration of the historic land use will support traditional management that can sustain valued habitats.

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SEO 2: In pockets of historic land use where natural and cultural heritage are both particularly rich, aim to restore and strengthen the historic landscape, ecological resilience and heterogeneity, and to conserve soils. Ensure that species-rich habitats are conserved and extended, including internationally important species-rich Chiltern downland. Secure environmentally and economically sustainable management to ensure conservation in the long term.

For example, by:

- Identifying current and future threats to historic land uses and features in the Chilterns and reviewing ecological, historic and landscape designations to ensure that there is appropriate protection. Consider ecological designations for parklands, orchards, chalk streams and hedgerows in particular. Develop a strategy for conserving historic features that are not recognised by Scheduled Monument or Registered Park and Garden designations, such as co-axial fields.
- Establishing resilient core areas from which to expand by targeting conservation in those locations where existing ancient natural and cultural features are particularly numerous and accessible to the public, including the strip parishes along the scarp, parklands, pockets of ancient field systems and areas of open access common and downland.
- Maintaining and enhancing habitat heterogeneity to support specialist and generalist species associated with historic land uses and to provide connections to assist species movement through the landscape. Develop a strategy to address northward and southward migration of species at the northern and southern ends of the Chilterns working across administrative boundaries.
- Restoring historic inter-visibility, long-distance views and viewpoints as appropriate, targeting historic assets that have since become wooded, such as prehistoric monuments on the escarpment.
- Beyond concentrations of habitat, working with neighbouring landowners to restore and create new areas of habitat and establish ecological and access connections, particularly in relation to fragmented chalk grassland and commons that are important to communities.
- Ensuring that planned change in the landscape, such as restoration and creation, is informed by an understanding of the area's historic landscape in order to avoid destruction of historic features and to identify opportunities to restore historic landscapes.
- Planning to strengthen networks or co-operatives of farmers, estates and land managers in order to facilitate landscape-scale approaches, including commercially viable large-scale downland grazing systems and catchment-scale resource protection.
- Ensuring that soil conservation is integrated into management objectives for historic landscapes, particularly where there is a long history of limited or no disturbance and chemical use. In doing so, secure climate regulation, soil quality and water quality benefits.

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SEO 2: In pockets of historic land use where natural and cultural heritage are both particularly rich, aim to restore and strengthen the historic landscape, ecological resilience and heterogeneity, and to conserve soils. Ensure that species-rich habitats are conserved and extended, including internationally important species-rich Chiltern downland. Secure environmentally and economically sustainable management to ensure conservation in the long term.

For example, by:

- Strengthening and creating new markets that support sustainable grazing and woodland management, including those around 'local'/'sustainable' products and recreation, for example visitor pay-back and charged car parking. Pursue opportunities to bring abandoned or neglected areas into productive management, particularly where losses to biodiversity and historic environment are high, such as on scrub-covered downland. Wood fuel and sheep's wool as insulation material are examples of products recently under demand which could potentially drive commercially viable management on a small or large scale.
- Creating new visions for habitat management and scenery where continuing tradition is not possible as a result of climate change or long-term economics. Explore possibilities such as non-traditional livestock on the downs, commercial recreational activities in woodlands, new species compositions and different vegetation structures in woodlands and grasslands. Planning to engage local communities in helping to conserve their local landscape by recruiting 'volunteer wardens' or 'lookers', attracting sponsors and establishing positive community uses of green spaces and rural buildings. Support and build capacity among existing community groups, for example the Chiltern Society, to conserve their local landscapes.
- Maximising visual and/or physical public access to restored historic landscapes, particularly near to settlements. Provide interpretation and education to enhance visitor experiences and encourage support for conservation activities, particularly near to settlements and at popular destinations.
- Enhancing visitor experience by providing a fit-for-purpose access network that links features across the landscape and appropriate visitor facilities that are sustainable and do not impact negatively on the rural scene.

Brick and flint are common building materials.

SEO 3: Conserve the Chilterns' groundwater resource, River Thames and chalk streams by working in partnership to tackle inter-related issues at a catchment scale and also across the water supply network area. Seek to secure, now and in the future, sustainable water use and thriving flood plain landscapes that are valued by the public.

For example, by:

- Working in partnership to meet Water Framework Directive objectives for good ecological status (surface water) or good status (groundwater) across the Chilterns. Working at a catchment scale, continue to investigate and implement measures that improve river morphology and river ecology, including measures to tackle low flows.
- Building on existing stakeholder groups and strategies involved in water resource management and conservation including, for example, catchment management plans, AONB management plans and county green infrastructure strategies.
- At the parish and neighbourhood level, providing information that will enable residents to recognise, conserve and enjoy their local chalk streams, ponds and other waterbodies. Strengthen the identity of chalk streams as positive focal points for settlements and communities.
- Drawing on best practice developed by the Chilterns Chalk Streams Project and others to deliver work along the entire length of chalk streams in the Chilterns.
- Reviewing ecological designations for chalk streams and other flood plain habitats in the Chilterns to ensure appropriate protection and conservation management.
- At a catchment scale, strengthening engagement with resident, workplace and farmer communities regarding water usage, pollution, flood risk and low flows in the Chiltern environment. Support consumers in bringing consumption rates down to average or below average levels.
- Through a partnership of water companies operating across the water supply network area, securing sustainable abstraction and consumption across the water supply network area. Recognise and address the links of supply and environmental impact between the Chilterns and other National Character Areas (NCAs), including Berkshire and Marlborough Downs, Inner London and North Downs.
- Building public and consumer support across the water supply network area for the conservation of groundwater and surface water by enhancing access to watercourses. Consider Local Nature Reserve declaration for chalk stream green spaces and hold events and volunteering activities at waterside locations.
- Providing information about chalk stream ecology and the negative impacts on the landscape of unsustainable water use. Enable consumers to recognise the visual/obvious signs of positive and negative impacts of their water use on Chiltern chalk streams.
- Bringing together the various recreational user groups relating to the Thames and Chilterns chalk streams so that they can shape the future of local watercourses as recreational assets and secure sustainable recreational use. Enable them to support conservation activities.

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SEO 3: Conserve the Chilterns' groundwater resource, River Thames and chalk streams by working in partnership to tackle inter-related issues at a catchment scale and also across the water supply network area. Seek to secure, now and in the future, sustainable water use and thriving flood plain landscapes that are valued by the public.

For example, by:

- Planning to review and build networks of stakeholders across a catchment and/or abstraction area to help conserve the water resource and develop approaches to deliver sustainable development, sustainable land management and sustainable water use. Focus particularly on achieving sustainable water use in areas where rivers and groundwater are considered to be over-abstracted and around growth areas such as Luton. Plan for climate change impacts and future consumer demands.
- Minimising soil compaction and soil sealing in order to facilitate infiltration to the aquifer and minimise the volume and rate of run-off.
- Maximising opportunities arising from waterside development to restore and enhance the adjacent watercourse. In relation to any development, seek planning gain that will restore modified sections and enhance visual and/or physical public access to a watercourse.
- Drawing from best practice and developing innovative solutions that restore watercourses constrained by existing development and that improve poorly engineered channels. Restore urban sections so that watercourses are attractive focal points within the urban environment.
- Expanding the areas of semi-natural habitat in chalk stream flood plains with the aim of improving the ecological network and increasing the extent of habitats of principal importance, such as wet woodland. Conserve and create new ponds. Create habitat so that it also provides recreation, floodwater storage, pollution filtration and biodiversity benefits, as appropriate.
- Designing any work on the ground to contribute positively to the ecological network and natural processes that operate across the landscape, both within and beyond the catchment and within both urban and rural settings. Where possible, restore natural channels to allow natural river processes to take place and create areas of floodwater storage in the flood plain. Seek to extend and connect fragments of semi-natural habitat in the flood plain and nearby.
- Planning any developments to minimise demands and impacts on the water resource, including incorporating features such as sustainable urban drainage systems (SUDS). Seek opportunities to address negative impacts of existing development, including tackling pollution pathways from industry.
- Supporting farmers and other land managers in preventing pollution, conserving soils, using water efficiently and managing and creating flood plain habitats. Draw on best practice, for example catchment sensitive farming techniques.
- Ensuring that there is adequate understanding of future water resource challenges among all key stakeholders, particularly in relation to resources and habitats that are already under stress, such as the Colne catchment.

SEO 4: Enhance local distinctiveness and create or enhance green infrastructure within existing settlements and through new development, particularly in relation to the urban fringe and growth areas such as Luton. Ensure that communities can enjoy good access to the countryside.

For example, by:

- Building on existing stakeholder groups and strategies that influence development, including, for example, AONB management plans and county green infrastructure strategies.
- Designing and locating development to maintain landscape character and enhance green infrastructure provision across the NCA, drawing on best practice as undertaken by, for example, the Chilterns AONB and North Wessex Downs AONB. Adapt or remove existing development where to do so would significantly strengthen landscape character, enhance views and address barriers to natural processes and public access to the countryside.
- Seeking to conserve the setting of the two AONB landscapes outside of their boundaries when undertaking development and land management, working across planning authority boundaries as necessary.
- Maximising the benefits of planning gain by strategically allocating gain across the NCA and across planning authority boundaries. Ensure that planning gain supports an ecosystems approach. Prioritise such efforts where there are development pressures, for example in growth areas.
- Ensuring that there is an accurate and up-to-date understanding of green infrastructure needs, particularly in relation to growth areas such as Luton.
- Responding to recreation demands and visitor pressures strategically. Manage green spaces and routes across the landscape as a connected network that can dissipate or concentrate visitor pressure.
- Addressing deficits in greenspace and access links, integrating the public transport and cycle network and creating new or improved multi-user routes and green spaces working across administrative boundaries as necessary.
- Supporting farmers in providing public access routes and areas and hosting school visits, particularly where this fills gaps in provision and secures access near settlements. Target farmers around Watford, Hemel Hempstead and Amersham.
- Maximising the appeal of existing and new green spaces and sustainable transport routes close to people's homes and workplaces, including in the urban fringe where it could also strengthen landscape character.
- Considering declaration of additional Local Nature Reserves and new country parks, particularly near to settlements. Ensure that visitor needs are well met at Local Nature Reserves and country parks.
- Establishing improved and new green infrastructure that supports natural processes through securing resilient ecological networks and functioning flood plains. Identify major barriers to significant ecological processes and seek to restore better ecological function working across administrative boundaries as necessary.
- Enhancing the rural and urban scene by promoting the use of traditional local building materials and vernacular styles and utilising appropriate infrastructure. Draw on best practice as developed by, for example, the Chilterns AONB.

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SEO 4: Enhance local distinctiveness and create or enhance green infrastructure within existing settlements and through new development, particularly in relation to the urban fringe and growth areas such as Luton. Ensure that communities can enjoy good access to the countryside.

For example, by:

- Addressing negative impacts on tranquillity associated with traffic and large visitor numbers across the NCA. Promote alternative routes and destinations at a strategic scale to disperse impacts where appropriate. Design new and existing green spaces, routes and visitor facilities to better manage noise, high visitor numbers and multiple user groups or activities. Identify those locations where improved tranquillity will significantly enhance people's experience of key places and routes across the landscape.
- Designing all development and transport infrastructure to support sustainable soil and water use, flood management and pollution prevention, incorporating features such as SUDS. Focus particularly on areas where pollution, flooding and/or low flows have a negative impact. Co-ordinate activity on a catchment scale. Consider opportunities to combine with green space, to realise biodiversity and access benefits.
- Adapting traditional building designs and materials as appropriate to ensure resilience to climate change.
- Supporting suppliers and contractors who can help to conserve the traditional built environment and incorporate traditional materials into new constructions.
- Identifying key viewpoints where the appearance of the landscape is particularly valued. Monitor and conserve these viewpoints as a priority and promote them as visitor destinations as appropriate.

Supporting document 1: Key facts and data

Area of Chilterns National Character Area (NCA): 164,093 ha

1. Landscape and nature conservation designations

Fifty per cent of the NCA (82,627 ha) lies within the Chilterns Area of Outstanding Natural Beauty (AONB) and 2 per cent (2,649 ha) within the North Wessex Downs AONB.

- Management plans for the protected landscapes can be found at:
  www.chilternsaonb.org/
  www.northwessexdowns.org.uk/

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Name	Area (ha)	% of NCA
International	n/a	n/a	0	0
European	Special Protection Area (SPA)	n/a	0	0
	Special Area of Conservation (SAC)	Chilterns Beechwoods SAC; Aston Rowant SAC; Hartslock Wood SAC	1,442	1
National	National Nature Reserve (NNR)	Aston Rowant NNR; Barton Hills NNR; Knocking Hoe NNR	169	<1
	Site of Special Scientific Interest (SSSI)	A total of 87 sites wholly or partly within the NCA	3,656	2

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.

Land covered by international and European nature conservation designations totals 1,442 ha or 1 per cent of the total land area; national designations cover 3,656 ha or 2 per cent. The SAC are also SSSI. Both Barton Hills and Knocking Hoe NNRs are within the SSSI designated area but Aston Rowant NNR is only partially SSSI designated.

There are 1,062 local sites in the Chilterns covering 12,647 ha which is 8 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

SSSI Condition Category	Area (ha)	Percentage of NCA SSSI Resource
Unfavourable declining	41	1
Favourable	2,336	64
Unfavourable no change	53	2
Unfavourable recovering	1,226	34

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

Elevation ranges from 18 m on the River Thames flood plain to a maximum of 267 m near Wendover on the chalk ridge. Mean elevation is 126 m.

Source: Natural England (2010); Chilterns AONB Management Plan 2008-13

2.2 Landform and process

Landform is dictated by chalk strata which have been tilted upward to create a north-east to south-west escarpment. The scarp faces north-west across low-lying vales. The dip slope descends down into the London Basin and appears as a plateau behind the crest of the scarp.

Numerous valleys incise the dip slope creating a ridge and valley topography. The landform is generally rounded and rolling.

Valleys without watercourses, known as dry valleys or 'coombes', are periglacial landforms created during the Quaternary (the last ice age) when frozen ground prevented water percolating into the chalk.

Some stretches of watercourses, known as 'bournes', only flow when the water table is high. Spring line watercourses rise at the foot of the escarpment to flow out across the clay vales to the north. The River Thames cuts a narrow valley through the chalk escarpment at Goring. Natural river processes are restricted where watercourses are heavily modified and artificial.

Source: Chilterns AONB Management Plan 2008-13; Chilterns Buildings Design Guide; Thames River Basin Management Plan

2.3 Bedrock geology

The Chilterns escarpment is composed of chalk and is part of a larger mass that extends from East Anglia through the Chilterns to the Wessex Downs and underlies the London Basin. It is a type of limestone created under unique conditions in warm, shallow seas 70 to 95 million years ago. Marl and flint nodules are often associated and some chalk layers yield important fossils such as sea urchins and ammonites. Lower Chalk forms the base of the escarpment, Middle Chalk forms the main slope of the scarp and Upper Chalk forms the top of the scarp and bulk of the dip slope. The Lower Chalk is marly (has more clay) and contains harder bands of rock including the Tottenhoe Stone. The Middle Chalk is banded top and bottom by harder chalk rock and Melbourn rock, with the latter forming the base of the main valleys in the Chilterns.

In addition the NCA contains more recent Tertiary sediments of 65 to 2 million years ago. Being on the rim of the London Basin, there are small outcrops of Lambeth Group deposits on the dip slope. Tertiary sediments are also found as loose blocks of silica-cemented sand or pebble conglomerates on valley slopes and bottoms. These rocks are called 'sarsen stones'.

Source: Chilterns Natural Area Profile; Chilterns AONB Management Plan 2008-13; Natural England county geology profiles

2.4 Superficial deposits

During the Quaternary, the chalk bedrock was subject to erosion by freezing and thawing, creating extensive 'clay with flint' deposits which cap the ridges between the valleys up to a depth of 4 m. Tundra conditions also deposited wind-blown material called loess.

Gravels lie at the foot of the dip slope including along the Thames valley. Archaeological artefacts have been found in gravels.

Source: Chilterns Natural Area Profile

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	14
National	Mixed Interest SSSIs	0
Local	Local Geological Sites	33

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

A mixture of acidic and calcareous soils, derived from the variable geology of chalk, clay and gravels, permits mixed farming. Thin rendzina soils are found on the chalk. Heavy clay soils containing flints are found across the plateau and often support woodland.

Source: Chilterns AONB Management Plan

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

Grade	Area (ha)	% of NCA
Grade 1	196	<1
Grade 2	18,049	11
Grade 3	109,004	66
Grade 4	5,942	3
Grade 5	55	<1
Non-agricultural	13,726	8
Urban	17,122	10

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 classification 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.

- River Thames 52 km
- River Lea or Lee 19 km
- River Misbourne 16 km
- Grand Union Canal 13 km
- River Chess 7 km
- River Ver 6 km
- River Hiz 6 km
- River Wye n/a
- River Gade n/a
- River Bulbourne n/a

Source: Natural England (2010)

Watercourses originate on the dip slope, at the foot of the scarp and from outside the NCA.

Chalk watercourses flow south-east off the dip slope and are tributaries of the Thames catchment, many with a long history of management and modification. There are numerous small streams and springs emerging onto the clay vales at the foot of the escarpment which are tributaries of the Thame (Thames) and Great Ouse (East Anglian) catchments.

The Thames flows from the clay vales to the north and cuts through the chalk ridge at Goring in the south.

The Grand Union Canal links London to the Midlands and has associated reservoirs and arms to Aylesbury and Wendover. It interacts with the Rivers Bulbourne, Gade and Colne.

Please note: Other significant rivers (by volume) may also occur. These are not listed where the length within the NCA is short.

Source: Thames River Basin Management Plan;

3.2 Water quality

The total area of Nitrate Vulnerable Zone (NVZ) is 154,097 ha, or 94 per cent of the 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 27,153 ha of woodland or 17 per cent of the total area, of which 12,113 ha or 7 per cent is ancient woodland. Within the NCA, the Chilterns AONB is one of the most wooded landscapes in England with 21 per cent woodland cover, of which 56 per cent is ancient. Watling Chase Community Forest covers 323 ha, less than one cent of the area.

Source: Natural England (2010), Forestry Commission (2011), Chilterns AONB Management Plan

4.2 Distribution and size of woodland and trees in the landscape

Woodland is widespread, being found on the plateau and as 'hanger' woods in the valleys and on scarp slopes. Woodland blocks are scattered densely across the NCA as a mosaic with other semi-natural habitats and farmed land, except in the northern third where woodlands are present as smaller, more isolated fragments. In the AONB, woodland cover is highest in the south-west – in Oxfordshire – at 30 per cent.

Broadleaved trees dominate. Varied geology supports a range of species including oak, birch, holly and hazel on the plateau and ash, wych elm, field maple and cherry on the chalk escarpment. Ancient beechwoods are a distinctive feature of the AONB and are particularly associated with the 18th and 19th century local furniture industry. Many woods have a history of being planted, replanted or selectively managed to create beech high forest, although records suggest beech is also the naturally dominant woodland type. As well as beech high forest, ancient coppice woodlands are also present. Cherry orchards can be found in the central Chilterns and very rare natural box woods are present on the scarp.

Tree clumps and field trees associated with parklands, wood pasture and large gardens also contribute to the resource. Ancient and veteran trees are also associated with former wood pasture on common land.

Source: Chilterns AONB Management Plan 2008-13; Natural Area profile; Ancient beechwoods in the Chilterns

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	21,517	13
Coniferous	3,807	2
Mixed	794	<1
Other	1,035	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	7,125	4
Planted Ancient Woodland (PAWS)	4,988	3

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Hedgerows are the main boundary type, many of them ancient.

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

5.2 Field patterns

Field patterns are variable although small fields are typical and especially common on steeper ground. Boundaries generally date back to medieval times. Between High Wycombe and Hemel Hempstead, fields are considerably smaller and are either rectilinear or small squares. In the south-west and north-east, fields are medium to large with generally irregular, gently curving boundaries. Subdivision of fields into horse paddocks is significant in the AONB where approximately 5 per cent of land is under equestrian use.

Source: Chilterns AONB Management Plan 2008-13; Countryside Character Area description; Countryside Quality Counts (2003); Chilterns Land Use Change Survey 2010 Report

6. Agriculture

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

6.1 Farm type

In 2009, holdings were predominantly cereals, 372 holdings or 32 per cent, grazing livestock accounted for 246 holdings or 21 per cent, 32 per cent of holdings were recorded as 'other types'. Far fewer holdings were mixed, 62 holdings or 5 per cent; horticulture, 50 holdings or 4 per cent; and dairy, 21 holdings or 2 per cent. In the AONB, diversity of livestock now includes alpacas, deer and emu. Between 2000 and 2009 cereal holdings reduced by 43 or 10 per cent and the most notable decrease was the halving of diary holdings from 42 to 21.

Source: Agricultural Census, DEFRA (2010); Chilterns AONB Management Plan 2008-13

6.2 Farm size

There were 1,168 recognised holdings covering 93,392 ha of the NCA in 2009. Farms of the largest size bracket were predominant; covering 68,999 ha or 74 per cent of the farmed area spread across 270 holdings. Farms of between 5 ha to 20 ha were more numerous in number at 387 holdings, but only accounted for 4,216 ha or 5 per cent of the farmed area. In the AONB, there are numerous large estates.

In the Chilterns AONB, there has been an increase in the number of small farms associated with hobby farming, in other words non-commercial holdings. In 2009, there were 112 farms of less than 5 ha recognised as commercial holdings in the NCA.

Source: Agricultural Census, DEFRA (2010); Chilterns AONB Management Plan 2008-13

6.3 Farm ownership

In 2009 owned land accounted for 60 per cent or 56,090 ha of the total farmed area, while the remainder was tenanted.

Source: Agricultural Census, DEFRA (2010)

6.4 Land use

Cereals have the highest land use cover in hectares, 37,115 ha or 40 per cent of farmed area, followed by grass and uncropped land at 34,211 ha or 37 per cent. Oilseeds at 6,497 ha or 7 per cent and 'other arable crops' 6,557 ha or 7 per cent made up the majority of the remaining area.

Between 2000 and 2009, cereals reduced by 5,718 ha or 13 per cent. Significant changes related to 'other arable crops' which increased by 40 per cent or 1,879 ha and vegetables which reduced to just 98 ha from 286 ha.

In the Chilterns AONB, small holdings associated with hobby farming exhibit mixed land uses.

Source: Agricultural Census, DEFRA (2010); Chilterns AONB Management Plan 2008-13

6.5 Livestock numbers

In 2009, sheep were the most numerous livestock (54,000 animals), followed by cattle (28,000 animals) and pigs (21,000 animals). All livestock numbers fell between 2000 and 2009; pig numbers most significantly, by over half from 50,000 to 21,000. Over the same period sheep numbers dropped by 10,000 or 16 per cent and cattle by 4,000 or 12 per cent.

Source: Agricultural Census, DEFRA (2010)

6.6 Farm labour

In 2009 there were 2,515 farm workers on commercial holdings, of which principal farmers accounted for 59 per cent. Only 120 salaried managers were employed, with 379 full time and 308 part time workers. Casual labour made up 8 per cent of labour.

Between 2000 and 2009, labour reduced by 167 in total, including losses among principal farmers (61) and full time workers (113). Part time workers increased by 75 and salaried managers by 5.

In the Chilterns AONB, there are a notable number of hobby farmers. In addition, the farmer demographic is ageing and the number of new entrants is declining.

Source: Agricultural Census, DEFRA (2010); Chilterns AONB Management Plan 2008-2013

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.

7. Key habitats and species

7.1 Habitat distribution/coverage

Semi-natural habitats are scattered across the area in a mosaic with farmed land. There are noticeably smaller and fewer areas in the northern third of the NCA. Woodland makes up the vast majority of the resource, while the remaining areas represent a variety of scattered, fragmented habitats including acid, neutral and calcareous grassland, chalk streams, heathland, wood pasture and parkland, reedbed and fen. The variety of habitat reflects the varied geology and history of land management. Ashridge Commons and Woods, near Hemel Hempstead represent the largest contiguous complex of varied habitats and cover an area of 627 ha. On a much smaller scale commons across the area, and notably within the AONB, contain remnants of chalk grassland, heathland, acid grassland, ponds and wood pasture as can be seen at Moorend Common on the Dunstable Downs.

The Chilterns have the most extensive native beech woodland in England, located on the plateau and as beech 'hangers' on steeper slopes. All the native beech wood types are present from the dry woods on acid soils, oak-beech woods on heavy clay to the most diverse on thin chalky redzina soils, plus the extreme yew and box wood types. The beech woods on the chalk scarp are the most interesting, supporting rare fungi and orchids such as the ghost orchid. Those on acid soils have poor ground flora interest, limited to species such as coralroot bittercress. A few woodlands are not dominated by beech and contain ancient coppice, for example Hodgemoor Woods, Hog and Hollow Woods. Much of the secondary woodland, including that on commons, has enhanced interest due to its history as former chalk grassland or wood pasture.

Remnants of chalk downland are found on the scarp face and steeper valley slopes. In the AONB a 2008 audit identified at least 700 ha of chalk grassland. Some of the chalk grassland will not be high quality and scrub encroachment reduces the area. Downland supports unique and rich plant communities including small scabious, rockrose, candytuft and others, and invertebrates such as silver spotted skipper and Duke of Burgundy fritillary. In addition, the Chiltern grasslands support species which are uncommon elsewhere on the chalk grasslands of southern England, for example, early gentian, monkey orchid and pasque flower. The Chilterns is a national stronghold for a short, very species rich type of chalk grassland characterised by sheep's fescue, mouse-ear hawkweed and basil thyme. It supports a range of specialised insects, mosses, liverworts, molluscs and invertebrates. Associated rare habitats are chalk heath found at Shirburn and Coombe Hills and juniper scrub at Aston Rowant.

Chalk rivers and streams are characterised by water crowfoots and support a high diversity of plants, insects, birds and fish, including some of the UK's most endangered species including reed bunting, water vole and brown trout. River margins are of interest as well as winterbourne sections which support a unique assemblage of plants and animals. The River Thames also has limited interest, including wet meadow and fen between Henley and Marlow and species including Loddon lily and Daubenton's bat. Other small wetland habitats in the Chilterns include rare calcareous fen, as at Pitstone and Bledlow, and wet woodland.

The farmed landscape supports nationally important assemblages of declining farmland birds including nationally important populations of corn bunting and linnet. The Chilterns are a national stronghold for arable weeds, including pheasant's eye and ground pine. In addition, the estimated length of hedgerow in the AONB part of the area is 4,045 km (2,528 miles), with much of this being species rich, including field maple, hornbeam, hazel and way faring tree among others. Hedgerows often contain ancient and veteran trees. Old trackways and ponds are also a feature of farmland that can support wildlife interest.

Source: Chilterns AONB Management Plan, Chilterns Natural Area Profile

7.2 Biodiversity Action Plan (BAP) 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.

Habitat	Area (ha)	% of NCA
Broadleaved mixed and yew woodland (Broad habitat)	14,732	9
Lowland calcareous grassland	1,192	1
Coastal and flood plain grazing marsh	341	<1
Lowland meadows	161	<1
Lowland dry acid grassland	53	<1
Fens	52	<1
Reedbeds	16	<1
Lowland heathland	14	<1
Purple moor grass and rush pasture	4	<1

Source: Natural England (2011)

- Maps showing locations of UK BAP 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 UK BAP 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

Neolithic clearance of woodland for agriculture and the development of an important Roman communications network established a settlement pattern still evident today. The oldest settlements are nucleated settlements located in valleys and at the foot of the escarpment, established due to reliable water supply. Many have Norman churches, village greens and ponds. Settlement on the higher ground was restricted to dispersed hamlets and farms until the mid-19th century, when scattered linear villages developed, usually around common land and along droving routes. Commons on the dip slope are very characteristic and are often associated with nearby towns and villages.

There are many parklands and designed landscapes along the River Thames and on sloping valley sides, including the Prime Minister's rural retreat at Chequers.

The proximity of the area to London meant that many of the towns along major road and rail corridors expanded greatly in the 19th and 20th centuries, including Luton and Hemel Hempstead in the north, Amersham in the centre on the Metropolitan London Underground line, and Thames-side, Marlow and Henley in the south. Major transport corridors follow the valleys and do not run along the escarpment.

Leisure land uses are prominent on the outskirts of towns and villages, including golf courses and horse paddocks.

Source: Chilterns AONB Management Plan, Chilterns Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main settlements within the NCA are: Luton/Dunstable; High Wycombe; Hemel Hempstead; Amersham/Chesham; Harpenden; Berkhamsted; Marlow and Henley-on-Thames. The total estimated population for this NCA (derived from ONS 2001 census data) is: 946,859.

Source: Chilterns Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

Timber-frame was the traditional material for most buildings until the 18th century when brick began to be widely used. Brick was often made locally, giving rise to variations of colour and quality. Flint was also widely used in combination with brick and is particularly common in the central plateau areas. Clay tiles became the general roofing material from 16th century, but Welsh slate is also found and in Oxfordshire, thatch. Rarely, local Tottenhoe Stone and clunch are used. The consistent range of building materials used in different combinations throughout the AONB is distinctive.

Dating back to the 1920s and 30s, buildings of the 'Metroland' style are found along the Metropolitan London Underground line.

Source: Chilterns AONB Management Plan, Chilterns Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

The Chilterns is a long-settled area with features dating back to prehistory. Many features survive in the AONB because the land has not been intensively cultivated or developed.

The earliest evidence of human activity is found at flint working sites in Caddington, dating back to the early Palaeolithic (125,000 – 70,000 BC). Subsequent periods of prehistory are evidenced by more visible earthworks, the majority being on the escarpment and in the Thames Valley. Neolithic barrows are found at Whiteleaf and around Dunstable. Barrows from the Bronze Age are more common, for example, Edlesborough and Wendover. Hill forts and dykes from the Iron Age are found along the scarp, connected by the Ridgeway or Icknield Way, which has been in use since the Neolithic, and along the Thames Valley. Grim's Ditch is one of several Iron Age linear dykes – evidence of extensive land divisions – stretching from Great Hampden to Dunstable. Pre-Roman 'co-axial' patterns of parallel trackways and fields exist.

The Ridgeway is reputedly the oldest road in the country dating back to prehistoric times when it linked Wessex to East Anglia. In the wider landscape, there are extensive ancient routes and sunken lanes or 'hollow ways'. The Roman roads of Watling Street (A5) and Akeman Street (A41) run through the Chilterns. The Anglo-Saxon boundary known as the Black Hedge and the old Hundreds boundaries are also of interest.

Medieval buildings survive, such as flint churches and timber-framed barns. Former parks are now evident as commons, for example at Ashridge, Hampden. Brick kilns, windmills, Brunel bridges, canals and designed landscapes are more recent historical features. Parklands include examples of 18th century designs by Bridgeman, Repton and Brown, for example Tring Park and Ashridge, and often contain or are surrounded by distinctive estate architecture.

Source: Draft Historic Profile, Countryside Character Area description

9.2 Designated historic assets

This NCA has the following historic designations:

- 40 Registered Parks and Gardens covering
- 4,696 ha (15 in the AONB)
- 0 Registered Battlefields
- 202 Scheduled Monuments (122 in the AONB)
- 6,851 Listed Buildings

Source: Natural England (2010); Chilterns AONB Management Plan 2008-13

- More information is available at the following address:
  http://www.english-heritage.org.uk/caring/heritage-at-risk/

  http://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/

10. Recreation and access

10.1 Public access

- Six per cent of the NCA or 10,642 ha, is classified as being publically accessible and includes significant areas of downland on the ridge.
- There are 3,563 km of public rights of way at a density of 2.2 km per km2.
- There are 2 National Trails within the NCA. The Thames Path extends over 54 km and The Ridgeway over 67 km, predominantly along the ridge of the escarpment.

Sources: Natural England (2010)

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)	1,745	1
Common Land	2,719	2
Country Parks	251	<1
CROW Access Land (Section 4 and 16)	4,829	3
CROW Section 15	2,751	2
Village Greens	127	<1
Doorstep Greens	3	<1
Forestry Commission Walkers Welcome Grants	4,316	3
Local Nature Reserves (LNRs)	649	<1
Millennium Greens	6	<1
Accessible National Nature Reserves (NNRs)	211	<1
Agri-environment Scheme Access	146	<1
Woods for People	6,301	4

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

Lowest scores for tranquillity are associated with the urban areas of Luton/ Dunstable, Hemel Hempstead and High Wycombe, and the concentration of development along the south-east boundary. The most tranquil areas are the scarp slopes of the north-west boundary and areas of the plateau, particularly to the south of Aylesbury.

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

Category of tranquillity	Score
Highest value within NCA	30
Lowest value within NCA	-108
Mean value within NCA	-21

Sources: CPRE (2006)

- More information is available at the following address: **http://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. A breakdown of intrusion values for this NCA is detailed in the table below.

Category of intrusion	1960s (%)	1990s (%)	2007 (%)	% change (1960s-2007)
Disturbed	41	59	67	26
Undisturbed	51	33	20	-31
Urban	8	8	13	5

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are significant loss of undisturbed land, just over 30 per cent, and an increase in the area of disturbed land of about 25 per cent.

- More information is available at the following address: **http://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)
- BAP 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%.
The convention <1 has been used to denote values less than a whole unit.

Supporting document 2: Landscape change

Recent changes

Trees and woodlands

- There has been an increase in the amount of woodland being managed under agreements with the Forestry Commission; increased from 27 per cent to 34 per cent of the eligible woodlands identified in the National Inventory of Woodland and Trees.
- Agreements have funded very limited woodland creation between 1999 and 2003.
- Of the NCA designated as the Chilterns AONB, 20 per cent of woodlands were in a Forestry Commission woodland grant scheme in 2009. By 2011, this had risen to 36 per cent, a total of 6,504 ha.
- Of the NCA designated as the Chilterns AONB, felling licences applied to 1,912 ha of woodlands in 2011.

Boundary features

- Between 1999 and 2003, only 3 per cent of the NCA's field boundaries received payments for management, restoration or creation under agri-environment agreements. 105 km of hedge was planted and restored and 55 km of hedge was managed.

Agriculture

- Between 1999 and 2003, the rate of grassland loss slowed and reversed so that there is currently a balance between cereals and pasture.
- Agri-environment scheme uptake in the NCA has been above the national average, with a focus on semi-natural grassland conservation. Almost half the NCA has been within a target area for Higher Level Stewardship, focusing support for management, restoration and creation of landscape features in the Chilterns AONB and North Wessex Downs AONB.
- Of the NCA designated as the Chilterns AONB, the total area in agri-environment schemes, Environmental Stewardship and Countryside Stewardship, was 67 per cent of farmland in 2011, well distributed across the Chilterns AONB. Higher Level Stewardship agreement coverage in 2011 was above the national average at 11 per cent (HLS) and 2.3 per cent (Organic HLS), totalling nearly 7000 ha.
- New linear features have been created in the NCA under agri-environment schemes. In 2003, this included permanent grass margins greater than 6 m (269 km), 2 m arable margins (103 km), creation of 2 m grass margins or beetle banks (31 km), and buffer strips (2 km).
- Cattle and sheep numbers declined by 12 per cent (3,921) and 16 per cent (10,538) respectively between 2000 and 2009.

Settlement and development

- There has been recent expansion around Dunstable, Harpenden, Hemel Hempstead and High Wycombe, with upgrading in 2003 of the A41 and a by-pass around Aston Clinton.
- Growth areas identified in the NCA include Milton Keynes-South Midlands and Cambridge-Stansted-Peterborough.
- Recent developments on the edge of scarp foot in and around historic market towns have altered the historic settlement pattern.
- Recreational land uses, including horse paddocks, golf courses and 'hobby' farms, are replacing commercial agricultural land uses.
- New road construction and road 'improvements' have affected the small scale road network, particularly on the dip slope and in the valleys.

Semi-natural habitat

- In 2003, land managers in the NCA were being supported through agri-environment schemes in managing 757 ha chalk grassland, 568 ha of lowland pasture on neutral/acid soils 430 ha of grassland restoration and 327 ha lowland hay meadow.
- Of the NCA designated as the Chilterns AONB, the area of species rich grassland being maintained or restored under Higher Level Stewardship has increased between 2009 and 2011 from 198 ha to 1,012 ha. Since 2009, agreements have funded 226 ha of species rich grassland creation.
- In 2011, 40 of the 187 commons were managed under woodland or agri-environment scheme agreements. In 2011, a Chilterns Common Project was launched to support management outside scheme agreements on 10 to 15 commons over 4 years.
- Of the commons which are SSSI, there were positive trends in condition with 97 per cent in favourable or unfavourable recovering condition.
- 30 per cent of all SSSI in the NCA are recovering from unfavourable condition whilst 1.5 per cent are declining in condition.
- Of the NCA designated as the Chilterns AONB, 99 per cent of the total SSSI area was in favourable or unfavourable recovering condition in 2011, compared to 94 per cent in 2009. The number of Local Sites in positive conservation management has risen from 29 per cent in 2009 to 39 per cent in 2011.
- Of the NCA designated as the Chilterns AONB, 86 per cent of SSSI where chalk grassland is the main habitat were in favourable or unfavourable recovering condition in 2009. This increased to 98 per cent in 2011.
- Since 2010, the Chilterns Chalk Grassland Project has cleared scrub and improved conservation grazing infrastructure across twelve sites owned by the Wildlife Trusts.
- A Plantlife project 'Saving England's Lowland Juniper' successfully propagated and planted young juniper at several sites in 2010 and 2011, improving the chances of population survival.

Historic features

- The rate of conversion of listed barns on a unit area basis is high, with over 200 conversions since 1999. About 67 per cent of listed historic farm buildings remained unconverted in 2003 and approximately 94 per cent were intact structurally.
- Parkland conservation has been supported by an Historic Parkland Grant for around 25 per cent of parkland and by agri-environment schemes for another 13 per cent.
- Scheduled monuments on the At Risk register in 2012 which were in a declining condition amounted to 15 sites, including two associated with Roman settlement near St Albans and Totternhoe Castle. No scheduled monuments or Registered Parks and Gardens were considered to be of improving condition in 2012.
- 90 ha of historic landscape have been managed under agri-environment schemes between 1999 and 2003.

Rivers

- Low flow alleviation schemes have been in place for several years on the Misbourne and Ver. The majority of chalk streams suffer low flows - Gade, Bulbourne, Chess, Wye, Hughenden, Ver and Misbourne.
- In 2012, a project to provide advice to farmers and land managers in the Colne catchment will tackle pollution affecting surface and ground waters.

Minerals

- Gravel working in the Thames Valley continues north of Maidenhead only.
- Active large chalk quarries are now limited to one in Bedfordshire. Totternhoe Stone (clunch) is quarried.
- Excavation for brick-making materials continues at two locations in Buckinghamshire; small scale brick making was once widespread.

An historic, hedged routeway leads to woodlands on Chinnor Hill.

Drivers of change

Climate change

- Aquifer recharge will be reduced. Hotter, drier summers will offer less rainfall and increased evaporation rates. Rainfall events in the winter may be increasingly concentrated in major downpours, much of which could be lost to surface run-off. Pollution incidents may also increase as a result of failed drains and rapid run-off during storms.

- Water-dependent chalk streams and springs and wetland habitats are vulnerable to low groundwater levels and their resilience is already reduced by historical low flows along many streams. Unpredictable and frequent periods of drought and flood will give rise to erratic flows and difficulties in managing flows. There may be downstream migration of stream heads and winterbourne sections. Water quality may also deteriorate as a result of high temperatures, lower oxygen levels and polluted run-off during storm events.

- Thermal stress will also impact on a range of species, especially those near or at the southern limit of their range. This is exacerbated where connectivity to upstream habitats or other catchments is inhibited.

- Livestock may be kept off the open downs to prevent exposure to extreme weather conditions; leading to under-grazing.

- Climate change favouring a longer growing season will exacerbate the problem of scrub and woodland encroachment onto valued open features such as downland and common land. Viewpoints, landmarks and historic features such as burial mounds and boundaries will become more rapidly obscured.

- More frequent drought increases the risk of fire in semi-natural habitats and will tend to depress agricultural productivity. With increasing warmth, new crops and varieties and cropping patterns and livestock systems may emerge.

- Trees in exposed positions, particularly within parkland, orchards, hedgerows and small woodlands, will be vulnerable to sun scorch, crown/root die back and windthrow. Associated lichen, fungi and invertebrate interest will also be affected. Loss of landmark trees will be particularly significant.

- Native beech woodlands will be affected. Survival rates of beech will vary depending upon underlying soils, with trees on the free-draining soils of northern facing slopes/coombes likely to fare better than some of the stands on the thinner soils of the south facing slopes. Where beech fails, there will be a change in species composition as more drought tolerant species prevail naturally or are planted. Beech dependent species, including fungi and invertebrates, will be disproportionately affected.

- High temperatures and summer drought are expected to reduce the species diversity of chalk grassland. Younger calcareous grasslands composed of fast-growing or short-lived species are likely to be more vulnerable than older calcareous grasslands (Grimes et al 2000). South-facing habitats will suffer greatest exposure to increased solar radiation.

- The fragmented and small size of some habitats in the Chilterns, including chalk grassland and common land habitats reduces their resilience to threats. The wider heterogeneity of the landscape offers a variety of aspects, such as hedgerows, as 'movement corridors' that will assist more mobile species in finding more favourable conditions.

- Climate change adaptations to building design will give rise to new features in the built environment, particularly where encouraged by schemes such as the Chilterns Buildings Design Award.

- Mild winters may lead to greater visitor numbers in the winter. Surfaces of access routes will be damaged by increased pressure following waterlogging and result in rapid run-off.

Other key drivers

- Growth areas affecting the NCA include Milton Keynes-South Midlands and Cambridge-Stansted-Peterborough. Further development and infrastructure elsewhere is also possible, such as along major railways and at Luton airport. Development will alter the appearance of the landscape and may reduce the sense of tranquillity. There will be associated demands on a variety of ecosystems in the area, including water availability and accessible green space.

- Agricultural and forestry economics will continue to shape the character of the rural landscape. Scrub and woodland encroachment upon open areas including downland may continue as livestock numbers decline and viability of sheep and cattle farming remains limited. In contrast, demand for wood fuel may bring unmanaged woodlands into production and galvanise efforts to manage deer. Demand for arable products will remain and may increase, encouraging deer management and demanding limited hedgerow management. Agri-environment schemes will continue to support sustainable agriculture.

- Smallholders and non-farmers own a significant proportion of land and may potentially convert agricultural land to non-productive land uses, for example horse paddocks and gardens.

- Land purchases driven by perceived development opportunities will give rise to land falling into disuse or temporary uses whilst awaiting development. This will be particularly acute in the urban fringe and especially in growth areas.

People are attracted to chalk streams such as the Hughenden Stream as they pass through settlements and greenspaces.

- Demand for recreation opportunities and associated visitor facilities will see changes to infrastructure in the countryside and possible deterioration of access routes, infrastructure and landscape features at the most popular locations. High visitor numbers may detract from visitors' experiences.

Easy access routes are established in the Chilterns.

- Visitors to the countryside may be unfamiliar with the countryside and may behave inappropriately. Visitors will require visitor information and signage to assist them. In addition, some visitors will be deterred by livestock in the countryside and others may worry livestock. As such, visitors present a particular challenge to grazing management of publicly accessible land.

- Interest groups will challenge the management of features in the landscape that they value, with tree clearance, fencing and new development being sensitive issues. Management of common land, for example, will require consultation and negotiation with the public. Demand for water at a local and regional level will impact the Chilterns groundwater resource and its management. Related impacts upon chalk streams will arise.

- Pests and diseases will influence woodland and cropping choices, giving rise to new woodland species compositions and new crops. The impact of disease upon ash trees may be significant in the Chilterns since ash is the second most common species after beech.

- Farming will increasingly incorporate measures that are resource efficient and prevent pollution. This will introduce new features, potentially at a catchment scale, including buffer strips and water storage reservoirs.

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.

Community groups conserve and celebrate the area.

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	Tranquility	Recreation	Biodiversity	Geodiversity
SEO 1: Manage the wooded landscape, the woodlands (including internationally important Chilterns beechwoods), hedgerows, commons and parklands with the aims of conserving and enhancing biodiversity and the historic landscape and its significant features; maximising the potential for recreation; and securing sustainable production of biomass and timber.	↔ ***	↗ **	↗ *	n/a	↑ **	↑ **	↔ *	↗ **	↑ **	↑ **	↗ **	n/a	n/a	↑ ***	↗ ***	↘ *	↗ **	↗ **	↔ ***
SEO 2: In pockets of historic land use where natural and cultural heritage are both particularly rich, aim to restore and strengthen the historic landscape, ecological resilience and heterogeneity, and to conserve soils. Ensure that species-rich habitats are conserved and extended, including internationally important species-rich Chiltern downland. Secure environmentally and economically sustainable management to ensure conservation in the long term.	↔ *	↔ **	↗ **	n/a	↔ **	↔ **	↗ **	↗ **	↑ **	↑ **	↗ ***	n/a	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.

Dark plum = National Importance; Mid plum = Regional Importance; Light plum = Local Importance

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	Tranquility	Recreation	Biodiversity	Geodiversity
SEO 3: Conserve the Chilterns' groundwater resource, River Thames and chalk streams by working in partnership to tackle inter-related issues at a catchment scale and also across the water supply network area. Seek to secure, now and in the future, sustainable water use and thriving flood plain landscapes that are valued by the public.	↘ *	↔ ***	↑ **	n/a	↔ **	↗ *	↑ ***	↑ ***	↑ ***	↑ ***	↔ **	n/a	n/a	↑ ***	↔ ***	↔ ***	↑ ***	↑ ***	↔ ***
SEO 4: Enhance local distinctiveness and create or enhance green infrastructure within existing settlements and through new development, particularly in relation to the urban fringe and growth areas such as Luton. Ensure that communities can enjoy good access to the countryside.	↔ **	↔ **	↗ *	n/a	o	↗ *	↗ **	↗ *	↔ **	↗ **	↗ **	n/a	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.

Dark plum = National Importance; Mid plum = Regional Importance; Light plum = Local Importance

Landscape attribute	Justification for selection
Chalk and periglacial landforms and features, including a prominent escarpment and dry valleys.	■ Adjacent to the clay vales, the Chalk escarpment is an abrupt change in elevation, 300 m above the Vale of Aylesbury. It stands as a distinctive relief feature visible from miles around. Extensive views are provided by the ridge, particularly from open downland. ■ The views and experiences across this landscape are variable, as a result, in part, of landform. The enclosed nature of small valleys contrasts with the extensive views and open landscape on parts of the scarp and ridges. ■ The crest line of the escarpment becomes progressively lower towards Hertfordshire, in the north-east, where it was overridden by ice sheets during the Anglian glaciation. ■ Exposed Chalk is infrequent and woodland cover is extensive; however, the underlying bedrock is made prominent by the few local landmark carved figures, for example Whiteleaf Cross. The few Chalk exposures provide access to key Cretaceous sequences and yields important fossils. ■ The numerous valleys across the dip slope create topography of alternating ridges and valleys, steep slopes and narrow valley floors. Some of these valleys are dry, while others are coursed by chalk streams with intermittent headwaters. ■ Sarsen stones (post-glacial sandstone blocks of Tertiary age) are known only at a few locations, for example Bradenham. ■ The Chilterns is part of a larger Chalk mass which functions as an aquifer. Unconfined areas of Chalk in the Chilterns represent key areas for re-charge (and pollution) of the aquifer. In addition to supplying local demand, the aquifer provides for London and the Thames.
River Thames valley and associated settlements including the important landforms of the Goring Gap and gravel river terraces.	■ The River Thames is culturally significant nationally and links the Chilterns to other NCAs within its catchment. Locally, it is an important recreational resource, a focus for settlement, an area of wetland interest and a major landscape feature. ■ The Goring Gap is a well-known landform created by the River Thames carving a passage through the Chalk ridge. ■ Quaternary deposits here are famous type localities for Thames' river terraces, aiding our understanding of the evolution of the Thames' course through geological time. ■ Being an important communication route and cultural attraction, historic features along the Thames are significant. There is a concentration of prehistoric monuments in the Thames Valley and internationally important prehistoric artefacts have been found in gravel terraces; for example, at Cannoncourt Farm Pit SSSI. ■ The Thames was also a focal point for some of the region's finest houses and associated parkland and designed landscapes. Distinctive river frontages and 'summer homes' from the 19th century are a feature of Thames-side towns such as Marlow.

Landscape attribute	Justification for selection
A diversity of semi-natural habitats and species special to the Chilterns.	■ A variety of soils which broaden the range of habitats beyond those typical of the Chalk. The extensive clay-with-flint deposits support acid heathland, grassland and woodland. ■ The Chiltern soilscape makes it possible for all native beechwood types to be present and also for small examples of rare chalk heath which comprise both acid-loving and calcareous plants. There are the dry beechwoods on acid soils; the oak-beech woods on heavy clays; and the beechwoods on thin, chalky rendzina soils. ■ Nationally important extremes of the beechwood series, the yew woods and box woods, are also present. Important wet habitats which contrast with the dry habitats on chalk; watercourses, springs and limited areas of fen and meadow are found in some valleys and along the foot of the scarp. ■ A few small areas of calcareous fen exist at Pitstone and Bledlow and, in the Thames Valley, there are SSSI wet meadows and fens between Henley and Cookham. Ponds form on impermeable clay-with-flint deposits and there are also man-made features including the Grand Union canal, mineral extraction pits and reservoirs such as Tring Reservoirs SSSI. The Thames and its valley represent the largest wetland feature and the Chess is the most significant of the chalk streams.. ■ Downland, common land, meadow, parkland and woodland have created diversity of habitat at a local scale. Common land often exhibits features resulting from different land management practices, including wood pasture, heathland/grassland and secondary woodland; for example, Naphill Common SSSI and Frithsden Beeches SSSI. ■ The red kite and deer are numerous in this area and, as a consequence, have become strongly associated with the Chilterns. ■ There are several rare or scarce species associated with the Chilterns. Grassland plant species include Chiltern gentian, fringed gentian, early gentian, wild candytuft, monkey orchid, and military orchid. Woodland species include firecrest, a number of scarce deadwood beetles and flies and also fungi such as Devil's or Satan's bolete, old man of the woods, and Inocybe patonillardii. Box woodlands support a number of rare lichens and liverworts. Chalk stream species include the water vole and cowbane.

Landscape attribute	Justification for selection
One of the most wooded lowland landscapes in the country, distinguishing the Chilterns from other more open chalk landscapes.	■ The Chilterns is one of the most wooded lowland landscapes in the country with over 23,000 ha of woodland covering 14 per cent of the NCA. The majority of woodland is broadleaved and much is native beechwood. ■ Over half the woodland resource is ancient. Extensive areas of woodlands have remained uncleared for centuries, particularly on steep slopes and over clay-with-flint deposits. ■ A variety of elements create this wooded landscape – farm woodlands, productive forestry, wooded commons, parklands (including designed woodlands, groves and tree avenues), orchards, hedgerow trees, field trees, hedgerows, gardens and roadside trees. ■ The Chilterns has the greatest extent of native beechwoods in the country. Chilterns Beechwoods SAC represents a major resource at over 12,000 ha. There are 'hanging' beechwoods on the upper slopes of the valley sides and on the scarp. Plantation beechwoods are renowned for their 'cathedral like' qualities. ■ Woodlands and hedgerows contribute to the seasonal variations in colour and are widespread enclosure elements creating a sense of intimacy and secrecy. There is a wealth of species in the typical Chiltern hedgerow including many typical of ancient woodland - hazel, field maple, holly, ash, elm, rose, dogwood, blackthorn, spindle, whitebeam and wild clematis. ■ The beechwoods have inspired artists and writers; for example, Paul Nash's painting 'Wood on the Downs'. ■ A strong association with the history of the country's furniture industry, particularly chairs, including the 'Windsor Chair', which relied upon local woodland products. ■ The dense shade cast by some beechwood types supports a unique ground flora community including saprophytic orchids. ■ Secondary woodland, for example on commons, has greater biological interest than would normally be expected because of its origin from natural succession of chalk downland or old wood pasture with scattered pollards; for example, Naphill Common SSSI and Ashridge Commons and Woods SSSI.

Landscape attribute	Justification for selection
An ancient landscape of commons, downland, woodland and field boundaries, fragments of preserved ancient land use patterns, historic monuments, settlements and routeways dating from prehistory to the more recent past.	■ The historic environment includes bronze-age barrows and field systems; iron-age forts and dykes; pre-Roman 'co-axial' patterns of parallel trackways and fields; Roman roads and villa sites; medieval churches, field patterns, strip lynchets and deer enclosures; ancient coppice woodlands; 18th century sawyer pits and parklands; and 20th century military trenches and 'Metroland'. ■ Prehistoric monuments are concentrated along two nationally significant historic communication routes passing through the Chilterns – the Ridgeway and the Thames. ■ Some ancient features are widespread and can be accessed and enjoyed by the public – ancient woodland, ancient boundaries, historic routeways including 'holloways', historic field and settlement patterns, manorial wastes and commons. In the half of the NCA designated the Chilterns AONB, 45 per cent of the landscape is of pre-18th century origin and 42 per cent of fields are pre-18th century. ■ Nucleated settlements with historic cores are associated with watercourses and springs. Despite significant 20th-century development, some settlements appear little changed, for example the historic village of Turville. Medieval flint churches are numerous. ■ Common land accounts for 2,179 ha, or 2 per cent of the area, and ancient woodland 12,113 ha or 7 per cent of the NCA. Historic downland is almost exclusively found along the scarp and accounts for 2 per cent of the area of the Chilterns AONB. As well as preserving historic land use patterns, such areas of ancient downland, common land and woodland are also rich with historic features, including scheduled monuments. ■ Ancient woodlands contain features associated with the industry, including the local furniture industry that was at its peak in the 19th century. Secondary woodland also preserves features pre-dating woodland cover; for example, Boddington hill fort. ■ Many places have a long history of management. On commons, for example, there can be remnants of previous land uses within secondary woodland, including wood pasture, heathland glades and ponds. Chiltern commons have historically been managed for all their naturally occurring resources including as wood pasture, woodland, deer park, pannage and for mineral extraction. ■ Around 40 per cent of hedged field patterns in the Chilterns are thought to have pre-18th century origins, with distinctive Saxon parish boundaries surviving along the scarp. The Black Hedge near Great Hampden and the Hundreds boundaries are significant Anglo-Saxon features. ■ There are 4,696 ha of Registered Parks and Gardens over 40 sites, many being visually prominent in the landscape and accessible to the public. Parkland can contain both biodiversity interests, including woodland, veteran trees, grassland and heathland, and historic features surviving from pre-existing landscapes.

Landscape attribute	Justification for selection
Fragmented species-rich chalk grassland on steep slopes, supporting rare plants and scrub communities including juniper, box and numerous orchids.	■ The resource is less extensive and more fragmented than other areas known for chalk grassland. This is the consequence of the unique combination of complicated topography, distribution of other habitats and pattern of land use over the centuries. ■ Chiltern grasslands are distinctive where they have a very short, highly diverse turf. A large number of rare and scarce vascular plant species have been recorded that are uncommon across other south England chalk grasslands. Several plant species are strongly associated with the Chilterns: Chiltern gentian, early gentian, fringed gentian, greater pignut. Many rare orchid species have been found and there are strong populations of some rare species such as the pasque flower at Barton Hills National Nature Reserve. ■ There are rich communities of invertebrates, liverworts and mosses including specialists of box and juniper scrub. Duke of Burgundy, small blue and chalkhill blue are butterflies of restricted distribution in the Chilterns. ■ Rare scrub communities include very important UK examples of lowland juniper scrub at Aston Rowant SSSI and Roughdown Common SSSI, and one of three sites in the country for native box scrub at Ellesborough and Kimble Warren SSSI.
Red brick and flint buildings are distinctive.	■ Settlement pattern and local vernacular building styles contribute greatly to the landscape character and a sense of history. Traditional building materials of brick and flint were historically used in all settings, from the farmstead to the village and town, and include churches, boundary walls and railway stations. Brick and flint continue to be used in some modern constructions. ■ Variations in the use of brick and flint create interest. Brick was often made locally, giving rise to variations of red colour, texture and quality. Bricks of varying colours and glazes were used to create ornamental details. Some buildings, including churches, may be constructed entirely from flint. The proportion of brick to flint is variable, as is the style. ■ Areas of 20th century development have introduced other styles and materials that can be dominant over the traditional character.

Landscape attribute	Justification for selection
Localised and occasionally modified chalk streams.	■ Chalk streams and associated wetland habitats occur in an otherwise dry landscape and support a high diversity of plants and animals. Further importance is attached to them as globally scarce habitats confined mainly to England and north-west Europe. There are unique assemblages of plants associated with winterbourne sections. ■ In the half of the NCA designated the Chilterns AONB, important biodiversity is recognised by two SSSI and 30 Local Wildlife Sites which incorporate sections of chalk river. ■ Chalk streams only occur where groundwater reaches the surface in the chalk valleys and along the foot of the scarp. Chalk streams in the valleys tend to be minor landscape features except in the case of the Chess. Some watercourses are intermittent at their headwaters, for example the River Misbourne, or along entire stretches, such as Hamble Brook. ■ Numerous springs and watercourses arising at the foot of the scarp. ■ The River Lee passes through Luton and the River Wye through High Wycombe. Rivers are often near to major roads following the valley floors and consequently have a long history of modification and pollution to the extent that no Chiltern chalk stream can be considered to be 'natural'. ■ Water meadows are found alongside the River Chess. ■ A localised feature, chalk streams are significant for their local biodiversity, history and community interest. There are six local community groups dedicated to the conservation of Chiltern chalk streams. Riverside urban green spaces and Barton Springs, for example, draw visitors. ■ Historic features include water cress beds along the Alderbourne and Chess, ornamental lakes as at Shardeloes, and mill remains.

Landscape attribute	Justification for selection
An agricultural landscape of cereals and livestock intimately mixed with woodland and defined by ancient hedgerow boundaries.	■ A patchwork land use pattern of woodland and farmland. At the farm scale, there is often a mix of woodland and farmland, with woodlands having historically been a useful resource for the farm itself. ■ Much of the patchwork land use pattern is intricate because it has the ancient characteristics of being small-scale, irregular and defined by ancient boundaries and routeways. Today, the farmed landscape dominates land use, combined with very high woodland cover. Grade 3 land accounts for 66 per cent of the NCA and dictates a mix of arable and livestock farming. ■ Livestock numbers have been in decline but livestock farming continues and helps conserve remaining areas of downland and meadow. There are no rare/traditional breeds particularly associated with the Chilterns. ■ Orchards and watercress beds remain as relicts of once significant local industries. ■ Despite a dramatic decline in the last 50 years, the Chilterns still stands out as a national stronghold for arable weeds including pheasant's eye, ground pine, broad-leaved cudweed and rough mallow. Areas of less intensive agricultural land, for example field margins, host these species. ■ A 2002 survey in the Chilterns AONB found that there are nationally important populations of farmland birds including corn bunting and linnet. Above average populations of skylark and yellowhammer were also found. However, species such as stone curlew are no longer present. ■ Species-rich grassland is present in the farmed landscape on limited areas of downland and meadow. In the part of the NCA designated the Chilterns AONB, a survey in 2006 and 2007 identified that there were many veterans amongst the hedgerow trees and 38 per cent of hedgerows surveyed were in good condition.

Landscape attribute	Justification for selection
Features linked to recreation are widespread, including an extensive rights of way network, open access land, horse paddocks and golf courses.	■ Areas of downland and the numerous scattered commons are designated as open access land. The extensive woodland resource also contributes to the area of open access. Open country includes key locations along the scarp, providing access to magnificent views, species-rich grassland and scheduled ancient monuments. ■ Commons are key green spaces within the villages, towns and larger urban areas and are scattered across the NCA. They are particularly important in more developed areas such as the Thames Valley, for example Cookham commons, and on the edge of London at places such as Chorleywood and Harpenden. ■ Popular visitor sites include Ashridge, Coombe Hill, College Lake, Tring Reservoirs, Wendover Woods, Dunstable Downs, Pegsdon Hills and Barton Hills. Recreation infrastructure including car parks, visitor centres and signage are associated with some popular green spaces, such as Dunstable Downs. Areas of tranquillity are significant in a landscape that is near to London, cut through by major transport routes and subject to development pressures. The scarp plateau, especially in the south, is the most tranquil area. ■ Accessibility by road has not been upgraded from single track lanes in some places and such areas feel 'secret' and tranquil; for example, Bix Bottom near Henley and Radnage Valley near High Wycombe. It is also possible to 'escape' where there are significant enclosure features such as narrow valleys, woodland, holloways and hedgerows. ■ The rights of way network is considered good. There are promoted routes incorporating all the key landscape attributes of the Chilterns, including 'Access for All' routes in the Chilterns AONB. Promoted routes include two National Trails – the Thames Path and the Ridgeway - towpaths along the Grand Union Canal and National Cycle Network routes. ■ Water-based recreation is possible along the Thames and Grand Union Canal, including fishing, boating, canoeing and birdwatching. Limited access is provided to the chalk streams, for example, Barton Springs is on open access land. ■ With over 10 million people living within an hour's drive or train journey, many people can benefit from the tranquillity and recreation opportunities of this area. ■ Areas of recreational use comprise over 2 per cent of the Chilterns AONB and consist of golf courses, playing fields, theme parks and zoos. The largest of these categories is golf courses. Some Registered Parks and Gardens are accessible to the public at cost, including National Trust properties such as Hughenden Manor and Greys Court. ■ In the half of the NCA designated the Chilterns AONB, a survey suggests that 5 per cent of the AONB is used for equestrian purposes and there are promoted horse riding routes. Subdivision of fields into paddocks is particularly evident near settlements.

Landscape attribute	Justification for selection
A settled landscape with 20th century development associated with major transport routes, but with small-scale, dispersed settlement and single track country lanes found off main routes.	■ Settlement is dispersed and there are major transport routes passing through the area. The built environment is therefore very much part of the Chiltern landscape, although the level of development varies across the NCA. ■ Good lines of communication with nearby London have been critical to the development of the area and also essential to a wider transport network which links London to the Midlands and the North. Beginning with the turnpike trust improvements to the main routes during the 18th and 19th centuries, links have been strengthened and include London's transport network of the Grand Union Canal, railway lines and several motorways. ■ Some settlements have been a particular focus for 20th century development due to their proximity to London and major transport routes. 'Metroland', which incorporates Amersham for example, was specifically developed and promoted in the early 20th century as a residential area for London commuters on the Metropolitan line. One of the first 'new towns' in the NCA, Hemel Hempstead, was designated in 1947. ■ Very limited 20th century expansion is found where the road network is small-scale. The plateau and valleys south of the M40 is a large area characterised by single track lanes and scattered farmsteads, hamlets and small villages. ■ In 2003, approximately 41 per cent of the NCA was included in the London Metropolitan Green Belt.
Frequent grand country houses and designed landscapes occupy prominent positions.	■ The proximity to London and Windsor attracted the landed elite in the 18th and 19th centuries. Grand country houses and parks reached their peak at 600 in 1820. Today 3 per cent of the NCA is included in the Register of Historic Parks and Gardens. ■ Designed landscapes of the 18th century, for example Tring Park and Ashridge, are best known and include works by Bridgeman, Repton and Brown. Some are associated with high profile figures including Chequers, the Prime Minister's rural home, and Hughenden, a home of Victorian Prime Minister Disraeli. ■ Public access is possible to many country houses and landscapes, including properties owned by the National Trust and others.

Landscape opportunities

- Protect the character and integrity of the rural landscape, by conserving the combination and balance of key assets; boundary features, semi-natural habitats, tranquillity and historic buildings.
- Identify and conserve views to and from key and popular viewpoints and landmarks by careful design and vegetation management, minimising the impact and effects of development, woodland planting and scrub encroachment.
- Conserve the patchwork land use pattern, valued farmland species and productivity of the landscape by securing sustainable forestry and mixed agricultural activity. This includes conservation of small farm woodlands, historic hedgerows, farmland birds, woodland birds and arable weeds.
- Plan and manage private and public spaces for recreation, such as golf courses and hobby farms, so that their design and their features positively contribute to landscape character. Seek the conservation, restoration and creation of natural and cultural features in these landscapes.
- Secure sustainable development which also reflects traditional local building styles and materials both within and outside the AONBs of the Chilterns and North Wessex Downs. Where landscape character and features are degraded by development, identify opportunities to re-develop areas and infrastructure, for example; re-modelling canalised sections of river and restoring key views.
- Conserve the range and mosaic of habitats found in the landscape by protecting traditionally managed or relict features such as chalk grassland, coppice woodland, orchards, laid hedgerows, veteran and ancient trees and commons.
- Support marginal and localised land management practices and develop 'products' attractive to modern consumers, including leisure products, local brands and wood fuel.
- Seek to reduce threats to natural and historic features by conserving or restoring their setting, addressing the problem of fragmentation particularly associated with chalk grassland and common land. Work at a landscape scale which reflects the ecosystem approach, ecological network approach and historic landscape character areas.
- Conserve, enhance and create new public access infrastructure, access links and accessible natural and cultural features, particularly near to settlements, in order to enhance the transitional areas between town and countryside and conserve tranquillity. Undertake appropriate visitor management to ensure sustainable visitor pressure at all sites but particularly focus upon 'honey pot' sites and those sites near to new development. Identify and promote alternative green spaces and entry points to reduce visitor pressure.

Landscape opportunities continued

- Conserve the extensive woodland cover and diversity of wooded features, particularly the ancient woodlands, native beech woodlands and wooded features in designed landscapes, in order to conserve the sense of place, biodiversity and historic landscape. Restore plantations on ancient woodland sites. Plan to improve the understanding of the extent and management requirements of the rare yew and box woods. Plan to build the resilience of woodlands to climate change impacts, particularly the valued beech woodlands which are vulnerable. Consider new species compositions and secure woodland across a variety of aspects.

- Engage landowners and managers of parklands in the management of trees and woodlands, particularly those outside grant schemes and those that are 'At Risk'. Conserve the best examples and variety of Chiltern parklands, maintaining their legibility and contents and ensuring management brings about positive outcomes for access and interpretation, biodiversity and the historic record. Manage veteran and ancient trees, woodlands and grasslands in parklands to strengthen biodiversity value.

- Conserve ancient routeways and existing hedgerow boundaries across the landscape to conserve boundary patterns and biodiversity. Create new hedgerow boundaries to fields and routeways to restore historic field patterns and benefit biodiversity, Carry out targeted surveys and possible Local Wildlife Site designation to conserve species-rich hedgerows and identify hedgerow trees of significant landscape and biodiversity value.

- Protect chalk streams and wetlands through securing sustainable levels of water abstraction and through pollution prevention measures in both their rural and urban settings. Harness catchment-scale approaches, recognising the entire length of chalk streams and groundwater resources. Pursue Local Wildlife Site designation to secure protection as appropriate.

- Manage the flood plain of chalk streams, including historic features such as watercress beds and channels, in order to conserve and create wetland habitat, filter runoff; and store water. In the urban environment, seek to restore degraded channels and extend the area of green space surrounding rivers for biodiversity, flood alleviation and public access benefits.

- Manage recent change in the landscape by establishing a dialogue with growing stakeholder groups, particularly hobby farmers, horse-owners and non-farmers owning significant areas of land and valued features. Develop best practice management guidance to disseminate to these growing audiences.

- Build on existing community interest and activity around chalk streams and common land to secure further improvements.

- Create urban fringe areas that deliver a variety of functions and contribute positively to sense of place. Create strong visions which help to manage land that is 'awaiting development'.

Ecosystem service analysis

The following section shows the analysis used to determine key ecosystem service opportunities within the area. These opportunities have been combined with the analysis of landscape opportunities to create Statements of Environmental Opportunity.

Please note that the following analysis is based upon available data and current understanding of ecosystem services. It does not represent a comprehensive local assessment. Quality and quantity of data for each service is variable locally and many of the services listed are not yet fully researched or understood. Therefore the analysis and opportunities may change upon publication of further evidence and better understanding of the inter-relationship between services at a local level.

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Soils, particularly Grade 1 and 2 land Arable farming Livestock production Aquifer Grassland	Approximately two thirds of the area is described as having Grade 3 land. There are significant areas of Grade 1 and 2 land on valley floors and along the foot of the scarp. Cereal production accounted for 40 per cent of farmed area, almost the equivalent area, 37 per cent, was grass or uncropped land[8]. Farming is less mixed in Hertfordshire where arable dominates[9]. In the Chilterns AONB, a 2008 survey found wheat growing on 50 per cent of cropped land; barley on 20 per cent and oilseed rape on 11 per cent[10].	National	Soils on Grade 3 agricultural land are suited to both cereals and livestock farming, hence the mixed farmed landscape. However, ongoing declines in sheep numbers reduce the capacity for local farming systems to sustain the traditional grazed downlands. The steep slopes of the scarp and valleys (often Grade 4 land) are difficult to cultivate. However, cultivated sloping land with shallow chalk soils are at risk of erosion.. Steep slopes under permanent pasture reap benefits for regulating soil erosion, for biodiversity and sense of place. Grade 1 and 2 land accounts for about 10 per cent of the NCA and is the most highly versatile, often growing high value arable crops. **Continued on next page...**	With approximately 10 million people living within an hour's travelling time of the Chilterns (including London), there are opportunities to build consumer markets around locality foods and rare livestock breeds linked to farming systems that conserve the Chilterns landscape. Improving the economics of sustainable livestock farming could bring important benefits to biodiversity and sense of place, if associated with targeting graziers to biodiverse grasslands.	**Food provision** **Sense of place** **Biodiversity** **Regulating soil quality** **Regulating soil erosion** **Regulating water quality** **Water availability**

[8] *Agricultural Census,* Department for Environment, Food and Rural Affairs (2010) [9] *Land Cover Map,* Centre for Ecology and Hydrology (2000)
[10] *Chilterns AONB Land Use Survey 2008,* Chilterns Conservation Board (2008)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision		There are several vineyards and micro-breweries in the area. In 2009, livestock numbers had dropped since 2000 with just below 54,500 sheep, just over 28,000 cattle and approximately 21,500 pigs.		**... continued from previous page** Despite the history of sheep grazing on the downlands, the Chilterns is not associated with any traditional rare breeds and there are also no locality foods recognised at a regional or national level[11]. Orchards are an important feature in the landscape, but are largely relict. Arable and vegetable production occasionally requires abstractions from groundwater and surface waters, sometimes to provide for spray irrigation. Climate change may encourage the expansion of vineyards in the Chilterns.	Resource-efficient farming should be encouraged and risks identified and managed to reduce negative impacts upon water resources, for example, arable reversion should be targeted to areas of high soil erosion risk and fertiliser use minimised where infiltration into the aquifer is rapid. Opportunities should be sought to bring relict orchards back into management for food, sense of place and biodiversity benefits.	

[11] *Exploration of the Relationship between Locality Foods and Landscape Character,* C. Trewin and L. Mason (2006; Land Use Consultants)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Beech and conifer woodland Coppice	Woodland is found across 14 per cent of the NCA[12] (or 21 per cent of the Chilterns AONB[13]), making this one of the most wooded lowland areas in England and with a potential annual production of 60,000 tonnes [14]. There is approximately 7,000 ha of conifer plantation and 14,000 ha of broadleaved woodland. 1,560 ha of woodland in the public forest estate is managed outside of woodland grant schemes for timber and other ecosystem services.	Local	During the 18th and 19th centuries, Chiltern woodlands provided a steady supply of beech wood to a significant local furniture industry. Today, timber production is largely limited to conifer woodlands. The more extensive broadleaved woodlands as well as hedgerow trees, parkland trees and field trees are not commonly managed for timber production. The woodland resource is undermanaged, with problems of over-stood coppice, a lack of thinning and over-mature beech. Various factors make forestry commercially unviable but particular issues in the Chilterns are the prevalence of beech which has a limited market and costs associated with pests, principally deer and grey squirrel[15]. Infrastructure, such as local sawmills, and the local skilled workforce once associated with this area has been in decline.	Opportunities are linked to developing local, small-scale markets and added value products, for example fencing, sustainable and local branded products,[16] with associated infrastructure and skills training needs being met. However, wood fuel opportunities may be greater. Woodlands managed for timber can also be managed to provide public amenity opportunities, conserve heritage and produce biomass.	**Timber provision** **Sense of place** **Sense of history** **Biodiversity** **Regulating soil quality** **Biomass energy**

[12] Natural England (2010) [13] *Chilterns Area of Outstanding Natural Beauty: Management Plan 2008 - 2013 – A Framework for Action,* Chilterns Conservation Board (undated)
[14] *LEADER Local Action Group Local Development Strategy,* Chilterns LAG (2008) [15] Ibid [16] Ibid; *Seeing the Wood for the Trees,* Forestry Commission (2004)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Aquifer Watercourses	Almost the entire NCA comprises a principal aquifer containing large quantities of high-quality potable water, corresponding with outcropping chalk[17]. It is the largest principal aquifer in the London Basin and the most significant in southern England. Abstraction volumes and development for abstraction is therefore significant[18]. The majority of volume abstracted in the Chilterns is from groundwater. This contrasts with nearby London or the Upper Thames Clay Vales where surface water abstractions dominate. In the northern half of the Chilterns, all the rivers and groundwater[19] units in the entire Colne catchment and in the Lee and Mimram management unit are 'over abstracted'.	National	South east England is a highly populated area with relatively low annual rainfall. It is also a region with higher than average consumption rates[20] and agricultural uses in the Chilterns include 'high loss' uses such as spray irrigation[21]. Some parts of the south-east have less useable water per person than some arid countries[22] and more homes are expected to be built. Public water supply needs, including those of London, have historically caused a greatly depressed water table and low flows in Chiltern chalk streams. Reliance upon groundwater resources will be particularly acute during periods of drought which may also coincide with increased demand by people. **Continued on next page...**	Opportunities to improve water availability are only effective when implemented on a large scale, with the exception being winter storage reservoirs. Work in partnership with water companies across the water supply network area to secure sustainable abstraction and consumption, including engaging water consumers about the negative impacts of unsustainable abstraction upon Chiltern chalk streams.	**Water availability** **Biodiversity** **Regulating water quality** **Regulating water flow**

[17] *Baseline Report Series 6: Chalk of the Colne and Lee River Catchments,* Environment Agency and British Geological Survey (2003) [18] *Catchment Abstraction Management Strategy for Colne,* Environment Agency (December 2007) [19] There are four Catchment Abstraction Management Strategies (CAMS) applicable to the Chilterns NCA – Upper and Bedford Ouse; Upper Lee; Colne; and Thame and South Chilterns. The CAMS area boundaries and the NCA boundary do not match and so CAMS information is approximated to fit the NCA. Two-thirds of the Chilterns NCA falls into the Colne and Thame and South Chilterns CAMs areas. [20] *Thame and South Chiltern Catchment Abstraction Management Strategy,* Environment Agency (2007) [21] *Catchment Abstraction Management Strategy for the Upper Lee,* Environment Agency (June 2006) [22] *Underground, Under Threat – The state of groundwater in England and Wales,* Environment Agency (undated).

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability cont...		In the south, all the groundwater units are 'over licensed' except the most southern groundwater unit in Oxfordshire which has 'no water available'. No rivers or groundwater units in the Chilterns are considered suitable for further extraction at low flows. Water is also imported into the Chilterns. The areas around Wycombe and Aylesbury are net importers from Thames-side sources [23]. Streams become more numerous towards the north. A large area of dip slope in Oxfordshire is without any watercourses and the two southernmost streams can be dry along their entire lengths (Hughenden Stream and Hamble Brook). A quarter of London's water supplies is drawn from its underlying confined aquifer which is supported by groundwater flows from the Chilterns and North Downs[24]. Groundwater flows in the south of the Chilterns aquifer also supply the nearby River Thames, supporting abstractions downstream including significant volumes for London[25].		Future demand associated with residential development threatens the sustainability of abstraction[26]. Water companies, in partnership with the Environment Agency, are carrying out work to address low flows and secure sustainable abstraction, including closing pumping stations and installing pipelines to transfer water. In the four Environment Agency catchments falling within this NCA, current abstraction at low flows is causing or has the potential to cause, unacceptable environmental damage, with the exception of the dip slope in Oxfordshire and the River Thames reach which are appropriately licensed[27]. **Continued on next page...**	Where recharge potential is greatest across the aquifer, work with land owners and managers to improve soils, vegetation cover and artificial surfaces to enhance infiltration and avoid contamination from, for example, nitrates. Resolve pollution issues at source where there is rapid infiltration. Support sustainable water consumption and pollution prevention in the design of new developments. Ensure the water supply network can meet demand from new development in a sustainable way. At a catchment scale, encourage take-up of land management measures that are water efficient and minimise pollution including winter storage reservoirs, best practice irrigation and contour ploughing.	

[23] Thames Water Utilities Ltd, personal commentary [24] *State of the Environment Report for London,* Greater London Authority, Environment Agency, Natural England and Forestry Commission (June 2011) [25] *Thames Corridor Abstraction Management Strategy, Environment Agency (2004). The Thames Corridor CAMS covers the freshwater River Thames, from Cricklade to Teddington, and the Thames Tideway as far down as Erith.* [26] *Catchment Abstraction Management Strategy for Thame and South Chilterns,* Environment Agency (March 2007)*; Catchment Abstraction Management Strategy for Colne,* Environment Agency (December 2007)*; Catchment Abstraction Management Strategy for the Upper Lee,* Environment Agency (June 2006) [27] Catchment Abstraction Management Strategy for Thame and South Chilterns, Environment Agency (March 2007); Catchment Abstraction Management Strategy for Colne, Environment Agency (December 2007); Catchment Abstraction Management Strategy for the Upper Lee, Environment Agency (June 2006); Catchment Abstraction Management Strategy for Upper and Bedford Ouse, Environment Agency (March 2005); Catchment Abstraction Management Strategy for the Thames Corridor, Environment Agency (June 2004)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability cont...		In the 'Thame and South Chilterns' and 'Colne' catchments[28], 40 per cent of total abstracted volume relates to uses other than public water supply such as agriculture, industry and recreation[29]. Secondary aquifers are associated with Quaternary gravel deposits along the Thames. There is hydraulic connectivity between the aquifer/ groundwater and watercourses. Tring Reservoirs supply water to the Grand Union Canal.		The northern catchments which are 'over abstracted' in the Chilterns are among only 15 per cent in England and Wales considered to be in this worst state and the availability of water for surface waters are at the highest risk from abstraction[30]. This poor picture of water availability is despite the Chilterns annual rainfall being higher than the average for the region. In the southern half of the NCA, the escarpment receives 708 mm average annual rainfall, although only 287 mm reaches watercourses and the aquifer[31]. Aquifer recharge is greatest high on the escarpment, in the valleys, not on the interfluves, and at the boundary between chalk and clay-with-flint deposits[32]. Groundwater abstraction is concentrated in the valleys, including the River Thames. Due to hydrological continuity between the watercourses and the aquifer, abstraction from the aquifer draws water from the rivers into the chalk. **Continued on next page...**		

[28] The Colne CAMS area and the Thame and South Chilterns CAMS area accounts for approximately two-thirds of the Chilterns NCA but the CAMS areas include additional areas outside the NCA.
[29] *Thame and South Chiltern Catchment Abstraction Management Strategy,* Environment Agency (2007). [30] *Land Use and Environmental Services,* Environment Agency (October 2009; Science Report SC080014/SR1) [31] *Catchment Abstraction Management Strategy for Thame and South Chilterns,* Environment Agency (March 2007) [32] *Baseline Report Series 6: Chalk of the Colne and Lee River Catchments*, Environment Agency and British Geological Survey (2003)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability cont...				Abstraction risks upon the Thames are not considered significant due to its large flows but there are risks to the smaller chalk streams[33]. Infiltration does not take place where there are overlying impermeable deposits, for example clay-with-flint, and where fissures in the chalk are poorly developed across the high ground of Oxfordshire in the south-west[34]. Abstraction pressures contributing to low flows are currently a concern for the rivers Ver, Misbourne, Mimram and Lee. Drying and variable river levels impact upon the ecology of rivers and water-dependent habitats such as meadows and wet woodland. Downstream impacts must also be considered, particularly since Chiltern watercourses contribute water to two key river systems – the River Thames and the rivers feeding into the Ouse Washes and The Wash. The Thames applies a large draw on groundwater in the south, contributing to a pattern of watercourses across the dip slope that sees an absence of watercourses at the southernmost end in Oxfordshire and increasing density of watercourses northwards.		
Genetic diversity	Orchards	Orchards in the central part of the NCA are small remnants of a historically significant local fruit industry.	Local	Predominantly out of production, these orchards may be in decline, however, they preserve a number of local and unusual varieties.	Engage owners in managing their orchards to conserve the genetic diversity they contain along with their biodiversity and cultural heritage.	**Genetic diversity** **Biodiversity** **Sense of place** **Sense of history**

[33] *Groundwater Quality Review – SW Chilterns and Twyford Brook*, Environment Agency (February 2005) [34] Ibid

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biomass energy	Woodland Short rotation coppice (SRC)	The Energy Crops Scheme 2000-2006 did not fund any miscanthus or short rotation coppice crops in the Chilterns. In this heavily wooded landscape, potential yields of biomass from trees are significant from thinnings, logs, chippings and other sources.	Local	The firewood market is thriving locally, with sale of logs for firewood being more of a driver for woodland management than timber. The potential yield from miscanthus is limited, while potential for SRC yields are mainly medium. SRC (willow, poplar) is inappropriate in the Chilterns where it reduces infiltration to groundwater, particularly in areas already under water stress. Suitable locations for biomass production are limited by the presence of vulnerable landscape features and views and also steep terrain, although the heavily wooded landscape offers some opportunities to assimilate SRC. Miscanthus will cause least landscape change if sited where intensive arable already exists, such as on the scarp foothills and Thames Valley. With approximately 10 million people living within an hour's drive (including London), there is a large potential market for wood fuel both from the domestic and commercial sector, including large and numerous premises with wood fuel systems, such as Heathrow Terminal 2 and Slough Heat and Power.	Seek growth in the market for woody biomass which secures additional benefits to biodiversity, timber production and conservation of woodland as an important landscape feature[35]. Establish appropriate management of native beech woodlands which realises their biomass potential and also ensures the conservation of their special biodiversity. Work with local educational institutions and land owners to develop a skilled workforce to manage woodlands across the NCA.	**Biomass energy** **Timber provision** **Biodiversity** **Sense of place**

[35] *Chilterns AONB State of the Environment Report,* Chilterns Conservation Board (2010)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Woodland Permanent pasture Wetland habitats Historic land uses such as downland and parkland	Although containing relatively low carbon concentrations, topsoils will contribute to carbon storage capacity. There are considerable areas of undisturbed soils supporting woodland and permanent pasture, including semi-natural chalk grassland, which are less likely to release their carbon stores and store more carbon than regularly cultivated ground. Permanent grasslands account for approximately 1,500 ha. Woodland cover is high across the NCA at 14 per cent, representing carbon stores in both soils and tree biomass. Wetland habitats in the valleys which may contain undisturbed peaty and/or deep soils with higher carbon storage capacity account for approximately 400 ha.	Regional	Soil carbon stores are limited in this NCA due to the predominance of mineral soils. However, carbon storage potential is maximised where there are undisturbed soils which have a considerable longevity of storage such as in historic downland, woodland, common land and parkland. The contribution that woodland makes to carbon sequestration is very limited compared to the UK's soil carbon stores and declines with increasing tree maturity. Woodland makes a greater contribution to climate regulation through reducing emissions as a provider of alternative fuels to fossil fuels.	The greatest contribution to be made to climate regulation will be through generating biomass fuels. Soil carbon stores should be conserved and well managed to maximise storage across the NCA. Incorporate organic matter, use cover crops and adopt reduced tillage techniques to improve soil structure so that there are benefits for carbon regulation, soil quality and soil erosion. When managing historic landscapes such as downland and parkland, avoid disturbance of soils to benefit long-established carbon stores as well as to preserve above-ground and below-ground archaeology. Conserve and manage ancient woodlands and their soils to maximise carbon storage while also delivering biodiversity and wood fuel benefits. Forestry activities, including planting and harvesting, should seek to minimise soil disturbance. Manage existing wetlands and seek to extend wetlands in order to secure the peat resource, benefit biodiversity and manage water resources.	**Climate regulation** **Regulating soil quality** **Biomass energy** **Sense of history** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Chalk Watercourse Vegetated slopes Cross-field hedgerows (in arable)	Natural process of water percolating through the Chalk. Woodland, areas of permanent pasture, cross-field boundary hedgerows and vegetated slopes found throughout the area reduce cross-ground water flow rates thereby increasing infiltration and the processes of natural filtration. 94 per cent of the NCA falls into a nitrate vulnerable zone (NVZ) providing groundwater and surface water protection, and the area around Luton falls into a catchment sensitive farming priority catchment.	Regional	The NVZ and catchment sensitive farming designations reflect the importance of the area to national water quality interests and to the location of polluting activities. Due to the hydraulic connectivity between groundwater/aquifer and watercourses, pollutants can cross-contaminate. Groundwater in the aquifer is generally high quality but pollution is present from urban point sources, such as industry in High Wycombe, St Albans, Luton, Dunstable, and from diffuse sources, such as nitrate concentrations from farming; a particular problem in the south of the area. River water quality is generally good in all but one of the four catchments in the NCA, the Colne, but pollutants are present. Groundwater and surface water protection in this NCA demands filtration of pollutants in both the rural and urban setting, with particular solutions required for the Colne in relation to interactions with the canal network. Settlement pattern means that urban centres are adjacent to watercourses, where there is limited green space to filter pollutants from runoff. Pollutants in runoff from arable land may be intercepted by the surrounding mosaic of hedgerows, woodlands, scrub and grasslands Existence of very rapid flow paths within the Chalk means that groundwater is susceptible to pollution incidents from a wide range of activities and there is potential to cause widespread and long-lasting pollution of the aquifer.	Target the development of sustainable drainage systems / green space within and downstream of urban centres to filter pollutants. Work with farmers and other land managers at a whole farm and at a catchment scale to maximise and strategically locate land cover which slows and filters run-off and improves water entering the aquifer, for example through arable reversion, hedgerows restoration and planting, permanent arable field margins and strips and reedbeds. Work with farmers and other land managers to maintain or enhance existing field drainage to improve infiltration and slow down runoff. Avoid new drainage of existing wetlands. Reduce compaction and erosion in all soils, and poaching in grassland, including remedial loosening. Encourage sustainable grazing regimes on permanent pasture and rough land.	**Regulating water quality** **Food provision** **Regulating soil erosion** **Regulation soil quality** **Regulating water flow** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Watercourses Wooded valley sides Vegetated steep slopes Water storage features, in-stream and in the wider flood plain such as wet meadows and watercress beds Permanent pasture	The middle reaches of the River Thames lie near the southern boundary of the NCA, flowing from the adjacent NCA Upper Thames Tributaries and on to London. The Thames flows across a wide flood plain offering flood storage capacity. The Thames Valley has a fairly high risk of flooding, with riverside settlements including Reading, Henley and Marlow susceptible. The Thames Valley also offers potential floodwater storage areas. Smaller scale flooding may also affect those settlements adjacent to chalk streams in the dip slope valleys but, historically low flows have been a more significant issue. Some watercourses are prone to drying in their upper reaches and the permeability of the Chalk means that infiltration can reduce overland flows. Five of the nine chalk streams are classified as 'heavily modified waterbodies'.	Local	Groundwater provides a relatively consistent flow volume to chalk streams. However, abstraction can give rise to artificial and low flow regimes which impact the ecology of rivers and water-dependent habitats such as meadows and wet woodland. Abstraction pressures contributing to low flows are currently a concern for the rivers Ver, Misbourne, Mimram and Lee. Treated discharges from sewage treatment works modify flows of rivers such as the Lee and Hiz. Low flow alleviation schemes have been implemented along several chalk streams including the Misbourne, Bulbourne and Wye[36]. Pumping stations along chalk streams have been closed and investigations continue along rivers such as the Wye. Chalk streams within the Chilterns AONB also benefit from the conservation activities of the Chiltern Chalk Streams Project which has been running for several years. Downstream impacts must also be considered, particularly since Chiltern watercourses contribute water to two key river systems – the River Thames and the rivers feeding into the Ouse Washes and The Wash. **Continued on next page...**	Target the development of sustainable drainage systems and green space within and downstream of urban centres to store floodwaters and filter pollutants. Work with farmers and other land managers at a whole catchment scale to improve soil management to aid water infiltration and to maximise and strategically locate land cover which slows and filters run-off, for example through arable reversion, hedgerows restoration and planting, permanent arable field margins, wooded slopes and reedbeds. Restore historic and natural features in flood plains to increase capacity for water storage, including wet meadows, watercress beds and reedbed.	**Regulating water flow** **Regulating water quality** **Water availability** **Biodiversity**

[36] Thames Water Utilities Ltd, personal commentary

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow cont...		There are landscape features which assist infiltration and slow overland flows, including extensive broadleaved woodland and a locally dense network of hedgerows.		**... continued from previous page** Across the Chalk, infiltration can reduce overland flows after rainfall events and so alleviate localised flooding. However, flooding can affect the many urban centres adjacent to chalk streams where there is significant run-off and limited flood storage space (with associated water pollution threats). The Thames can bring floodwaters into the NCA and on into London. Narrow valleys on the dip slope restrict flood storage capacity while the wide Thames flood plain offers some opportunity for storage. The dominance of heavily modified watercourses amongst the chalk streams means natural river processes are restricted at times of high water flows. Establish land cover which slows runoff in the urban and rural environments. The role that water flow management in the Upper Thames Tributaries can play in attenuating Thames floodwater will also benefit this NCA and London.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Permanent pasture Calcareous soils Grade 1, 2 and 3a land Soils under woodland	Prime agricultural land of Grades 1 and 2 is associated with the lower scarp and Thames flood plain and covers about 10 per cent of the NCA area or about 18,000 ha. There are soil types of a calcareous nature which are naturally resilient to drought if well managed. These are shallow lime-rich soils over chalk or limestone covering around 15 per cent of the NCA and also freely draining lime-rich loamy soils which account for just over 10 per cent of the NCA area. Soils across approximately half the NCA are vulnerable to compaction. These include the slightly acid loamy and clayey soils associated with the dip slope ridges (covering just over 40 per cent) and the freely draining slightly acid but base-rich soils (covering just over 10 per cent). There are considerable areas of uncultivated soils under woodland and grassland, some of which have been undisturbed for centuries such as ancient woodland, downland and fen. Permanent grasslands account for approximately 1,500 ha and fen 52 ha. Woodland cover is high at around 23,000 ha, of which 12,000 ha is ancient.	Regional	The best and most versatile agricultural land (Grade 1, 2 and 3a) is a priority for protection from loss by development. Almost half the NCA, including much of the plateau, is vulnerable to poaching and compaction and this threatens soil structure, versatility and productivity. The national importance of the chalk aquifer makes overlying soil structure and soil contaminants significant in terms of water filtration. There are significant potential pollutant sources including urban centres, roads and intensive agriculture.	Conserve and maximise the resource, aiming particularly to avoid deterioration of soils with high Agricultural Land Classification grades. Ensure there is good soil management in woodlands as well as across farmland. Across all soils, reduce soil compaction and erosion. Avoid land management practices which can lead to compaction such as over-stocking and working machinery on wet ground. Carry out remedial work such as loosening where necessary. Reducing intensity of tillage and encouraging use of additional sources of organic matter on intensively managed soils, such as cover/catch crops and manures, should help increase soil carbon and improve soil structure. This, with careful use of fertilisers, should help reduce nitrous oxide emissions. Good soil management will also benefit food production in the long term, aid infiltration to the aquifer and reduce pollutants entering surface and ground waters.	**Regulating soil quality** **Regulating soil erosion** **Food provision** **Regulating water quality** **Regulating water flow** **Water availability** **Climate regulation** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Soils Permanent pasture Woodland	Steep slopes across the Chilterns make soils vulnerable to erosion under certain land uses. Some Chiltern soils types are also intrinsically vulnerable to erosion. The extensive woodland cover protects a large proportion of Chiltern soils. Soils under permanent vegetation – grassland and scrub – are less prone to wind or water erosion.	Local	Soil management is critical as many of the Chiltern soil types are vulnerable to damage and hence erosion. Erosion of thin chalk soils can lead to total loss of soil to expose bare rock. Soils under woodland will be conserved but are not accessible for food production. With the NCA falling into a Nitrate Vulnerable Zone overlying a regionally/nationally important aquifer, soil erosion is a concern in relation to water quality because water can transfer sediments and contaminants into groundwater and surface water. The predominant loamy and clayey soils with impeded drainage, covering almost half the NCA, are easily compacted by machinery or livestock if accessed when wet, increasing the risks of soil erosion by surface water run-off. The majority of these soils are also prone to capping/slaking, as are some of the freely draining lightly acid but base-rich soils (around 10 per cent of the NCA), leading to increased risk of erosion. The shallower lime-rich soils (around 15 per cent of the NCA) are at risk of erosion on sloping cultivated ground or where bare soil is exposed, as are the freely draining lightly acid loamy soils (covering about 20 per cent of the NCA), where there is also the potential for wind erosion on some coarse textured cultivated variants. The remaining loamy/ clayey soils (flood plain or seasonally wet soil types covering less than 5 per cent of the NCA) are at low risk of erosion.	Encourage farmers and land managers to manage land on steep slopes as pasture, especially where there are thin chalk soils and where biodiversity benefits are significant. Incorporate organic matter, adopt reduced tillage and avoid compaction in order to minimise runoff and soil erosion. Incorporate features such as hedgerows and grassland buffers which can intercept runoff and so reduce widespread erosion, filter contaminants and enhance the landscape. Encourage longer growing periods between grazing and increase sward diversity in leys to increase root penetration and increased soil stability.	**Regulating soil erosion** **Regulating soil quality** **Regulating water quality** **Food provision**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Species-rich grassland Hedgerows Woodland edge	Habitats supporting pollinating insects are provided by the Chilterns' hedgerows, species-rich grasslands, wetlands and exposed rock.	Local	In the Chilterns AONB, a 2008 survey found wheat growing on 50 per cent of cropped land; 20 per cent barley and 11 per cent oilseed rape[37]. Graminae species, such as maize and cereals, dominate Chilterns' crops and are wind pollinated so do not require pollinators. However, crops that are insect pollinated and are grown here now and may be in the future include soft and top fruit, linseed, oil seed rape, and a variety of beans.	Maintain pollinator habitat and, where possible, create new pollinator habitat. Where crops are grown that require insect pollination, create new pollinator habitats including chalk grassland.	**Pollination** **Food provision** **Biodiversity**
Pest regulation	Habitat mosaic	The high degree of heterogeneity in the landscape, as opposed to a monoculture landscape, provides resilience against widespread pest and disease damage.	Local	There is recognised pest damage affecting timber production/trees in the Chilterns: mammals including grey squirrels, fat dormouse), muntjac and fallow deer, and insects, including oak processionary moth at Pangbourne and west London, and horse chestnut leaf miner. Sudden oak death, ash dieback and red band needle blight are also affecting trees in the Chilterns[38]. Non-native species such as signal crayfish are also threatening native aquatic biodiversity. The mosaic of woodlands, hedgerows and watercourses may facilitate disease and pest dispersal. However, the mosaic of habitats will potentially support natural predators.	Maintain and build resilience against pests and diseases by supporting diversity within species populations and in terms of habitats and crop types. Focus upon managing impacts upon food and timber provision and biodiversity. Establish pest and disease management strategies for the Chilterns woodlands and watercourses in particular.	**Pest regulation** **Timber production** **Biodiversity**

[37] *Chilterns AONB Land Use Survey 2008,* Chilterns Conservation Board (2008)
[38] *Chilterns AONB State of the Environment Report,* Chilterns Conservation Board (2010)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
A sense of place/ inspiration	Panoramic views Beechwoods Historic environment Watercourses Escarpment River Thames Traditional built environment Downland Open access land and rights of way Farms hosting school visits	As a result of the special qualities of much of this landscape 52 per cent is designated AONB – the majority being the Chilterns AONB and a small area to the south of the Thames being the North Wessex Downs AONB. There is public access to locations and viewpoints with diverse and ancient natural and cultural heritage, including barrows and hill forts, and rare and unique features, such as the Chiltern gentian and Whiteleaf Cross, a carved chalk figure. Wide views and feelings of space and height are also gained from high points overlooking the clay vales or valley flood plains. A dense hedgerow network, holloways, woodland and branching steep valleys create an intimate landscape in places. The Thames is a dominant feature in the south. **Continued on next page...**	National	Some modern development is reinforcing traditional building styles, particularly in the AONB. The AONB designation of the majority of this NCA reflects a strong scenic and landscape character and provides resources for conserving and enhancing the natural beauty of the area. Natural and cultural heritage is accessible and celebrated in local museums, parklands, urban spaces, countryside sites and on commons. Local communities are active in engaging both local people and visitors in local heritage through town centre trails, museums, promoted countryside routes and events. Several farms host school visits to engage children in their local working countryside, but there are few near to London.	Work with the AONB to conserve and enhance the landscape and the special qualities of the AONB and consider applications of best practice beyond the AONB boundary. Further develop strong locality products where this supports the management of the landscape, for example woodland and sheep farming products and local building materials. Further engage active communities in conserving and enhancing the landscape, and the distinctive physical and cultural character of the area. Engage farms near to London in hosting school visits.	**Sense of place/ inspiration** **Sense of history** **Food provision** **Biodiversity** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
A sense of place/ inspiration cont...		Consistent use of traditional building materials provides consistency and connection with local geology. Attractive villages and dispersed farmsteads give a sense of rural tranquillity and affluence while large urban centres and major roads are busy. Designed landscapes provide a sense of grandeur. Local museums celebrate local, personalities, artistic endeavour and heritage, for example the Roald Dahl Museum and Henley River and Rowing Museum. Nineteen farms in the NCA host school visits under agri-environment schemes[39].		There is an absence of strong local brands associated with food, wood or other products, suggesting that the identity of the working landscape is not as strong as it could be. In the past, orchard produce was associated strongly with this area; a characteristic now widely lost. The Chilterns AONB considers that the conservation of the built environment is largely dependent upon outside sources for materials and skills[40]. The area continues to provide stimulation for many writers, artists, poets and painters.		

[39] Based on analysis of agri-environment scheme data held by Natural England, 2012

[40] *Chilterns Area of Outstanding Natural Beauty: Management Plan 2008 - 2013 – A Framework for Action,* Chilterns Conservation Board (undated)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Scheduled Monuments and other, unscheduled heritage assets Registered Parks and Gardens Listed buildings Traditional built environment, both urban and rural Ancient natural features Ancient woodlands and their traditional management and production	There are 202 Scheduled Monuments, including parts of the well known prehistoric routeway called the Ridgeway. Around 15 of these monuments are declining in condition and on the At Risk Register. Additional monuments are at risk and of an unknown or stable condition. Bronze-age barrows and iron-age hill forts and dykes found along the scarp connected by the Icknield Way which has been in use since the Neolithic period Iron-age hillforts and dykes found along the Thames Valley to the south. Roman influence is still evident through the communications network and settlement pattern, and medieval influence is reflected in settlement and field patterns. Chalk streams reveal unique features associated with watercress growing and numerous mill sites.	Regional	The history of the landscape is evident in numerous historic features from various ages dating back to prehistory. Some historic features are widespread, including ancient boundaries, holloways, commons, ancient woodlands, churches, and buildings in the vernacular style. Public access is provided to some key heritage assets and landscapes including parklands, monuments along the Ridgeway and commons, increasing the opportunity to understand and interpret the historic environment. Woodland archaeology reveals changes in woodland management and climate including coppice stools linked to medieval activities and saw pits and other features associated with the furniture industry of the 18th and 19th centuries. **Continued on next page...**	Engage communities and owners of historic features in celebrating and conserving the historic environment, including developing skills and industry around historic environment conservation and traditional building materials and construction. Improve public access and visitor facilities to key historic features. Enhance the setting of historic features as part of landscape-scale projects which integrate multiple landscape objectives. Establish positive management of woodlands which conserves their archaeology and draws on traditional techniques while also benefitting biodiversity, wood fuel production and carbon storage.	**Sense of history** **Sense of place/ inspiration** **Timber provision** **Biodiversity** **Geodiversity** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history cont...		More recent heritage assets include the Grand Union Canal. There are 6,851 Listed Buildings. Traditional materials in the built environment include flint, brick, tiles and in places weatherboard and thatch, plus old farm buildings characterised by large timber-framed barns clad with black weatherboard. The use of Totternhoe Stone (clunch) as a building material is a characteristic of this area. Forty registered historic parks and gardens in the NCA, many the works of key 18th century designers such as Bridgeman, Repton and Brown Ancient woodlands are extensive and contain a variety of archaeology, veteran trees and ancient coppice stools.		Some settings of historic features could be improved, as could their management, for example through the reduction in arable cultivation currently affecting monuments. There is also concern about visitor pressure negatively impacting historic features, including historic routeways and popular landmarks. The value of such an ancient landscape is heightened by the fact that it lies adjacent to modern development including the London edge and several motorways. Local museums, historic character mapping projects and historic sites celebrate and engage people in the historic environment. There are local community groups working to conserve and engage people in the historic environment. The collected expression of taste and wealth seen in the many grand houses and parks and gardens, reflects the proximity of the area to London and the past and ongoing popularity of this highly scenic landscape.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Secluded valleys Scarp Woodlands	The largest area of high to medium tranquillity is in the south-west, including around Henley-on-Thames. Elsewhere, parts of the escarpment and a few valleys without major roads and settlements are highly tranquil and there are also very small pockets of medium to high tranquillity near to the London edge, for example between Amersham and Hemel Hempstead. Only 20 per cent of the NCA is assessed as 'undisturbed'.	Regional	The Chilterns is a transitional area in which levels and areas of tranquillity increase with distance away from London, except in the north where Luton and Stevenage influence tranquillity. Low tranquillity scores are dispersed across the NCA reflecting settlements and major transport corridors. Experiences of tranquillity in those pockets of high to medium tranquillity near to the London edge and in the Thames Valley will be particularly significant and valued. Luton and Stevenage are a focus for further development and so the surrounding areas of high to medium tranquil spaces may be detrimentally affected. Traffic, a key contributor to disturbance, affects popular countryside visitor destinations as well as more traditional rural settlements. Traffic calming measures and support for non-car transport has reduced traffic issues at Ashridge.	Distinctive elements of the Chilterns landscape, woodlands, flowing water and the 'rural' scene, should be conserved and managed to improve perceptions of tranquillity, particularly near to settlements. Traffic calming measures and support for non-car travel at popular countryside destinations should be encouraged and supported and will improve tranquillity and recreation experiences generally. Further erosion of tranquillity should be avoided or minimised by ensuring development in areas of high to medium tranquillity is appropriate to the setting and incorporates measures, such as tree planting and green 'buffers'.	**Sense of tranquillity** **Sense of place/ inspiration** **Sense of history** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Ridgeway National Trail Thames Path National Trail Open access land Public rights of way National cycle routes and regional trails Grand Union Canal Public forest estate Historic parks and gardens River Thames The scarp slope	More publicly accessible routes and green spaces are needed for the populations of Luton, Hemel Hempstead and High Wycombe but other settlements have good access provision per head of population[41]. There are 3,563 km (equivalent to 2.17 km per km^2) of rights of way, and over 3,500 ha of open access land (around 2.5 per cent of the NCA), including significant tracts of common land. There are three National Nature Reserves. 1,560 ha of woodland in the public forest estate is managed outside woodland grant schemes for timber and other ecosystem services.	Regional	In 2007, it was estimated that there were just over 55 million leisure visits made to the Chilterns AONB[42]. A survey at 11 sites in the AONB established that 74 per cent of visits were made by local residents and 83 per cent were made by groups; family and/or friends[43]. The Chilterns represents an important local recreational resource for approximately 1.38 million residents in the 11 district council areas in which the AONB falls[43]. In addition, the area is easily accessible from London and other major urban centres, such as Milton Keynes, and offers relative tranquillity[44]. Some locations are recognised 'honey pot' sites, for example, Wendover Woods and Ashridge Estate[45] and the resilience of these sites' features to visitor pressure is a concern. Traffic on rural routes also affects enjoyment. **Continued on next page...**	Improve the bridleway network as a multi-user network and also to meet the demands of the considerable resident population of horse owners. Manage visitor pressure upon fragile locations by promoting alternative, more robust and equally attractive destinations and increase the resilience of vulnerable sites. Maximise the contribution that volunteers and local communities can make to the maintenance of landscape features which are recreational assets. Support, create and improve links between recreational assets and settlements. Address gaps in the provision of routes and green spaces, targeting efforts around Luton, Hemel Hempstead and High Wycombe.	**Recreation** **Biodiversity** **Sense of place/ inspiration** **Sense of history**

[41] Based on visual analysis of countryside access data held by Natural England, 2012 [42] *Chilterns AONB Visitor Survey 2007,* Tourism South East (2008) [43] Ibid [44] *Chilterns Area of Outstanding Natural Beauty: Management Plan 2008 - 2013 – A Framework for Action,* Chilterns Conservation Board (undated) [45] *Chilterns AONB Visitor Survey 2007,* Tourism South East (2008)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation cont...		Two National Trails run through the area; the Ridgeway follows the crest of the scarp and the Thames Path follows the course of the river. There are a number of National Cycle Network routes and regional routes, the Icknield Way and the Chiltern Way. The Ridgeway, Grand Union Canal and National Cycle routes are multi-user routes along much of their length. Water-based activities are provided along the Thames and Grand Union Canal. There are a wide range of activities offered by this area, for example walking, cycling, horse riding, gliding, canoeing, mountain biking, canal boating and bird watching[46]. A large number of organisations provide events for the public[47]. The Chiltern Society volunteer groups assist in the maintenance of the rights of way network.		A survey of 11 sites in the Chilterns AONB also suggested the majority of visits involve passive activities, such as walking or enjoying the view, rather than active pursuits such as off-roading or paragliding[47]. There is demand for more multi-user routes, particularly along the Thames Path. Common land, lying in close proximity to homes, workplaces and schools, is particularly well used. Large areas are open to the public by the National Trust, Forestry Commission, wildlife trusts and local authorities, with a particular assemblage along the ridge providing some of the best views in the area[46]. The percentage of open access land and accessible natural green space[48] in the AONB is relatively high and well spread. Locally promoted routes equally serve different users, including 'easy access' circular trails. **Continued on next page...**		

[46] *Chilterns Area of Outstanding Natural Beauty: Management Plan 2008 - 2013 – A Framework for Action,* Chilterns Conservation Board (undated) [47] Ibid [48] Accessible natural green spaces are areas of countryside that provide both public access and a potential wildlife habitat – woodlands, grasslands, wetlands, rivers, canals and country parks.

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation cont...		Visitor experiences at some sites may be negatively impacted by congestion and noise.		Approximately three-quarters of accessible natural green space is woodland, with around a third of open access woodlands being provided by the Forestry Commission. Key landscape features are accessible and offer a broad appeal, including picturesque villages, waterways, biodiverse habitats and historic places[49]. Boat traffic has reduced along the Thames in recent years[50].		

[49] *Chilterns Area of Outstanding Natural Beauty: Management Plan 2008 - 2013 – A Framework for Action,* Chilterns Conservation Board (undated) [50] Ibid

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Species- rich chalk grassland Ancient woodland Ancient hedgerows Sustainably managed farmland Chalk streams Common land habitats Parkland Farmland birds Arable weeds Local Nature Reserves	Recognised at an international level, the beechwood SACs cover just less than 1 per cent of the NCA. There are 3,670 ha of land designated SSSI, dominated by chalk grassland and broadleaved woodland. 98 per cent of SSSI are in 'favourable' or 'unfavourable recovering' condition. There are 1,062 Local Wildlife Sites. The provision of Local Nature Reserves does not meet the recommended 1 ha per 1000 population in any district. Biodiversity of parklands, chalk streams and orchards is under-represented amongst all designated sites. Semi-natural habitats are restricted in extent, except woodland. Chalk grassland and common land habitats exist as scattered fragments, although the extensive hedgerow network provides potential linkages.	National	Important areas and types of semi-natural habitat are designated, although stretches of chalk stream, ancient hedgerow, parkland and farmland biodiversity are under-represented. Larger areas of woodland, common and grassland represent core areas of habitat. Chalk streams and ancient hedgerows can function as corridors. Declining livestock numbers have made conservation of open habitats difficult, giving rise to significant losses to scrub and woodland. Open habitats are largely conserved only where agri-environment schemes support management. Conservation of woodland biodiversity relies upon grant schemes, although a growing wood fuel market is reviving management in some woods. Many woods have long been unmanaged, leading to declines in woodland birds and butterflies. Orchards are largely unmanaged. **Continued on next page...**	Establish a resilient ecological network. Identify and address gaps and build core areas, particularly in relation to chalk grassland and flood plain habitats. Incorporate access improvements to provide for public engagement with nature Realise greater recognition of the biodiversity interest of parkland, chalk streams and orchards by seeking designations as appropriate and by integrating biodiversity conservation into management of associated historic assets. Conserve important species populations in semi natural and farmland settings through supporting sustainable farming. Where possible, management to conserve biodiversity should also seek to assist water and soil conservation, focusing upon areas where risks are highest and the value of the asset greatest, for example, chalk grassland on steep slopes or wet meadows alongside a chalk stream.	**Biodiversity** **Recreation** **Sense of place** **Sense of history** **Regulating soil quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity cont...		Chalk streams support characteristic species and also strengthening populations of water vole. However, the ecological status of the rivers Gade and Ver is considered 'bad' and less than five waterbodies are considered 'good'. Arable weeds are localised but there are strong populations of shepherd's needle, for example. Farmland birds include corn bunting, grey partridge and yellowhammer. The red kite draws visitors to the Chilterns, as do rare plants such as the pasque flower at Barton Hills NNR.		Farmland birds benefit from the mosaic of habitats and from sustainable farming practices supported by agri-environment schemes. Chalk stream ecology is negatively affected by low flows, engineered channels and pollution. Low flow alleviation schemes, resource protection measures across farmland and improvements delivered by community groups are improving condition in some places. Chalk streams within the Chilterns AONB have benefitted from a dedicated long-running Chalk Streams Project which promotes best practice conservation and development and supports conservation activities. Project work has secured improvements to stream and flood plain habitats along several rivers including restoration of water meadows and improved fish passage along the Chess[51].	Engage local communities and landowners in conserving their local biodiverse spaces as part of a wider, co-ordinated ecological network, particularly those near settlements and popular with visitors such as Barton Hills NNR. Restore chalk streams, flood plain habitats and flood plain function. Innovative solutions will be required along significant stretches of watercourse due to the constraints of existing development and settlement. Review the Local Nature Reserve resource and identify and address any gaps, particularly where new development is taking place. Secure biodiverse green infrastructure as part of development. Manage visitor pressure upon fragile locations by promoting alternative, more robust and attractive destinations and increasing the resilience of vulnerable sites.	

[51] *Annual Report 2011-12,* Chilterns Chalk Streams Project (undated)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity cont...				Commons and riversides are significant as biodiverse spaces near to settlements. Access to urban-edge grasslands and woodlands may also be significant for local people to experience 'common' or 'urban' wildlife. Local Nature Reserves are relatively few considering the population size. With many key areas of habitat, including downland, being subject to public access, there can be issues around visitor pressure and conflict between visitors and management activities. Local authorities, private farms, the National Trust, Wildlife Trusts and Forestry Commission provide public access to biodiverse sites. Promoted routes and interpretation boards in the countryside celebrate the natural interest of the Chilterns. Landowners deliver nature conservation management under agri-environment schemes while numerous community groups and organisations also carry out nature conservation work.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Chalk River terrace gravels Fluvial geomorphology	There are 14 geological SSSI and 33 Local Geological Sites. The form of the Chilterns Chalk outcrop is prominent and a distinctive landform that is visible and accessible for interpretation. Some periglacial landforms, such as dry valleys, chalk carved figures and disused quarries, some of which are designated, are accessible by the public, for example. Whiteleaf Cross, College Lake, Totternhoe Quarry. Landforms of the Thames Valley, including the Goring Gap and gravel pits, can be accessed and enjoyed by the public from the Thames Path and from locally popular vantage points such as Winter Hill, near Cookham. **Continued on next page...**	Local	The geology and processes that underpin the area have generated much of the areas agriculture, land use and now cultural heritage. Despite being almost entirely underlain by the Chalk, a diversity of soils have developed through the interplay of climate, topography, vegetation and human influence, which in turn support the characteristic habitats and land uses across the Chilterns. Of the few green spaces with very good visitor facilities such as car parks and visitor centres, many have geodiversity interest that can be promoted to the public. Historic buildings built with local materials and historic excavation sites on commons also represent an important resource near to settlement. Public access to exposures of chalk is rare and new excavations are not taking place.	Work with existing and new groups, including landowners of green spaces, to build capacity to carry out geoconservation activities and education. Secure benefits to geodiversity through landscape scale projects which integrate multiple landscape objectives. Engage communities and property owners in celebrating and continuing use of local building materials, including developing skills and industry around traditional building materials. The relationship between geodiversity in this area and the underlying aquifer, water quality and availability, and soils presents an opportunity to engage a wide audience in better understanding natural processes that limit available resources.	**Geodiversity** **Sense of place/ inspiration** **Sense of history** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity cont...		Traditional building materials also celebrate local geology. Local museums and promoted routes contribute to the interpretation of local geodiversity. There are local community groups carrying out geoconservation and public engagement activities. Pitstone Quarry SSSI is famous for an organic deposit (around 180,000 years BP) which is evidence of a previously unknown British interglacial.		Those groups which are seeking to engage the public and study geodiversity have restricted resources, relying largely on volunteers, consequently public engagement in geodiversity is small-scale.		

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National Character Area profile:

111: Northern Thames Basin

Supporting documents

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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.

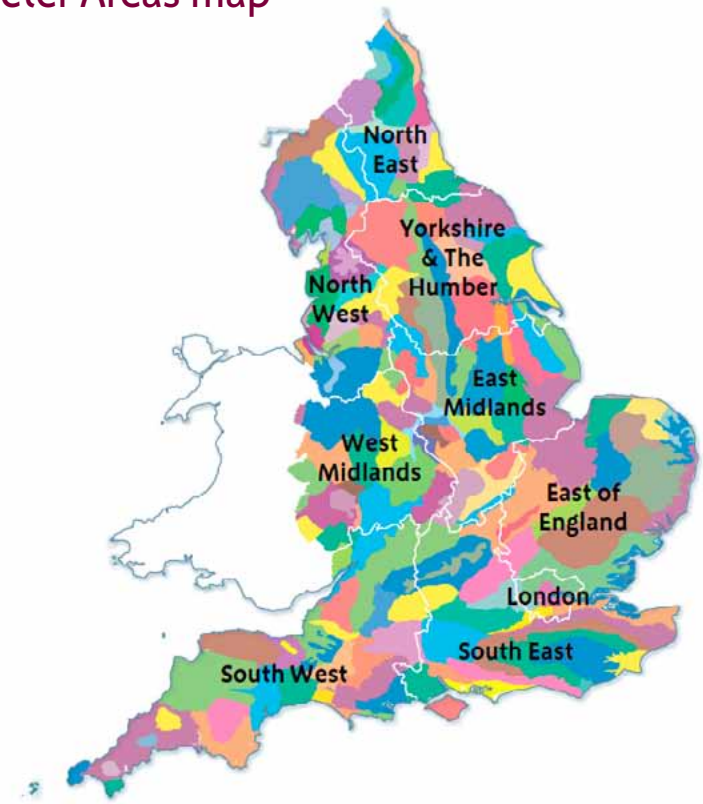
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and 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



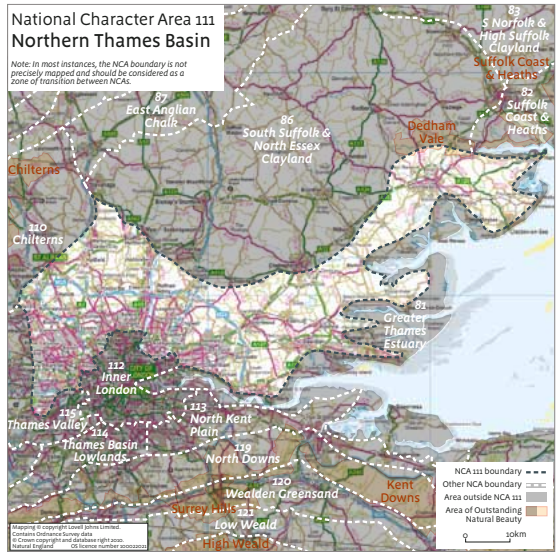
[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: www.official-documents.gov.uk/document/cm80/8082/8082.pdf)
[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf)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

Summary

The Northern Thames Basin is a diverse area which extends from Hertfordshire in the west to the Essex coast in the east. It is separated from the North Sea and Thames Estuary by a narrow band of land that makes up the Greater Thames Estuary National Character Area (NCA). Included within this NCA are the suburbs of North London and also historic towns and cities including St. Albans and Colchester, as well as new and planned towns such as Welwyn Garden City, Hatfield and Basildon. Although arable agriculture is a large industry in the area the soil quality ranges from good to poor quality. The London Clay provides a poor quality soil that becomes waterlogged in winter and cracks and shrinks in summer. Better quality soil is found in areas that contain alluvial deposits from the Thames and other rivers in the area as they formed and changed position over time.

The Northern Thames Basin is an area rich in geodiversity, archaeology and history and diverse landscapes ranging from the wooded Hertfordshire plateaux and river valleys, to the open landscape and predominantly arable area of the Essex heathlands, with areas of urbanisation mixed in throughout. Urban expansion has been a feature of this area since the 16th century when wealthy merchants who were conducting business in London built homes on its outskirts, mainly in the Hertfordshire area. This trend increased dramatically from the mid-19th century as infrastructure improved and people could travel to work in London from the surrounding areas in an hour or less. This has put increased pressure on the area in terms of extra housing developments, schools and other necessities for expanding populations, with a consequential reduction in tranquillity. Tranquil areas can still be found in parts of Hertfordshire and Essex in areas that have a more dispersed settlement pattern broken up by arable land and semi-natural habitats.

There are a wide variety of semi-natural habitats in the area and these support many important species. However, the habitats have become fragmented over time and a landscape-scale approach is needed to connect them so that they can be sustained and provide beneficial functions including; increasing pollinating insects, acting as flood defences and water storage areas, preventing soil erosion and helping to improve soil and water quality as well as maintaining the area's sense of place and history. This NCA includes many internationally and nationally designated sites including 72 Sites of Special Scientific Interest (20 of which are designated wholly or in part for their national geological importance), 6 Ramsar sites, 6 Special Protection Areas, 3 Special Areas of Conservation and 2 National Nature Reserves. The majority of these sites are estuaries and woodlands. The estuaries support migrating and overwintering birds as well as rare or locally important plants and invertebrates. The selected woodlands are ancient and have a long history of management through coppicing and pollarding, which has allowed rich ground flora to develop and also supports rare mosses and deadwood invertebrates.



Click map to enlarge; click again to reduce.

The main changes to the area have resulted from increased construction and commercial-scale farming. Both of these have increased pressures on water availability, water flow, soil quality, biodiversity and sense of place. Although housing, other construction and agriculture are significant for the area it is important that these are developed in a sustainable way so that predicted changes in climate and the effects on the area's character are considered and sense of place and history are preserved.

The main opportunities available to this area are the continuation of the agricultural tradition, but within this land management should consider methods that are more sustainable in terms of water use and soil quality in order for it to continue to be a viable industry in the future. The areas of various semi-natural habitats also present opportunities to improve water storage and soil quality for surrounding agricultural land as well as to increase advantageous species that will aid pollination and reduce pest species. In addition to this the woodlands in the area could be an important resource to supply timber and fuel to the local area if they were managed effectively.

Farmland next to the River Colne in Essex.

Statements of Environmental Opportunity

SEO 1: Manage rivers and river valleys to protect and improve water quality and help to alleviate flooding in the downstream urban areas, while also helping to improve aquifer recharge and provide a sufficient store of water to meet future need, especially with predicted climatic changes. Conserve the riparian landscapes and habitats, for their recreational and educational amenity for their internationally significant ecological value.

SEO 2: Manage the agricultural landscape and diverse range of soils which allow the Northern Thames Basin to be a major food provider, using methods and crops that retain and improve soil quality, water availability and biodiversity.

SEO 3: Protect and appropriately manage the historic environment for its contribution to local character and sense of identity and as a framework for habitat restoration and sustainable development, ensuring high design standards (particularly in the London Green Belt) which respect the open and built character of the Thames Basin. Enhance and increase access between rural and urban areas through good green infrastructure links to allow local communities recreational, health and wellbeing benefits.

SEO 4: Manage and expand the significant areas of broadleaf woodland and wood pasture, and increase tree cover within urban areas, for the green infrastructure links and important habitats that they provide, for the sense of tranquillity they bring, their ability to screen urban influences and their role in reducing heat island effect and sequestering and storing carbon.

Ancient woodland at Pound Wood in Benfleet, Essex.

Description

Physical and functional links to other National Character Areas

The Northern Thames Basin forms the rising land above the low-lying marshy landscapes adjoining the coast and estuaries of the Greater Thames Estuary and the Suffolk Coast and Heaths National Character Areas (NCAs) to its east and south-east extent and enjoys associated views of these areas. Chalk geology commonly underpins this NCA and the neighbouring Chilterns and South Suffolk and North Essex Claylands NCAs to the west and north; The Chilterns, a formation of chalk hills and plateaux with a prominent escarpment, offers views across to this similarly elevated NCA. To the south-west the Thames Valley NCA forms a wedge-shaped area containing the open Thames flood plain surrounded by rolling clay farmland. Directly south is the Inner London NCA on the banks of the Thames where the river valley widens out into a broad flood plain.

The London Basin Chalk aquifer, which underlies much of the western section of the Northern Thames Basin NCA, is the principal aquifer supplying water to Inner London. The Chalk is confined in the basin by the overlying Tertiary formations of London Clay, which means recharge largely occurs in the extensive Chalk outcrop of the Northern Thames Basin and into the Chilterns NCA to the north and the North Downs to the south.

A small part of the Dedham Vale Area of Outstanding Natural Beauty (AONB) straddles the eastern edge of this NCA, the more northerly South Suffolk and North Essex Claylands and the south- western tip of the Suffolk Coast and

Major transport links include the M25 motorway.

Heaths NCA. The urban character in the south of the Northern Thames Basin continues into the Thames Valley and Greater Thames Estuary NCAs.

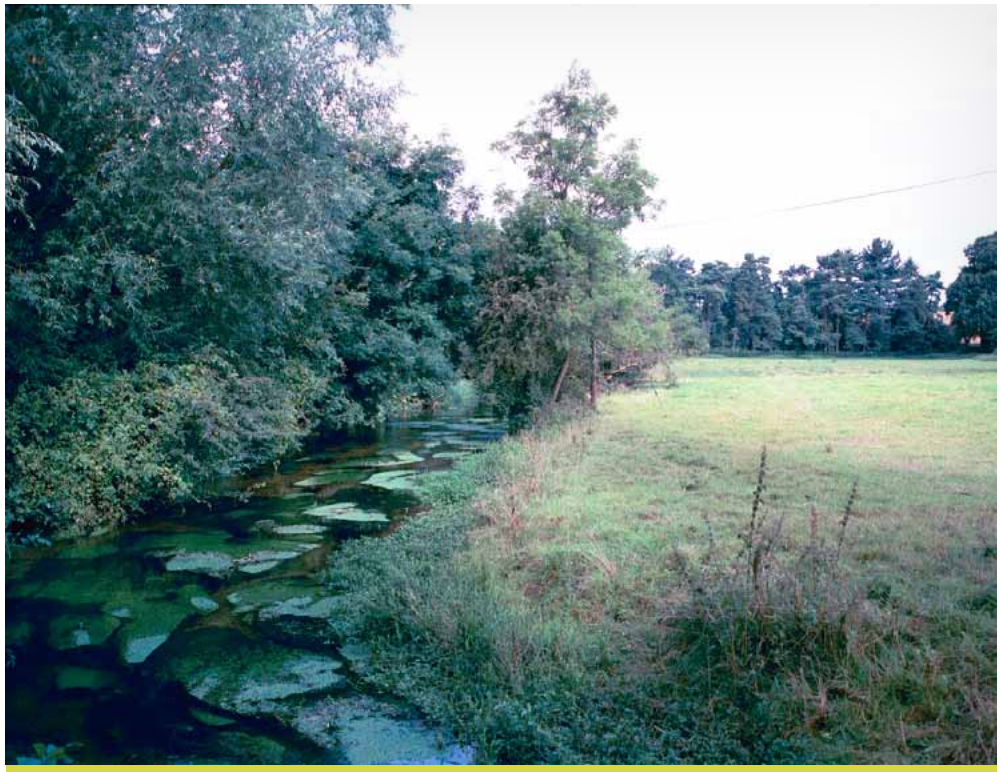
The landscape becomes extensively urbanised towards the Inner London NCA and includes major transport links from outside the area such as the East Coast mainline railway, M11 which connects to London and Cambridgeshire, the M1 which passes north-west through the Chilterns to the Midlands beyond, and

the M25 which provides circular access to all parts of London and the south. Important A roads providing wide physical links include the A12 and A120 and the A1(M), which has a similar route to the M1 but diverts towards the East Anglian Chalk and Bedfordshire Claylands NCAs.

Many watercourses feed in or flow from surrounding areas, often along courses incised into boulder clays or tills, for instance the Blackwater and Colne flowing from the South Suffolk and North Essex Claylands and the Ver and Lea from the westerly Chilterns NCA which flow into Hertfordshire before joining the Thames in inner London. These, along with others, form a series of river valleys draining south to the Thames and east to the North Sea and Thames Estuary, including the Roding, Wid, Chelmer, Roach and Crouch. Also notable is the Grand Union Canal, which runs from here through several other NCAs northwards to Birmingham.

Distinct areas

- Hertfordshire plateaux and river valleys
- Essex wooded hills and ridges
- London Clay lowlands
- Essex heathlands



River Mimram valley flood plain, Hertfordshire.

Key characteristics

- The landform is varied with a wide plateau divided by river valleys. The prominent hills and ridges of the 'Bagshot Hills' are notable to the north-west and extensive tracts of flat land are found in the south.
- Characteristic of the area is a layer of thick clay producing heavy, acidic soils, resulting in retention of considerable areas of ancient woodland.
- Areas capped by glacial sands and gravels have resulted in nutrient-poor, free-draining soils which support remnant lowland heathlands, although these are now small. Areas that have alluvial deposits present are well drained and fertile.
- The water bearing underlying Chalk beds are a main source of recharge for the principal London Basin Chalk aquifer.
- A diverse landscape with a series of broad valleys containing the major rivers Ver, Colne and Lea, and slightly steeper valleys of the rivers Stour, Colne and Roman. Numerous springs rise at the base of the Bagshot Beds and several reservoirs are dotted throughout the area
- The pattern of woodlands is varied across the area and includes considerable ancient semi-natural woodland. Hertfordshire is heavily wooded in some areas as are parts of Essex, while other areas within Essex are more open in character. Significant areas of wood pasture and pollarded veteran trees are also present.
- The field pattern is very varied across the basin reflecting historical activity. Informal patterns of 18th-century or earlier enclosure reflect medieval colonisation of the heaths. Regular planned enclosures dating from the Romano-British period are a subtle but nationally important feature on the flat land to the south-east of the area. In the Essex heathlands 18th- and 19th-century enclosure of heathlands and commons followed by extensive 20th-century field enlargement is dominant.
- Mixed farming, with arable land predominating in the Hertfordshire plateaux, parts of the London Clay lowlands and Essex heathlands. Grasslands are characteristic of the river valleys throughout. Horticulture and market gardening are found on the light, sandy soils of former heaths in Essex, particularly around Colchester, along with orchards, meadow pasture and leys following numerous narrow rivers and streams.
- The diverse range of semi-natural habitats include ancient woodland, lowland heath and floodplain grazing marsh and provide important habitats for a wide range of species including great crested newt, water vole, dormouse and otter.
- Rich archaeology including sites related to Roman occupation, with the Roman capital at Colchester and City of St Albans (Verulamium) and links to London. Landscape parklands surrounding 16th- and 17th-century rural estates and country houses built for London merchants are a particular feature in Hertfordshire.
- The medieval pattern of small villages and dispersed farming settlement remains central to the character of parts of Hertfordshire and Essex. Market towns have expanded over time as have the London suburbs and commuter settlements, with the creation of new settlements such as the pioneering garden city at Welwyn and the planned town at Basildon.
- Brick-built dwellings are characteristic from the late 17th century onwards. Prior to this dwellings and farm buildings tended to be timber built with weatherboarding, now mainly painted white but traditionally black or tarred, and whitewashed plaster walls.

Northern Thames Basin today

The Northern Thames Basin is a large and diverse landscape with a similar overarching character of agricultural land, interspersed with woodland, dissected by rivers and influenced by the urban areas of North London. It falls naturally into several distinct areas, shaped by their geology, topography and land use which are called: Hertfordshire plateaux and river valleys, Essex wooded hills and ridges, London Clay lowlands and the Essex heathlands

The Hertfordshire plateaux and river valleys to the north-west of the NCA are high, broad arable plateaux divided by wooded and pastured valleys which have a mainly rural feel with, on the whole, small developments. Rivers that drain the plateaux are the Colne, Ver and Lea and the soils are mainly underlain with London Clay, resulting in heavy, acidic, nutrient-poor soils with poor drainage; however, in the river valleys alluvial deposits provide fertile and well-drained soils. The area is underlain by extensive Chalk beds of the principal London Basin chalk aquifer, which provides the main source of water for London. Recharge of the aquifer largely occurs from the Chalk as water flows underground to London from the Chilterns, and water quality and availability within the aquifer are largely dependent on land management practices in the area.

While the plateaux are predominantly in arable use, the valleys by contrast contain areas of pasture and have a more intimate character, although some have been heavily modified by reservoirs, gravel workings, landfill sites and river realignments. The valleys contain all the main settlements within the area. Field boundaries are dominated by informal enclosure patterns of the 18th century, with thorn hedges relating to rationalisation and amalgamation of this pattern in the 18th and 19th centuries. It is a well-wooded landscape, especially to the east, with a number of ancient broadleaved woodlands including oak and hornbeam coppice. Isolated areas of remnant heathland survive within commons. The area retains a substantial legacy of funerary monuments and settlement sites associated with the prehistoric period and was intensively settled in the Roman times, with a number of major and minor towns (including St Albans and Welwyn) having a Roman origin. Today, a medieval pattern of small villages and dispersed farming settlement is central to the area's character and there is good survival of medieval timber-framed houses and barns, moated sites and small medieval castles. The 16th and 17th centuries saw the growth of rural estates and country houses for London merchants and the landscape parklands surrounding these houses are a particular feature of the

Grazing marsh at Kings Meads Valley Meadowlands alongside the urban landscape of Hertford.

area today. The area merges with the outer London suburbs of Enfield, Barnet, Harrow, Hillingdon and Hounslow. It also contains many large towns including Watford, Hatfield, Hertford and St Albans which have developed as commuter settlements as well as the pioneering and influential garden cities of Ebenezer Howard at later Welwyn. Road and rail routes plus utility infrastructure are now dominant features of some parts of the area. To the far south the area is heavily urbanised as it becomes part of London, where housing, industrial areas and shops dominate. Green areas are restricted to city parks, grassed areas in front of housing developments and residents' gardens.

The Lea Valley within the area has been exploited for supplying London with water and for generating power for a wide range of industries, together with extraction of sand and gravel. This historic use has underpinned its current importance for wildlife. The Lower Lea valley, which lies in the south of the area and in the adjacent Inner London NCA, was heavily regenerated for the 2012 London Olympics, bringing ecological landscape, recreational and economic benefit.

The designations afforded to this area are Ramsar, which is an international designation for wetland habitats, and Special Protection Area (SPA), which is a European designation; also, within the Lea Valley and the surrounding areas there are many Sites of Special Scientific Interest (SSSI). The main reasons for the designations within the Lea Valley area are its importance as a wetland site; wetlands and reservoirs occupy a large part of the valley and support many important overwintering waterfowl. The species of particular importance are bittern, which over-winter in the reedbeds in the area which at peak times can support around 6 per cent of the UK's population, as well as gadwall and shoveler which also over-winter here (representing almost 2 per cent of their overwintering European population). There are also two important woodland complexes within the area: Wormley and Hoddesdon Park Wood, which is a Special Area of Conservation (SAC) and Broxbourne Wood, which is a National Nature Reserve (NNR). Wormley and Hoddesdon Park Wood is an almost exclusively hornbeam woodland which has been managed through coppicing with oak standards. The ground flora supports bluebells and great wood-rush as well as important mosses. Broxbourne Wood is an ancient woodland which supports the rare butterfly purple emperor and also has historical value as the area has been managed since Roman and medieval times as a source of wood

The Essex wooded hills and ridges lie to the east of the Hertfordshire plateaux and river valleys to the north of the NCA. This area has several ridges where the soils are acidic and stony and have low fertility but are easily cultivated. This and the wet soils at the base of the Bagshot Beds limit the agricultural potential for the hill slopes, but farmland can be found in the lower-lying areas. The ridges of Epping Forest, Brentwood to High Wood, Thorndon to Billericay and Danbury to Wickham Bishops are dissected by the river valleys of the Roding, Wid and Chelmer. The Ter, Brain and Blackwater also contribute to the drainage of the area and Hanningfield Reservoir provides an area of open water.

This area is in the central part of the NCA, and extends roughly from Epping Forest in the west to Danbury in the east. It is a transitional landscape between the London Clay lowlands and the South Suffolk and North Essex Claylands NCA. It is formed by a series of hills and ridges created by the resistant Bagshot Sands which rise up above the clay lowland as at Epping Forest, Brentwood to High Wood, Thorndon to Billericay and Danbury to Tiptree. These well-wooded hills contain extensive areas of ancient woodland, remnant wood pasture and secondary woodland on commons as well as more recent plantations. These include the substantial wooded areas of Hainault Forest and Epping Forest, formerly Royal Forests, now managed for conservation and recreation.

Historically, settlement was sparse with scattered villages associated with the commons and areas of wood pasture. Today, settlement is dominated by large, 20th-century urban areas. The A12, the former Roman road connecting London with Colchester, is a major commuter route through the area.

Within this area Epping Forest is an important site for wildlife and as such has been designated as an SAC. The main reason that this site is important is the beech forests found here and the rare species that these support – rare mosses and also fungi and deadwood invertebrates owing to the high number of veteran trees present. Also found here are significant populations of stag beetle.

The London Clay lowlands lie south and east of the Essex wooded hills and ridges and are characterised by the heavy, acidic soils associated with this area, which is the dominant feature of the London Basin, although lighter soils can be found on some footslopes. The heavy soils are difficult to drain and easily become waterlogged. The area is drained by numerous rivers such as the Roach, Crouch and Blackwater, which merge to create the flat marshes to the east. The large expanse of open water at Abberton Reservoir, formed by the damming of the Layer Brook on its way to the Roman River, is a notable feature.

This area embraces the outer east London suburbs at Grays and Thurrock and extends eastwards to the Dengie Peninsula. It includes the town of Basildon.

This area is essentially a flat to gently undulating lowland landscape. Local variation is created by the Laindon and Hockley Hills, formed of the more resistant sandy Bagshot Beds which cap the clay.

The east of the area is characterised by a planned Roman landscape with a rectilinear pattern of fields which is a nationally important but subtle feature

Wet heathland, acid grassland and coppiced ancient woodland at Bricket Wood Common, Hertfordshire.

of the landscape today. The heavy clays were difficult to work and remained in pasture; however, during the 1950s and 1960s the land was improved so that arable is now also a dominant land use. By contrast, the hills around Laindon, Hockley and Rayleigh are relatively well wooded. In addition, 19th- and 20th-century plantations and regenerated, formerly urbanised plotland landscapes add a further wooded aspect to parts of the area. The landscape today has an urban character, including the expanded resort of Southend, the 1950s planned

town of Basildon and extensive 20th-century commuter settlements such as at Laindon and Rayleigh. Large areas of recreational land including parkland, golf courses and horse paddocks serve the urban population.

This area has many important wetland sites including Abberton Reservoir (designated as a Ramsar site and SPA) and also two reservoir areas recognised as SPA, the Crouch and Roach Estuary and Blackwater Estuary: however, only a small proportion of the two estuaries is found in this NCA with the majority falling within the Greater Thames Estuary. Abberton Reservoir is a significant site as it supports many important overwintering waterfowl such as golden plover, gadwall, shoveler and teal, as well as breeding cormorant, and also qualifies as a wetland of importance as it supports more than 20,000 waterfowl. The Crouch and Roach Estuary is an important site for overwintering dark-bellied Brent goose and the Blackwater Estuary (which is also an NNR) is important for overwintering avocet, golden plover, hen harrier, dark-bellied Brent goose, redshank and breeding little tern: it too is recognised as a wetland of international importance because it supports more than 20,000 waterfowl.

The Essex heathlands lie north-east of the London Clay lowlands and Essex wooded hills and ridges, in the north-east of the NCA. The geology of the area is predominantly sands and gravels, which were deposited by the Thames as it changed its course over time to its present location. Around the Tendring area deposits of wind-borne silty loam overlie the sands and gravels but overall the soils are light and free draining. The area is relatively flat with contrast provided by the steep-sided slopes of the Stour, Colne and Roman river valleys which, along with their tributaries, drain the plateau and are eventually discharged into the North Sea.

The east of this area is broadly bounded by the Stour Estuary to the north and the Thames Estuary to the south and east, and covers the land around Colchester and the Tendring plain. It is separated from the North Sea and Thames Estuary by a narrow strip of coastal marshes which form part of the Greater Thames Estuary.

The area consists of a broad, sandy plateau created by ancient river deposits from the Thames. Historically it was dominated by extensive heaths and commons, although these are now restricted to isolated fragments of heath and scrub within an intensively farmed and largely arable agricultural landscape. Agriculture includes improved grassland and arable fields as well as distinctive areas of horticulture and market gardening associated with the light, sandy soils of former heaths. Orchards are a feature around Colchester.

A pattern of small but intricate creeks and valleys breaks up the plateau edges where the land falls to the Thames Estuary along the coast and extends the coastal influence inland. The narrow river valleys which incise the plateau also create areas of contrasting enclosed landscape, with abundant woodland and meadows, some with wider flood plains and wetland vegetation. Much of the woodland is ancient; however, in general the plateau has an open, treeless character owing to the loss of field boundaries.

Vernacular buildings are constructed of timber, with either weatherboarding or whitewashed plaster. The principal settlement is Colchester, the walled Roman capital and England's oldest town, dating from 49 AD.

Within this area is Hamford Water, designated as a Ramsar site as well as an SPA and SSSI owing to the important waterfowl that use it. Many species over-winter here, including avocet, golden plover, ruff, black-tailed godwit, grey plover, ringed plover and teal – up to 25 per cent of the UK population of overwintering avocet has been recorded here. In addition, little tern use it

as a breeding site and the area is considered to be a wetland of international importance as it supports more than 20,000 waterfowl. Part of the Colne Estuary is in this area (although the majority of it falls within the Greater Thames Estuary NCA); this is also a Ramsar site and SPA, and of national importance for geology. Similar species are found here to those found in Hamford Water, and in addition overwintering hen harrier, dark-bellied Brent goose and redshank. This area is also considered a wetland of international importance and includes a small part of the predominantly pastoral character of the Dedham Vale AONB. St Osyth marsh is an important site for salt marsh morphology dating back around 4,000 years, while geological exposures at East Mersea show important deposits beneath gravels which are attributed to the Thames and Medway system and are of considerable importance in Pleistocene studies.

The whole area is a combination of countryside mixed in with urban areas, with important habitats and species, especially woodland and wetland habitats and associated species. The rural area acts as a recreational opportunity for those living in the surrounding towns and cities and the urban areas offer work and recreation opportunities for those living in more isolated villages and settlements in the rural environment. There is strong historical association throughout the area owing to its close proximity to London and the Roman occupation of Colchester and the links that this creates within the area as a whole. Dedham Vale is strongly associated with the artist John Constable whose paintings were inspired by the landscape.

The landscape through time

The NCA is the northern part of the London Basin, a broad, concave fold which opens out towards the East Coast. This structure means that the oldest rock strata are at the periphery, with younger deposits towards the centre. Chalk deposited in the tropical seas of the Cretaceous Period (65–95 million years ago) underlies the area and forms the bedrock of adjacent NCAs, extending beneath London and providing the major aquifer for the capital. The folded structure, a syncline, developed some 20–40 million years ago during the Tertiary Era (2–64 million years ago) at the time that the Alps were being formed in southern Europe. During this period of uplift, the area became dry land and rivers developed, including the proto-Thames along a course to the north of its present location. Overlying the chalk is a series of sands and mudstones (Reading Beds) deposited during the Tertiary Era by ancient river systems that drained into the basin. The thick layer of London Clay which characterises this NCA today was laid down as a sequence of fossiliferous, shallow marine sediments under semi-tropical seas some 55 million years ago. Overlying the London Clay are sands and clays of the Bagshot, Barton and Bracklesham Beds.

The diverse geology has considerable influence on the landscape. The London Clays are heavy and typically difficult to work, resulting in the retention of pasture and considerable areas of ancient woodland. The lighter, sandy soils of the Bagshot Beds are likely to have remained relatively open and unwooded since prehistoric times and areas of remnant heath are a feature, particularly within the Essex heathlands and wooded hills. In Essex, the harder rocks of Bagshot Beds deposits form distinctive features, creating low hills and ridges such as at Danbury Hill, rising to a high point of 116 m.

The Quaternary deposits which overlie the clay provide an insight into Britain's most recent geological past. The Anglian ice sheet which reached

the outskirts of London approximately 500,000 years ago (evidenced at Hornchurch SSSI) advanced to the rim of the basin, leaving a series of glacial sands, gravels and clays and moving the course of the Thames southwards to its present location. Quaternary deposits have yielded artefacts illustrating early human presence (approximately 300,000 years ago) in the Thames Basin and more recently the evolution of prehistoric society. By the time that Britain was cut off as an island during the Holocene, humans had settled along the margins of the Thames and its tributaries. The light, sandy soils of the Essex heathlands to the east are particularly rich in buried archaeological remains associated with prehistoric and Roman occupation. Funerary monuments and settlement sites visible as cropmarks and earthworks are also a feature of the Hertfordshire plateaux and valleys and were extensively cleared and occupied in the prehistoric period. Here, the limited survival of coaxial field systems potentially of bronze-age origin is highly significant.

Roman occupation has left a significant impact on the area. A major road, now the A12, connected the Roman capital at Colchester to London. Other major and minor Roman towns and cities include St Albans and Welwyn and there are extensive villa estates, notably in the west of the area (in Hertfordshire). Also in Hertfordshire, the distinctive settlement pattern of 'homestead moats' aligned with the grid pattern is thought to be influenced by Roman estate management techniques. The London Clay lowlands are also characterised by planned landscapes created during the Roman period, forming a still distinct rectilinear pattern of enclosure on the Dengie Peninsula and in the area between Thurrock and Wickford. By comparison, the central part of the NCA (the Essex wooded hills) was relatively sparsely settled. Orchards were established around Colchester, as well as a significant area of meadow pasture and leys following the numerous narrow rivers and streams.

Traditional medieval timber-framed houses in Colchester, Essex.

Throughout the Northern Thames Basin, settlement is essentially based on a pattern of dispersed nucleated villages and farming settlements established in the medieval period. Post-Roman decline in Hertfordshire is evident in the number of medieval place names and settlement patterns which imply re-colonisation and clearance of a wooded landscape and late-medieval timber-framed houses and moated sites are a distinctive feature. In the Essex heathlands the dispersed settlement pattern was established within extensive tracts of heathland. In the London Clay lowlands some larger villages and small towns developed in the medieval period associated with local centres of civil

or religious authority. The exception to this dispersed pattern is in the Essex wooded hills where settlement remained sparse in the medieval period and was associated with the extensive commons or management of wood pasture and other resources belonging to medieval monastic houses.

The 16th, 17th and 18th centuries saw the growing influence of London, particularly in Hertfordshire, with the growth of market towns and rural estates and country houses for London merchants. Profitable farming conditions saw the demise of much medieval parkland in the 17th and 18th centuries, alongside the growth of substantial farming estates for the London merchants, rising nobility and gentry. The remaining associated parkland landscapes form a distinctive feature of the area today, particularly within the Hertfordshire plateaux area.

Industries based on agricultural produce (such as malting and brewing, paper making, hat making and tanneries) contributed to the prosperity of the market towns and developed further in the 19th century, aided by the growth in communications. This also stimulated the development of commuter settlements in the 19th and 20th centuries, and the urbanisation and expansion of existing towns and villages. The creation of new settlements is a particular feature, with the pioneering garden city at Welwyn and the planned 1950s town of Basildon. The edge of London has also expanded outwards with suburbs now embracing former villages. Communication routes – motorways (the M1, A1(M) and M11), main roads and railways running north–south connecting to London, plus the M25 radial route – are dominant features.

In the 1970s Dutch elm disease transformed many parts of the landscape, with the loss of tree and woodland cover, and the area continues to change with pressure for housing and industrial growth associated with, for instance,

Mixed coppice ancient woodland at Norsey Wood near Billericay, Essex.

the Thames Gateway, Haven Gateway and other strategic growth points such as Chelmsford, identified in the East of England Improvement Plan, the Lea Valley regeneration area (including the Olympics legacy) and changes in the agricultural landscape.

Ecosystem services

The Northern Thames Basin 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 Northern Thames Basin NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** This is a predominantly arable landscape with arable crops covering 53 per cent of the area – primarily wheat and oilseed rape. The area also includes a sizeable sheep flock (approximately 18,800 breeding ewes in 2007) but relatively few cattle (only approximately 2,600 breeding dairy cattle and 3,200 breeding beef cattle), all of which have declined in number since 2000.

- **Timber provision:** The area only has 6 per cent woodland cover. This resource is unevenly distributed and some parts of the NCA have a relatively high woodland cover. The main areas of commercial timber are the coniferous plantations situated on former lime tree woods in the river valleys of Hertfordshire; these cover some 0.7 per cent of the total area of the NCA.

- **Genetic diversity:** Remnant traditional orchards provide a genetic stock of old apple varieties, many of which are no longer commercial. There are also rare animal breeds associated with the area including the British Saddleback Pig (which is partially bred from the Essex Pig), White Park Cattle, Red Poll Cattle, Jacob Sheep, Bagot Goat, Hackney Horse, Hackney Pony, shire horses and British Percheron Horse.

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

- **Climate regulation:** Soils, woodland and hedgerows are likely to be significant stores of organic carbon across this area.

- **Water availability:** The Chalk which underlies the west of the area is extensively abstracted for drinking water in the NCA and provides a main source of recharge for the principal aquifer supplying Inner London.

- **Regulating soil erosion:** The sandy soils of the Essex heathlands and hills and ridges are susceptible to erosion if high risk crops are cultivated on sloping ground and in dry summers will become increasingly prone to wind erosion if they are left exposed. The restoration of hedgerows across the landscape can reduce the scale of wind erosion.

The River Lee near Hertford.

- **Regulating soil quality:** This NCA has a range of soil types and the condition of these soils varies significantly. Within the area as a whole more than 50 per cent of the land is classified as excellent to good/moderate quality, which supports a wide range of agricultural and horticultural crops.

- **Regulating water quality:** The rivers flowing south and east from the chalk strata into the Thames and to the coast are of variable ecological quality. While most are considered to be of moderate quality, parts of the Lea are of poor quality as are some of the smaller rivers, such as the Rib. These classifications are based on results from the Environment Agency within their work under the European Water Framework Directive. Land management practices within the NCA will have a major impact on water quality in the underlying aquifer.

- **Pollination:** The areas of semi-natural habitat – heathlands, grasslands and woodland edges in parts of Essex and Hertfordshire – provide important habitats for pollinating insects. The extensive agricultural lands can provide habitats in the form of hedgerows, edges of farm tracks and 'set aside' areas. This in turn will be beneficial for food production through pollination of food crops, particularly oilseed rape, through pollinating invertebrates.

- **Pest regulation:** The presence of semi-natural habitats such as grasslands, woodlands, road-side verges and uncut farm tracks can provide overwintering habitats for beneficial predatory invertebrates which will help to control populations of many pest species. An example of this is the Carabidae family of beetles which feed on a number of pest species. Careful management of land to encourage such species can reduce the need for chemical control measures.

Cultural services (inspiration, education and wellbeing)

- **Sense of history:** A strong sense of history is captured in the ancient woodlands and trees of the area – the Broxbourne Woods and Epping Forest – and also the built environment, including significant estates.

- **Recreation:** There is a strong appreciation of the local landscape as a 'green lung', offering opportunities for active and passive recreation away from the Greater London conurbation, and a ready recognition of the coast as offering a nearby visitor destination. The easy accessibility of the countryside and coast is a very important aspect of the lives of local residents.

- **Biodiversity:** The diverse range of semi-natural habitats present in the NCA, which includes 3 SAC and 3 SPAs, include ancient woodland, lowland heath and floodplain grazing marsh and provide important habitats for a wide range of species including great crested newt, water vole, dormouse and otter. The area is also important for wetland birds, especially the Ramsar wetland sites of Lee Valley, Hamford Water and Abberton Reservoir.

- **Geodiversity:** The area has a clear identity created by the geodiversity underpinning the diverse landscape. The underlying sediments themselves contain a record of ancient landscapes and climates. There are 20 geological SSSI in the area and 3 Local Geological Sites which are of local and national importance. These sites preserve important deposits of chalk stratigraphy and evidence for the formation of the London Clay as well as conserving several key geomorphological features. The majority of sites within this NCA, however, preserve evidence for past glaciations and the evolution of the Thames during the Quaternary. These sedimentary deposits and the fossils contained within them represent significant records of climate and environmental change that provide an important context for our understanding of and insights into the potential impacts of future climate change on our landscapes. Several sites also preserve important evidence for early human occupation of the area dating back around 300,000 years.

Statements of Environmental Opportunity

SEO 1: Manage rivers and river valleys to protect and improve water quality and help to alleviate flooding in the downstream urban areas, while also helping to improve aquifer recharge and provide a sufficient store of water to meet future need, especially with predicted climatic changes. Conserve the riparian landscapes and habitats, for their recreational and educational amenity for their internationally significant ecological value.

For example by:

- Managing and enhancing the river valleys and wetland habitats for the important habitats and species that they support, their geodiversity, landscape and recreational value, and to increase water storage capacity to reduce flood events in downstream urban areas.
- Sustainably managing the water resource including watercourses and aquifers, by implementing catchment-wide land management practices to help reduce pollution and aid aquifer recharge.
- Maintaining, enhancing and increasing the network of hedgerows along river valleys, especially in flood plains, to act as water stores which will absorb excess water during high rainfall, slowly release water in drier periods and reduce wind evaporation on fields in drier periods.
- Enhancing and creating riverside buffer strips of natural vegetation, including the conservation and planting of a new generation of riverside willows that will reduce overland run-off and help to minimise the deposition of soil and silt in channels and stop nitrates entering the watercourse in order to prevent adverse effects on aquatic life.
- Creating reedbeds in areas of potential pollution including along roads and near road bridges and agricultural drainage areas. This will help to improve urban diffuse pollution.
- Utilising semi-natural habitats to replace current engineered flood management. Current flood management will be insufficient to counteract future flooding, so allowing natural processes to reduce water levels in priority areas is the most sustainable alternative. Allowing rivers to flood naturally will also increase biodiversity and enhance geomorphology, wetland habitats and riverine character.
- Restoring river valley mineral sites to wetlands and washlands while enhancing geodiversity and archaeological interest.
- Raising awareness within the general public as to how they can individually help to reduce water waste and prevent contamination.
- Encouraging landowners to store water for individual usage, from using water butts for small gardens to larger storage systems for arable land and golf courses.
- Growing crops that are more resilient to drought so that less irrigation is needed in drier periods when water availability decreases.
- Restoring and improving the natural geomorphology of rivers in the area including urban rivers so that the quality of not only the water but also the river ecology as a whole improves by reducing pollution, sedimentation, invasive species etc; reducing the prolificacy of invasive aquatic and marginal plant species, including floating pennywort and Himalayan balsam, which cause waterways to become blocked, increase sedimentation, reduce biodiversity and affect movement of aquatic life as well as recreation activities along watercourses.

SEO 2: Manage the agricultural landscape and diverse range of soils which allow the Northern Thames Basin to be a major food provider, using methods and crops that retain and improve soil quality, water availability and biodiversity.

For example by:

- Retaining the overall agricultural diversity with areas of arable land, horticulture and pasture which are so important for food provision in the area, while encouraging sustainable management to protect agricultural soils and enhance biodiversity. Encouraging the use of sustainable farming methods to enhance soil quality, such as maintaining vegetation cover, reducing tillage and encouraging the use of organic manures and composts. This will help to retain organic matter, which is vital for productive soils.
- Managing, enhancing and, where appropriate, expanding hedgerows and grass strips as field boundaries as these help to bind the soil, reducing soil erosion, while also providing habitats for pollinating insects as well as various farmland birds, mammals and invertebrates. Hedgerows will also create habitat corridors, connecting habitats and so allowing wildlife to disperse and increase its range, creating a more diverse landscape.
- Encouraging a reduction in compaction of the clay-based soils in the area which can damage their structure and drainage potential and reduce aquifer recharge. This includes reduced poaching from livestock and careful use of heavy machinery.
- Encouraging the management of the heathland soils to prevent wind and water erosion using hedgerow and tree boundaries to reduce overland run-off and to act as a wind shield. These soils are more prone to erosion than the more clay-based soils and are usually of high quality in terms of arable usage.
- Encouraging improvements to water management within agricultural land using boundary features such as hedgerows and grass buffer strips to store water during wet periods and retain it in drier periods.
- Adopting land management practices, including the use of buffer strips next to watercourses, to reduce diffuse pollution from agricultural sources, prevent contamination of groundwater and safeguard future water quality and availability.
- Improving biodiversity in the area by putting aside less productive land and creating semi-natural habitats such as wildflower meadows and grasslands. The promotion of agri-environment schemes can help to establish these opportunities

SEO 3: Protect and appropriately manage the historic environment for its contribution to local character and sense of identity and as a framework for habitat restoration and sustainable development, ensuring high design standards (particularly in the London Green Belt) which respect the open and built character of the Thames Basin. Enhance and increase access between rural and urban areas through good green infrastructure links to allow local communities recreational, health and wellbeing benefits.

For example by:

- Conserving historic features in the landscape with heritage interest and improving the condition of heritage assets through appropriate measures, and seeking to reduce conflicting or unsympathetic management regimes.
- Conserving and interpreting archaeological earthworks and sub-surface archaeology while recognising the high potential in this landscape for undiscovered remains.
- Preserving and enhancing current public access sites including nature reserves, common land, country parks and public footpaths and rights of way to attract the wider community.
- Creating better access to the countryside with an increased number of public footpaths and rights of way so that more of the area is open access. Enhancing current public access paths would also be beneficial to make the experience of the countryside more inviting and enjoyable.
- Restoring the connectivity of key habitats as well as expanding and creating new habitats which will maintain and enhance their attraction for visitors. Also, working to increase species diversity and density to increase this attraction for the community.
- Preserving the open landscape, enhancing geodiversity and biodiversity, for example the iconic species and habitats that attract visitors, to preserve their appeal to the wider community.
- Maintaining and enhancing the status of Sites of Special Scientific Interest, Special Protection Areas, Special Areas of Conservation, National Nature Reserves and Ramsar sites. This will preserve the character of the landscape, protecting and enhancing the sense of place.
- Increasing awareness and raising understanding within the community of the natural environment to improve their appreciation of their landscape so as to help to enhance their experience. This will also help to instil a sense of place.
- Planning for future pressure from urban expansion and urban-related development, major roads and other infrastructure as a result of the expansion of Stansted and Luton international airports (impacting from adjacent NCAs) and the impact of strategic growth in and around the NCA, such as at the Thames and Haven Gateways, Chelmsford and Southend, and the regeneration in the Lea Valley. Seeking measures to help to implement the All London Green Grid frameworks in order to ensure that associated design standards are of a high quality and pay due regard to the natural environment for the benefit of people and wildlife.
- Planning for a new vision of agricultural landscapes in areas of significant planned growth such as within the Thames Gateway, Haven Gateway and M11 corridor, including, potentially, the exploration of new forms of community food growing and community land ownership, providing a 21st-century interpretation of the plotlands of the 1920s and 1930s that are characteristic of this NCA.
- Ensuring positive management of land that may be developed in the future to preserve the character of the area and not adversely affect the rural areas that provide many resources, including food provision, carbon sequestration and recreation for the rural and urban communities.

SEO 4: Manage and expand the significant areas of broadleaf woodland and wood pasture, and increase tree cover within urban areas, for the green infrastructure links and important habitats that they provide, for the sense of tranquillity they bring, their ability to screen urban influences and their role in reducing heat island effect and sequestering and storing carbon.

For example by:

- Promoting the establishment of a coherent and resilient network of treescapes (native woodland, wood pasture, parkland, coppice, scrub, field trees and hedgerows) through expanding and linking existing woodland with areas of new planting.
- Managing the area's diverse range of historic woodlands, veteran trees and wood pasture and parklands to enhance landscape character and safeguard their biodiversity value while seeking opportunities to enhance access.
- Expanding current woodlands to create a greater resource and re-introduce coppicing and other management back into woodlands so as to make wood available to be sold commercially.
- Working within established management plans to ensure that the viability of the woodlands is not affected and that biodiversity is maintain or enhanced.
- Creating new woodlands, taking into account natural processes and bringing them into wood production management. Sensitively incorporating them into and around new developments to enhance landscape character. Community woodlands should be maintained and increased where possible for this purpose as well as for recreation.
- Creating new woodlands around or near to urban areas, which will, through carbon sequestration, help to counteract the carbon that is produced. Woodlands within urban areas will help to reduce the heat island effect.
- Incorporating woodland rides and paths within woodlands to allow for public access but also to create a variety of habitats within the woodlands which will increase biodiversity.
- Maintaining and enhancing woodland habitats which support important invertebrate species such as stag beetles, rare fungi and priority species such as dormouse. Ancient woodlands also support ground flora such as bluebells.
- Maintaining the diverse appearance of the landscape and shield developments and infrastructure from the wider landscape. This character should be maintained within any future developments that are built.
- Managing, restoring and re-linking areas of remnant lowland heathland and acid grassland found on areas capped by glacial sands and gravels, notably within the Essex heathlands and wooded hills and ridges.
- Conserving characteristic landscapes linked to the arts, such as Dedham Vale in the north- easternmost corner of the NCA (the inspiration for Constable), and the rich heritage of designed parklands associated with estates (particularly in the Hertfordshire plateaux and river valleys and the Essex wooded hills and ridges).

Additional opportunity

Continue to utilise the mineral resource as appropriate, ensuring screening and restoration plans are in place to protect landscape assets. Restore, enhance and manage previous mineral sites as suitable habitats or sites of key geological importance to demonstrate the significance of the rich mineral resources in shaping the area's landscape, and their potential as recreational and ecological assets of the future.

For example by:

- Appropriately utilising the minerals which are a much-needed resource in the area, with the continuing demand for new housing and other building projects. Ensure long term restoration plans seek landscape and ecological benefit so this resource can provide a source of revenue and jobs for the area as well as an opportunity to enhance our knowledge and awareness of geodiversity, and provide new assets for the community in the long term
- Restoring previous extraction to habitats that are appropriate for the area to improve the network of semi-natural habitats, and the recreational and educational opportunities for local communities.
- Provide appropriate access and interpretation to important geological sites once mineral extraction is completed to use this exposed resource to educate and inform people of the geological and geomorphological features.
- Encouraging an understanding of the interrelationships between the geological and archaeological heritage of the area.
- Ensuring appropriate management, educational access and interpretation of important geological and above and below ground archaeological features and sites throughout the area.

Supporting document 1: Key facts and data

Total area: 251,000 ha

1. Landscape and nature conservation designations

The Northern Thames Basin NCA contains 1,208 ha of the Dedham Vale Area of Outstanding Natural Beauty (AONB) covering less than one per cent of the NCA.

The management plan for the protected landscape can be found at: www.dedhamvalestourvalley.org/

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Name	Area (ha)	% of NCA
International	Ramsar	Abberton Reservoir; Lee Valley; Crouch and Roach Estuaries (Mid-Essex Coast Phase 3); Colne Estuary (Mid-Essex Coast Phase 2); Blackwater Estuary (Mid-Essex Coast Phase 4); Hamford Water	1,123	<1
European	Special Protection Area (SPA)	Abberton Reservoir SPA; Lee Valley SPA; Crouch and Roach Estuaries (Mid-Essex Coast Phase 3) SPA;	1,123	<1
	Special Area of Conservation (SAC)	Epping Forest SAC; Wormley-Hoddesdonpark Woods SAC; Essex Estuaries SAC	2,041	1
National	National Nature Reserve (NNR)	Broxbourne Woods NNR; Blackwater Estuary NNR	241	<1
National	Site of Special Scientific Interest (SSSI)	A total of 72 sites wholly or partly within the NCA	6,156	2

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.

All of the Ramsar sites are also SAC. Some of the areas covered by international and European designations are also designated nationally (SSSI or NNR).

There are 1,814 local sites in Northern Thames Basin covering 23,482 ha, which is 9 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: 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

A breakdown of SSSI condition as of March 2011 is as follows:

SSSI condition category	Area (ha)	% of SSSI land in category condition
Unfavourable declining	125	2
Favourable	3,232	53
Unfavourable no change	328	5
Unfavourable recovering	2,453	40

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

Elevation in the NCA ranges from 0.02 m below sea level to a maximum of 155 m above sea level. The average elevation of the landscape is 47 m. The 'Bagshot Hills' are prominent features of the Essex part of the NCA, rising to a high point of 116 m at Danbury Hill.

Source: Natural England 2010

2.2 Landform and process

This NCA can be broken down into four sub-character areas: Hertfordshire plateaux and river valleys; Essex wooded hills and ridges; London Clay lowlands; and Essex heathlands. The Hertfordshire plateaux and river valleys area is topographically complex, having many valleys cut into the broad plateau landform which is often obscured by vegetation cover. In places river erosion has created isolated landforms such as the Shenley Ridge. The Essex wooded hills and ridges rise above the London Clay lowlands to an altitude of approximately 100 m AOD. The London Clay lowlands are generally flat and typically gently undulating. Broadly, the Essex heathlands landform is relatively flat with only minor undulations; however, some of the river valleys are steep sided such as the Stour, Colne and Roman.

Source: Northern Thames Basin Countryside Character Area description, London Basin Natural Area Profile

2.3 Bedrock geology

The London Basin is a concave dish which formed as a result of the Alpine Orogeny (mountain building episode). It overlies the Chalk, which was laid down in warm shallow seas during the Cretaceous (95 to 65 Ma) and which is the main aquifer for London. As a result of the Orogeny the land here rose above sea level and it was subject to major erosion. The sea level then rose again and the basin was filled by Palaeogene and Neogene (Tertiary, 64 to 2 Ma) sands and mudstones. After continued sea-level rise some 55 Ma, the London Clay was laid down. Overlying the London Clay are the Bagshot, Barton and Bracklesham Beds. These sands and clays were deposited on a large coastal plain as the sea level fell again.

Source: Northern Thames Basin Countryside Character Area description, London Basin Natural Area Profile, British Geological Survey maps

2.4 Superficial deposits

Important Quaternary sediments are present, recording the changing temperatures during this Period and the presence and absences of ice-sheets. The Anglian ice sheet advanced as far south as the northern rim of the London Basin and forced the young River Thames to change its course to its current one. Fluvial sediments deposited by the Thames river system before the Anglian Ice Age occur predominantly along the northern edge of the London Basin, parallel with the axis of the syncline. Sediments deposited after the Anglian Ice Age are found along the flood plains of the current rivers. These latter deposits are found at lower altitudes than their predecessors, as a result of a combination of factors. The youngest sediments are sands and gravels deposited by the Thames in its current location since the last ice age.

Source: Northern Thames Basin Countryside Character Area description, London Basin Natural Area Profile, British Geological Survey maps

2.5 Designated geological sites

Designation	Number of sites
Geological Site of Special Scientific Interest (SSSI)	17
Mixed interest SSSI	3

There is 1 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

London Clay gives rise to heavy acidic soils often prone to flooding in winter and cracking in summer. River valleys are fringed by well-drained fertile brown earths, produced from alluvial deposits. Sand and gravels give rise to nutrient poor, free draining soils, for example in the Bagshot Hills and Essex heathlands. Light sandy soils of former heaths are found in Essex, particularly around Colchester.

Source: Northern Thames Basin 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	23	<1
Grade 2	28,676	11
Grade 3	120,556	48
Grade 4	5,418	2
Grade 5	39	<1
Non-agricultural	19,032	8
Urban	70,745	28

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 classification 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 (km)
River Lea or Lee	41
River Colne	33
Grand Union Canal	28
River Crouch	15
Roman River	13
Cobbin's Brook	9
River Ver	8
River Beane	6
River Chelmer	6
River Blackwater	5
River Rib	3
Chelmer and Blackwater Navigation Cobbin's Brook	2
Langford Cut	1
River Stort	<1
River Ter	1

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.

Hertfordshire plateaux and river valleys: Rivers cut through the broad plateaux, draining into the Colne and Ver to the north-west and Lea to the east. Reservoirs and canals are features of this area.

Essex wooded hills and ridges: The ridges of Epping Forest, Brentwood to High Wood, Thorndon to Billericay and Danbury to Wickham Bishops are dissected by the valleys of the rivers Roding, Wid and Chelmer. The Ter, Brain and Blackwater also contribute to the drainage of much of the area. Hanningfield Reservoir provides a notable body of open water within the sub-area.

London Clay lowlands: Undulating lowlands drained by numerous streams including the Roach, Crouch and Blackwater, which merge before widening into the flat marshes to the east. Layer Brook in the north is dammed on its way to the Roman River to form Abberton Reservoir.

Essex heathlands: Steep sided valleys of the Stour, Colne and Roman and their tributaries drain the plateau before discharging into the North Sea.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 185,636 ha or 74 per cent of the 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 http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 20,914 ha of woodland, 10 per cent of the total area, of which 7,742 ha is ancient woodland. Twelve per cent or 29,366 ha of the NCA is land within Community Forests; Watling Chase 18,522 ha and Thames Chase 10,843 ha.

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

4.2 Distribution and size of woodland and trees in the landscape

Significant areas of wood pasture and notable numbers of pollard ancient and veteran trees are found across the area, including Hainault Forest, at Thorndon Country Park, Wormley and Hoddesdon Great Park, Epping Forest and Richmond Park. Epping Forest, within the Essex wooded hills and ridges sub-area, includes mixed woodland and blocks of broadleaved woodland greater than 500 ha in extent.

The eastern part of the Hertfordshire plateaux is heavily wooded, including coppiced hornbeam woods with oak standards. Areas of coppice are up to 20 ha in size. Large blocks of woodland occur along river valleys in Hertfordshire, including former lime woods replanted with conifers. Some conifer blocks are over 150 ha. The hilltops and ridges of Essex are crowned by woods, including ancient woodland and secondary woodland on commons. These woods are mainly smaller than 50 ha.

The distinctive 'plotland' woods of Laindon and Thundersley can be found in the London Clay lowlands sub-area. These are mainly less than 50 ha in size. Small clusters of secondary and ancient woodland exist along shallow valleys in the Essex heathlands area, which is predominantly open. Apple orchards are a feature of the London Clay lowlands and Essex heathlands.

Source: Northern Thames Basin Countryside Character Area Description

4.3 Woodland types

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

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

Woodland type	Area (ha)	% of NCA
Broadleaved	20,914	8
Coniferous	1,760	1
Mixed	290	<1
Other	1,104	<1

Source: Forestry Commission (2011)

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

Woodland type	Area (ha)	% of NCA
Ancient semi-natural woodland	6,090	2
Ancient re-planted woodland (PAWS)	1,652	1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

In the Hertfordshire plateaux and river valleys woody and species rich hedgerows are the main boundary types. Hawthorn hedgerows surround more recent fields with wire fencing commonly around horse paddocks close to settlements. In the London Clay lowlands boundaries are often formed by long lengths of hedgerows which historically have been dominated by elm, although there has been significant loss through Dutch elm disease. Blackthorn hedgerows are now the most common. In the Essex heathlands hedgerows are the dominant boundary feature on land surrounding the heaths. These vary much in species richness and composition.

Source: Northern Thames Basin Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

Field pattern is varied across the basin reflecting historical enclosure patterns. The Hertfordshire plateaux and river valleys are dominated by the informal patterns of 18th century or earlier enclosure reflecting the medieval colonisation of the heaths and woodland. This is particularly noticeable in the east where small organic-shaped fields are common. In the west ancient organic-shaped fields can be found alongside regular 'Enclosure Acts' fields. Similar pre-18th century irregular small enclosures can be found in the Essex wooded hills and ridges with some later, more regular, medium sized fields present. Within the London Clay lowlands large rectangular fields dominate arable land on the heavy clay soils. Early, Roman planned 'Dengie' form regular enclosure patterns occur, which are a subtle but important feature of land in the east of the area. In the Essex heathlands 18th and 19th century enclosure of heathlands and commons followed by extensive 20th century field enlargement is dominant. Straight edged fields surround areas of remnant heath with small fields characterise the river flood plains. Some areas of regular enclosure are associated with the rationalisation and amalgamation of farms and estates in the 18th and 19th centuries.

Source: Northern Thames Basin 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

Broader plateaux areas in the NCA are mainly in agricultural use, with a mix of arable and pastoral farming. There has been a 62 per cent decrease in dairy farms from 37 to 14 farms. Trends also show a decrease in the number of specialist pig farms from 26 to 14 farms or a 46 per cent reduction. There have also been reductions in the number of horticulture holdings from 298 to 165 or 45 per cent, of mixed holdings from 92 to 62 or 32 per cent, of specialist poultry farms from 54 to 45 or 17

per cent, of general cropping from 132 to 110 holdings or 17 per cent, and of lowland grazing livestock units from 215 to 190 or 12 per cent. The general category of 'other' holdings, most commonly associated with small-holdings, has seen an increase of 9 per cent from 373 to 405 holdings. The number of cereal holdings has remained relatively static with 494 reducing to 480 or a decline of 3 per cent.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

Farms between 5 and 20 ha are the most common in the area, 428 holdings accounting for 29 per cent of all holdings, followed by farms over 100 ha, 340 in number or 23 per cent of holdings, farms between 20 and 50 ha, 323 or 22 per cent of holdings, and farms under 5 ha, 207 or 14 per cent of holdings. The least common farms in the area are those holdings between 50 and 100 ha at 187 or 13 per cent of holdings. The largest holdings, those over 100 ha, make up 75 per cent of the total farmed area, compared to those under 5 ha which cover less than 0.5 per cent of the farmed area. The trends in farm size show a significant decrease in the number of farms of less than 5 ha decreasing by 42 per cent from 358 to 207. The number of holdings between 5 and 20 ha also decreased by 12 per cent from 485 to 428, as did the number of holdings between 50 and 100 ha by 7 per cent from 200 to 187, and the number of holdings over 100 ha also by 7 per cent from 366 to 340. The number of holdings between 20 and 50 ha increased by 4 per cent from 311 to 323.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

Sixty-six percent of the total farmed area is owner occupied. There has been a 3 per cent increase in the owned area of farmland over the 2000 to 2009 period and a 2 per cent increase in the tenanted farm area.

2009: Total farm area = 113,572 ha; owned land = 74,843 ha
2000: Total farm area = 113,897 ha; owned land = 72,846 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

The dominant agricultural land uses are cereals, accounting for 48,817 ha or 43 per cent of the total farmed area, and grass and uncropped land which accounts for 32,804 ha or 29 per cent. These are followed by oilseeds which cover 11,742 ha, 10 per cent of the area, and 'other' arable crops which cover 7,252 ha or 6 per cent of the area, with other agricultural land uses each representing less than 5 per cent of the total farmed area. Between 2000 and 2009 there was a 6 per cent decrease in the area of cereals, a reduction by 2,937 ha, and a 7 per cent decrease in the area of grass and uncropped land, a reduction by 2,352 ha. The area under oilseeds increased by 4,284 ha, or 57 per cent, and the area under 'other' arable crops increased by 519 ha, or 8 per cent. There have also been increases in the area of land used for growing stock feed by 325 ha or 183 per cent, cash roots by 377 ha or 11 per cent, and vegetables by 62 ha or 5 per cent. A decrease was seen in the area of land used for fruit growing, down by 374 ha or 47 per cent, and glasshouses, down by 46 ha or 26 per cent. Other agricultural land uses were relatively static or related to less than five holdings.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

Sheep are the most numerous livestock within this landscape, numbering 35,500 animals. Pigs are the next most numerous with 17,500 animals and cattle numbered 16,500. All livestock numbers have decreased during the period 2000 to 2009. Pig numbers decreased by 52 per cent (19,100 animals), cattle by 39 per cent (10,500 animals) and sheep by 27 per cent (12,900 animals).

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

The majority of holdings are run by principal farmers, including their spouses and business partners, rather than salaried managers; 1,974 principal farmers and 317 salaried managers. Together, employed full time and part time workers

(1,520 full time and 620 part time) are more numerous than casual/gang workers (1,147). Trends from 2000 to 2009 show a decrease in the number of principal farmers, down by 509, and an increase in salaried managers, up by 30. During this period the number of casual/gang workers also increased, by 148, as have full time workers, up by 89, but the number of part time workers has decreased, down by 293.

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.

7. Key habitats and species

7.1 Habitat distribution/coverage

Hertfordshire plateaux and river valleys:

Woodland: The river valleys contain some of the largest blocks of woodland. Many woods have been felled and replanted with non-indigenous species, such as former lime woods which are now coniferous plantation. These woods often follow and accentuate the valley form, following the contours of the valley sides above flat and predominantly open valley floors. The woodland cover also comprises a number of small ancient beech and oak woods found mainly in the valleys to the west. The eastern part of the plateaux is heavily wooded with some traditional coppice woodland, with oak as standards and coppiced hornbeam; the unusual prevalence of hornbeam is related to its historical use as a quality firewood crop for London. Birch and ash are also frequent in this area. Wood pasture and parkland was once more widespread. Remaining areas such as around Broxbourne contain many veteran trees.

Flood plain grazing marsh: Remaining areas of grazing marsh can be found throughout the river valleys.

Wetlands and open water: Many of the river valleys have been modified by reservoirs, current and reclaimed gravel pits, landfill sites, artificial wetlands, river realignments and canals many of which are important as a recreational and wildlife resource, for example along the River Lea.

Lowland heathland: Only isolated remnants remain within commons such as at Bricketwood Common or Colney Heath Common.

Essex wooded hills and ridges:

Woodland: The woodland found on the prominent hills and ridges of Epping Forest, Hainault, Thorndon, Galleywood and the Danbury to Tiptree ridge, exists on a belt of sand often referred to as the 'Bagshot Hills' stretching through Essex from Epping Forest to Tiptree. Many are ancient but there are also some large areas of secondary woodland on former common land. Many of the wooded commons have veteran trees associated with them and some secondary woodland is defined in many places by medieval wood banks. There are also some notable areas of wood pasture and parkland associated with historic 'gentry' houses and their grounds.

Flood plain grazing marsh: Remnants of grazing marsh remain within the river valleys.

London Clay lowlands:

Woodland: The south-east Essex Hills around Langdon, Hockley and Rayleigh are quite well wooded relative to the heavily developed surrounding land. The 'plotland' woods of Laindon and Thundersley provide wildlife benefits on former urbanised land.

Open water: To the north, the tiny Layer Brook has been dammed on its way to the Roman River to form Abberton Reservoir. The open expanse of Abberton Reservoir provides a popular wildlife resource.

Essex heathlands:
Arable land and field margins: Improved grassland and arable fields, punctuated by a regimented pattern of horticultural holdings and market gardening on the light sandy soils of the former heaths dominate the area. It is important for farmland birds and other species associated with farmland for example brown hare.

Lowland heathland: Historically there were extensive heaths and commons north of Colchester and as far as Dedham. However, the area is now generally characterised by small isolated pockets of largely scrub-dominated heathland within the mixed agricultural landscape.

Rivers and streams: The steep-sided slopes of the Stour, Colne and Roman River valleys, with their tributaries, have associated abundant woodland and small fields with dense hedgerows. Gentler slopes have areas of coastal and flood plain grazing marsh, fen and reedbed at the river margins. An intricate pattern of hidden creeks and small valleys extend the influence of the coastal grazing marshes inland.

Source: London Basin Natural Area Profile

7.2 UK Biodiversity Action Plan (BAP) 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; 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.

UK BAP priority habitat	Area (ha)	% of NCA
Broadleaved mixed and yew woodland (broad habitat)	10,598	4
Coastal and flood plain grazing marsh	1,677	1
Lowland heathland	838	<1
Lowland dry acid grassland	517	<1
Lowland meadows	377	<1
Reedbeds	304	<1
Fens	252	<1
Mudflats	22	<1
Purple moor grass and rush pasture	8	<1
Lowland calcareous grassland	3	<1

Source: Natural England (2011)

- Maps showing locations of UK BAP 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 UK BAP Priority Habitats are available at: http://magic.defra.gov.uk/website/magic/ – select 'Habitat Inventories'
- Maps showing locations of S41 species are available at: http://data.nbn.org.uk/

8. Settlement and development patterns

8.1 Settlement pattern

There is generally a high degree of dispersed settlement in the landscape. The creation of new settlements is also a feature of the area, beginning with the pioneering new Garden Cities at Welwyn and Letchworth. There has been a high rate of change to urban fringe areas. There is evidence of an extension of urban influences into fringe areas creating peri-urban centres around some of the larger towns such as Colchester, Tiptree, Wickford, Greys, Hatfield, St Albans and Rickmansworth. In addition there is evidence of more scattered development on greenfield sites throughout especially between Benfleet and Billericay.

Source: Northern Thames Basin Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main settlements within the NCA are; North London suburbs, Watford, Chelmsford, Basildon, Southend-on-Sea, Colchester, Harwich, St Albans, Welwyn Garden City, Hertford, Brentwood, Billericay, Benfleet, Clacton-on-Sea and Harwich. The total estimated population for this NCA (derived from ONS 2001 census data) is; 4,080,214.

Source: Northern Thames Basin Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

Throughout the NCA brick was increasingly used from late 17th century. In the London Clay lowlands traditional buildings are of timber with brownish red plain tiled roofs. Weatherboarding is usually more typical than colour-washed plaster as the principal walling material. The weatherboards are often painted white, although traditionally they were painted black or tarred. The browns and reds of the tiled roofs form a contrast with the black or white painted weatherboards. The principal building type characteristic of the Essex heathlands are antique timber buildings with weatherboarding and white-washed plaster typically used as wall finishing materials. Brick is generally more common in the north of the Heathlands.

Source: Northern Thames Basin Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

The Hertfordshire plateaux and river valleys were extensively cleared and occupied in the prehistoric period leaving a substantial legacy of funerary monuments and settlement sites, visible as both crop marks and earthworks. Prehistoric and early historic settlement pattern in the London Clay lowlands area is also extraordinarily rich in evidence, in particular of extensive Roman and Saxon settlement. In addition the Essex heathlands offer evidence including territorial earthworks, perhaps most famously relating to the powerful tribes of the Iron Age and the establishment of the Roman capital at Colchester – Britain's earliest urban settlement, and first Roman capital.

Limited survivals of co-axial field systems are present in the woodlands east of Broxbourne and north of Borehamwood and are potentially of Bronze Age origin and therefore highly significant. There is also significant, if limited, survival of co-axial and irregular sinuous enclosures in the vicinity of Waltham Abbey and Loughton.

Profitable farming conditions saw the demise of much medieval parkland in the 17th and 18th centuries, alongside the growth of substantial farming estates.

The Hertfordshire plateaux area is dominated by informal enclosure patterns of 18th century or earlier framed by woody hedgerows. Parliamentary enclosure had little impact on the adjacent Essex woodland hills, and then mostly on the

late surviving common, the remaining examples of which, for example Nazing, are infrequent but highly significant. The Essex wooded hills have a characteristic pattern of substantial farmsteads within regular patterns of enclosure from the late 18th and 19th centuries especially in the more low lying areas.

Extensive areas of ancient woodland with remnant wood pasture occur and are now mainly managed for conservation and recreational values. The survival of ancient woodlands, such as Broxbourne and Wormley Woods, is a feature of the area. Smaller copses and belts of ancient woodland and modern plantation are commonly associated with areas of former medieval and post medieval parkland.

The heathlands were intensively farmed for centuries and subjected to widespread enclosure in the 19th century, which brought about the pattern of new farmsteads and mixed farming still in evidence today.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 58 Registered Parks and Gardens covering 5,159 ha
- 2 Registered Battlefields covering 119 ha
- 181 Scheduled Monuments
- 8,363 Listed Buildings

Source: Natural England (2010)

More information is available at the following address:

- http://www.english-heritage.org.uk/caring/heritage-at-risk/
- http://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/

10. Recreation and access

10.1 Public access

- Five per cent of the NCA, 12,028 ha, is classified as being publically accessible.
- There are 3,084 km of public rights of way at a density of 1.2 km per km2.
- There are no national trails within the NCA

Sources: Natural England (2010)

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

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	96	<1
Common Land	1,289	<1
Country Parks	3,261	1
CROW Access Land (Section 4 and 16)	184	<1
CROW Section 15	3,368	1
Village Greens	184	<1
Doorstep Greens	11	<1
Forestry Commission Walkers Welcome Grants	4,268	2
Local Nature Reserves (LNR)	1,907	1
Millennium Greens	3	<1
Accessible National Nature Reserves (NNR)	241	<1
Agri-environment Scheme Access	86	<1
Woods for People	7,054	3

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) it appears that the least tranquil areas are associated with urban centres such as the north London suburbs of Watford, Chelmsford and Basildon together with Colchester towards the north and the coastal towns of Southend-on-Sea, Clacton-on-Sea and Harwich. Other areas of disturbance are associated with the main transport routes linking these centres including the M25, M11, A1(M), A12 and A127 roads. The most tranquil areas tend to be the lowland areas to the east of the NCA towards the coast. These more rural areas are more sparsely inhabited, such as around the Maldon District and to the south of Colchester around the Abberton Reservoir, and less disturbed. In the west of the NCA the area around Broxbourne Woods to the east of Hatfield provides some tranquillity from the surrounding disturbed areas.

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

Tranquillity	Tranquillity Score
Highest value within NCA	44
Lowest value within NCA	-135
Mean value within NCA	-30

Sources: CPRE (2006)

More information is available at the following address:
http://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 a similar pattern to the tranquillity mapping, with areas of disturbed land associated with urban areas, for example Watford and Chelmsford, and towns, such as Colchester and Harwich, and the main road and rail transport corridors linking these centres. Light pollution resulting from intensive agriculture, growth of settlements and road infrastructure improvements (A1M) is particularly apparent in the flat terrain.

A breakdown of intrusion values for this NCA is detailed in the table overleaf.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	40	56	55	15
Undisturbed	36	20	13	-22
Urban	24	24	32	7

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are that disturbed or intruded land has increased by nearly 15 per cent during the period between 1960 and 2007 which is matched by a reduction of around -22 per cent of undisturbed or un-intruded land over the same timescale.

More information is available at the following address:
http://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 Inventory of Woodland & Trees, Forestry Commission (2003)
- Countryside Quality Counts Draft Historic Profiles, English Heritage (2004)*
- Ancient Woodland Inventory, Natural England (2003)
- BAP 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)Detailed River Network, Environment Agency (2008)

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%. 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

- Woodland cover is extensive across the Hertfordshire plateaux and the Essex wooded hills and ridges. Smaller intimate tree-lined valleys provide a strong contrast through un-wooded areas. About 50 per cent of the woodland cover is on ancient woodland sites. The proportion of these sites covered by a woodland grant scheme has remained around 40 per cent since 1999. There have been a significant number of agreements for coppice management. Evidence suggests woodland character has at least been maintained. New tree planting is concentrated into larger blocks with apparent targeting within the Community Forests that occur in the area.

- Deer impact on woodland flora and succession of tree species is an increasing pressure on woodlands locally.

Boundary features

- The main boundary feature in this area is hedgerows which accounts for most of the existing boundary features found here. The other two features found are ditches and woodlands.

- Between 1999-2003 Countryside Stewardship capital agreements for linear features including hedge management, planting and restoration, amounted to only two per cent of the total resource.

Agriculture

- The area has a varied land use pattern comprising a mix of arable and pasture land. There has been an overall loss of mixed and general cropping and horticulture since 1998, although the rate of grassland loss has slowed and the mix of farm holding types has stabilised.

- There has been a reduction in livestock numbers across the NCA with cattle numbers suffering the steepest decline of 52 per cent between 2000 and 2009. The number of livestock farms reduced during this time by 21 per cent. There was a reduction of grazing intensity between 1990 and 2003, which is below the national average.

Mixed farming at Nyn Manor Farm in Hertfordshire.

- A loss of landscape character of agricultural land during the period between 1998 and 2003 is suggested by CQC data from inappropriate management of set aside land in some areas of the Hertfordshire plateaux and river valleys and a decoupling of historic farmsteads from modern agriculture resulting in a redundancy of traditional barns and other buildings. In London Clay lowlands mineral extraction is also replacing some farmland.

Settlement and development

- London has an expanding population and pressure to meet housing demand and other changes is placing pressure on existing greenspace which varies considerable in quality. There is an overall lack of access to greenspace especially in the case of deprived urban communities.

- Small parts of the Northern Thames Basin NCA fall within The Thames Gateway Growth Area, including the new town of Basildon, the hinterland of Thurrock and most of Southend. Industrialisation has left a legacy of industrial and minerals sites that are now used as geology and wildlife nature reserves or to house development for example in Thurrock. The sub-regional priorities include promoting green infrastructure to improve the quality of the environment and create habitats and attract visitors through the ongoing application of the All London Green Grid more widely. Thames Chase Community Forest provides a substantial new element of green infrastructure in this area.

- Within the Heart of Essex sub-region, as defined within the East of England Implementation Plan, growth is focussed within the character area on the town of Chelmsford due to its good links with London and proximity to Stansted airport. Chelmsford is a strategic Growth Point, but retains issues in relation to flood risk in the town centre. It is an area heavily influenced by its proximity to London, containing the M25 and the London section of the M11, as well as high quality natural environments such as Epping Forest, the Lee Valley Regional Park and Hatfield Forest. The proximity to London already puts strong pressure for housing on the area, and affordable housing is a need. The Lee Valley is identified as a priority area for regeneration.

- The part of the Northern Thames Basin in Colchester Borough lies within the Haven Gateway Growth Point. This sub-region is one of the key international gateways to the UK. Colchester is part of the regional 'cities' east initiative. The rural hinterland includes nationally important landscapes (Dedham Vale AONB) and internationally important ecological designations. The sub-region is subject to major housing and jobs growth putting potential pressure on sensitive landscapes and habitats through increased public access and recreation. Water resources are predicted to become stretched.

- Brownfield sites can be a great source of biodiversity in developed areas, becoming a haven for many invertebrate species some of which may be locally or national important. Demand for housing and development in the area often results in the loss of these sites.

Semi-natural habitat

- Recent reductions in heathland extent and quality in the NCA have been caused by development pressure, a lack of active management (including traditional grazing practices) resulting in succession to woodland, over-management by amenity cutting, and recreational pressure. Major heath restoration and recreation works are currently progressing in Essex under Environmental Stewardship concentrated in Epping, Danbury and Tiptree with the aim of creating 20 ha of habitat and restoring 75 per cent of the existing resource.

- Lack of management of coppice woodlands in Hertfordshire and Essex has resulted in the growth of dense 'high forest'. Less than one per cent of woodland types are classified as coppice. This could be one cause for the lack of shrubs and young trees found in the NCA as less than 0.5 per cent of the woodland include these. This is also exacerbated by the high numbers of deer found in woodlands and rural areas.

Restoration of acid heathland at Layer Breton in Essex.

- Major losses of semi-natural woodland especially in the Essex wooded hills and ridges. In 2010 woodland covered 6 per cent of the total NCA area. This includes ancient semi-natural woodland (2 per cent) and ancient re-planted woodland (1 per cent).Community woodlands make up the largest proportion of woodlands with a total area of 12 per cent. There are two community woodlands – Watling Chase, which is in the south Hertfordshire/ north London area straddling three major roads, the M25, M1 and A1, and Thames Chase, which is found in the south Essex/east London area. Both where established in the early 1990s.

- A decline in orchards, especially apple, has mainly affected Essex. Since 1990 orchards have declined significantly and this trend is continuing. Steps are in place to stop the reduction and future plans are to restore and increase the areas of orchards.

- There is a localised loss of hedgerows due to the creation of larger fields and the loss of elm trees to Dutch elm disease. Through initiatives that use a landscape scale approach, hedgerow planting is being utilised to connect up isolated habitats which may help increase the viability of existing hedgerows and increase the total number.

- A loss of pasture land on the flood plains due to changes in agricultural practices has mainly impacted on the Hertfordshire area.

- The majority of SSSI within the Northern Thames Basin are in favourable condition and only seven per cent are classified as unfavourable declining or unchanged.

Historic features

- This area has a rich historical heritage and has historical evidence of settlement in the Hertfordshire, Essex heathlands and London areas dating back to prehistoric period along with palaeoenvironmental, Palaeolithic and archaeological evidence.

- Although evidence of early settlements in the Essex wooded hills is sparse it is possible this area was managed for timber and fuel.

- This area has nine sites on the English Heritage at risk register and many listed buildings. The main threats to these sites are the continued need for urban expansion and housing or industrial development and the management of agricultural land. This can be counteracted in some ways by the land owners entering into agri-environmental schemes.

Coast and rivers

- In recent years rivers and coastal features have been enhanced in terms of chemical and biological quality and SSSI condition by uptake of agri-environmental agreements for management and restoration of riverine and/or coastal features.

- Research from 2006 on nitrate vulnerable zones found that in the Hertfordshire and London area, nitrates have the biggest impact on surface water, with only a small affect on groundwater. In the Essex area nitrates affects both ground and surface water, with a greater affect on groundwater toward the coast. Phosphorus is another factor that can affect the health of river systems and can enter the water from agricultural land. This is having an increased impact in the Essex part of this character area.

- Other factors affecting the rivers are invasive species, such as floating pennywort. This blocks water courses, preventing movement of animals and affects some recreational activities such as boating and canoeing. Himalayan Balsam grows alongside river banks and creates a monoculture, out-competing other plants and preventing their growth. It also increases sedimentation in rivers as it dies back in winter leaving the banks exposed, so soils are easily washed into the rivers during heavy rainfall or flooding. Efforts are being made to remove these plants and others from river habitats through funding from Defra and as of 2014 some species of invasive plant, including floating pennywort, will be banned from being sold commercially in the UK.

- Recreational activities such as boating can lead to increased rates of sedimentation within watercourses, especially along the River Lea and the Grand Union Canal. Modification of many watercourses can also have a detrimental effect on water overall water quality and the ecology of the area's rivers. There has been extensive morphological alteration of rivers over many years, mainly in the London areas, to create canalised river systems with reinforced banks to prevent flooding and allow dredging to occur. This has resulted in a loss of habitat for species that cannot survive in fast flowing waters (including the young of many fish), the potential for increased erosion of banks that are not enforced, loss of bank/marginal habitats and potential loss of in-channel habitats through dredging. These problems need to be remedied as part of the Water Framework Directive (WFD), in order to obtain a 'Good' status. Funding is currently being invested in creating in-channel habitats for species that do not flourish in fast flowing waters, improvements/removal of bank profiling where suitable and reversal of canalisation where possible.

- Urban diffusion pollution is also affecting parts of this character area and results from runoff from roads, air emissions contributing to acidification, organic waste (mainly from dog fouling), fertilisers and pesticides from gardens, parks and road verges, phosphorus from incorrectly plumbed washing machines and sediment from construction sites. These may result in high metal levels and biodegradable organic matter within the water (resulting in increased oxygen demand reducing the oxygen available for aquatic life).

Urban character of Raynham Street in Hertford.

Drivers of change

Climate change

- The Northern Thames Basin is among the warmest and driest parts of the UK. A number of characteristic specialist species, more typical of continental climates, survive here on the edge of their European range.

- With predictions of increased temperatures, it is projected that species will advance their range northwards therefore the range and types of species found will change over time.

- To facilitate the migration of species, better connectivity between habitats is required to prevent their extinction through loss of appropriate habitats and an inability to move to other areas.

- Agricultural land is also at risk from soil erosion and nutrient loss as the soil becomes more susceptible to wind erosion in the predicted hotter and drier periods and water erosion in the wetter, colder periods. Increasing the size and connectivity of surrounding habitats, such as grasslands, will help support new species and improve biodiversity as well as reduce the affects of soil erosion. Also pollinating insects will benefit from the increase in semi-natural habitats and these in turn will benefit the local agricultural landscape. Predicted longer growing seasons and earlier onsets of spring will present an opportunity for introducing growth of new drought tolerant species.

- There is a possibility that there will be species gains and losses, due to changes in season lengths and weather fluctuations. This could result in new combinations of species and communities.

- Water availability will be a concern, with the potential loss of specific drought intolerant species, as a result of reduced soil water moisture and rising temperatures.

- Woodland habitats (which make up a large proportion of semi-natural habitats in this area) may have increased above ground biomass due to increased carbon dioxide and nitrogen availability. This may have an impact on ground or lower growing flora.

- Wetlands and open water habitats and associated species are likely to have to cope with greater fluctuations in water levels which could be droughts or low rainfall in the summer with flooding or heavy rainfall in the winter. As great crested newts are found in relatively large numbers in this area, it may have an adverse affect on this protected species.

- The characteristic geological and archaeological deposits are susceptible to predicted changes in soil moisture content and the patterns of stability on exposed sections will change, necessitating new management methods.

- Inner London and surrounding areas, which already have a micro climate/ urban heat island (UHI) effect, are likely to experience higher temperature increases than surrounding areas and this could result in species changes, possibly supporting more exotic invasive species such as parakeets that are already living wild in city parks. It is likely that water availability will become an increasing pressure.

- Ideas to reduce the UHI affect include, creating urban forests and parklands to increase vegetation and to use all public green space as potential carbon sequestration. Other adaptations could be to increase the use of garden roofs on high buildings or creating 'green roofs' (where grass or other vegetation is able to grow in the roofs) on housing.

Other key drivers

- Pressure for continued urban expansion and regeneration including industrial development, offers opportunities to improve well-being conditions for local communities such as, improving greenspace quality and provision, but will also put pressure on water availability and habitat fragmentation. Future mitigation needs to ensure these factors are considered when developments occur.

- The Environment Agency, through the Water Framework Directive (WFD), is obligated to engage with stakeholders and communities to help improve the ecological status of the rivers by 2027. In this area most river stretches are classified as 'moderate' but some are classified as 'poor' or even 'bad' ecological status, especially those in the Thames area.

- The affects of agriculture practices on water quality, abstraction and surrounding habitats and wildlife will continue to be a challenge. This can be negated through continued support from agri-environmental schemes, which will enable landowners to continue their involvement in creating a diverse and productive environment.

- Fragmented habitats could be improved by buffering and putting in place measures to create a network of connected habitats to allow species to disperse and become more healthy and resilient to the impacts of climate change. Gapping up of patchy hedgerows is one method that could be used and improvements in urban planting in gardens and public parks could also help support biodiversity for example, planting nectar-rich species.

- There is scope to expand the area of recreation provision by improving public access, while ensuring the needs of sensitive sites are not adversely damaged through for example disturbance or excessive trampling.

- The increased pressure for infrastructure development around London is going to continue to grow and create difficulties in preserving the London green belt. Care must be taken so that important habitats, geological, archaeological features and recreational greenspace is not destroyed in the process and the character of the area adversely affected.

- There is significant opportunity to engage urban and rural communities in educational and volunteering activities for the benefit of the natural environment.

- There are many existing mineral sites in the area and the demand for building material is large so this creates industrial opportunities. However, priority habitats need to be preserved to maintain the geodiverse and biodiverse nature of the area. There are also opportunities to return abandoned mineral sites back to the habitats that were previously found there and expand the biodiversity of the area. These mineral sites also reveal important and interesting geological features allowing greater understanding in the development of the local area and provide an important context and insight into our understanding of the potential impacts of future climate change and global warming. These can be useful research and education sites.

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.

River Ver chalk stream near Drop Lane in Hertfordshire.

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: Manage rivers and river valleys to protect and improve water quality and help to alleviate flooding in the downstream urban areas, while also helping to improve aquifer recharge and provide a sufficient store of water to meet future need, especially with predicted climatic changes. Conserve the riparian landscapes and habitats, for their recreational and educational amenity for their internationally significant ecological value.	↘ *	↗ *	↑ ***	↗ *	↑ *	↑ ***	↑ **	↑ ***	↗ *	↗ *	↗ **	↗ **	N/A	↗ *	↔ **	↗ **	↗ *	↑ **	↑ **
SEO 2: Manage the agricultural landscape and diverse range of soils which allow the Northern Thames Basin to be a major food provider, using methods and crops that retain and improve soil quality, water availability and biodiversity.	↑ ***	↔ **	↑ **	↗ *	↔ ***	↗ **	↗ **	↗ *	↑ ***	↑ **	↗ ***	↗ ***	N/A	↗ *	↗ *	↔ ***	↗ *	↗ ***	↔ ***
SEO 3: Protect and appropriately manage the historic environment for its contribution to local character and sense of identity and as a framework for habitat restoration and sustainable development, ensuring high design standards (particularly in the London Green Belt) which respect the open and built character of the Thames Basin. Enhance and increase access between rural and urban areas through good green infrastructure links to allow local communities recreational, health and wellbeing benefits.	↗ *	↗ **	↔ ***	↗ *	↗ *	↗ **	↔ ***	↔ ***	↔ ***	↔ ***	↗ *	↗ *	N/A	↑ ***	↑ ***	↗ ***	↑ ***	↗ *	↗ *
SEO 4: Manage and expand the significant areas of broadleaf woodland and wood pasture, and increase tree cover within urban areas, for the green infrastructure links and important habitats that they provide, for the sense of tranquillity they bring, their ability to screen urban influences and their role in reducing heat island effect and sequestering and storing carbon.	↔ **	↑ ***	↗ **	↔ ***	↑ ***	↑ **	↗ **	↗ *	↗ *	↗ *	↗ **	↗ **	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 .

Dark plum =National Importance; Mid plum =Regional Importance; Light plum =Local Importance

Landscape attributes

Landscape attribute	Justification for selection
A diverse mixture of large urban areas, smaller urban settlements, as well as remote villages and hamlets surrounded by agricultural lands, grasslands/heathlands and woodlands.	■ The CPRE Intrusion Map (2007) found the area to be 32 per cent urban, 55 per cent disturbed and only 13 per cent classified as undisturbed due to the network of towns, roads and other infrastructure that criss-cross this area. ■ Since the 1960s the area of disturbance and urbanisation has expanded out from London, Colchester and other towns to encase most of the Hertfordshire area and South Essex and has extended to most of the Essex heathlands and wooded hills and ridges. ■ Remoteness is still achievable in parks, woods and fields throughout the area. A recent addition to this is the development and management of the community woodlands, Watling and Thames Chase. ■ Levels of tranquillity are still high in the more rural areas of the Northern Thames Basin.
Underlying Chalk aquifer. London Clay gives rise to heavy acidic soils often prone to flooding in winter and cracking in summer. The river valleys are fringed by well-drained fertile brown soils, produced from alluvial deposits which in Essex creates a more open 'heathy' landscape.	■ The chalk layer that underlies the London Clay in the west of the NCA is a main source of recharge for the principal aquifer supplying London. ■ London Clay has traditionally been used as pastoral lands due to its poor quality soil but with developments in farming such as use of fertilisers and improved ploughing methods and a drive for self-sufficiency after the Second World War caused this area to develop into arable farming in the 1950s. ■ Almost 60 per cent of agricultural land is Grades 1 to 3 with the majority of the grade 1 and 2 land in the 'heathy' areas of Essex. ■ From 2000 to 2009, the dominant agricultural land use was cereal production (43 per cent) and grass and uncropped land (29 per cent) as fits in with the soil types in this area. The areas of cereal grown decreased by 6 per cent and grass and uncropped land decreased by 7 per cent. These have probably been replaced by oilseed, stock feed and other arable crops as these increased during the same period.

Landscape attribute	Justification for selection
A varied pattern of woodlands across the area including considerable ancient semi-natural woodland.	■ Woodlands help to maintain the distinction between urban and rural areas by filtering views and helping to visually contain the extent of individual settlements. ■ Many areas of larger woodland offer key recreational resources. ■ Overall woodland covers 6 per cent of the area (15,488ha.) which understates the influence of woodland within this NCA and its very high recreational value. Reflecting this, the NCA includes the areas of two Community Forests – Watling Chase (Hertfordshire) and Thames Chase (east of Ilford and Romford and south of Brentwood) which now form part of the Green Grid of the Thames Gateway. ■ The pattern of woodlands is varied across the area. The eastern part in Hertfordshire is heavily wooded both on the plateaux and in the river valleys including the Broxbourne Wood complex as are the Bagshot hills and ridges of Essex. ■ Other areas within the London Clay lowlands and Essex heathlands are more open in character although woodland is found in areas of now derelict plotlands, in the remnant shelterbelts around Colchester, on the well-wooded hills around Laindon, Hockley and Rayleigh and in the river valleys of the Essex heathlands. ■ Nearly half of the remaining woodlands are ancient semi-natural (2.4 per cent of the area) and a further 0.7 per cent is made up of planted ancient woodland sites (PAWS) including past lime woods within Hertfordshire. The ancient semi-natural woodland is a distinctive feature of much of the area, dominated by hornbeam coppice with oak standards, as in the Broxbourne woods complex of Hertfordshire. These ancient woodlands are of high nature conservation value and include the Epping Forest SPA (1,700 ha) and the Wormley-Hoddesdon Park Woods (336 ha). Priority habitats include 2,500 ha of wet woodland and 1,900 ha of lowland mixed broadleaf woodland. ■ Woodlands in the area include Epping Forest and Wormley-Hoddesdon Park Wood both of which are Special Areas of Conservation (SAC) and also Broxbourne Wood which is a National Nature Reserve (NNR). ■ They are a haven for wildlife in a heavily urban and agricultural environment, allowing a more diverse species population to continue in this area, for example the BAP priority species, the dormouse, has good populations in the woodlands of the south Essex area and along the Essex hills and ridges.

Landscape attribute	Justification for selection
Significant areas of remnant wood pasture and pollarded veteran trees, including Hainault Forest, Thorndon Country Park, Wormley and Hoddesdon Great Park, and Epping Forest, comprising a distinctive ecological habitat and recreational resource.	■ Wood pasture was once a dominant feature of this NCA providing the interlinking fabric between the wooded and open commons and areas of ancient woodland in the Essex wooded hills and ridges and the Essex heathlands. It was a characteristic of the Royal Hunting forests of the area as still preserved within Epping and Hainault forests within the Essex wooded hills and ridges. This is a particularly important habitat and landscape asset having suffered a dramatic reduction in area over the last century as sites have been lost to development, agricultural intensification and recreational development – especially as golf courses. ■ The ancient pollards provide local oases of species richness for lichens. This is especially where old forest species have survived in undisturbed pockets of woodland (with the surrounding woodland buffering the ancient pollards from the damaging effects of air pollution) and where old exposed trees are set in undrained, unploughed valley parkland. Management by pollarding over the centuries has produced boles of increasing age and decay, which provide the habitats vital to deadwood feeding invertebrates as well as bats.
Field patterns are very varied across the basin reflecting historical patterns.	■ Informal patterns of enclosure from the 18th century or earlier reflect the medieval colonisation of the heaths and woodlands and are common in the Hertfordshire plateaux and river valleys and Essex wooded hills. ■ Within the London Clay lowlands regular Roman planned enclosures are a subtle but important feature to the east of the area. In the Essex heathlands 18th and 19th century enclosures of heathlands and commons followed by extensive 20th century field enlargement is dominant. ■ These features represent the long history of human settlement in the area and it gives an historical character to the area that can be promoted and maintained in future developments. ■ In many areas a scattered appearance of settlements creates open views of the landscape and gives a sense of place. ■ The tradition of enclosures gave rise to the use of hedgerows as boundaries. Although many are now gone due to the change in recent years to larger field farming they can still create important habitats for many species and connect fragmented habitats to provide connectivity throughout the landscape.

Landscape attribute	Justification for selection
A series of river valleys draining south to the Thames and east to the North Sea/Thames Estuary, including the Ver, Colne and Lea in Hertfordshire, and the Roding, Wid and Chelmer, Roach, Crouch and Blackwater in Essex.	■ River valleys are a prominent and distinctive feature; cutting into the clay lowlands they often intimate pastoral character contrasting with the more open arable land surrounding. ■ Many contain remnant flood plain wetlands and new wetlands created both through gravel extraction as in the Lea Valley and through the construction of reservoirs. ■ Much reduced in extent, the NCA still includes some 5,100 ha of wet woodland, 2,500 ha of coastal and flood plain grazing marsh and 300 ha of fen. SPAs associated with wetlands include Abberton Reservoir, the gravel pits and reservoirs of the Lea Valley, and parts of the estuaries of the Crouch and Roach, Blackwater and Essex Colne. ■ Many river systems have been adapted to cope with urban development affecting their ecological status so future work through the Water Framework Directive will have the challenge of improving these sections of river. ■ Recent work to improve the chemical and biological status of the rivers has resulted in their improvement and work is continuing to maintain and improve their status further. ■ This area includes 4 Ramsar sites which provide habitats for over wintering birds as well as various important plant and invertebrate species. Some of the species found in these sites are internationally important and British Red Data Book species.
A rich heritage of geological, archaeological and historical evidence chronicling past landscape and climate change, human settlement and activities within this landscape since the prehistoric period, that have all helped to shape the landscape of today.	■ Characteristics of the landscape today links to historical settlement patterns such as the scattered arrangement of villages and hamlets surrounded by dispersed farming settlements. ■ After the Anglian glaciations the area - particularly the Thames and its tributaries - was occupied at times by early humans, with flint artefacts found at many sites throughout the London Basin. ■ Field boundaries are dominated by informal enclosure patterns of the 18th century surrounded by thorn hedgerows which have become patchy over time due to enlargement of the fields after the Second World War and lack of management. ■ Interspersed throughout the landscape is evidence of Roman occupation including the origins of towns such as Colchester (the largest Roman city in Britain), St. Albans and Welwyn and roads such as the A12 as well as the East Coast mainline railway. ■ During the 16th, 17th and 18th centuries the growth of London's importance had an influence which resulted in the development of market towns and also rural estates and country houses created by London merchants. This particularly impacted on the Hertfordshire area.

Landscape attribute	Justification for selection
A mixture of priority habitats, the most abundant being woodlands (wet and lowland mixed deciduous), and coastal and flood plain grazing marshes.	■ Wet woodlands are the largest priority habitat found in this area with the majority present in south Essex and Hertfordshire. A large area of this woodland type is found in the Waltham Abbey/Loughton area of Essex. ■ The lowland deciduous woodlands are the second largest habitat and are found most abundantly in the Essex heathland area and in Hertfordshire. ■ Coastal and flood plain grazing marshes are the most abundant habitat after woodlands and they are found evenly distributed over the whole area except for London. ■ Habitats found within the London area are small patches of reed beds, lowland meadows and fens. On the very edge of this area are also wet woods and lowland heaths. ■ As the greatest amounts of habitats are made up of those reliant on water, how water is used and preserved in this area could have a huge impact. ■ These habitats are now rare as a consequence of agricultural land drainage, gravel extraction and landfill and river valleys providing the routes of transport infrastructure and power lines (much evident in the Lea Valley).
A significant complex of designed parklands, especially in Hertfordshire, with their mature parkland trees.	■ Within Hertfordshire, the 16th, 17th and 18th centuries saw the growth of rural estates and country houses for London merchants. The landscape parklands surrounding these houses are a particular feature of the area, such as the grounds of Brockett Hall near Welwyn and Hatfield House. These extend the character and habitat of remnant wood pasture.
A number of distinctive landscapes captured in the arts through the centuries.	■ Landscape settings for the arts include Epping Forest and Dedham Vale (on the Stour in the very north-east of this NCA), the setting for Constable's painting the Hay Wain. ■ The Hertfordshire countryside was also the setting to E. M. Forster's book, Howards End.
Important Tertiary and Quaternary deposits, the latter demonstrating the close inter-relationship between geological history and human development.	■ Exposures of Tertiary sedimentary deposits reveal fossil remains at a number of SSSI within the NCA. The fluvial Quaternary sediments deposited by the Thames river system before the Anglian glaciation occur predominantly along the northern edge of the London Basin, while sediments deposited after the Anglian glaciation are found along the flood plains of the current rivers, including the Thames and Lea. ■ The youngest sediments are sands and gravels deposited by the Thames in its current location since the last ice age. These deposits also preserve a record of past landscapes and climates. ■ Archaeological artefacts found in these Quaternary deposits assist in deciphering our human history with evidence of some of the earliest human occupation.

Landscape attribute	Justification for selection
Providing comparatively undeveloped countryside on the very edge of London, accentuated by its well-wooded and prominent hills and ridges, particularly on the Hertfordshire plateaux and the Essex wooded hills.	■ The comparatively undeveloped nature of the countryside is felt by residents to be one of the over-riding characteristics of this disparate landscape. ■ It is both a product of the Metropolitan Green Belt that has restricted the coalescence of settlements over much of the NCA and the medieval origins of parts of the landscape that, in the main, has created a relatively enclosed and intimate 'bosky' landscape with development off the higher plateaux. This characteristic tends to contain the visual influence of development in parts (but not all) of the NCA.The NCA provides easily accessible countryside both to the large and growing population of the NCA and that of north London, serving a population in excess of 4 million.
An area of mixed farming, with arable land predominating on the Hertfordshire plateaux, parts of the London Clay lowlands and the Essex heathlands, and grassland often characteristic of the river valleys, while orchards and horticulture are found on the lighter sandy soils of past heathland.	■ Differences in agriculture reflect the underlying soils with arable, up until the post Second World War years, associated with the lighter soils of the Hertfordshire plateaux and the Essex heathlands. With agricultural improvements and under-drainage, arable production has spread into the London Clay lowlands and some river valleys, although since 2000 there has been a slight increase in the areas under grassland and a slight fall in the areas under arable and horticulture. ■ Orchards and horticulture are found on the lighter sandy soils of past heathland north of Colchester in the Essex heathlands and in parts of the Essex wooded hills and ridges.
A varied field pattern reflecting historical evolution with hedgerows and hedgerow trees once a common feature contributing considerably to the enclosed and wooded character of the Hertfordshire plateaux and river valleys and the Essex wooded hills and ridges, while some strong hedgerow patterns remain in the London Clay lowlands and the Essex heathlands.	■ Roman grid field divisions are still evident on the Dengie Peninsula while medieval and later informal enclosures are characteristic of the Hertfordshire plateaux and river valleys and parts of the Essex wooded hills and ridges, and river valleys elsewhere. ■ Parliamentary enclosures are more characteristic of the Essex heathlands and London Clay lowlands. ■ Across much of the area hedgerows were characteristically thick with a large population of hedgerow elms that have been lost in the last 40 years to Dutch elm disease, significantly opening up the landscape.

Landscape opportunities

- Protect and enhance the character of 'undeveloped' countryside on the edge of London, much assisted by significant areas of woodland cover, which retains a strong sense of tranquillity and aids the retention of a clear distinction and separation between different settlements.

- Protect the overall agricultural diversity of the wider countryside with areas of arable, intensive horticulture and pasture, encouraging sustainable management to protect agricultural soils and enhance farmland biodiversity.

- Protect the underlying dispersed medieval settlement pattern characteristic of much of the NCA with attractive hamlets and villages with their distinctive vernacular, (including timber-framed houses often with timber weatherboard and small parish churches with timber spires and shingle cladding) important historic towns (including Colchester and St Albans - Verulamium) of Roman origin, and the more recent garden city of Welwyn and the plotlands of the 1920s and 1930s.

- Protect and appropriately manage the rich archaeology of the area including buried archaeology, iron-age hill forts and the sites of abandoned prehistoric settlements (especially found on the Hertfordshire plateaux and Essex heathlands), and the rich heritage of designed parklands associated with estates of Hertfordshire and Essex, while also conserving landscapes linked to the arts – most notably Dedham Vale, the inspiration for the painter, Constable.

- Protect and appropriately manage important exposures of the Tertiary and Quaternary sedimentary deposits with the latter demonstrating the close inter-relationship between geological history and human development.

- Manage and significantly reinforce the distinctive and varied hedgerow pattern with medieval enclosures contributing to the enclosed and wooded character of the Hertfordshire plateaux and river valleys, the Essex wooded hills and ridges and river valleys elsewhere. Replace lost hedgerows to reinforce field pattern in the Essex heathlands and London Clay lowlands. Significantly increase the population of hedgerow trees that were once a common feature across the NCA before the onset of Dutch elm disease.

- Manage and significantly expand areas of remnant wood pasture that was once a dominant feature of this NCA, providing the interlinking fabric between the wooded and open commons and areas of ancient woodland and royal hunting forests in the Essex wooded hills and ridges and the Essex heathlands. Re-link remaining fragments of wood pasture where possible and create new areas where this can contribute to enhancing recreational opportunities and biodiversity and can provide appropriate restoration of past mineral workings.

- Manage, restore and re-link areas of remnant lowland heathland found on areas capped by glacial sands and gravels, notably within the Essex heathlands and Essex wooded hills and ridges sub-areas, through localised restoration of agricultural land, conversion of conifer plantations and the sympathetic management of recreation facilities, especially golf courses.

- Manage, restore and significantly expand the wetlands of the river valleys of the NCA including wet grassland, valley woodlands, flood plain woodlands, non-coastal grazing marsh, fens, rush pasture, swamp and valley mires which, with their high water tables are important sites for over-wintering wildfowl, adding significantly to biodiversity and landscape character. Restore river valley minerals sites to wetlands and washlands and seek

opportunities to restore the natural geomorphology of rivers where this will significantly enhance their biodiversity and landscape contribution, including the conservation and planting of a new generation of riverside willows.

- Manage water quality impacts to the principal chalk aquifer by implementing land management practices to reduce sources of pollution, and to improve recharge.

- Plan for a significant expansion in the woodland cover of this NCA, conserving and re-linking areas of ancient woodland, bringing enhanced landscape structure to the open landscapes of the NCA, and providing new woodland as a recreational resource close to settlements. This will provide a means of creating a clear division between expanding settlements, building on proposals for the Green Grid and of the Community Forests of the area, and through the restoration of mineral workings, potentially providing a mosaic with wetland habitats.

Ecosystem service analysis

The following section shows the analysis used to determine key Ecosystem Service opportunities within the area. These opportunities have been combined with the analysis of landscape opportunities to create Statements of Environmental Opportunity.

Please note that the following analysis is based upon available data and current understanding of ecosystem services. It does not represent a comprehensive local assessment. Quality and quantity of data for each service is variable locally and many of the services listed are not yet fully researched or understood. Therefore analysis and opportunities may change upon publication of further evidence and better understanding of the inter-relationship between services at a local level.

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Fertile soils Climate	53 per cent of land use in this area is arable, mainly wheat and oilseed rape, but in addition to this there are sizable flocks of sheep grazed on the land with an estimated 18,800 breeding ewes in 2007. The most fertile soils are found in the river valleys of Hertfordshire and Essex heathlands with the majority of Grade 1 and 2 agricultural land found in the latter. In the London Clay areas improvements in knowledge and technology over time has allowed this poorer quality soil to be used for arable but it is also used as pasture land too which is its traditional use.	Regional	Arable farming is a major industry within the area and provides a significant food resource. Farming can have an impact on the surrounding environment especially in terms of water availability. Demands for water in the area are high due to the size of the local population so extraction of water for irrigating crops can create an added pressure on this limited resource. Crop type and the cultivation techniques may need to be modified in coming years to increase drought resilience and reduce diffuse pollution. The sandy soils of the Essex heathlands and the Essex hills are susceptible to erosion on slopes and in dry summers to wind erosion. Climate change predictions indicate that summers will become longer and drier and this will create many challenges of farming. Careful crop selection and cultivation may be required in response to reduced water availability and as a means of reducing soil erosion as conditions become hotter and drier.	Manage the landscape to retain the value of food provision, employing sustainable farming practices to increase the value of other ecosystem services including biodiversity, water availability, and soil and water quality. The uptake of agri-environment schemes will help to achieve this.	**Food provision** **Regulating soil quality** **Water availability** **Regulating water quality** **Regulating soil erosion** **Sense of place / inspiration** **Sense of history** **Biodiversity** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Conifer plantations planted on previous lime woods in Hertfordshire Semi –natural woodlands (ancient, wet and deciduous woodlands) Recreational woodlands	Coniferous plantations (0.7 per cent of the area) and woodland cover as a whole makes up only 6 per cent of land use. Many of these woodlands have evidence of previous management through coppicing and pollarding going back several hundred years where the wood was used for fuel and building materials. Management today is patchy or non-existent reflecting the declining trend of woodland management since the Second World War but the opportunity remains to reinstate this management. Within the area there are two community forests; Watling and Thames Chase, which are currently managed as recreational areas for the heavily urbanised areas around London. They represent large areas of potential timber resource.	Local	Although woodlands only make up a small proportion of the area they are one of the largest BAP priority areas and are important for wildlife and biodiversity. Commercial timber provision is relatively small scale but the woodland area provides an important role for carbon sequestration and as a recreational resource. They also provide a sense of tranquillity and preserve the landscape character. Timber production gives the opportunity to expand habitats and the biodiversity associated with woodlands. Coppicing in selected areas of the woodland has potential to increase the overall biodiversity of the habitat, improving conditions for many species of invertebrates, birds and mammals. Expansion of the forest area would not only increase timber availability but also help to increase climate change regulation, as woodlands offer one of the most effective means of carbon sequestration within this landscape. If woodlands are to be expanded then it is important that other key habitats are not damaged in the process, for example planting on existing heathlands, species rich grasslands and wetlands. It is important to consider the land which is most important in terms of food provision when considering woodland expansion along with historical and geological features.	Seek opportunities to increase woodland management and return existing woodland to active management where this will benefit timber provision, the landscape and biodiversity. Recreational woodlands should be managed and extended to include timber provision. Other opportunities that would support the creation or expansion of woodlands should also be secured in appropriate locations.	**Timber provision** **Biodiversity** **Recreation** **Biomass energy** **Climate regulation** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	London Basin Chalk aquifer Extensive network of rivers Expansion of Abberton Reservoir	The west of the NCA is underlain by an extensive chalk outcrop of the principal London Basin Chalk aquifer, which provides the main source of water for London. Recharge of the aquifer largely occurs from the chalk outcrop as water flows underground to London from the Chilterns[4]. The aquifer is extensively abstracted for public water supply, both within the NCA and Inner London. Currently there is no groundwater available for extraction in the western section of the NCA but water is available around the River Lee and M11 areas[5]. In the east the groundwater is over abstracted so the central area is the only place that has surplus water available. There is an attempt to address this by the use of reservoirs and attempts to expand them where possible as has recently been done in Abberton, Essex. With recent trends of drought weather in summer there has been increasing pressure on water systems in the area with rivers and groundwater being over abstracted which causes major problems to natural habitats and the species that they support. **Continued over...**	Regional	Meeting the large demand for potable and irrigation water in this area is a big challenge and one that needs to be addressed to meet the needs of an expanding population and the impacts of climate change. The west of the NCA also provides the main source of water for Inner London through recharge to the principal aquifer, and as such land management practices within this area will have major impacts on the availability of water in the confined chalk under London. Urban areas are continuing to expand and new housing estates are created within the more rural areas increasing the local demand for water supply. Many of these houses will have gardens further increasing demand for water especially in the hotter months when demand is already high. Current management of arable land often involves using drains to remove excess water from fields into nearby water systems to prevent water logging. This enables nitrates and pesticides to enter the water system and also removes water that maybe needed when conditions become drier. **Continued over...**	Work with land managers to improve land management practices, such as increasing soil organic matter and reducing soil compaction, to improve infiltration and aid aquifer recharge. Ensure the sustainable management of the principal chalk aquifer through catchment-wide integrated water management policies. Secure measures to reduce water wastage in the home and commercial enterprises by using rainwater recycling measures and promotion of drought resistant planting schemes including in domestic gardens. Work with land managers to put in place storage measures to help meet their water demands in drier periods. Similar measures should be encouraged on recreational sites such as golf courses. Measures to reduce wind evaporation on fields particularly in drier periods, such as the through planting of hedgerows, should be encouraged. **Continued over...**	**Water availability** **Regulating water quality** **Regulating soil erosion** **Biodiversity** **Geodiversity**

[4] *Management of the London Basin Chalk Aquifer – Status Report*, Environment Agency (2012) https://publications.environment-agency.gov.uk/skeleton/publications/ViewPublication.aspx?id=e068d7b0-7eb2-4461-b5d7-07dc3be75c28

[5] *London Abstraction Licensing Strategy*, Environment Agency (Feb 2013) http://www.environment-agency.gov.uk/business/topics/water/132669.aspx

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability continued		**...continued from previous** Due to large demand for water for this area, in extremely dry summers water has needed to be obtained from outside of the area to meet these demands. This is supplied by the rivers in the Norfolk area which feed into the Ouse Groundwater system and transfer water to the Abberton Reservoir. Therefore the requirement for water within this area also has an impact on other NCAs including the Brecklands. Predictions of the impact of climate change on water availability expect that there will be shorter winters with increased precipitation and longer summers with reduced precipitation, therefore future planning will need to consider how water availability will be affected.		**...continued from previous** During drier conditions, this area cannot meet the high demand for water from its own supplies and relies on supplies being met from groundwater aquifers in Norfolk. Predicted future weather patterns indicate that summers will be longer, dry and hotter suggesting demands for water during these months will increase. Relying on water supplies from surrounding areas will not be sustainable in the long term as the pressures on these areas for water are also likely to increase. The area needs to become more sustainable in regards to its water use but this becomes increasing difficult with continuous demands for new housing. As demand increases reservoir capacities will be insufficient requiring increased capacity. Abberton Reservoir in Essex has recently been expanded to meet growing demands and work has been accomplished without impacting significantly on the wildfowl that use this important Ramsar site.	**...continued from previous** Promote the planting of drought tolerant crops. Encourage land managers to allow natural flooding to help restore wetlands helping to store water in wetter periods; increasing water availability during drier months while limiting over abstraction.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	Orchards with heritage species of fruit trees including rare species Local breeds of pig, cattle, sheep, goat, horse and pony	Traditional orchards are still in existence but in a poor state and are declining. The decline in Essex has been significant. There are many local varieties still grown including a very old variety dating back to 1785 (the D'Arcy Spice apple). There are rare breeds of cattle, pig, sheep, goat, horse and pony that are still likely to be found in small numbers.	Local	Many orchards have been neglected or destroyed, but efforts are underway to protect these habitats and prevent further losses. The preservation 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 varieties of apples are still sold in the area but on a small scale such as in farm shops or markets.	Return existing orchards into active management. Establish new orchards using traditional varieties of fruit trees and encourage local markets for the produce.	**Genetic diversity** **Food provision** **Biodiversity** **Sense of history** **Sense of place / inspiration** **Pollination**
Biomass energy	Woodland management (coppicing / felling) Growth of miscanthus Short rotation coppice (SRC) using willow and poplar	Woodlands only make up 6 per cent of the area with an additional 12 per cent of community woodland. Management of the woodlands in the area is low and has rapidly decreased since the end of the Second World War. In 2013 there was only one area in Hertfordshire growing energy crops.	Local	In terms of woodlands being used as a biomass resource the current area is relatively small and under-managed but there is potential to increase capacity provided management enhances the health of the woodland habitat. The majority of this area has been highlighted as having a high yield potential for both miscanthus and SRC but a balance has to be struck between the need for this crop and the need for food production. It is also important that existing habitats are not destroyed to meet the demand for energy.	Secure the management of existing woodlands and establish the opportunity for woodland creation in appropriate locations for biomass production. Evaluate the potential to grow miscanthus and the short rotation coppice as sustainable source of biomass where appropriate.	**Biomass energy** **Biodiversity** **Regulating soil erosion** **Pollination** **Regulating water quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Field boundaries – hedgerows Woodland Heathlands (small contribution) Soils (limited contribution) Unimproved grasslands	Over 50 per cent of this area is arable land which is not the optimal form of land management for carbon sequestration (storage) as soil disturbance often results in the release of carbon stored in the substrate. The presence of hedgerows and woodlands in the area helps as these habitats are good carbon stores. Heathland and grassland habitats also help with carbon sequestration and storage.	Regional	Woodland habitat can perform an important role in carbon sequestration but the woodland habitats in this area are currently small in extent so their impacts in reducing carbon levels are limited. Hedgerows are also a feature of the landscape but over time many have been removed to make way for larger fields as farming practices have changed. The most extensive land use in the area is agriculture. It is important that the arable cultivation techniques employed do not deplete soil carbon levels further. Careful cropping techniques, the use of cover crops and measures to actively increase the organic content of soils could enable increased carbon sequestration within some areas of the NCA. The relatively high levels of organic matter in the soils within wetland habitats also helps with carbon storage but again these habitats only make up a very small part of the overall landscape.	Support woodland and tree planting and enhance the hedgerow network to enhance landscape character and improve carbon sequestration by for instance expanding woodland edges into improved grassland and reinstating hedgerow field boundaries. Promote the planting of trees and hedgerows within new developments. Encourage measures to reduce tillage and increase the planting of cover crops and the organic matter within the soil. Secure opportunities to improve heath land and grassland management by reducing cutting and over grazing.	**Climate regulation** **Food provision** **Regulating soil quality** **Regulating soil erosion** **Biodiversity** **Biomass energy** **Water availability** **Sense of place / inspiration** **Sense of history** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Rivers Wetlands Woodland Hedgerows	Groundwater status is poor in much of the NCA, although it has been classed as good in large parts of the underlying Chalk beds that provides the main source of recharge for the principal chalk aquifer[6]. The current ecological status of the rivers shows that the majority of rivers are of moderate status and only part of the River Lee was found to have good ecological status. Several rivers were found to be poor including the rivers Chelmer, Hanningfield and parts of the River Rib, the Stort and Lee. The River Ver and the Cobbins Brook were found to be in bad ecological status. The majority of the failures are associated with either poor morphology and/or pollution.	Regional	High population densities within the NCA put pressure on water quality through discharges from sewage treatment works and diffuse pollution. Growth and regeneration of urban areas will be increasing demands on the water resource but also present an opportunity to make improvements to the water environment. Diffuse pollution from agricultural areas is also a major pressure on the water environment in the NCA. Aquifers supply 40 per cent of the drinking water and supply flow for rivers and wetlands within the area. Safeguarding supplies and the environment by protecting groundwater from pollution is essential. The majority of rivers are classified as having moderate ecological status or lower mainly due to high levels of phosphates effecting the biological systems within the river. High levels of phosphates can have detrimental impacts on the ecology of rivers and other water bodies by reducing the amount of available oxygen within the water which in turn can reduce the diversity of aquatic plants, invertebrates and fish. **Continued over...**	Implement catchment-wide water management plans to ensure a coordinated approach to reducing the impacts of pollution. Ensure local development plans include the sustainable management of water resources and promote measures to reduce adverse impacts on water quality in the future, including the use of sustainable drainage systems (SuDS), sewage treatment options and reducing nutrients from diffuse pollution. Reinstate natural water filters such as reed beds, tree lines, hedgerows and grass verges to help filter surface water run-off from roads, gardens arable fields and other areas before surface run-off enters watercourses. Improve the morphological features of the rivers, including urban rivers to help reinstate natural biological processes to help maintain and improve surface water quality. **Continued over...**	**Regulating water quality** **Biodiversity** **Food provision** **Regulating soil quality** **Geodiversity**

[6] *Thames River Basin District Management Plan*, Environment Agency (Dec 2009). Accessed March 2013 at http://www.environment-agency.gov.uk/research/planning/125035.aspx

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality continued				**...continued from previous** There are chemical failures in local rivers which are likely to be related to run-off from roads in the urban areas. The loss of morphology within many urban rivers has reduced natural processes that would otherwise help to maintain and improve water quality. The loss of morphology and increased pollution impacts on the numbers of fish and invertebrates. Efforts are being made to reduce the levels of agricultural fertilisers, pesticides and herbicides and the introduction of new technology, such as precision farming, will further help to reduce levels of chemicals entering the water system. Semi-natural habitats play an important role in filtering surface water run-off before it enters watercourses. Reed beds and wetlands are good examples but tree lines, woodlands, hedgerows and grass verges will also play a part in reducing the levels of chemicals that can enter water systems. Many of these habitats are only found in small fragments across the area and are absent from many locations where they would have the most value.	**...continued from previous** Work with land managers to continue to use new technologies and techniques in farming that reduce the levels of fertilisers, herbicides and pesticides used on land which will not only reduce the levels of contaminated run-off entering water systems, including the principal aquifer, but also improve the productivity of farming.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow (flooding)	Flood plains Wetlands Woodlands Grasslands Rivers Reservoirs	Much of the Essex area of the NCA is at low risk from flooding, however there are some parts that are at higher risk. The rivers Colne, Chelmer and Crouch present the greatest flood risk in the area and will mainly affect Colchester, Maldon, Basildon and Wickford. There is also the possibility that the two large reservoirs in the area (Abberton Reservoir and Hanningfield Reservoir) could have future flood risk potential and could affect surrounding areas. In the London and Hertfordshire areas of the NCA the main risk of flooding arises from the River Lee. The levels of development on the flood plain are very high in the North London area, which will increase the risk of flooding of properties in the area. This risk reduces in the Hertfordshire area but some risk still exists. The urban areas in the NCA face increased surface water flooding risk. The areas most likely affected are London and its suburbs, Southend and Thurrock. There is also potential for coastal flooding in some areas as sea levels rise; the places most likely to be affected are Harwich, Rayleigh and Southend.	Regional	The rivers in the area that are most likely to present flood risk are the rivers Lee, Colne, Chelmer and Crouch. Areas close to these rivers have an increased risk of flood damage to land and property and this problem is increased in urban areas especially when the flood plain has been heavily developed. London areas are most effected by flood plain development and it has been accepted that previous measures to reduce risk of flooding (straightening of rivers) is no longer suitable and cannot mitigate the effects of climate change. Upper reaches of the Lee in Hertfordshire also have an increased risk of flooding as the flood plains here are wide and flat so properties nearby face increased flood risk. There are many reservoirs in the area and these may help to alleviate some pressure by storing water during high rainfall events. There is only a small area of the NCA which is near the coast. Parts of Harwich, Rayleigh and Southend are near enough to put them in potential danger of increased flooding if sea levels continue to rise.	Opportunities to reinstate areas of active flood plain through development designed to adapt to and deal with current and future flood risk, should be secured when developments occur in or close to flood plain areas. Secure opportunities to expand or create areas of semi-natural habitats such as woodlands (particularly wet woodlands), flood plain grazing marshes, reed beds and grasslands to increase soil infiltration helping to alleviate flood risk. Consider the use of existing and newly created semi natural habitat to act as buffer zones to protect existing development and important arable land from flooding. Flood storage schemes may need to be put in place where flood defences will be difficult to implement and opportunities to incorporate constructed storage (reservoirs) with natural storage (semi-natural habitats) should be explored and secured.	**Regulating water flow** **Water availability** **Regulating water quality** **Pollination** **Pest regulation** **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
Regulating soil quality	Agricultural land Semi-natural habitats	There are 7 main soilscape types and these are; slowly permeable seasonally wet, slightly acidic but base rich loamy and clayey soils (48 per cent of NCA); slightly acidic loamy and clayey soils with impeded drainage (19 per cent); freely draining slightly acidic loamy soils (14 per cent); loamy soils with naturally high groundwater (7 per cent); slowly permeable seasonally wet acid loamy and clayey soils (4 per cent); lime rich loamy and clayey soils with impeded drainage (2 per cent); and loamy and clayey flood plain soils with naturally high groundwater (2 per cent). The most common soil type that makes up 48 per cent of soils in the area could suffer from compaction and capping as it is more prone to damage when wet. The second most common soil type that makes up 19 per cent of soil is at risk from poaching from livestock and compaction from heavy machinery and top soil of weak structure can easily be damaged so activities should be carefully timed to prevent compaction within the soil. The soil type that makes up 14 per cent of the NCA has the potential to increase its organic matter content with the correct management.	Local	The main soils in this area are affected by compaction in wet conditions that can result in poor water infiltration into the soil and increased overland run-off, which is likely to increase diffuse pollution into associated water courses. The acid loamy and clayey soils (19 per cent) are easily poached by animals and compacted by machinery so careful management of these soils is required to prevent damage. Slightly acidic loamy soils (14 per cent) are an important resource as there is potential to increase organic matter levels which can help with the recharge of the underlying chalk aquifer helping to improve water availability in this NCA and beyond. Reduced organic matter is the main risk to all soil types. Increasing organic matter in soils will afford an increased ability to store nutrients and water and will increase storage of carbon. Reducing the effects of compaction of soil will help to solve many problems faced by land management at present and in the future. Careful management of soils is needed to prevent compaction, which not only damages the structure of the soil, but also prevents water infiltrating the soil, resulting in increased rates of overland run-off entering water courses. Management practices could be adapted to help improve soil quality, which could help to increase agricultural yields in the long term.	There are opportunities to change practices and manage the soil in a way that increases organic matter. Seek to reduce compaction of soil, by using agricultural equipment with a low ground pressure during periods of wet weather and managing livestock to reduce the risk of poaching. Consider establishing continuous vegetation cover where high risk crops are currently cultivated in high risk locations where these are associated with high rates of diffuse pollution.	**Regulating soil quality** **Food provision** **Regulating soil erosion** **Regulating water quality** **Water availability** **Climate regulation** **Geodiversity** **Biodiversity** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Semi-natural habitats Hedgerows and trees Woodlands	Most soils in this area are at low risk of erosion but some soil types (21 per cent) are affected by compaction in wet conditions that can damage the soils structure, reducing the amount of water that can be absorbed by the soil. This can lead to increased overland run-off that can lead to erosion of the soils surface. The soils found in the Essex heathlands and Essex hills and ridges are at risk or erosion on sloping land, especially when left exposed, and this risk increases in soils with low organic matter.	Local	In general, the soils in the area are at low risk of erosion. Where they are at risk is where the soil is of the best quality and of value for food production. Exposed soils are at risk of water and wind erosion and reduced organic matter content. Poaching can be an issue in some areas resulting in direct erosion and compaction which damages the soils structure and subsequent erosion. Heavy machinery could also be an issue in this instance requiring effective management to reduce damage. Wind erosion may have an effect in some instances where the soil is comprised of fine material and unsheltered by trees and hedgerows.	Water erosion can be reduced by increasing organic matter in the soil and ensuring that bare soils are kept to a minimum. Areas affected by wind erosion will benefit from the introduction of hedgerows and tree lines to act as wind breaks. This can also help with water erosion by reducing the effects of overland run-off. Careful management decisions should be made, especially during wet conditions, to reduce the effects of compaction from livestock and heavy machinery.	**Regulating soil erosion** **Food provision** **Regulating soil quality** **Regulating water quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Semi-natural habitats especially hedgerows and grasslands/field margins Orchards	At present this area has the required habitats to aid pollinators but the areas are very small and fragmented so this limits the numbers of pollinators that can be supported. Pollination is needed for oilseed rape and this is one of the main crop types grown in the area so pollination is a big part of the NCA as more than 50 per cent of the area is agricultural land and a large percentage of this is arable.	Local	The semi-natural habitats required for pollinators are small and fragmented throughout the landscape but pollinators could help to improve the yield of some crops grown here. It is likely that land managers have compensated for this by importing bumblebees commercially; however, stricter regulation on the introduction of species from outside the UK is likely to make this practice more difficult in the future. Practices that encourage pollinators have been adopted by many and with the help of agri-environmental schemes many landowners have been able to put aside land and manage it in a way that benefits wildlife in general. If the level of pollinators is to increase these steps need to go further by encouraging more landowners to set less valuable land aside to be given over to field margins and hedgerow planting and connecting habitats to expand the species range. This could possibly help to reduce the cost of food production by reducing or eliminating the need to import pollinators and could also help to expand the success of orchards. The extent of semi-natural habitat within the urban areas of the NCA is likely to have a limiting effect on the range and number of pollinating insectsalthough domestic gardens will support larger numbers.	Improvements could be made to semi-natural habitats by expanding their range where possible and connecting habitats by creating corridors that allow pollinators to expand their numbers and range. To engage more with landowners and give help and advice on the agri-environmental schemes available which can help to compensate for land lost to the creation of field margins and hedgerows. Help inform the wider community of the benefits that pollinators can offer in terms of food provision. Promote the importance of creating better habitats in urban areas by encouraging local authorities to adapt how they manage public land such as roadside verges, parks and other green areas, too allow areas to develop into grassland and wildflower areas, increasing the wildlife value of parklands while benefiting many pollinating invertebrates.	**Pollination** **Food provision** **Biodiversity** **Pest regulation** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pest regulation	Semi-natural habitats	As with pollinators this area has the required habitats to support the necessary invertebrate species but the habitats are small and fragmented limiting the density of the species that can live in the NCA as a whole.	Local	There are a variety of predatory invertebrate species that are found throughout the area which could help to limit the need for chemical control measures if found in greater numbers. As with the pollinators there are opportunities for landowners to adopt more sensitive management of land to encourage predatory invertebrates to expand their range and increase their populations. Measures could include putting aside less productive land to become grasslands/wildflower meadows and creating more field margins and hedgerows as boundary features. Many landowners already do this throughout the area but there is potential to expand this practice. The urban environment could also play its part in the creation of suitable habitats such as changing management regimes of roadside verges, parks and other green areas to provide for the needs of invertebrates and other wildlife, allowing them to use the urban environment to disperse throughout the landscape.	Secure opportunities to expand or create suitable semi-natural habitats and effectively manage to ensure they remain viable to support the species required, such as maintaining effective grasslands using suitable levels of grazing. Engage with local landowners and promote the benefits of agri-environmental schemes. Encourage local authorities in urban areas to adapt the management plans for public green areas, such as parks and grass verges, to be less intensive so suitable habitats for predator species can be available in these areas so their range and numbers can increase.	**Pest regulation** **Food provision** **Biodiversity** **Pollination** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place / inspiration	Mixtures of urban area surrounded by an open undeveloped landscape Ancient woodland throughout the Hertfordshire plateaux and Essex wooded hills and ridges Grasslands, heathlands and fens Inspirational landscape of natural beauty, such as Dedham Vale	This area has a diverse appeal as it has a strong mixture of urban and rural. North and North West London forms part of this NCA which is much urbanised and heavily populated. Further north from London into Hertfordshire and Essex, the area becomes increasingly rural with development much more dispersed and patchy intersected by agricultural land, woodlands and hedgerows. The area has some large woodlands and important ancient woodland, with woodland a key feature of ridgelines and hills in parts, giving a strongly wooded character.	Regional	The mix or urban and rural is a key part of the character of this area and is a balance which needs to be managed as pressure for increased settlement and infrastructure development is high. Appropriately managing the woodland for its contribution to the landscape, but also for the habitats it provides and the recreation resource it offers the large surrounding population is important in this area. Woodland can be used to screen urban edges and offer green infrastructure links to the surrounding countryside. Ensuring the quality of the large areas of ancient woodland is maintained while accommodating recreation use will help protect this resource for the future. This landscape is highly valued by the surrounding urban populations for the opportunity to escape the hustle and bustle of London. Residents enjoy the ability to escape to the countryside or the coast, while not having to travel far from home. The diversity and quality of the rural landscape in close proximity to London, is strongly desired and needs to be retained if the area is to keep its character.	Maintain and enhance the balance of the urban and rural landscapes ensuring the character of the area's settlements is maintained in the rural areas and urban encroachment kept to a minimum. Conserve and enhance the rural urban fringe through the spatial planning process and through good design in new development. Protect and enhance the wooded character of the area, creating new woodland as appropriate on the urban fringes to screen settlement edges and provide habitat and green infrastructure benefits. Provide good recreational infrastructure while also protecting and managing habitats in the areas of ancient woodland to ensure the local community can enjoy the areas without detriment to the important wildlife.	**Sense of place / inspiration** **Recreation** **Tranquillity** **Sense of history** **Biodiversity** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Long settlement history including many Roman connections Traditional orchards and ancient woodland Archaeology	This area has a rich heritage and has historical evidence of settlement in the Hertfordshire, Essex heathlands and London areas dating back to the prehistoric along with palaeoenvironmental, Palaeolithic and archaeological evidence. There is a long settlement history in this NCA, being close to the City of London towns such as St Albans and Welwyn in Hertfordshire can trace their origins to the Roman occupation of the area and the NCA includes Colchester, the Roman capital city of Britain. The area has a strong natural history, evident within the remnants of traditional orchards and local fruit varieties and the ancient woodlands, such as Broxbourne Wood and Epping Forest, with their beautiful displays of bluebells and other wildflowers.	National	The presence of the City of London in close proximity to the NCA has helped shape the area as it is today. From the development of parklands and large country houses in Hertfordshire, that were developed by rich London merchants , to the criss-cross of roads, rail and waterways that have been created to connect London to surrounding areas and the country as a whole. The strong Roman history of the area is evidenced by the presence of Colchester and its castle which started out as a Roman temple and was rebuilt as the Norman castle seen today. The historical settlement pattern of the area remains in some places, which consist of dispersed hamlets and villages surrounded by farmland and farmsteads. Traditional 18th century hedgerow boundary markers still exist but have diminished extensively since the Second World War. There are more recent Second World War landmarks such as the many pillboxes scattered around the areas near the coast. Historical features are important visitor attractions and could help improve the local economy. Care should be taken that the attractions that bring people to the area are not destroyed in expansion projects to accommodate the influx of new residents and visitors.	Protect and promote the strong Roman history in the area, offering education and interpretation to highlight the importance of the area in Roman Britain. Promote the recreation and tourism potential available in the area which allows the local community and visitors to interact with centuries of local history. Use this resource to improve the local economy without damaging the character of the area. Manage the orchards and ancient woodland in good condition to ensure this resource, which has provided many generations with food and fuel, is maintained into the future.	**Sense of history** **Sense of place / inspiration** **Biodiversity** **Tranquillity** **Recreation** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Semi-natural habitats Well-wooded areas Dispersed settlement patterns Agricultural landscape	According to the CPRE intrusion map (2007) this area is 32 per cent urban and 55 per cent disturbed leaving only 13 per cent of the area undisturbed. Owing to this, areas around large settlements have low levels of tranquillity but surrounding areas where agricultural land, woodlands and other semi-natural habitats dominate the tranquillity levels increase.	Local	Inward migration to the area has increased housing, infrastructure and in urban sprawl supported by improved transport links to London. This in turn has reduced the tranquillity of the area over time. Remote areas remain and the presence of woodland, especially the wooded hills and areas of ancient woodland, along with wider areas of agricultural use, has retained some degree of tranquillity.	Ensure the dispersed settlement character in some parts of the NCA is retained through careful design and location of new development. Promote the creation of woodland, hedgerows and other semi-natural habitats to help integrate future developments and infrastructure into the surrounding landscape.	**Tranquillity** **Biodiversity** **Sense of place / inspiration** **Sense of history**
Recreation	Country parks Historical sites Nature reserves Open access areas Strategic green infrastructure and walk networks Public parks Woodlands – Woods for People	This area has 3,084 km of public rights of way (at a density of 1.2 km per km^2) but only 5 per cent of the NCA is classified as publically accessible. The largest areas of publicly accessible land are Woods for People (3 per cent of the NCA), land within the Forestry Commission Walkers Welcome Grants (2 per cent), Countryside Right of Way Act Section 15 land (1 per cent-3,368 ha), country parks (1 per cent-3,261 ha) and Local Nature Reserves (1 per cent-1,907 ha). The designated sites allow people access to rare wildlife such as bats, water voles, otters, bluebells and various orchids as well other wildlife such as badgers, foxes and various types of birds, butterflies and invertebrate to enhance the visitor experience of wildlife and the natural environment. The reservoirs, canals and rivers are well-used for recreation and provide good green infrastructure links from urban to rural areas.	Regional	With such a large adjacent urban population, the access and recreation assets of this NCA are highly valued and highly used. There is a need to manage the resources so they do not become degraded, at the same time as promoting the opportunities to ensure they bring maximum benefit to a large number of people. The presence of many nature reserves and country parks offers the chance for urban populations to easily access open green space, bringing health and recreation benefits. Footpaths and trails are limited and dispersed but are found throughout the area. The All London Green Grid initiative contains a series of frameworks designed to deliver and improve strategic and local green infrastructure.	Improve access to the rural environment through new green infrastructure links, ensuring this is considered in the planning process and in any large scale conservation projects. Implement measure that engage adults and children in the design and use of local greenspace improve understanding of the natural environment and provide volunteering opportunities to increase experience with the natural world. Maximise opportunities through development and regeneration to help implement the All London Green Grid Frameworks.	**Recreation** **Biodiversity** **Geodiversity** **Tranquillity** **Sense of place / inspiration** **Pollination** **Pest regulation** **Climate regulation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Semi-natural habitats / BAP priority habitats Orchards Hedgerows Agricultural land	There are 14,593 ha of BAP priority habitats within the NCA which equates to almost 6 per cent of the land area. There are also 6 Ramsar sites, 6 Special Protection Areas, 3 Special Areas of Conservation, 2 National Nature Reserves and 72 SSSI (please note that some sites have more than 1 designation so there is some double counting within these figures). Many of the BAP habitats in the NCA are wetland sites so water is a necessity for these sites to remain viable.	National	There is a range of habitat types supporting a modest number of species. A significant barrier to increasing biodiversity is that the semi-natural habitats are small in extent, fragmented and under continuous threat of being destroyed through inappropriate management or the continued need to accommodate new development in the area. Appropriate active management of remaining semi-natural habitats should be accompanied by measures to increase the extent of key habitats and their overall connectivity within the landscape. This could enable healthy populations of important wildlife including dormice, bats, water voles and great crested newts to be retained within the landscape Some work is currently underway to apply a landscape scale approach to habitat connectivity and protection from outside pressures, such as development, pollution and water resources , connecting sites and enabling greater species dispersal. In some agricultural settings farmers are helping to improve biodiversity by managing land to create semi-natural habitats and allowing hedgerows and margins along field edges to remain uncultivated. These efforts are usually possible through the establishment of agri-environmental schemes that can compensate landowners for the loss of income associated with more intensive farming techniques. These measures provide a vital role in supporting biodiversity on a landscape scale.	Enhance, connect and expand semi-natural habitats to help improve biodiversity and make it more resililient to pressures for change. Continue to engage farmers in agri-environmental schemes, which will allow landowners to receive funding to continue to manage their land in an environmentally sensitive way.	**Biodiversity** **Sense of place / inspiration** **Sense of history** **Pollination** **Pest regulation** **Food provision** **Climate regulation** **Genetic diversity** **Tranquillity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Geological SSSI Local Geological Sites Quaternary sediments allowing study into the formation of the Thames	There are 20 Geological SSSI with just over half in favourable condition and 3 Local geological Sites. These sites have been selected for their importance to the study of the formation of the local area and in some cases they contain rare examples of geological formation of regional and national importance. Many of these sites are in unfavourable condition but none are declining.	National	There is high demand for minerals nationally and some sites are still usebeing extracted. Many are now disused. Much of the evidence found relates to the formation of the local area, particularly the movement of the Thames south to its current location; some of the stratographical evidence has not only regional but national significance too. Much of the evidence relates to the Pleistocene period. Continuous pollen records have been found that give insight into periods of formation history as well as mammal, invertebrate and plant remains some of which are now extinct and others that are no longer native to Britain. This gives an insight into changes over time and how the local area and country as a whole has evolved. The most important sites in the area are now protected but many are listed as being in unfavourable condition. Many of these sites are still involved in ongoing research so it is important that they are preserved.	Ensure sensitive practices are employed in the ongoing extraction of mineral resources from the area. work to retain the value of the areas geological resource, promoting access and interpretation of important geological sites to increase understanding of the local history and geology of the area.	**Geodiversity.** **Recreation** **Sense of place / inspiration** **Sense of history**

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