National Character Area profile:

90. Bedfordshire Greensand Ridge

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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.

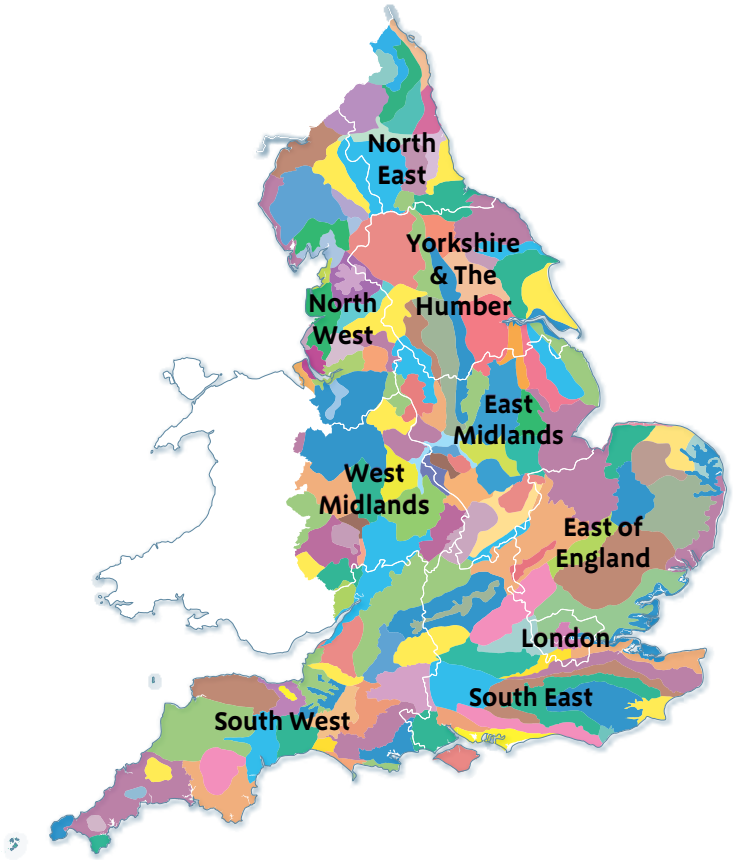
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

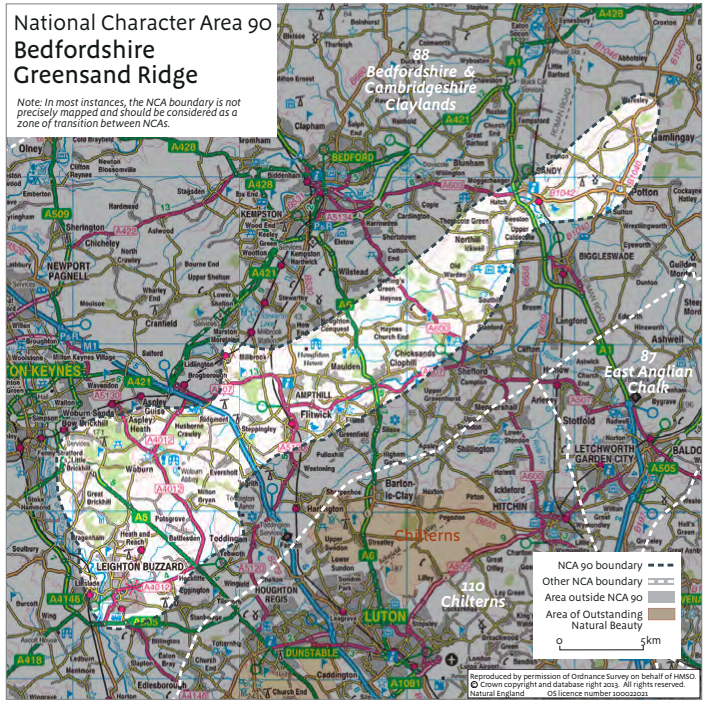
Summary

The Bedfordshire Greensand Ridge National Character Area (NCA) is a narrow ridge running north-east, south-west, rising out of – and entirely surrounded by – the Bedfordshire and Cambridgeshire Claylands NCA. It is a distinctive ridge with a north-west-facing scarp slope, formed by the underlying sandstone geology which has shaped the landscape and industry of the Ridge. Its historic landscapes, including the farmland, parklands and historic architecture, combined with small settlements, greenbelt and woodlands ancient and modern, give parts of the NCA a more timeless feel than the Bedfordshire and Cambridgeshire Claylands which surround it.

There is a patchwork of semi-natural habitats throughout the NCA, including flood plain grazing marshes, lowland heathland and meadows and mixed deciduous woodland.

The north-west-facing scarp slope, with its mix of coniferous and deciduous woodland, pasture, arable and heathland, overlooks Milton Keynes and the Marston Vale, forming a significant landscape feature from a distance. There are a number of fine panoramic views over the surrounding landscape.
Food, timber and biomass provision on the Ridge are regionally important, and the Ridge is nationally important for recreation: Woburn Abbey and its associated safari and deer parks are well known and attract visitors from far and wide, as do other houses and estates along the Ridge – Haynes, Shuttleworth, Sandy Lodge and Southill. The historic houses, both great and small, with their vernacular architecture, are of significance.

The main pressures on the NCA are (or would result from) development, use of bland, non-local materials, increased congestion and increased traffic noise and light pollution.



Click map to enlarge; click again to reduce.

Statements of Environmental Opportunity

- **SEO 1**: Protect, manage and enhance the historic landscape and its wealth of sites of heritage interest, including the remnant ridge and furrow, iron-age hill forts, designed parklands and associated country houses, estate villages, farmsteads and houses using traditional building material, for their contribution to landscape character and as a recreational and educational resource.

- **SEO 2**: Manage the agricultural and woodland resource and priority habitats for the benefit of biodiversity, landscape character and the economy.

- **SEO 3**: Protect the Ridge's aquifer, the river valley landscape of the Flit, Ivel and Ouzel to benefit biodiversity, prevent soil erosion, improve river flow and quality, support pollinators and protect and enhance wildlife and recreational corridors.

- **SEO 4**: Promote and protect the distinct character and geodiversity of the Greensand Ridge landscape, with its prominent sandstone ridgeline rising from the surrounding low-lying vales; protect the long open views and high levels of tranquillity to ensure continued enjoyment of the landscape and plan for the sustainable extraction and restoration of sites associated with the distinctive geology.

Haynes Park Mansion.

Description

Physical and functional links to other National Character Areas

The Bedfordshire Greensand Ridge National Character Area (NCA) is entirely surrounded by the Bedfordshire and Cambridgeshire Claylands NCA. The dominant and highly visible north-west-facing scarp slope with its mix of coniferous and deciduous woodland, pasture, arable and heathland overlooks Milton Keynes and the Marston Vale; the ridge offers fine panoramic views out over the surrounding landscape, including reciprocal views of and from the Chilterns to the south. The undulating dip slope is relatively gentle with shallow dry valleys generally sloping southwards. It is the marked contrast between this island of Greensand and the encircling Clayland vales and low hills over which it rises that makes the area both attractive and distinctive within the wider setting.

The porous nature of the Woburn Sands, a major constituent of the Lower Greensand Group, makes it an important aquifer supplying potable water and water to agriculture and industry to both this and nearby NCAs. The rivers Flit and Ouzel rise in the Chilterns, the Ivel in the East Anglian Chalk; all pass through the periphery of the area to join the Great Ouse, including drainage from the north-west-facing escarpment in the middle of the NCA which flows to the Elstow Brook. Although much straightening and deepening has been carried out, there are still traditional flood meadows, acid mires and wet woodland in the valley floors which form corridors of riparian habitat linking the Greensand Ridge and the Bedfordshire and Cambridgeshire Claylands NCAs. The Flit largely forms the southern boundary of the NCA. There is much boating activity on the Grand Union Canal which cuts through the west of the

View from the Ridge to the Claylands.

NCA and connects all the NCAs between London and Birmingham; this is also an important route for walkers and cyclists.

The Bedfordshire Greensand Ridge NCA is bisected by the East Coast Main Line railway with trains running between London and Peterborough stopping at Sandy; the Midland Mainline via Bedford to London St Pancras runs through the NCA with a station at Flitwick, and the West Coast Main Line nips the western extremity of the NCA with London Midland trains stopping at Leighton Buzzard. The M1 motorway runs through the Ridge, with junctions just north and south of it, with the A1 cutting through near Sandy. The A6 runs north–south through and from Bedford and Luton, with the A5 cutting through the south-west between Dunstable and Milton Keynes. The western end of the NCA is part of the greenbelt around Luton.

Key characteristics

- Narrow escarpment resulting from the erosion-resistant sediments of the Lower Greensand Group, with a distinct scarp slope to the north-west and dip slope to the south-east.
- The rolling and elevated Ridge provides a north-west-facing wooded skyline offering extensive panoramic views across the lower-lying Bedfordshire and Cambridgeshire Claylands and towards the Chilterns.
- Well-drained acidic sandy soils are capped in places with drift deposits of Boulder Clay. Sand and gravel deposits are present in the Ouzel valley, and there are deposits of peat in the Flit valley between Flitwick and Clophill.
- Substantial blocks of ancient woodland and coniferous plantation are found on the Ridge and steeper slopes. Wood pasture and numerous hedgerow trees, copses and shelterbelts are associated with the estate farmland and parkland trees.
- Mixed field and roadside boundaries range from mature shelterbelts to gappy, short flailed boundaries to intact evergreen hedgerows. Commercial arable cropping within a network of large geometric fields is associated with the better soils on the dip slope.
- A patchwork of semi-natural habitats including mire habitats, lowland heathland and lowland mixed deciduous woodland species, including coppiced hazel which is important for dormice at Maulden Wood. Adders are particularly associated with heathland areas of the Ridge. The mire habitats are notable for their invertebrate interest, especially in terms of beetles.
- The Ridge is dissected by the rivers Ouzel and Ivel, which have carved distinct valleys with riparian habitats, and it is partially bounded to the south by the River Flit. Springs arising from the Ridge support important wetland habitats, including acid mire and wet woodland.
- Visible heritage of iron-age banks and ditches at Kings Wood and Glebe Meadows, Houghton Conquest Site of Special Scientific Interest (SSSI) and iron-age hill fort remains at Sandy. Remnant ridge and furrow at Hockliffe and Potsgrove. Historic parklands and estates associated with grand country houses such as Woburn.
- Dispersed settlement pattern along the Greensand Ridge, with the majority of towns and villages lying along the river valleys and southern dip slopes. Estate villages, houses and farmsteads use local building materials including clay brick and tile, locally quarried brown ironstone, thatch and render. Several of the villages (including Southill, Woburn and Old Warden) are estate villages and have their own distinct styles.
- Major communications infrastructure includes the Sandy Heath transmitter. Road and rail links cut north–south through the Ridge.

Bedfordshire Greensand Ridge today

The Bedfordshire Greensand Ridge NCA stretches between Leighton Buzzard and Gamlingay; it is entirely surrounded by the Bedfordshire and Cambridgeshire Claylands NCA and is a dominant feature that rises above its surroundings. Its tree cover creates a distinct contrast to the surrounding open arable land. The undulating dip slope is a mix of arable land and estate parklands, villages and woodlands, giving the impression of a carefully tended landscape.

Agriculture is important on the Ridge, with cereals and vegetables grown on the lower slopes. Cereal growth accounts for nearly 40 per cent of the agricultural area. The most numerous livestock are sheep.

Much of the Ridge has acidic, free-draining soils which are less fertile than the surrounding Claylands and historically suitable for hunting estates of heath and mixed woodland. In the more fertile river valleys there is some pasture and market gardening. A variety of sand types occur here, including a pure 'silver sand' quarried especially around Heath and Reach, which is both important and famous for glass-making. Fuller's earth has been worked from large quarries at Woburn Sands and Clophill.

The scarp slope has extensive woodland cover with areas of heath and pasture; the dip slope has a mixture of arable and wooded land. Ancient semi-natural woodlands occur largely on the Boulder Clay; woodland areas on the sand have been planted with conifers or sweet chestnut. The Forest of Marston Vale, one of 12 Community Forests across England, aims to increase woodland cover to 30 per cent by 2031; it covers 2,178 ha (8 per cent) of the NCA.

On acidic soils, the ancient woods are characterised by sessile oak and birch with a diverse understory of holly and rowan and small-leaved lime, bracken and bluebells. Numerous rare species of fungi are found. Woodlands on the heavier clays are characterised by pedunculate oak and ash with an understory of field maple, hazel and dogwood. Mistletoe occurs on a number of trees and hedgerows near woods at Houghton and Ampthill.

The Ridge is valuable for fauna such as adders.

Wood pasture and parkland are characteristic of the estates, with extensive areas of grassland especially rich in old trees supporting many species including beetles and bats. Flitwick Moor SSSI is one of the most important wet woodland sites in south-east England. Wet woodlands are found in the river valleys and around springs, providing shady conditions for fungi and liverwort species. The rare black poplar also grows here.

The Ridge is important for species including adders, woodlarks, natterjack toads and specialised mere plants. The scarp and upper ridge have poor quality acidic soils. Here, there are important heath habitats, some of significant wildlife value.

Capbility Brown planting in Ampthill Park.

The River Ivel breaches the Ridge west of Sandy. The course of the River Flit forms a dominant valley through the Lower Greensand, flowing through a landscape of paddocks, pasture and arable fields and helping to define the southern boundary. The dip slope is drained by a series of streams which flow southwards to join the rivers Flit and Ivel. The Ridge is an aquifer and significant groundwater abstraction takes place both within the NCA and beyond its boundaries. There are many springs – notably the Boiling Pot at Lidlington where the water bubbles up rather than simply rises; this water flows into the E lstow Brook catchment. The Ouzel and Flit valleys have flood meadows which are grazed in summer.

The Ridge supports a mixed agriculture with cereals and some vegetables grown on the lower slopes of the dip slope. The area has a varied field pattern and a high proportion of woodland cover. In some places it is comparable with the large agricultural field pattern of the adjacent Claylands; however, the landscape character of old is retained in pockets associated with the estates where the pattern of mixed hedgerows with standard oaks survives.

The historic fields, settlements and buildings display distinctive patterns of historical land use. Iron-age remains, such as the hill forts at Sandy Lodge, demonstrate the strategic importance of the gap where the River Ivel cuts the Ridge. The long development of the agricultural holdings in the area is evident in the uniform distribution of surviving pre-18th-century, potentially medieval, irregular enclosures, and most dominant are the more regular thorn-hedged enclosures laid out by the major estates in the late 18th and 19th centuries. There are important examples of ridge and furrow at Hockliffe and Potsgrove. The Grand Union Canal cuts through the very south-west of the NCA. A concentration of vernacular historic houses, parks and gardens has had a considerable influence on the character of the area and on settlement patterns. With country houses and parkland estates, including Woburn, Haynes, Shuttleworth, Sandy Lodge and Southill, the Ridge boasts a higher percentage of historic parklands than any other NCA.

The Bedfordshire Greensand Ridge has a dispersed settlement pattern. The settlements are restricted to small groups. Movement between settlements along the Ridge involves a series of narrow winding roads and sunken lanes, often with rough verges of bracken.

The major towns in the area (Leighton Buzzard and Sandy) are generally located towards the edge of the escarpment. Ampthill, however, although it has effectively merged with Flitwick to the south, sits in the middle of the area behind the Ridge, adjoining Ampthill Great Park.

Many older buildings are constructed from distinctive local stone. The varied traditional building materials include brick, thatch and sandstone, including occasional dark brown ironstone – the latter being found in the churches around Ampthill. The combination of ironstone and green or orange sandstones in buildings such as churches is unique. Locations with more diluted 'Greensand' character correspond to pockets of chalky Boulder Clay (glacial till) which overlie the sandstone.

Recreation is important here. In addition to the major attractions of Woburn Abbey and its attendant deer and safari parks, horse riding is popular and there are many pony paddocks across the Ridge. The wooded Greensand Ridge Walk is increasingly popular and the Grand Union Canal is used for boating, walking and cycling. The Lodge (now the UK headquarters of the Royal Society for the Preservation of Birds (RSPB)), Shuttleworth and Rushmere Country Park are also popular recreational facilities. A new Centre Parc is opening in 2014.

The landscape through time

The Lower Greensand Group, including the Woburn Sands, was laid down in shallow tropical straits between two landmasses 124–112 million years ago during the Cretaceous Period. In some places, ash deposits from volcanoes active in north-west Europe at this time have subsequently been altered to become what are now localised patches of fuller's earth found at Woburn Sands village and Clophill. Subsequently, Gault Clay and Chalk were deposited on top of the Woburn Sands with the whole succession then tilted and eroded to create the scarps and vales of the Greensand Ridge that are such a feature of the Bedfordshire landscape today.

Locally extensive glacial clay deposits and associated sands and gravels overlie the Cretaceous rocks. These sediments were deposited during the Anglian glaciation (approximately 290,000 years ago) when the area was covered by an ice sheet from the north. The area was not covered by ice sheets of later glaciations but was affected by the fluctuating interglacial (temperate) and glacial (tundra-like) climate, the latter leading to extreme periglacial erosion. Alluvial sand and gravel were deposited in the Ouzel valley and peat deposits have subsequently been laid down in the Flit valley.

The well-drained soils of the Greensand Ridge led to it being extensively settled and cleared of much of its tree cover early in Neolithic times. There is evidence of bronze-age activity near Flitwick and of iron-age hill forts at Sandy, Wavendon and Heath and Reach.

Roman settlement was extensive, with small towns attached to the major Roman roads passing through the area at Sandy and south of Milton Keynes, and a wider pattern of small farming settlements and villas (for example, Shefford). Roman finds have been made in the Haynes and Flitwick areas while the present-day A5 follows the line of the Roman Watling Street.

The medieval period, when less valuable land was often given to the Church for the establishment of ecclesiastical houses, saw the creation of monastic institutions including large Cistercian abbeys at Warden and Woburn and smaller priories at Chicksands, Beadlow and Millbrook. These institutions controlled a large proportion of the farmland and heaths, managing woodland (eight great oaks were sent from Chicksands for the construction of the lantern at Ely Cathedral), grazing sheep and developing extensive warrens because the sandy infertile soils were not well suited to arable agriculture. There are traces of ridge and furrow and old field systems, including important earth banks marking ownership boundaries, within areas that have since been wooded for centuries. Nationally important remnant ridge and furrow survives at Hockliffe and Potsgrove.

After the Dissolution of the Monasteries, these lands became the estates of the aristocracy – the remains of such estates, with their large houses and parkland, remain a feature of the Greensand Ridge; there are parkland remains at Woburn, Old Warden/Shuttleworth, Ampthill – where Catherine of Aragon was imprisoned – and Southill, with small remnants at places like Battlesden and Stockgrove. Estates have strongly influenced the architecture of farmsteads, villages and towns. The Dukes of Bedford rebuilt Woburn Abbey in 1747–61 in the classical style. Part of the project was the relocation of the village of Woburn which today retains a distinctively complete and elegant Georgian high street. At Old Warden, the houses and village are of Victorian vintage. A model village was created by Lord Onslow with spacious thatched cottages in various architectural styles. The associated Shuttleworth House is of Italianate style. The estate also contains the Swiss Garden. A number of the remaining settlements contain attractive brick Georgian homes, for example those at Ampthill.

Agricultural advances in the 18th and 19th centuries meant that the extensive grazing of open heaths ceased to be a key element of the local farming economy. With developments in fertiliser application and irrigation, many of the areas of light sandy soil became productive arable land. Other areas were planted with conifers; the extensive plantations at Wavendon, Aspley and Millbrook were all previously heathland. There are still some relatively extensive areas of grassland. Market gardening developed on the peats of the Flit valley while summer grazing of flood meadows still continues in the Ouzel and Flit valleys.

Agricultural buildings are now finding a new lease of life.

Horticulture, based on the light and fertile soils of the Ivel valley, developed in the later 19th century and remained a major element of the landscape until the late 20th century. Dairy farming was an important component of farming on the dip slopes and river valley pastures into the early 20th century.

Traditional coppice management of ancient woodlands had all but disappeared by the early part of the 20th century; some were grubbed out and turned over to arable crop production while others were planted with conifers. The Bedford Estate has an active forestry section but generally the poor economics of forestry does not lead to high levels of activity.

Some of the estates, for example Southill, owned by the Whitbread family, have retained their traditional form. In others, opportunities for tourism have been developed, for instance at Woburn with its safari and deer parks. Specialist users have also arisen, for example at Sandy Lodge, where the RSPB has its headquarters, and the internationally famous Woburn golf course set amid the pine trees.

The influence of the estate owners has restricted the size of local settlements and controlled 20th-century development; however, the proximity of the area to major communications routes has led to the expansion of settlements around all the towns and most of the former village nucleations.

Modern alterations to the pattern of fields take two competing forms. Boundary loss resulting in the expansion of arable fields is widespread across the dip slopes and on parts of the northern scarp, and is most noticeable within the corridors of the A5/M1 and A1 where traditional patterns are also disrupted by roads. Conversely, the area also exhibits much post-1950s enclosure – mainly small subdivisions of pasture for paddocks and stabling, which is widespread but more concentrated around the larger villages and towns.

More recent development has also shaped the area with a regional transmitter mast at Sandy Heath, several major national road routes which cut north–south through the Ridge, including the A6, M1 and A5 roads, and three mainline railways. Historic market towns and villages provide popular dormitory settlements for commuters and there has been some settlement expansion. The presence of rich gravelly alluvial soils has led to the development of market gardening, with areas of glasshouses, along the River Ivel. There is also a series of past and current gravel pits, with old sites generally being restored as water bodies. The presence of the purer quality sands has led to extensive quarrying at Heath and Reach, exposing significant geological sites.

There will inevitably be pressure for this area to accommodate further development growth with consequential impact on its predominantly quiet rural character.

Ecosystem services

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

Provisioning services (food, fibre and water supply)

- **Food provision:** The Bedfordshire Greensand Ridge NCA supports a mixed agriculture. Commercial quantities of cereals, along with some vegetables, are grown on the lower slopes. There is no major meat production here although there used to be lamb production. Some venison from the Woburn deer park is sold but it is not marketed in a big way. Some very small areas of market gardening survive around the village of Northill.

- **Timber provision:** The Bedford Estate and Forestry Commission land here is commercial but otherwise the woodlands of the Ridge are mainly managed for conservation. Most of the commercial forestry takes place near Clophill and Chicksands, at Maulden Wood, Wilstead Wood, Chicksands Wood, Pedley Wood and Rowney Warren.

- **Biomass energy:** There is currently significant biomass provision – wood chip and similar products – from the Bedford Estate (Woburn) and elsewhere, with local markets.

- **Water availability:** The Ridge is an aquifer and significant groundwater abstraction takes place both within the NCA and beyond its boundaries.

Coopers Hill, Ampthill, is easy to get to and very popular.

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

- **Soil quality:** Most of the non-arable land is of low quality and supports pastoral agriculture. Areas under woodland or permanent vegetation result in stability in soil quality and increases in organic material and soil fauna.

- **Soil erosion:** Preventing soil erosion would greatly benefit food production and would also help semi-natural wetland habitats in the areas which are sensitive to sediment run-off. Keeping soil on the land and out of the water is an important measure that helps to improve biodiversity and the ecological status of rivers and streams; this is a requirement of the EU Water Framework Directive.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** The marked contrast between this island of Greensand and the encircling Clayland vales and low hills it rises above makes this area distinctive within the wider regional setting. Its largely intimate rural character, mosaic of semi-natural habitats and dominant ridge with its wooded skyline give the Greensand Ridge a unique sense of place. There are views over the surrounding Claylands and across to the Chilterns.

  The local stone building materials and the nucleated settlement pattern in rural areas contribute to the rural character of the whole area, and the numerous historic parklands with their grand houses are a major factor in the Ridge's sense of place. The ruin of Houghton House, just outside Ampthill, which provides a prominent landmark, is reported to be the inspiration for the 'House Beautiful' in John Bunyan's *Pilgrim's Progress*.

- **Sense of history**: There is a strong sense of history throughout the Ridge landscape, arising from the presence of the hill forts at Sandy to the buildings and parklands of estates such as Woburn Abbey. This was originally a Cistercian abbey, founded in 1145 and later developed to include a deer park. It was substantially renovated after the Second World War and is now open to the public. There are several parklands designed by 'Capability' Brown, including the one at Ampthill Park which was designed for the Earl of Upper Ossory in the 1770s.

- **Tranquillity**: There are tranquil areas away from transport corridors, especially outside the main tourist season and along the Greensand Ridge Walk. The wooded and undisturbed character gives pockets of isolation and remoteness.

- **Recreation**: Many areas of the NCA are used for leisure, especially Ampthill Park, Maulden Wood and Cooper's Hill (a Wildlife Trust site) which are easily accessible. Woburn's safari park is a major draw and its deer park, at 1,200 ha, is one of the largest private conservation parks in Europe, surrounded by an 11 km-long wall. Rushmere Country Park, with its picnic facilities and walks, is a major attraction. The Greensand Ridge Walk is increasingly popular. The Grand Union Canal at the western end of the NCA is a key recreation feature for both walking and boating. At its eastern end, the grounds of the RSPB's headquarters at Sandy are very popular with birdwatchers and other wildlife enthusiasts.

- **Biodiversity**: Ancient, semi-natural woodland is found on a mix of soil types ranging from heavy, poorly drained clays to acid well drained soils associated with the Lower Greensand.

The lowland heathland, typified by heather and wavy hair grass, supports a characteristic mix of species, which along the Ridge include notables such as the natterjack toad, nightjar, adder and proliferous pink. Open sandy areas provide excellent conditions for a range of specialised invertebrates, especially bees, wasps and spiders.

Lowland acid grassland is characterised by fine-leaved grasses such as fescues and bents, with a range of plants such as tormentil, heath bedstraw, shepherd's cress and clovers. Bryophytes, rare and/or scarce macrofungi and lichens are a special feature. Common blue and small copper butterflies can be abundant and there are records for bugs such as the bishop's mitre shield bug. Some of the best remaining areas of acid grassland in the county are at places such as Ampthill Park and Woburn Park.

- **Geodiversity**: The landform created by the resistant geology of the Bedfordshire Greensand Ridge distinguishes it from the surrounding Claylands. Building stone quarried here characterises the local landscape, and fuller's earth and sand for glass-making are quarried here. The aquifer created by the porous sandstone is important both within and outside the Ridge. The famous Shenley Limestone is highly fossiliferous.

Cross-stratified sandstone at The Lodge, Sandy.

Statements of Environmental Opportunity

SEO 1: Protect, manage and enhance the historic landscape and its wealth of sites of heritage interest, including the remnant ridge and furrow, iron-age hill forts, designed parklands and associated country houses, estate villages, farmsteads and houses using traditional building material, for their contribution to landscape character and as a recreational and educational resource.

For example, by:

- Conserving historic buildings and structures using traditional techniques and vernacular materials.
- Protecting the area's distinctive estate villages from development – access to major commuting routes has led to the expansion of most of the larger villages and towns within and adjacent to the Greensand Ridge. This trend is changing the intrinsic character of many of the historic settlements.
- Maintaining historic features associated with parklands, including access routes, traditional walls and bridges, railings, fencing, woodland, veteran trees, wood pasture, hedging and shelterbelts.
- Promoting sustainable access to the Greensand Ridge to users of the Grand Union Canal.
- Promoting the importance of the historic estate landscapes along the Greensand Ridge through enhanced interpretation for education and recreation.
- Protecting and maintaining historic farm buildings, both through reuse in the planning system and by encouraging uptake of agri-environment schemes, to ensure that they maintain their historic character.
- Promoting, as appropriate, the reinstatement of areas of former parkland where these have been converted to arable and restoring areas which are in decline. Managing these areas with livestock where possible, focusing on areas where original parkland trees survive.
- Preserving settlement character, including listed buildings and Arts and Crafts architecture, promoting the use of local vernacular and traditional building materials in restored features, new buildings and highway schemes, including the use of stock bricks, clay tiles and selective use of Greensand in churches and boundary walls.
- Promoting awareness of and mitigation of potential impacts of larger recreational/tourism facilities (for example, Woburn Safari Park Shuttleworth Collection and proposed Center Parcs) that may increase pressures on the local landscape.
- Conserving remaining areas of ridge and furrow through agri-environment agreements.
- Conserving and interpreting the remains of bronze-age hill forts by preventing them from becoming overgrown, or clearing overgrowth where this has already happened, so that they can be clearly seen and their original layout understood.
- Minimising the visitor pressure on iron-age banks and ditches by limiting visitor numbers through permissive (rather than open) access.
- Recognising the high potential for archaeological remains in this area.

SEO 2: Manage the agricultural and woodland resource and priority habitats for the benefit of biodiversity, landscape character and the economy.

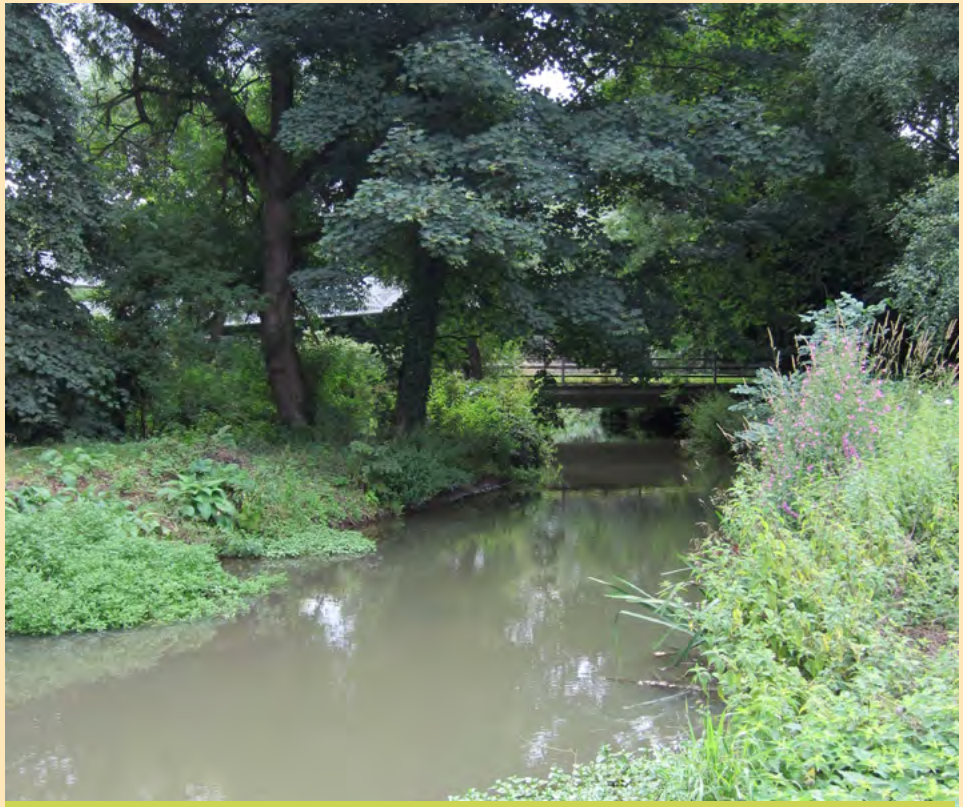
For example, by:

- Promoting sustainable and water-friendly agriculture and minimising run-off containing agricultural chemicals (fertilisers, pesticides) as well as managing the soils to keep them on the field and to sequester CO2 to mitigate climate change.
- Promoting limited use of the landscape for root crops and free range pigs on lighter soils where soil erosion is a problem.
- Promoting greater take-up of woodland grant schemes and encouraging a reduction in the proportion of conifers in favour of indigenous broadleaves. Managing broadleaved areas with an emphasis on sustainable practices (for example, coppicing of sweet chestnut, as found on the Woburn Estate, and hazel) and retaining conifer content as a characteristic feature of the ridgeline.
- Creating new woodlands, especially within the Forest of Marston Vale, and managing existing ones using traditional methods including coppicing, and extending and linking these with ancient woodland sites and smaller woodland blocks in valleys, while maintaining the landscape character without creating excessive visual enclosure.
- Promoting sustainable new uses and viable markets for private woodlands to bring them back into management and enhance their environmental value.
- Protecting the peats of the Flit valley.
- Creating and reinstating areas of heathland habitat through appropriate land management methods including clearance of coniferous woodland and scrub on poorer soils which are developing acidic plant and animal communities.
- Promoting Environmental Stewardship to deliver maintenance, restoration and re-creation of semi-natural habitats such as acid grassland as well as arable options for farmland birds and farmland wildlife.
- Reinstating and restoring hedgerow features, where possible reflecting historic pre-enclosure boundaries, expanding outwards from areas of more intact condition.
- Ensuring that steeper scarp slopes are retained predominantly for pasture and woodland so as to maintain traditional patterns and protect from soil erosion.
- Protecting, enhancing and linking priority habitats, including heathland, acid grassland, acid mires and woodland, and creating and expanding buffer zones for birds, especially nightjars and woodlarks.
- Enhancing and expanding suitable conditions for dormice at Maulden.
- Enhancing and expanding suitable conditions for adders at three isolated locations across the Ridge.
- Encouraging the sensitive generation of alternative energy by promoting the scope for biomass crops of small-scale short rotation coppice and miscanthus, on arable sections of the dip slopes reflecting existing field patterns.

SEO 3: Protect the Ridge's aquifer, the river valley landscape of the Flit, Ivel and Ouzel to benefit biodiversity, prevent soil erosion, improve river flow and quality, support pollinators and protect and enhance wildlife and recreational corridors.

For example, by:

- Protecting the aquifer from pollution and over-extraction.
- Reinstating flood meadow pasture to allow for seasonal high water levels and summer grazing and to support its associated species and assemblages.
- Enhancing and expanding suitable conditions for wetland species including natterjack toad, sedges, lower plants including liverworts, and fungi.
- Enhancing river corridors by planting wet woodland, including native willow, poplar and alder.
- Working with partners to ensure that water abstraction has the minimum impact on designated wetland habitat, minimising its effect on biodiversity and water quality.
- Maintaining input, where possible, from springs.
- Seeking opportunities to reinstate arable land to pasture, particularly in association with rivers and settlement edges.
- Increasing the current flood storage capacity by creating or increasing areas of flood plain grazing marsh reedbeds, concentrating on areas at risk.
- Enhancing and protecting biodiversity and the ecological status of rivers and streams to enable EU Water Framework Directive objectives to be achieved.
- Preventing the introduction and spread of non-native invasive species (plants and animals) that have an adverse impact on river life biodiversity and ecological status.



The River Flit at Clophill.

SEO 4: Promote and protect the distinct character and geodiversity of the Greensand Ridge landscape, with its prominent sandstone ridgeline rising from the surrounding low-lying vales; protect the long open views and high levels of tranquillity to ensure continued enjoyment of the landscape and plan for the sustainable extraction and restoration of sites associated with the distinctive geology.

For example, by:

- Identifying and conserving key geological features, including quarry exposures of Greensand and Gault (for example, Double Arches Pit SSSI and Nine Acres Pit SSSI).
- Preserving exposures of the local stratigraphy for research and education as well as for their aesthetic value
- Demonstrating the history of mineral extraction within the NCA, for building stone, high-quality sands and fuller's earth.
- Creating and promoting interpretation of, and access to, geological features and assets of the area, highlighting links to other interests including historic earthworks, local building materials, distinctive habitats, flora and fauna.
- Working to agree restoration plans and management agreements between landowners, operators and the Minerals Planning Authority for existing and former extraction and quarry sites that demonstrate geological, landscape, biodiversity and public access benefits, including those where extraction of nationally scare minerals such as fuller's earth has taken place.
- Promoting the importance of smaller-scale locally distinctive features such as acidic mires, that are a feature of the local geology.

Additional opportunity

1. Manage and plan for the recreational use of the area by putting in place multifunctional green infrastructure networks and green space provision which respects intrinsic character and provides enhanced access and connections for people and wildlife.

For example, by:

- Creating, promoting and improving interpretation of existing rights of way and strategic facilities (for example, the Greensand Ridge Walk), providing new and enhanced connections to strategic routes from adjacent settlements and increasing promotion of health walk initiatives.
- Providing enhanced sustainable access for longer journeys and promoting the use of buses and trains.
- Creating new access links within and between existing local communities and amenities, and creating natural public green space in areas of need as identified in Natural England access maps.
- Seeking opportunities to increase public access along river corridors.
- Reviewing adequacy and management of existing parking areas providing access to the countryside.
- Ensuring that formal sports facilities (for example, golf courses) are created and managed to respect and emphasise local landscape character and create/maintain public access opportunities.
- Ensuring that liaison and understanding are maintained with major landowners to balance the pressures of public access with private ownership interests.
- Promoting the creation of new green infrastructure, including quality green space provision for existing and new populations to meet any local short falls in resource.
- Identifying remaining tranquil areas and safeguarding them from further intrusive developments and activities.
- Creating access to the wider countryside for the benefits that would bring for the public using this access.
- Linking green infrastructure for the benefit of visitors as well as species.

Supporting document 1: Key facts and data

Area of Bedfordshire Greensand Ridge National Character Area (NCA): 27,337 ha

1. Landscape and nature conservation designations

There are no National Parks or Areas of Outstanding Natural Beauty in this NCA. Management plans for the protected landscapes can be found at:

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)	N/A	0	0
National	National Nature Reserve (NNR)	Kings Wood	62	<1
	Site of Special Scientific Interest (SSSI)	A total of 16 sites wholly or partly within the NCA	646	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.

There are 123 Local sites in Bedfordshire and Greensand Ridge NCA covering 3,953 ha which is 14 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	7	1
Favourable	420	65
Unfavourable no change	28	4
Unfavourable recovering	191	30

Source: Natural England (March 2011)

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

2. Landform, geology and soils

2.1 Elevation

The Bedfordshire Greensand Ridge is a large scale elevated landscape providing extensive views across the surrounding Bedfordshire and Cambridgeshire Claylands. The lowest points are found in the valleys at around 20 m, the highest in the south west near Leighton Buzzard at over 150 m with a gentle drop towards Gamlingay in the north-east.

Source: Natural England (2010)

2.2 Landform and process

The sands and sandstone of the Bedfordshire Greensand Ridge were laid down in shallow tropical seas in the Cretaceous Period. Deposition of volcanic ash at this time has given rise to localised patches of fuller's earth (a clay mineral that has particular absorbent properties).

Tilting during the Alpine Orogeny (mountain building period) followed by millions of years of erosion has given rise to the scarps and vales that are such a feature of this area of Bedfordshire as well as small areas of both Buckinghamshire and Cambridgeshire.

The ice ages of the last million years covered the area with ice sheets increasing the erosion and leaving behind the glacial tills and boulder clay that still shroud the underlying greensand in many areas. The Greensand, being made up of more resistant sands, was not eroded as much as the surrounding softer clays and when the ice retreated, the Greensand Ridge was left as a prominent feature on the landscape.

The scarp slope of the Greensand Ridge is a significant landscape feature facing north over Milton Keynes and the Marston Vale. The dip slope is relatively gentle with the shallow undulations of dry valleys generally sloping southwards. The Greensand Ridge provides a strong contrast with the clay vales either side and supports woodland, pasture and mixed arable farmland.

Source: Bedfordshire and Greensand Ridge Countryside Character Area Description; Greensand Ridge Natural Area Profile

2.3 Bedrock geology

The Greensand Ridge is dominated by the sands and sandstones of the Lower Greensand Group, laid down in shallow tropical seas during the Cretaceous Period around 124-112 million years ago. These include a thin layer at the top, extraordinarily rich in fossil marine shell species, especially brachiopods - the famous Shenley Limestone. A shallow shelf was created, fringing the East Anglian Massif to the north-east and areas of higher ground to the west. Known as the 'Bedfordshire Straits', this shelf linked seas to the north and south. Repeated marine flooding from the north deposited the marine Lower Greensand Group. The layers of fuller's earth found in the Greensand were formed when ash produced by a series of volcanic eruptions settled in the shallow waters of the sea that covered what is now central and southern England. Fuller's earth contains a clay mineral with particular absorbent properties. It has been quarried and used to extract the grease from sheep's wool, a process called fulling, hence the name. More recently, fuller's earth is used for a variety of chemical processes.

Source: Natural England (2010); Greensand Ridge Natural Area Profile; Bedfordshire and Greensand Ridge Countryside Character Area Description

2.4 Superficial deposits

Extensive glacial clay deposits and associated sands and gravels overlie the Cretaceous rocks. These sediments were deposited during the Anglian glaciations (approximately 290,000 years ago) when the area was covered by an ice sheet from the north.

In the Flit valley between Flitwick and Clophill there are extensive deposits of peat that are important both agriculturally and for supporting biodiversity.

Source: Greensand Ridge Natural Area Profile; Bedfordshire and Greensand Ridge Countryside Character Area Description

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	2
National	Mixed Interest SSSI	0
Local	Local Geological Sites	15

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

Much of the Bedfordshire Greensand Ridge is located on Cretaceous sands and sandstones, which give rise to acidic, nutrient poor, free draining soils. These are lower in fertility than the surrounding claylands. This has influenced the vegetation and agricultural activities of the area, making it more suitable for the establishment of hunting estates comprised of heath and mixed woodland than for agriculture. These areas are highly distinctive of the area and many are of high biodiversity value. There are also areas of heavy, poorly-drained clay soils where woodland can often be found. Where fertility is higher, for example in the river valleys, some pasture land and limited market gardening takes place.

Source: Greensand Ridge Natural Area Profile; Bedfordshire and Greensand Ridge 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):

Grade	Area (ha)	% of NCA
Grade 1	609	2
Grade 2	5,553	20
Grade 3	12,593	46
Grade 4	2,980	11
Grade 5	N/A	N/A
Non-agricultural	4,186	15
Urban	1,415	5

Source: Natural England (2010)

- Maps showing locations of Statutory sites can be found at: http://magic.Defra.gov.uk/website/magic/ – select 'Landscape' (shows ALC 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 Flit 12 km
- River Iver 5 km
- River Ouzel 7 km
- River Lovat 7 km
- Grand Union Canal 6 km

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.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 27,337 ha, 100 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 4,786 ha of woodland (17.5 per cent of the total area), of which 1,419 ha (5 per cent) is ancient woodland. The Forest of Marston Vale, one of twelve Community Forests established to demonstrate the contribution of environmental improvement to economic and social regeneration, covers 2,178 ha of this NCA, which is 8 per cent.

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

4.2 Distribution and size of woodland and trees in the landscape

The NCA has extensive woodland cover comprising ancient woodland, plantations, wet woodland and wood pasture and parkland. The north-west facing scarp slope has a high proportion of woodland (both deciduous and coniferous) and areas of heath and pasture, producing a distinctive wooded skyline with a strong sense of enclosure. On the dip-slope to the south-west there is a medium-sized arable and wooded landscape where areas of pasture intersperse arable and wooded land cover.

Ancient, semi-natural woodland is found on a range of soil types ranging from heavy poorly drained clays to the acidic well drained soils associated with the Lower Greensand. Some areas on the boulder clay have been planted up with conifers or sweet chestnut. Those ancient woods on acidic soils are characterised by trees of sessile oak and birch with holly and rowan in the under storey with the uncommon small-leaved lime. Bracken often dominates the ground vegetation which is characterised by bluebells and wood sorrel. The conditions are ideal for fungi and numerous rare species are found.

Woodlands on the heavier clays are characterised by pedunculate oak and ash with an under storey of field maple, hazel and dogwood. The ground flora is typical of poorly drained soils with species such as rushes and primrose characteristic. Mistletoe unusually occurs on a number of trees and hedgerows near woods at Houghton and Ampthill.

Wood pasture and Parkland is characteristic of the area associated with the estates especially on the eastern side of the ridge although most are remnants they have extensive areas of grassland and are especially rich in old trees a habitat that supports many species from beetles to bats.

The NCA is home to one of the most important wet woodland sites in south-east England: Flitwick Moor Site of Special Scientific Interest (SSSI). Wet woodlands are found within the river valleys and around spring-fed sites arising from the Greensand Ridge. Species characteristic here are alder, birch and willow, providing shady conditions for fungi and liverwort species. The rare black poplar can also be found.

Source: Greensand Ridge Natural Area Profile

4.3 Woodland types

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

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

Woodland type	Area (ha)	% of NCA
Broadleaved	3,120	11
Coniferous	1,361	5
Mixed	52	<1
Other	253	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	1,419	5
Planted Ancient Woodland (PAWS)	768	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

The NCA contains variable field and roadside boundaries ranging from mature shelterbelts to gappy, short flailed boundaries to intact evergreen hedges.

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

5.2 Field patterns

The dip slope of Bedfordshire Greensand Ridge features medium sized arable fields and a wooded landscape. The removal of some of the hedges and hedgerow trees has taken place to create larger fields; however the area still remains distinctive from the surrounding lower lying Claylands.

Source: Bedfordshire and Greensand Ridge 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

Almost half the farms in this area are arable (45 per cent), with the 30 cereal farms accounting for 30 per cent of all holdings. Livestock farming accounts for 21 per cent of holdings. Between 2000 and 2009 the number of farms has decreased by 6 per cent. Arable farms declined by 19 per cent and mixed farms by 12 per cent. Livestock grazing farms increased by 10 per cent from 58 in 2000 to 64 in 2009 and other types increased by 28 per cent from 61 to 78.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

Many of the farms are relatively small, with farms below 20 ha comprising 46 per cent of the total number of farms although these account for only 5 per cent of the agricultural land area. 73 per cent of the agricultural area is in 39 farms (19 per cent of the total) over 100 ha. There has been an overall reduction in the number of farms (19) in the last decade, the majority of which is among farms smaller than 50 ha.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 14,149 ha; owned land = 8,331 ha
2000: Total farm area = 14,713 ha; owned land = 9,830 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

Land used for cereal production still accounts for 38 per cent of the agricultural area (5,317 ha), although this has declined by 22 per cent (1,509 ha) in the last decade. A similar proportion of land (36 per cent, 5,089 ha) is under grass or is uncropped. This has increased substantially (by 16 per cent, 711 ha) since 2000. Other changes include a decrease in the land under cash roots, an increase in oilseeds and other arable crops.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

The most numerous livestock are the 13,900 sheep, which has increased by 10 per cent since 2000. Cattle numbers have remained relatively stable at 4,200. Pig numbers have declined dramatically, from 9,100 in 2000 to 1,600 in 2009.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

Over half of all farm labourers are farmers, their spouses and business partners, comprising 268 in total, although these have decreased by 38 in the last decade. The most substantial increase has been in part time workers (up by 22 to 67) and casual / gang workers (up by 28 to 55).

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

Arable land: Agriculturally improved pasture comprises a significant proportion of the habitats now present within the area which contain important features such as hedgerows and mature trees, ponds and small watercourses and semi-improved grassland such as that found alongside tracks and on road verges. These give much of the character to the area and support a wide range of species, including some that have undergone dramatic declines such as skylark, grey partridge and a number of rare arable weeds such as broad-leaved spurge, fine-leaved sandwort, sand spurrey and toothed medick.

Ancient, semi-natural woodland: Found on a mix of soil types ranging from heavy poorly drained clays to acid well drained soils associated with the Lower Greensand. This reflects the species composition of the vegetation and associated species found there.

Lowland heathland: usually found on outcrops of Greensand and is typified by heather and wavy hair-grass. The density and age range of heather is variable both on and between sites depending on management, but the heath usually occurs in a complicated matrix with areas of acid grassland. There are also areas of bracken, with gorse and broom. Remaining sites support a characteristic mix of species, which along the ridge includes notables such as the natterjack toad, nightjar, adder and proliferous pink. Open sandy areas provide excellent conditions for a range of specialised invertebrates, especially bees and wasps and spiders.

Lowland acid grassland: Restricted to well drained Greensand soils and often found in close association with areas of grassland or heathland although much has been lost to agriculture and plantations. The sward is characterised by fine-leaved grasses such as fescues and bents, with a range of plants such as tormentil, heath bedstraw, shepherd's cress and clovers. Bryophytes, rare/scarce macro fungi and lichens can be a special feature. Common blue and small copper butterflies can be abundant and there are records for bugs such as the bishops mitre shield bug. Some of the best remaining areas of acid grassland in the county are at places such as Maulden Heath and Woburn Park.

Acidic mire, floodplain grazing marsh and wet woodland: The acidic waters rising from the Greensand aquifers supports a mix of different wetland habitats including acid mire, floodplain grazing marsh and wet woodland. These have a rich assemblage of specialised wildlife, especially sedges, lower plants such as bog-mosses and liverworts, and invertebrates. The wet woodlands are characterised by alder, birch and willow, providing shady conditions for specialised fungi and liverwort species. The rare black poplar can also be found. There are also some areas of marsh and fen on more calcareous soils, with species like greater tussock sedge, and jointed rush.

Wood pasture and parkland: remaining areas are characteristic and significant in Bedfordshire. Many contain extensive areas of lowland grassland and are especially rich in mature and veteran trees.

Source: Greensand Ridge Natural Area Profile

7.2 Priority habitats

The Government's new strategy for biodiversity in England, *Biodiversity 2020*, replaces the previous Biodiversity Action Plan (BAP) led approach. Priority habitats and species are identified in *Biodiversity 2020*, but references to BAP priority habitats and species, and previous national targets have been removed. Biodiversity Action Plans remain a useful source of guidance and information.

More information about *Biodiversity 2020* can be found at:

http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/englandsbiodiversitystrategy2011.aspx

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

Priority habitat	Area (ha)	% of NCA
Broadleaved mixed and yew woodlands (Broad habitat)	1,885	7
Lowland dry acid grassland	715	3
Lowland meadows	209	1
Lowland heathland	174	1
Coastal & floodplain grazing marsh	137	1

Source: Natural England (2011)

- Maps showing locations of priority habitats are available at: **http://magic.Defra.gov.uk/website/magic/** select 'Habitat Inventories'

7.3 Key species and assemblages of species

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

8. Settlement and development patterns

8.1 Settlement pattern

Settlement pattern includes estate villages and hamlets in the fold of the ridge. Numerous transport corridors traverse the ridge. There are both working and disused sand quarries around Leighton Buzzard.

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

8.2 Main settlements

The main settlements are: Leighton Buzzard and Linslade: 37,410; Flitwick: 13,550; Sandy: 11,700 and Ampthill: 7,000. The total estimated population for this NCA (derived from ONS 2001 census data) is: 89,994.

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

8.3 Local vernacular and building materials

A number of the villages comprise time capsules of a given style, often relating to the rebuilding of the great house in the vicinity. The Dukes of Bedford rebuilt Woburn Abbey in 1747-61 in the classical style. Part of the project was the relocation of the village of Woburn which today retains a distinctively complete and elegant Georgian High Street. At Old Warden the houses and village are of Victorian vintage. A model village was created by Lord Onslow with spacious thatched cottages in various architectural styles. The associated Shuttleworth House is of Italianate style. The estate also contains the Swiss Garden. A number of the remaining settlements contain attractive brick Georgian homes, for example those at Ampthill. Elsewhere, the traditional building materials are varied and include brick, sandstone, thatch and occasional ironstone - the latter being found in the churches around Ampthill. Tall and extensive estate walls in brick enclose some of the parklands such as Woburn while, within the woodland areas, timber picket fencing and clipped hedgerows are characteristic.

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

9. Key historic sites and features

9.1 Origin of historic features

Roman settlement was extensive, with small towns attached to the major Roman roads passing through the area at Sandy and south of Milton Keynes, and a wider pattern of small farming settlements and villas (as at Shefford). The medieval period saw the creation of monastic institutions within the Bedfordshire ridge including large Cistercian abbeys at Warden and Woburn and smaller priories at Chicksands, Beadlow and Millbrook. These institutions controlled a large proportion of the farmland and heaths, managing woodland (trees were sent from Chicksands to Ely Cathedral) and developing extensive warrens. The dissolution of these houses in the early 16th century added to the proliferation of large private estates which had already become a feature of the area. Historic parklands and estates (for example, Woburn, Southill, Haynes) are a dominant feature of the area, often based upon earlier ecclesiastical foundations and highly influential in the architecture of individual late 18th and 19th century farmsteads (such as the Duke of Bedford's estates) and entire villages and towns (such as Woburn, Old Warden, Southill).

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 11 Registered Parks and Gardens covering 1,936 ha
- 0 Registered Battlefields
- 36 Scheduled Monuments
- 1,099 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

- 4 per cent of the NCA 1,192 ha is classified as being publically accessible.
- There are 458 km of public rights of way at a density of 1.7 km per km2.
- There are no National Trails within the NCA; however, the area contains a significant access trail. The Greensand Ridge Walk is Bedfordshire's premier long distance walk passing through Buckinghamshire and Cambridgeshire. Opened in 1986 it follows the Greensand Ridge above the surrounding clay vales on either side and is an ideal introduction to the history, landscape and wildlife of this part of the country. The 64 km walk starts in Leighton Buzzard and finishes in Gamlingay.

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)	0	0
Common Land	1	<1
Country Parks	14	<1
CROW Access Land (Section 4 and 16)	188	<1
CROW Section 15	406	<1
Village Greens	8	<1
Doorstep Greens	0	0
Forestry Commission Walkers Welcome Grants	166	<1
Local Nature Reserves (LNRs)	82	<1
Millennium Greens	3	<1
Accessible National Nature Reserves (NNRs)	62	<1
Agri-environment Scheme Access	28	<1
Woods for People	1,046	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

Based on the CPRE map of Tranquillity (2006) the least tranquil areas in the west of this NCA are around the major settlements of Leighton Buzzard, Ampthill and Flitwick. The most tranquil areas are fairly dispersed but mainly found at the Cambridgeshire end of this NCA around Gamlingay.

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

Category of tranquillity	Score
Highest value within NCA	33
Lowest value within NCA	-79
Mean value within NCA	-10

Sources: CPRE (2006)

- More information is available at the following address: **http://www.cpre.org.uk/campaigns/landscape/tranquillity/our-tranquillity-map-explained**

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 picture to the tranquillity data with the most disturbed areas found around major settlements and road networks such as the M1, A1 and A6. A breakdown of intrusion values for this NCA is detailed in the table below.

Category of intrusion	1960s (%)	1990s (%)	2007 (%)	% change (1960s-2007)
Disturbed	24	57	67	43
Undisturbed	72	39	27	45
Urban	4	4	6	2

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are the significant increase in the area of disturbed land, matched by a strong decrease in the amount of land considered as being undisturbed. The amount of urban intrusion has increased, but by smaller amount.

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

Agriculture is a major part of the Ridge's economy.

12. Data sources

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

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

Supporting document 2: Landscape change

Recent changes

Trees and woodlands

- Trees and woodlands including parkland are significant features of the landscape, although there is evidence of some neglect. Of the existing woodlands, approximately one-third (by area) is ancient semi-natural woodland sites that are being maintained, with around half now being covered by a Woodland Grant Scheme. There is a mix of deciduous and conifer plantations and on balance a gradual move towards an increase in broadleaved woodland has taken place.

- Between 1999 and 2003 an area equivalent to 2 per cent of the 1999 total stock was approved for new planting under a Woodland Grant Scheme agreement (76 ha). There have been over 400 ha of Woodland Grant Scheme agreements for improved access since 1999; however, the area of parkland within a Countryside or Environmental Stewardship agreement for managing historic landscape is limited.

- The Forest of Marston Vale, one of the 12 Community Forests, is working to increase woodland cover within their boundaries tenfold to 30 per cent by 2031.

- A 'Working Woodlands Centre' is being developed at Maulden Wood to promote business and enterprise associated with woodlands, education and awareness-raising.

- At Flitwick Moor, a rare example of mire and wet woodland, management continues to control water levels and the encroachment of scrub and to prevent the spread of non-native species such as Himalayan balsam.

- In other places along the Greensand Ridge, areas of former conifers and scrub are being restored and managed as traditional lowland heath and lowland acid grassland (e.g. at RPSB Sandy Lodge where a historic hill fort has been revealed).

Boundary features

- There is evidence of neglect in relation to hedges. Historic field patterns have been neglected and become fragmented through field expansion, particularly in the river valleys. Much hedgerow had been lost historically but, as with the grasslands, this decline has slowed.

- Between 1999 and 2003, Countryside Stewardship capital agreements for linear features included fencing (11 km), hedge management (11 km), hedge planting and restoration (37 km) and restored boundary protection (14 km). The estimated boundary length for the NCA is approx 1,678 km. Total length of agreements between 1999 and 2003 is equivalent to about 4 per cent of this total.

Agriculture

- There has been a decline in amount of grassland within the NCA although the rate of decline has slowed. In contrast the popularity of owning horses has led to an increase in the number of pony paddocks, especially between Stockgrove and Woburn. There has been a general shift away from cereal production to mixed cropping, with an increase in oilseed rape, although

wheat is still the main crop, and from lowland cattle to sheep in the Ivel valley. Horticulture and market gardening in the Ivel Valley and Potton areas has also declined.

- There has been some localised agricultural intensification and farm amalgamation leading to larger field sizes and hedgerow/field tree removal, particularly in the Ivel Valley, which has blurred the distinction with the adjacent Claylands in this part of the NCA.

- The Ridge creates a big impact on landscape character, particularly on northern escarpment where it is in stark contrast to woodland/grassland but the dominance of estate management in some areas such as around Southill and Woburn has mitigated this change compared to adjacent areas.

- There is not much livestock farming on the Ridge. The most numerous livestock are sheep, the numbers of which increased by 10 per cent between the years 2000 and 2009; during the same period, pig farming decreased dramatically here but the numbers of cattle remained stable. The area of uncropped land or land under grass increased during this time.

Settlement and development

- Development pressure has been concentrated along the urban fringe at the edges of existing settlements both within and outside of the NCA. Encroachment of settlement to the edge of the Greensand Ridge particularly in the southwest around Leighton Linslade and northeast around Sandy has impacted on rural character. Although the rate of development outside the urban and fringe areas is moderate, local development has also impacted on the character of Sandy, Upper Caldecote, Potton, Flitwick, Ampthill and Leighton Buzzard where ribbon development has merged settlements.

- Leighton-Linslade, within the Ouzel Valley, is the only major urban area of the Ridge. It is based on the sand industry and has strong rail and road links. Flitwick has seen rapid recent growth.

- The major transport corridors that transect the area have a negative impact on its predominantly quiet, rural character and are a barrier to access.

- Large areas of the western end of the NCA are within greenbelt land; this is under pressure from development around e.g. the towns of Flitwick and Ampthill.

Semi-natural habitat

- The most extensive annual Countryside Stewardship agreements in 2003 were for lowland pastures on neutral/acid soils (245 ha) and regeneration of grassland/semi-natural vegetation (53 ha). There were also annual agreements for enhancing existing lowland heath (30 ha).

- Lowland heathland and lowland acid grassland habitats have been reduced in extent by conifer plantation and neglect leading to scrub invasion. Areas remaining are now relatively small and fragmented. The RSPB, Greensand Trust and Wildlife Trusts are reversing this trend with acid grassland and, to a lesser extent, with heathland.

Historic features

- Some historic features, including parkland, are showing signs of neglect.

- There are limited Countryside Stewardship agreements for the management of historical landscapes. In 1918 about 14 per cent of the NCA was historic parkland. By 1995 it is estimated that 29 per cent had been lost. About 51 per cent of the remaining parkland is covered by a Historic Parkland Grant,

and about 8 per cent is included within an agri-environmental scheme. It should also be noted that about 79 per cent of historic farm buildings remain unconverted and most are structurally intact. Historic local churches are defining landscape features.

Rivers

- There has been work on the banks of the River Ivel at the Riddy near Sandy to alleviate flooding risk. Much straightening and deepening has been carried out where the Rivers Flit, Ouzel and Ivel pass through the area and hard engineering work has taken place in response to flood protection issues around Flitwick, The Ivel and Flit were both navigable in downstream sections – the last few kilometres of the Flit are known as the 'Ivel Navigation'.

- Although small, there were mills at Flitwick, Clophill, Shefford, Clifton (outside NCA) and the channels were modified during their construction. There are also modifications at Chicksands, where the Flit runs into and out of a lake.

Minerals

- In addition to local Greensand stone being quarried and used in construction including walls, bridges, churches and houses, the area has been a centre for the extraction of a number of nationally significant, but rarely occurring minerals

- High quality sands, used for making glass, have been extracted from Leighton Linslade.

- At Woburn Sands and Clophill, there are deposits of the uncommon fuller's earth (reworked bentonite clay) which have been used in cleaning wool during the production process and in paper manufacturing.

- Some former quarries are now being restored to wetland, agricultural, recreational or residential after use.

Drivers of change

Climate change

- Climate change may bring more extreme weather which could have an impact on the NCA. There may be drier summers and wetter winters, larger storms or an increase in droughts.

- Some of the urban areas are susceptible to flooding and are therefore vulnerable to extreme weather resulting from climate change.

- The agricultural landscape may change as farmers adapt to changes in weather or water availability by producing new crops. A longer growing season may lead to winter cropping and a loss in winter stubble with a consequent loss of food sources for farmland birds.

- The semi-natural grassland and heathland of the NCA would be susceptible to increasing periods of drought with possible change in species composition as a consequence. In addition warmer winters might make acid grassland and heathland prone to invasion by bracken.

- The area's woodlands particularly those on drier soils may be at increasing risk of fire. Species change may occur as trees from southern Europe that are more tolerant of drought conditions, such as the Holm oak, out-compete native trees.

- In addition climate change may make trees more vulnerable to disease such as *Chalara fraxinea* (ash dieback). Warmer winters may allow pathogens and their vectors to increase their range.

Other key drivers

- The ease of accessibility of the area to major commuting routes has led to the expansion of most of the larger villages and towns within and adjacent to the Greensand Ridge, a trend which appears to be continuing and changing the intrinsic character of many of the historic settlements.
- There are potential visual impacts from the long, open viewpoint on the ridge as considerable development is planned for the surrounding claylands.
- Future mineral extraction may put pressure on the area's semi-natural habitats, although there may also be opportunities to restore old sites to habitat.
- Greater demands on agriculture to produce higher yields could put pressure on the remaining areas of semi-natural grassland and other semi-natural habitats. It may also lead to deterioration in water quality, through the run-off of soil nutrients and increased use of herbicides and pesticides.
- Tourism and leisure continue to create pressure on Woburn, Shuttleworth, Rushmere, Ampthill, and the Lodge. Further may be caused by the new Center Parcs, due to open in 2014, unless it can be designed and managed to reduce the impact on the surrounding landscape.

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.

Field of brassicas.

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: Protect, manage and enhance the historic landscape and its wealth of sites of heritage interest, including the remnant ridge and furrow, iron-age hill forts, designed parklands and associated country houses, estate villages, farmsteads and houses using traditional building material, for their contribution to landscape character and as a recreational and educational resource.	↔ **	↗ **	↔ ***	N/A	↗ **	↔ **	↗ **	↗ **	↔ **	↗ ***	↔ **	↔ *	N/A	↑ ***	↑ ***	↗ ***	↑ ***	↗ **	↑ ***
SEO 2: Manage the agricultural and woodland resource and priority habitats for the benefit of biodiversity, landscape character and the economy.	↑ **	↑ ***	↗ ***	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: Protect the Ridge's aquifer, the river valley landscape of the Flit, Ivel and Ouzel to benefit biodiversity, prevent soil erosion, improve river flow and quality, support pollinators and protect and enhance wildlife and recreational corridors.	↔ ***	↗ ***	↑ ***	N/A	↗ ***	↔ ***	↑ ***	↑ ***	↑ ***	↑ ***	↔ **	↔ **	N/A	↑ **	↗ ***	↗ ***	↑ ***	↑ ***	↗ ***
SEO 4: Promote and protect the distinct character and geodiversity of the Greensand Ridge landscape, with its prominent sandstone ridgeline rising from the surrounding low-lying vales; protect the long open views and high levels of tranquillity to ensure continued enjoyment of the landscape and plan for the sustainable extraction and restoration of sites associated with the distinctive geology.	↔ ***	↔ ***	↗ ***	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
A distinctive ridge with a north-west facing scarp slope, shaped by the underlying Greensand geology.	■ The dip and scarp landform of the Ridge results from the underlying geology. ■ The stratigraphy provides evidence of the Ridge's geological history and of the geological history of surrounding NCAs; the strata were originally laid down horizontally but were tilted during the Alpine Orogeny (mountain-building episode). Harder rocks such as those of the Lower Greensand Group have eroded more slowly than the softer, surrounding sediments and thus stand proud from the surrounding Bedfordshire and Cambridgeshire Claylands NCA. ■ Views across the Bedfordshire and Cambridgeshire Claylands NCA, and to the Chilterns NCA, from the Ridge. ■ Being visible from surrounding lands makes the Ridge a distinctive and dominant feature.
Historic landscapes including the parklands and historic architecture.	■ The rich diversity of archaeological and historic features expressed in the landscape contribute to the sense of history and act as important reminders of the area's past, from bronze-age activity and iron-age hill forts onwards. It has areas of medieval ridge and furrow, Capability Brown designed landscapes, and several country estates. ■ The Greensand has the highest surviving percentage of historic parkland (for example Woburn, Southill, and Haynes) of any National Character Area. These estates have many veteran trees and have also strongly influenced the architecture of individual late 18th- and 19th-century farmsteads and entire villages and towns. ■ In Victorian times a model village was created at Old Warden, by Lord Onslow, with spacious thatched cottages in various architectural styles. Shuttleworth House in the village is of Italianate style. The estate also contains the Swiss Garden. A number of the remaining settlements – Ampthill, for example – contain attractive brick Georgian homes. ■ The Arts and Crafts architecture and designed parklands give the Ridge a timeless feel.
Woodlands, ancient and modern, characterise the NCA.	■ 4,237 ha (16 per cent) of the NCA is covered by woodland including 1,419 ha (5 per cent of the NCA) of ancient woodland. ■ The Forest of Marston Vale, which is one of 12 Community Forests, covers 2,178 ha (8 per cent) of the NCA. Their vision is to increase woodland cover within their remit tenfold to 30 per cent by 2031. ■ There is commercial timber production here but it is not is a major economic sector due to its poor economics. ■ The wooded ridge line adds to the profile of this NCA and further makes it stand proud of the surrounding Claylands. ■ The Greensand Ridge has important areas of wet woodland.

Landscape attribute	Justification for selection
A patchwork of semi-natural habitats throughout the NCA.	■ Lowland heathland, typically heather and wavy hair grass, is usually found on outcrops of Lower Greensand; lowland acid grassland is restricted to well-drained Greensand soils. ■ The acid waters rising from the aquifers support a range of wetland habitats including wet woodland, flood plain grazing marsh and acidic mires. These all have a rich assemblage of specialised species including lower plants and invertebrates. ■ The Ridge is important for many species including, on the heathland, natterjack toad, nightjar, adders and large quantities of pink. The grasslands have fescues and bents, with a range of plants such as tormentil, heath bedstraw, shepherd's cress and clovers. Bryophytes, rare/scarce macrofungi and lichens can be a special feature. Common blue and small copper butterflies can be abundant.
A rural feel with small settlements and greenbelt.	■ The Ridge has a predominantly, quiet, rural character with attractive market towns and villages, often constructed from local vernacular stone, providing popular dormitory settlements for commuters. However, an intimate rural character remains in many areas, adding to its popularity as a place to live. ■ The influence of the estate owners has restricted the size of settlements here. This has in turn controlled the amount of 20th century development. However, the proximity of the area to major communications routes has led to the expansion of settlements around all the towns and most of the villages with a degree of ribbon development and there is pressure resulting from the proximity of transport corridors and hubs. ■ Much of the western end of the Greensand Ridge is greenbelt land but is nevertheless under pressure from development.
Tranquillity	■ Away from urban areas and transport routes, the Ridge can be tranquil. This peace is a major factor in the enjoyment of, for instance, the Greensand Walk.

Landscape opportunities

- Conserve and promote the area's geological heritage including designated sites and vernacular building stone. Continue small-scale quarrying of locally distinctive stone and sand to help maintain and enhance the historic built environment.
- Historic parklands are significant here – there is a need to maintain veteran and specimen trees to retain the parklands' character and to protect ridge and furrow and other archaeology including securing improved interpretation opportunities.
- Protect and enhance woodlands.
- Protect and appropriately manage priority habitats and plan to link fragmented habitat wherever possible through new habitat creation.
- Manage development impacts, where possible obtaining improvements to biodiversity, access and greenspace, so that the structure of the area is maintained and the impacts of development on tranquillity and landscape quality in the area are minimised. Plan for multi-user networks of green infrastructure.
- Work to minimise the effects of light and noise pollution, especially from transport routes, in rural areas.

Vernacular local stone was used to build Old St Mary's Church, Clophill.

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 Mixed pastoral and arable farming Woburn Deer Park	The Ridge supports a mixed pastoral/ arable (mostly cereals with some vegetable crops) farmed landscape. 46 per cent of the agricultural land was classified as Grade 3 under the Provisional ALC Survey, and a further 20 per cent as Grade 2. Venison from Woburn Deer Park is a local delicacy but is not marketed widely.	Regional	The Ridge supports mixed pastoral and arable agriculture but the statistics indicate a decrease in farmed area, cropping and livestock numbers since 2000. Within the historic parklands the farmed landscape is perhaps less likely to be influenced by changes in the market than is the case for other NCAs. Population increase is likely to drive the pressure for increased yields locally and this will place further demands on ecosystem services such as regulation of soil erosion, soil quality and water quality.	Promote best practice principles, through agri-environment schemes, including the establishment of wide buffer strips and tall hedgerows, to help address soil erosion, soil quality, water quality and water availability issues. Secure opportunities to encourage sustainable farming to enhance biodiversity by, for instance, reducing herbicide/ pesticide use, providing uncultivated strips around field margins and retaining winter stubble. Promote the sale of locally sourced high-quality venison from Woburn Deer Park.	**Food provision** **Biodiversity** **Regulating soil erosion** **Regulating soil quality** **Water availability** **Pollination** **Sense of place / inspiration** **Sense of history**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Areas of conifer plantation woodland Wet woodland and mire at Flitwick Moor	There is a high proportion of coniferous and deciduous woods, heath and pasture on the scarp slope and woodlands plus medium-scale arable farming on the dip slope. There are areas of Forestry Commission land within the NCA with, for instance, Maulden Wood and Rowney Warren being the largest at 182 and 114 ha respectively.	Regional	There is scope to increase timber production but this would have to be balanced against other ecosystem services including biodiversity and food production. One third of the woodland is ancient semi-natural woodland and not suitable / available for timber provision. A Working Woodland Centre has been established to promote woodland business and education. The creation of the Forest of Marston Vale across part of the NCA will yield increased woodland cover (up to 500 ha or more) and future timber supply.	Promote sustainable forestry with replanting to replace harvested trees. Promote awareness of woodland and its associated industries and purposes via the Working Woodland Centre. Support the work of The Marston Vale Trust in creating the Forest of Marston Vale.	**Timber provision** **Biodiversity** **Recreation** **Climate regulation** **Regulating water flow** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Aquifer Rivers Flit, Ivel and Ouzel	Due to the porous nature of the underlying geology, the Ridge is an aquifer and groundwater abstraction is a significant local resource. The main watercourses are the River, Flit, Ouzel and Ivel. The whole of the NCA is classed as a Nitrate Vulnerable Zone (NVZ).	Regional	Groundwater availability is good across the NCA. The Woburn Sands Aquifer is extracted both with the NCA and for at least 13 km beyond its boundaries; many of these abstractions are for agricultural or industrial uses rather than for potable water. Anglian Water has several large public water supply abstractions from the aquifer. Increased storminess and drought resulting from climate change are likely to increase and measures needed to be taken in preparation for this. Flood plain grazing marsh and wet woodland habitats are particularly sensitive to water availability.	Promote the sustainable use of local water resources by both commercial and domestic users. Work to maintain and improve, as appropriate water quality in local watercourses. Encourage water efficiency measures in the design of any new development. Work with the Environment Agency and the water industry to ensure that abstraction does not damage or cause loss of semi-natural habitats. Address the issues of over abstraction which can have an impact on river flows affecting the ecology during low flow periods.	**Water availability** **Regulating water quality** **Regulating water flow** **Climate regulation** **Biodiversity** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	N/A	N/A	N/A	N/A	N/A	**N/A**
Biomass energy	Existing woodland and new plantations	There is significant biomass provision for wood chip and similar products from the Bedford Estate (Woburn) and elsewhere with local markets.	Regional	It would be possible to increase biomass provision from this NCA by appropriate traditional coppice management of existing woodland and as a by-product of the Ridge's timber production. Miscanthus could be grown in pockets on the dip slope but could have a detrimental impact on land use and agriculture.	Secure opportunities to increase further and small-scale biomass production on the dip slope including wood chips as a result of active woodland management.	**Biomass energy** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Woodland including wet woodland Semi-natural grassland Heathland Unimproved pasture Soils	The wooded nature of the NCA heightens the role that it plays in the sequestration and storage of carbon, especially where the woodland is under management. The soils also have a role in carbon storage, especially the areas of peat in the Flit valley, as do the limestone strata where these exist.	Local	The Ridge is well-wooded with areas of deciduous trees as well as coniferous plantations. In addition to the commercial forestry there are many mature trees in the NCA's parklands. There is potential for further woodland planting which would increase the carbon storage potential further as long as this results in a net increase of the woodland cover. The enhancement of semi-natural habitats such as grassland and heathland would improve the NCA's ability to sequester and store carbon. Carbon is locked up in peat and, to a lesser extent, in other habitats including woodland, grasslands and heathland and continued careful management, and even expansion where appropriate, would enhance the ability to sequester and store carbon. Where the Ridge is underlain by limestone, for example, the Shenley Limestone Formation, carbon was locked up in its formation.	Increase the area under woodland for commercial, conservation and recreational purposes as well as to mitigate climate change. There are opportunities to extend and improve the condition of semi-natural habitats to increase their carbon absorption capacity. There are opportunities to encourage sustainable farming to support soil carbon storage capacity by, for example, ploughing less frequently and adding organic matter as appropriate. There are opportunities to protect the peats in the Flit valley. Explore opportunities to promote biomass fuel from forestry operations. There are opportunities to increase soil organic matter helping carbon retention as well as the drought-tolerance of crops in the short term.	**Climate regulation** **Biomass provision** **Biodiversity** **Sense of place / inspiration** **Sense of history**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Aquifer and rivers Soils Woodland including wet woodland and mire Semi-natural grassland Hedgerows	The Woburn Sands Aquifer extends over an area of at least 870 km^2. Groundwater quality is very good. Due to the porous nature of many areas of the local soils, surface water is quickly absorbed where these soils are found. The ecological status of rivers within the NCA varies from poor to good. The River Flit has good ecological status; the Ivel has poor potential and the Ouzel moderate potential. The sandy soils of the Ridge act as filters to maintain and improve water quality. The flora of the Ridge – its woodland, hedgerows and grasslands all have a role to play in water quality.	Regional	The underlying geology, woodland, grassland and similarly-functioning semi-natural habitats have the potential to filter out pollutants This ability could be greatly strengthened by linking or expanding existing fragments of these habitats. Waterbodies in the rivers Ouzel, Flit and Ivel catchments are under investigation by the Environment Agency to establish reasons for failure to achieve good ecological status and to identify actions that should be taken to improve the situation. This work is required by the EU Water Framework Directive. Reasons for failure can be one of a combination of pressures, for example, lack of flow, the impact of point sources such as treated sewage effluent discharges, diffuse pollution from agricultural and urban land, poor river bed and bank condition and the impact from non-native invasive species such as signal crayfish and Himalayan balsam. Many wetland habitats are sensitive to poor water quality. There are problems with sewage effluent at Flitwick Catchment-sensitive farming helps reduce the inputs of phosphates and nitrates to watercourses.	Work with public bodies, farmers and non-government organisations to reduce surface and groundwater pollution at a catchment scale by using fertilisers strategic Manage farmland under the principles established under the England Catchment Sensitive Farming Delivery Initiative. Encourage landowners and managers to manage land to prevent the drying out of peat. Encourage the establishment of increased areas of semi-natural habitat such as flood plain grazing marsh and reedbed which slow the passage of water through the hydrological system. Encourage the reversion from arable to species-rich acid grassland where appropriate close to sensitive semi-natural habitats. There are opportunities to work with farmers to reduce surface and groundwater pollution at a catchment scale by using fertilisers more strategically and maintaining good quality water in the aquifer. **Continued on next page...**	**Regulating water quality** **Biodiversity** **Regulating soil quality** **Regulating soil erosion** **Sense of place / inspiration** **Pollination**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality cont					**... continued from previous page** Expanded areas of woodland and grassland could also act as filters and would also help to improve biodiversity. Seek opportunities to manage and treat effluent.	
Regulating water flow	Bedrock/aquifer Rivers Woodland including wet woodland and mire Hedgerows Soils	The bedrock and its aquifer absorb much meteoric water and prevent flooding that would otherwise be caused by runoff. Some of this water flows out through the springs and thence into the rivers rather than being stored in the aquifer. Much water also flows through the NCAs from higher up the rivers' courses.	Local	The expected changes in rainfall pattern due to climate change with more rainfall in winter and more intense rainfall in summer could exacerbate flooding events. Good flow regulation within the NCA would be helpful in preventing erosion of the banks of watercourses. The woodlands of the Ridge affect its hydrology as they take up large quantities of water and their roots act as a physical barrier. There have been hard flood defences around Flitwick, where hard engineering has consequently taken place. There are still traditional flood meadows in the valley floors which form corridors of riparian habitat linking the Greensand Ridge and the Bedfordshire and Cambridgeshire Claylands NCAs. There has been major work to link wetland habitats along the Flit valley, especially between Flitwick Moor and Flitton Moor.	Increase the current flood storage capacity by creating or increasing areas of flood plain grazing marsh reedbeds, concentrating on areas at risk. Implement the recommendations from the EA Anglian Habitat Restoration Programme. Produce a strategy to develop a sustainable, integrated and long term flood risk management approach. Use hedgerows and buffer strips to protect semi-natural habitats. Explore opportunities to work to reduce over abstractions and their effect on water flow.	**Regulating water flow** **Regulating soil quality** **Regulating soil erosion**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Soils Woodland Semi-natural habitats Unimproved pasture	The Ridge has a mixture of soil types, with loams and sandy soils predominating. Areas of clays resist water infiltration and can be a source of diffuse pollution as a result of surface run-off. Only 2 per cent of the NCA's soils were classified as Grade 1 under the Provisional Agricultural Land Classification Survey and 20 per cent as Grade 2; 46 per cent was classified as Grade 3. The remaining 32 per cent was of lower grade or non-agricultural (for example under woodland) or urban. There is a mosaic of semi-natural habitats and unimproved pasture where soils are not (directly) subject to agricultural inputs.	Local	Most of the non-arable land is of low quality and supports pastoral agriculture. Areas under woodland or permanent vegetation result in stability in soil quality or increases in organic material and soil fauna. In the main, continuing pastoral land use will maintain the current condition of soils. Localised compaction and erosion may occur in areas with high levels of visitor access; on or around marked routes and in areas of open access. Current levels of grazing are unlikely to cause negative impacts in soil quality. Where land is in arable use, there are more risks to soil quality.	Encourage best practice grazing regimes to avoid localised areas of poaching and compaction. Manage areas with high levels of visitors and recreational use that result in localised soil compaction to avoid further impacts on soil quality or relieve current negative impacts. Any increase in the area under cropping should aim to use soil-friendly cultivation techniques. There may be opportunities for local composting to provide increased soil carbon at selected spots. Opportunities to work to keep the soil on the land by reducing erosion. Encourage the adoption of the Defra Code for Good Agricultural Practice (2009) and Environment Agency's Think Soils' manual (2008) to avoid soil compaction and maintain good soil structure.	**Regulating soil quality** **Regulating soil erosion** **Food provision** **Biodiversity** **Climate regulation** **Sense of history** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Soils with high organic matter Semi-natural habitats Extensively grazed permanent grassland Trees and woodland Hedgerows	The acidic, nutrient-poor, free draining soils are less fertile than the surrounding Claylands. This has influenced the vegetation and agricultural activities of the area, making it more suitable for the establishment of hunting estates comprised of heath and mixed woodland than for agriculture, reducing soil erosion.	Local	Use of heavy high-powered equipment increases the risk of soil compaction and consequently incidence of enhanced run-off and erosion by water. For mineral soils, management to build up soil organics reduces the chance of soil compaction and therefore erosion. Preventing soil erosion would greatly benefit food production but would also help semi-natural wetland habitats such as the fens in the areas which are sensitive to sediment run-off. Soil erosion, (by water or wind) from cultivated and unvegetated land has an important link with pollution to surface waters, particularly from pesticides and phosphates although the latter originate significantly more from sewage than from agriculture. Erosion on the Ridge also occurs as a result of mountain biking, especially at Rowney Warren and Aspley Heath.	Encourage landowners and managers to use farming methods that protect the soil, such as maintaining vegetative cover or improving the soil structure with organic matter. Use of grass buffer strips in areas of arable land can reduce soil erosion from susceptible arable fields in the autumn and winter. Encourage the adoption by farmers and landowners of the Environment Agency's 'Think Soils' manual (2008) Seek opportunities to work to keep the soil on the land. Consider laying tall hedgerows, where appropriate, to restrict the transport of sediment by wind and water and reinstate hedgerows where also appropriate and in keeping with the character of the landscape.	**Regulating soil erosion** **Regulating soil quality** **Food provision** **Biodiversity** **Climate regulation** **Sense of history** **Sense of place**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Heathland Grassland Gardens Field margins	Lowland meadows, lowland heathland and flood plain grazing marsh jointly make up approximately 3 per cent of the NCA's area.	Local	Habitat for pollinating insects includes small areas of lowland meadows, lowland heathland, and flood plain grazing marsh. Increasing and securing pollinator numbers increases food security.	There are opportunities to restore areas of semi-natural habitats Use the environmental stewardship scheme (for example pollen and nectar mixes for field margins) to enhance landscape character and increase landscape connectivity. This would increase the ability of the pollinators to service nominated food crops.	**Pollination** **Food provision** **Biodiversity** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
A sense of place/ inspiration	The Greensand Ridge, rising from the surrounding lowland Wooded horizons and the wooded ridgeline Distinctive Geodiversity Long views over the surrounding rural landscape Traditional building material, and 'Arts and Crafts' architecture A high concentration of parkland and large houses	The Bedfordshire Greensand Ridge has a strong and distinct sense of place. The scarp and dip slopes have a distinct but only slightly different character. The orange colour of the exposed faces of quarries such as those at Sandy contrasts strongly with the colours of the surrounding Claylands. The pattern of woodlands, especially around Sandy and heathland in the NCA, add to this. The woodlands are a distinct contrast to the Claylands around the Ridge. The views across the surrounding Claylands and to the Chilterns also contribute to the sense of place as do the traditional building material, nucleated settlement pattern, 'Arts and Crafts' architecture and other vernacular building materials and styles , which are strongly evocative of the time they were built and is locally distinctive. Older buildings constructed with local materials – sandstone, ironstone, brick, thatch and render add to this distinctiveness.	Regional	The main pressures which could affect the sense of place and inspiration of the Greensand Ridge include development that could obscure the landform, imported and bland building materials such as corrugated metals for industrial units. Development of inappropriate style could also damage the sense of community on the ridge.	There are opportunities to prevent inappropriate development and to maintain the parklands and estates. There are opportunities to maintain the distinctive character of local buildings and villages Opportunities to promote distinctive local recreation such as the Greensand Ridge Walk.	**Sense of place / inspiration** **Sense of history** **Recreation** **Tranquillity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Historic settlements, farmsteads and buildings Fine examples of Arts and Crafts vernacular Country Houses and associated Parklands 'Capability Brown' plantings Ridge and furrow	This NCA has many historic structures and contains more country houses than any other NCA area for area. There is a wealth of historic farm buildings and churches. Nationally important examples of ridge and furrow survive at Hockliffe and Potsgrove.	Regional	The many heritage assets, including the country houses, Woburn Abbey and Deer Park and the many properties in "Arts and Crafts" style contribute to the sense of local history as much as they do to the sense of place. The great majority of farm buildings are unconverted and intact and historic churches are 'stand-out' features in the landscape. The ridge and furrow at Hockliffe and Postsgrove, surviving under grassland, is of national importance. The main pressures on the sense of history are, or would result from, inappropriate development either destroying or obscuring historic features.	Use agri-environment agreements where possible to protect historic farmsteads and buildings and features including ridge and furrow and other earthworks. Promote and use local building materials –brick, thatch and render and, locally around Ampthill, ironstone, and use local styles when restoring existing structures or building new developments. Put in place design and conservation plans to guide and inform new development to ensure it respects intrinsic character. The landscapes designed and planted by Capability Brown are ideally placed for continuing conservation. Seek opportunities to preserve the history and living history of the great houses and parklands.	**Sense of history** **Tranquillity** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Areas of woodland and heathland Historic parkland and country parks Rivers, flood plains Greenbelt	The more tranquil areas of the Ridge are found in the north-west of the NCA. There are numerous areas of woodland and heathland along the Ridge as well as areas of historic parkland and country parks. The southern boundary of the NCA is marked by the River Flit. The greenbelt proportion of the NCA provides tranquillity in the areas it covers.	Local	The growth in road and rail traffic since the 1960s, and the development of the settlements within the NCA, has contributed to the decrease in areas free from intrusion. Intrusion by light and noise pollution has increased considerably since the 1960s when only Leighton Buzzard and major transport routes were intruded. Woodland and heathland provide recreation away from the hustle and bustle of everyday life.	There are opportunities to work with local authorities and Railtrack to minimise noise and light pollution, for example by "screening" major transport routes by hard landscaping or by the planting and/or screening hedgerows. Seek opportunities to protect woodlands and to manage recreation sites in such a way that sound from them does not carry further afield.	**Tranquillity** **Sense of place / inspiration** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Country parks and Woburn Safari Park Historic country houses and associated parkland Right of way networks and footpaths including the Greensand Ridge Walk Grand Union Canal	The Woburn estate and its associated Safari Park and Deer Park, and other historic houses, are major draws for tourists offering history and wildlife. The rights of way and the Greensand Ridge Walk offer good opportunities for long-distance walking. Boating is popular on the Grand Union Canal which cuts though the NCA and the towpath acts as another long-distance path. The grounds of the RSPB's headquarters at Sandy provide important tranquillity with high biodiversity.	Regional	Increased public access through the creation of country parks, Forestry Commission woodland and the Greensand Ridge Way, which follows the length of the ridge, has widened the public perception of this relatively private landscape. Pressures on the NCA's recreational facilities include, especially in the case of Woburn Abbey and its parks, over-use and congestion, traffic noise and pollution. While there is little pressure on the designed walking routes, there is much boating and recreational pressure on the Grand Union Canal. While the grounds of the Lodge are tranquil, there is a danger of pressure on the loading leading to it from Sandy. There are numerous cycling routes – including circular ones – along the Ridge. A Centre Parc holiday village is currently under construction; Rowney Warren Wood Forestry Commission/Southill Estate are popular for walking and cycling; At Old Warden/Shuttleworth, there are an aircraft museum, Swiss gardens, and a birds of prey centre.	There are opportunities to increase the availability of 'green' transport to the country parks and stately homes. There are opportunities to manage the parks while balancing their use with the protection of their historical quality and character There are opportunities to maintain and extend rights of way along the Ridge both for local usage and tourists. Also to manage the use of bicycles and to minimise soil erosion resulting from their use. There are also opportunities to increase sustainable recreation and tourism including walking along the Greensand Walk. Also to increase access to, and promotion of, 'free' resources such as views Explore opportunities to provide sustainable transport options to increase access to woodland sites. Seek opportunities to encourage users of the Grand Union Canal to leave their boats temporarily and explore the local area.	**Recreation** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Semi-natural habitats Ancient woodlands Rivers and wetlands Wildlife Historic Parklands with veteran trees Greenbelt	The Greensand Ridge has a wealth of semi-natural habitats. There are a number of ancient woodlands within the NCA. Priority habitats including lowland heathland and flood plain grazing marshes are scattered throughout the NCA. Rivers and wetlands here support a wide range of species including, lower plants including liverworts, and fungi. The wetlands include former quarries restored under the Nature After Minerals scheme. Adders have been reintroduced and supported at isolated locations along the Ridge. A large part of the western end of the NCA is classified as greenbelt.		The priority habitats of the Ridge, resulting largely from the geology and hydrology, support a wide range of flora and fauna. Ancient, semi-natural woodland is found on a mix of soil types ranging from heavy poorly drained clays to acid well drained soils associated with the Lower Greensand. Lowland heathland usually found on outcrops of Greensand and typified by heather and wavy hair-grass supports a characteristic mix of species, which along the Ridge includes notables such as the natterjack toad, nightjar, adder and proliferous pink. Open sandy areas provide excellent conditions for a range of specialised invertebrates, especially bees and wasps and spiders. **Continued on next page...**	Designated sites could be managed, protected and extended and fragmented habitats connected and expanded. Buffer strips could be created around field margins. There are opportunities to ensure that any development in the NCA is sustainable. Awareness of local, important species can be raised and measures to protect them and increased their range/numbers put in place. Continue to value and retain the Greenbelt. Prevent the introduction and spread of non-native invasive species (plants and animals) that have an adverse impact on river life biodiversity and ecological status.	**Biodiversity** **Regulating Water Quality** **Regulating Water Flow** **Sense of place/ Inspiring Places** **Sense of Tranquillity** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity cont				**... continued from previous page** Lowland acid grassland is restricted to well-drained Greensand soils. The sward is characterised by fine-leaved grasses such as fescues and bents, with a range of plants such as tormentil, heath bedstraw, shepherd's cress and clovers. Bryophytes, rare/scarce macrofungi and lichens can be a special feature. Common blue and small copper butterflies can be abundant and there are records for bugs such as the bishops mitre shield bug. Some of the best remaining areas of acid grassland in the county are at places such as Ampthill Park and Woburn Park. The acidic waters rising from the Greensand aquifers supports a mix of different wetland habitats including acid mire, flood plain grazing marsh and wet woodland. These have a rich assemblage of specialised wildlife, especially sedges, lower plants such as bog-mosses and liverworts, and invertebrates. The wet woodlands are characterised by alder, birch and willow, providing shady conditions for specialised fungi and liverwort species. The rare black poplar can also be found. There are also some areas of marsh and fen on more calcareous soils, with species like greater tussock sedge, and jointed rush. Remaining areas of wood pasture and parkland are characteristic and significant in Bedfordshire. Many contain extensive areas of lowland grassland and are especially rich in mature and veteran trees.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Striking landform that clearly reveals geological processes Natural exposures Geological and mixed interest SSSI and Local Geological Sites Quarries – fuller's earth and high-quality sands Vernacular building stone	The geological importance of the Greensand Ridge is underlined by the SSSI designated for their geological interest and by 15 Local Geological Sites. The bedrock geology dates from the Cretaceous Period but two of the Local Geological Sites also have Quaternary interest. The Greensands include a thin layer, the famous Shenley Limestone, at their top; this is extraordinarily rich in fossil marine shell species, especially brachiopods. High-quality sands from the Ridge are used for glassmaking and fuller's earth, originally used to remove grease from sheep's wool, is currently used in a variety of chemical processes. Local stone is important here as a distinctive building material.	National	The underlying Cretaceous geology of the Lower Greensand Group gives the Ridge its distinctive landform and has influenced the NCA's social and economic history and provides the route for the Greensand Walk. Exposures of rock, especially those designated as SSSI or Local Geological Sites, are important for the geology and geological processes they reveal. The fossil fauna of the Shenley Limestone is important for the biology it reveals. Local stone is an important resource – vernacular buildings such as churches would be difficult to repair or renovate without bringing stone long distances.	There are opportunities to maintain views of and access to geological features and exposures where appropriate, improving access to cuttings, quarries and other exposures of geological features for increased understanding and enjoyment of geodiversity as well as for uncovering fossils and stratigraphy of major importance. Seek opportunities to interpret the geology to enhance the Greensand Ridge Walk. Maintain resources such as small-scale quarries for the repair and renovation of local vernacular buildings.	**Geodiversity** **Sense of place/ inspiration** **Sense of history** **Recreation**

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