National Character Area profile:

44. Central Lincolnshire Vale

Supporting documents

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Introduction

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

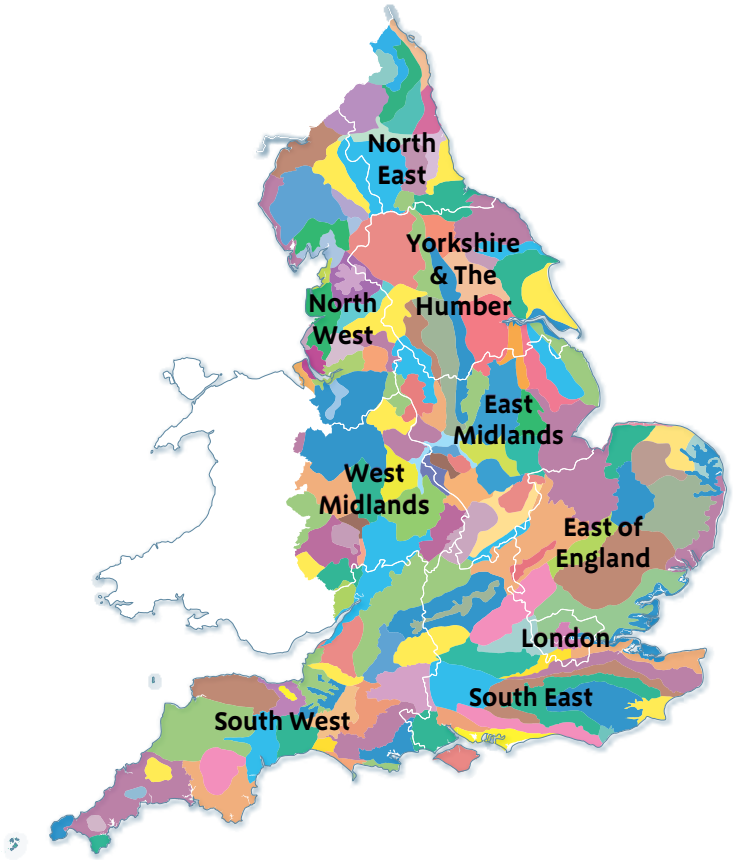
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

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

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

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

National Character Areas map



[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: www.official-documents.gov.uk/document/cm80/8082/8082.pdf)

[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf)

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

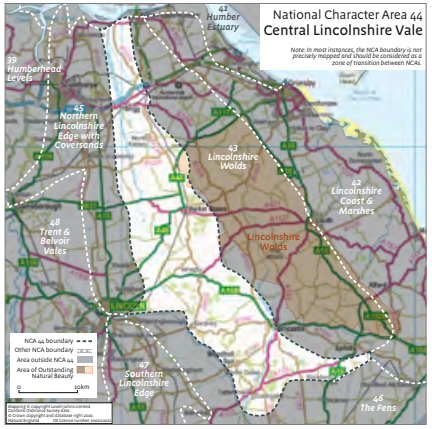
Summary

The Central Lincolnshire Vale National Character Area's (NCA's) tranquil, rural and sparsely settled landscape is largely used for agricultural production, mainly for the growing of arable crops, principally cereals. This is in spite of historically challenging soils and conditions. Its dominant 'boulder clay' derived soils underlain by mudstone bedrock lead to seasonably waterlogged conditions which, under natural unmodified conditions, support wet grasslands and woodlands; however, a history of agricultural improvement along with modern machinery and agrochemicals have transformed the land and vastly increased its productivity.

An imperceptible rise in landform across the centre of the NCA means that the northern half drains north into the River Ancholme and out to the Humber, while the southern end drains into the River Witham and The Wash. Most of this natural drainage pattern has been straightened, deepened and confined within steep embankments and the land drained – especially north towards the Humber. In contrast, pockets of wind-blown sand deposits (the Coversands) and river-derived sands and gravels (the Fen Edge Gravels) have led to localised contrasting landscapes where soils are sandy, acidic and infertile and heathland habitats are found along with some extensive coniferous plantations.

The Vale formed part of the ancient Anglo-Saxon kingdom of Lindsey (meaning 'island of Lincoln') which was almost cut off from neighbouring land by the Humber, The Wash and extensive wetlands between, with the only easy land access being along Ermine Street on the narrow Lincolnshire Limestone ridge, where Lincoln has been the key settlement of the wider area since Roman times. Access to the city and the sea via the River Witham has had important influence and led to a cluster of medieval settlements and monastic sites near to its course. The Vale still retains a sense of remoteness enhanced by its thinly scattered population and general lack of development and major roads and one of its key ecosystem services is the tranquillity of its landscape. The low, open nature of the land means that skies are expansive and relatively free of light pollution.

Other key ecosystem services include its biodiversity resource which, despite being very limited overall, provides clusters of value, perhaps most notably but not exclusively in the Bardney Limewoods National Nature Reserve which provides the greatest concentration of original wildwood left in the country. The recreational potential of the area is also important because of the Vale's close proximity to Lincoln and also the Lincolnshire Wolds Area of Outstanding Natural Beauty, of which a small part extends into the area. Provision of food is a very important function of the NCA. A key challenge for the Vale is balancing agricultural and forestry production with the enhancement of other ecosystem services such as the regulation of water quality.



Click map to enlarge; click again to reduce.

Statements of Environmental Opportunity

- **SEO 1**: Restore natural watercourse and flood plain functionality within the Vale, ensuring no harm to archaeological assets, and seek habitat creation and linkages and land management changes through the area, to improve resilience and ecosystem capacity to regulate water quality, regulate water flow and reduce soil erosion. This will also enhance riverine character, recreational experience and ecological connectivity.

- **SEO 2**: Protect and enhance the rural character and tranquillity of the Vale, much valued for their contribution to sense of place, inspiration and recreation. Ensure that new development is informed by local assessments, opportunity and mapping studies to help to minimise impact and maximise environmental gain through good design and appropriate screening, and promote green infrastructure links to ensure that the surrounding settlements have access to the many recreation assets which contribute to the health and wellbeing of both residents and visitors.

- **SEO 3**: Manage the valuable ancient lime woodlands, enhance and increase the woodland and hedgerow network, and seek to restore and re-create heathland and acid grassland, where appropriate, to strengthen ecological diversity and connectivity, enhance landscape character, improve soil and water quality, reduce soil erosion, increase carbon storage, and bring opportunities for timber and biomass provision.

- **SEO 4**: Improve the environmental sustainability of agriculture within the Vale and enhance the capacity of natural ecosystems to support the long-term provision of food, improve soil quality, enhance water quality (especially in the Ancholme basin), provide habitat for pollinators, enhance farmland habitats and benefit climate regulation.

- **SEO 5**: Protect and enhance the historic character of the Vale including the monastery sites, shrunken medieval villages, parklands and villages. Increase awareness of the richness of this resource, protect it from neglect and physical damage, and ensure that future development complements and enhances the sense of history.

Description

Physical and functional links to other National Character Areas

Links to surrounding landscapes are strong in the Central Lincolnshire Vale National Character Area (NCA). Lying between the higher ground of the Northern Lincolnshire Edge with Coversands NCA to the west and the Lincolnshire Wolds NCA to the east, it also adjoins the flat landscape of The Fens NCA in the south while its short northern edge merges with the Humber Estuary NCA.

The low hills of the Wolds form a visual backdrop along the eastern margin, provide extensive views over the Vale and are the source of most of the streams that flow across it. At their lower northern end, these hills cross into the Vale providing geological and geomorphological links common with the rest of the range. The Vale is also linked to the landscape of the Lincolnshire Edge with part of the dip slope of this limestone geology forming the bedrock (and an important aquifer) along the western margin of the Vale, before becoming confined below the younger Jurassic mudstones of the NCA. In the south, the Vale shares the common boundary of the River Witham with the adjoining Fens NCA and this river also links the Vale with The Wash, into which it flows. The Witham also provides links to its source in the Kesteven Uplands NCA and to the Trent and Belvoir Vales NCA, through which it flows, while both the Witham and the Ancholme are linked to the River Trent's catchment via the Fossdyke, whereby water from the Trent is pumped to supplement their flows. The Fossdyke also provides a waterway link from the Witham to the wider navigable waterway network and the Witham corridor provides a recreational link from the city of Lincoln into the Vale.

Links to the Humber Estuary are also strong: the River Ancholme flows into this internationally important habitat and many waders of the mudflats come inland to roost and feed on the fields in the Ancholme Valley at high tide. Prior to drainage and conversion to farmland, much of this part of the NCA comprised intertidal creeks and a functional part of the estuary. There are views out of the Vale over the estuary from the northern Wolds escarpment.

A few main roads which link Yorkshire and the North Midlands with the Lincolnshire coastal resorts and Humber ports cross the Vale, while a train line linking Grimsby to Lincoln runs through the northern half of the NCA. The Viking Way long-distance footpath crosses the Vale providing a walking link all the way to Rutland Water, while a small part of the Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB) extends into the NCA around Claxby.

Distinct areas

- The Coversands and the Fen Edge Gravels.
- The Wolds.

Key characteristics

- A predominantly broad, low-lying, very gently undulating arable vale with a bedrock, chiefly of Jurassic mudstones and almost entirely covered by a variety of superficial deposits, largely of glacial till (boulder clay), and with the Wolds scarp providing an often prominent boundary to the east.
- Seasonally waterlogged loamy clay soils, grading to deeper calcareous loams towards the Wolds and contrasting with deep acidic sandy soils on the Fen Edge Gravels and the wind-blown Coversands.
- A landscape crossed by many streams flowing from the Wolds towards the heavily modified courses of the main rivers: the straight course of the canalised River Ancholme which flows north into the Humber and the similarly modified River Witham which flows south to The Wash.
- Woodland cover is variable with little on the central and northern clay soils, much more on the Coversands and Fen Edge Gravels including extensive conifer plantations, while there is a concentration of ancient lime woodland between Wragby and Bardney.
- Land used mostly as arable farmland with pasture on the heavier clays and around villages.

Continued on next page...

The rare red-brick medieval Tattershall Castle and moat, now a popular visitor destination.

Key characteristics continued

- In general, a regular pattern of medium to large-sized arable fields with hawthorn-dominant hedgerows enclosing most fields and with few hedgerow trees. Significant variation found on the Coversands and Fen Edge Gravels where field boundary trees are a feature, and on the flat land of the Ancholme Valley where rectilinear fields tend to be divided by ditches and dykes.
- Very limited semi-natural habitat, most being lost through drainage and commercial agriculture and forestry; however, significant remnants of lowland heath and acid grassland survive on the Coversands and Fen Edge Gravels, and Bardney Limewoods represents England's biggest concentration of ancient small-leaved lime-dominated woodland.
- A landscape rich in medieval sites with remnant ridge and furrow, deserted medieval villages and a cluster of monastic sites close to the River Witham, while Lincoln Cathedral, just outside the Vale, in the west provides a landmark across much of the area.
- Traditional building materials predominantly of brick and pantile reflecting the availability and suitability of local clay with stone from surrounding areas used in churches and high-status buildings. Large modern barns and outbuildings contrast with the established character.
- A deeply rural, tranquil landscape with sparsely distributed small nucleated settlements and isolated farmsteads linked by an extensive but sparse network of minor roads and tracks with few major roads.
- A variety of recreational assets including routes within the Lincolnshire Limewoods, several Forestry Commission managed plantations and woodland sites, the Viking Way long-distance footpath, Woodhall Spa, Tattershall Castle and waterborne recreation provided by the rivers Witham and Ancholme and some flooded gravel pits.

Central Lincolnshire Vale today

The Central Lincolnshire Vale is a long, linear NCA which runs south from the Humber Estuary to the Fens and comprises the broad, low-lying vale between the Lincolnshire Wolds and the Lincolnshire Edge. It is a very gently undulating landscape, becoming flat and near to sea level in the Ancholme Valley in the north and on the edge of the Fens in the south. The scarp slope of the Wolds in the east provides a strong visual boundary for the northern half of the Vale and north around Elsham these hills cross into the Vales rising around 90 m above the flats of the River Ancholme's flood plain. The pasture and contour-hugging woodland of the scarp contrast with the open, rectilinear, arable farmland below, while east of the crest lies the large-scale, open, arable landscape of the Wolds dip slope. The western NCA boundary is less well defined, by the indistinct dip slope of the Lincolnshire Edge in the north and by the River Witham and the flat Fens in the south.

Jurassic mudstones dominate the solid geology, while Lower Cretaceous chalk rocks of the Wolds feature in the far north. Most of the area is blanketed by a variety of superficial deposits. Glacial till – known as diamicton or boulder clay – covers most of the Vale while wind-blown sand deposits (the Coversands) are found against the Wolds scarp around Market Rasen and Elsham. Fluvio-glacial sands and gravels (the Fen Edge Gravels) are found around Tattershall, while flood plain alluvium and lacustrine (lake) deposits and some small areas of peat are found in the Ancholme Valley.

Soils vary accordingly – till deposits have given rise to the loamy and clayey soils of moderate fertility with impeded drainage, often waterlogged in winter. This is the main soil type. Similar soils have developed in the Ancholme flood plain, with peaty soils in places. In contrast, the Coversands and Fen Edge Gravels have given rise to very acidic, infertile, sandy soils, while freely draining, lime-rich, loamy soils have developed over the Wolds chalk in the far north.

Goslings Corner Wood SSSI with ancient woodland and open species-rich glades.

The drainage pattern generally comprises streams flowing from their source in the Wolds south-west across the area into the two main rivers of the NCA – the Ancholme and the Witham, both orientated roughly north–south. An inconspicuous central watershed divides this drainage which in the north flows into the Humber and in the south flows to The Wash. Much of the drainage has been heavily modified, more so the closer to the Fens in the south and the Humber Estuary in the north. The River Ancholme itself hosts a series of impressive historic bridges which act as notable features in the landscape today. A new channel cut in the 17th and 18th centuries forms a strongly embanked straight course from Bishopbridge to the Humber. The old river is still present mostly as a series of meandering ditches either side of the manmade channel. The old River Bain remains despite the section between Horncastle and the River Witham being canalised in the 18th century to form what is now the non-navigable Horncastle Canal. Within the Fen Edge Gravels, where sand and gravel extraction takes place, there is a concentration of flooded former workings. Despite the severe modification, the watercourses do provide an interconnected network of habitats and recreational value throughout the Vale. The drainage ditches provide good habitat for migratory warblers while both the rivers Bain and Ancholme are known to be used by otters. The upper River Rase has a relatively natural habitat supporting a rich chalk stream invertebrate fauna.

There is generally very little woodland cover on the clay soils of the northern half of the NCA. Further south, however, there are important woodlands including the concentration of medium-sized woods which represent Britain's greatest concentration of small-leaved lime-dominant woodland. The majority of the Lincolnshire Limewoods, but not exclusively, are designated as Bardney Limewoods National Nature Reserve. These ancient woodlands may be the earliest surviving landscape elements in Lincolnshire and have important populations of butterflies and moths, including the white admiral, brown hairstreak, grizzled skipper, bee hawk-moth and many other nationally scarce species. They also support four species of bat, breeding woodcock and nightingale, while dormice were re-introduced in 2002.

Greater tree cover is also found on the sandy soils, much of which comprises some large coniferous plantations on the Coversands, while some ancient oak woodland and ancient alder-dominated wet woodland remains on the Fen Edge Gravels. While field, field edge, roadside and hedgerow trees are not typical, within parts of the Lincolnshire Limewoods, Fen Edge Gravels and Coversands areas they are, such as around Holton le Moor where mature oaks line the edges of fields.

Arable agriculture is the main land use, interspersed with pasture on heavier clays, on the Wolds scarp slopes and around villages. Within the Coversands and Fen Edge Gravels, land use is more varied with forestry and recreational uses featuring prominently as well as gravel extraction around the lower reaches of the River Bain.

Semi-natural habitats are generally very limited, isolated and fragmented, mostly due to agricultural improvement, while much of the lowland heathland habitats on the sandy acidic soils were lost to mid-20th-century conifer plantations. Around 750 ha of heathland habitats remain providing refuge for a thriving diversity of invertebrates including the grayling butterfly, while breeding birds include nightjars, woodlarks and tree pipits. Adders, slow worms and five species of bat are also present.

Farmland habitats include those associated with old farm buildings, some unimproved grassland, field margins, hedgerows, copses, ponds and the fields themselves. The Vale farmland supports a good brown hare population and several important farmland bird species reliant on arable farmland including lapwing, grey partridge, corn bunting and yellow wagtail. It is also within the top ten NCAs in England for skylark, tree sparrow and yellowhammer. Agri-environment schemes have enabled some arable reversion to grassland on the scarp slope of the Wolds such as at Horkstow, while nearby, within the Ancholme flood plain, some wet grassland areas have been created which are important for birds using the nearby internationally important habitat of the Humber Estuary and that need inland areas in which to feed and roost during high tide.

Field sizes vary but are generally medium to very large rectangular fields, becoming more rectilinear closer to the Humber in the Ancholme Valley relating to the flatter ground here and the patterns of drainage dykes which often form field boundaries. In many places, field amalgamation has formed areas that appear very expansive, particularly where divided by ditches, thereby lacking visual vertical boundaries. Smaller fields of pasture are commonly found around settlements, often reflecting the pattern of ancient enclosure. Hedgerows are predominantly of hawthorn and vary considerably in quality from low, gappy and degraded to full, dense hedgerows and new hedgerow planting, while wooded hedgerows are common within the Limewoods, the Coversands and Fen Edge Gravels.

Widespread earthwork (with some upstanding) medieval remains of deserted and shrunken villages and monasteries, notably the Witham Abbeys, feature particularly in the south of the area. Other historic assets include the fine 15th-century brick keep tower of Tattershall Castle, the old cores of the small towns and villages and their churches, and the many historic farmsteads. There are few estates or parklands though notable exceptions are the registered parklands at Scrivelsby Park and Revesby Abbey, both derived from medieval deer parks. Lincoln Cathedral, within the adjacent NCA, is seen as a fine historic landmark in clear weather across much of the wider area.

The main settlements are Brigg, Horncastle, Market Rasen and Woodhall Spa. There is a slightly higher density of settlement in the Tattershall area with an RAF base at Coningsby and scattered smallholdings. Other than this, settlement is light and dispersed, consisting of tiny hamlets and farmsteads and the occasional larger village. Linking these is an extensive but sparse network of minor roads and tracks with few main roads. Overall the Vale has a quiet rural character without much traffic and high levels of tranquillity. Some busy trunk roads cross the area, such as the A158 as well as the M180, but away from these there is little disturbance.

Kirby Moor SSSI with a mosaic of heathland and surrounding woodland.

Characteristic traditional building materials are red brick and clay pantile; yellow brick also features but to a lesser extent. Many buildings are also rendered and painted. The dominance of brick and clay tile reflects the availability and suitability of local clay which began use in the medieval period, as seen in the 15th-century Tattershall Castle. Churches and other high-status buildings typically feature imported stone from adjoining areas: limestone from the Lincolnshire Edge and Claxby Ironstone, Tealby Limestone and Spilsby Sandstone from the Lincolnshire Wolds. Frequent large agricultural buildings constructed of modern materials contrast with intrinsic character.

The Victorian resort of Woodhall Spa remains a resort to this day with hotels, caravan and camping sites and two high-class golf courses. Nearby Tattershall Castle is managed by the National Trust while a leisure park occupies a cluster of flooded former gravel pits. A small part (751 ha) of the Lincolnshire Wolds AONB extends into the NCA around Claxby. A National Cycle Network route passes through the centre of the NCA on minor roads while another runs from Lincoln to Boston beside the River Witham on minor roads and a dismantled railway known as the Water Rail Way. The Viking Way long-distance footpath starts on the River Humber, crosses into the NCA at South Ferriby, runs alongside the NCA on top of the Wolds escarpment and crosses the Vale between Horncastle and Lincoln. This 237-kilometre route from Rutland Water to the Humber is named to reflect the influence of Danelaw in the eastern counties of Britain[4]. Other recreational assets include several promoted cycling and walking routes, several accessible Forestry Commission managed plantation sites (for example Chambers Farm Wood), Market Rasen Racecourse, Elsham Hall Gardens and connections to the waterway network via the River Witham and the River Ancholme, while the trail beside the River Ancholme provides a good north–south link through the Vale.

The landscape through time

The vast majority of the bedrock of the Central Lincolnshire Vale was laid down during the Jurassic Period. As sea deepened during the Jurassic, the shallow water marine limestones of the Lincolnshire Edge gave way to deeper water muds and silts which today underlie most of the NCA. They range in age from 165 to 151 million years old and include Kellaways, Oxford Clay, West Walton, Ampthill Clay and Kimmeridge Clay formations. The area is rich in fossils – the ammonite Rasenia from the Kimmeridge Clay is named after Market Rasen. The mudstones, being relatively soft, were easily eroded, leading to today's low-lying landform. Harder rocks of the following Cretaceous Period feature in the north where chalk 99–65 million years old crosses into the area forming the higher ground of the Wolds along the eastern margin of the NCA.

Glacial, periglacial and interglacial fluvial action was significant in shaping the land with bedrock scoured out creating the Wolds escarpment and the deposition of huge amounts of material covering nearly all of the NCA's bedrock. Glacial till (boulder clay) from the moraines of advancing and retreating glaciers smothers much of the area south of Market Rasen while lacustrine (lake), river and marine alluvium deposits dominate the Ancholme Valley. A large area around Tattershall became covered in sand and gravel deposited from the large, braided, meltwater-fed ancestral River Trent whose course is speculated to have flowed out through the 'Ancaster Gap' in the Lincolnshire Edge flowing eastwards into The Wash – this early river is known as the River Ancaster. Its course was probably blocked by ice forcing it to flow northward draining into the Humber as today. When tundra conditions prevailed at the end of the last glaciation there was little vegetation to prevent sand being blown by strong winds and deposited against the foot of the Wolds around Market Rasen and Elsham.

[4] Accessed October 2013; URL: **http://microsites.lincolnshire.gov.uk/Countryside/visiting-the-countryside/walking/viking-way**

Flint contained within the chalk and glacially derived sediments was of huge importance to early man and there is a wealth of prehistoric archaeology contained within the fens and former fens of the Ancholme and Witham valleys. The Ancholme was a complex of intertidal creeks exploited by man from an early date, witnessed by discovery of the Appleby longboat dating from c.11,000 BC, while prehistoric track ways and burial monuments, submerged beneath fen peat and alluvium, are a particular feature of the Witham.
Following the last ice age, woodlands became established and the area became largely covered in dense forests of oak and alder. Small-leaved lime eventually became the dominant species in the mixed deciduous woods which once probably covered much of the better soils in lowland Britain and Europe. The ancient limewoods of the Vale may have been continuously wooded since the species first arrived some 5,000 to 8,000 years ago. During the Bronze Age, significant settlement took place and extensive areas of woodland were cleared for farming.

Clearance continued during the Roman period. Horncastle became established while Lincoln became a key Roman settlement at the junction of Ermine Street and the Fosse Way. Remains of a luxurious Romano-British villa in the village of Horkstow indicate a flourishing late Romano-British society in the area. Following Roman departure in the 5th century, incoming groups of Angles settled heavily in the area establishing the Anglian kingdom of Lindsey between the Witham and the Humber, later absorbed into Mercia in the 8th century. A large Danish raiding army landed in East Anglia in 865 and in the subsequent years large swathes of Anglo-Saxon England became conquered and controlled under Danelaw and settled by Scandinavian settlers who followed. Their legacy is preserved in the many place names that end in 'by' across the Vale.

Several monasteries were founded from the 7th century onwards in the south of the NCA including at Tupholme, Bardney and Barlings. Their location by the River Witham was good for trade as the river was the key transport route between Lincoln and the sea. The woodland and much of the farmland in this area would have formed part of the estates of these abbeys, and their survival may be due to their use by the monasteries. Under medieval arable cultivation, local soils were not very productive and it is likely the woodlands would have been extensively used for fuel-gathering, as hunting grounds and for livestock grazing, with consistent management as coppice and high forest since the 11th century[5].

The mixed arable and grazing landscapes of the earlier medieval period gave way to extensive enclosed pasture from the 14th century onwards and significant numbers of settlements such as Spridlington, Cold Hanworth and Goltho succumbed to desertion in the face of conversion to sheep pasture, among other reasons such as the Black Death.

Significant landscape change came with enclosure of farmland. The dominance of large landholdings, especially in the Lincolnshire Limewoods, resulted in the early spread of regular medium-scale general enclosure now characterised by mature and well-wooded hedgerows. Elsewhere, across the clay vale and the lowland heaths, enclosure by Parliamentary Act between 1760 and 1830 was often required to deal with the more complex medieval legacy of multiple holdings, resulting in equally regular fieldscapes, but more often bounded by simple thorn hedges. The reclamation of the Ancholme Valley fens, largely completed in the early 18th century, produced a still larger and more regular pattern of fields, invariably bounded by ditches.

A leading figure in the agricultural revolution of the late 18th century as well as the drainage of the fens[6] was the botanist Sir Joseph Banks (1743–1820) who travelled the south Pacific with Captain Cook and whose home was the Revesby estate to the south of Horncastle. Meanwhile, at Horkstow north of Brigg, George Stubbs, the painter best known for his depiction of horses, began in 1756 his great work in dissecting and drawing *The Anatomy of the Horse*[7].

[5] *The Historic Character of the County of Lincolnshire*, English Heritage (2011)
[6] *Lincolnshire: A Shell Guide,* Henry Thorold and Jack Yates, Faber & Faber (1965)
[7] The British Sporting Arts Trust , **http://www.bsat.co.uk/artists.php?aid=12**

The continued rationalisation of the Vale's farmland culminated in the dominance of the estate farms of the late 18th and early 19th centuries, often with new, impressive brick-built farmsteads with cattle courts set within the extensive ranges of regular large-scale enclosures separated by straight fieldways and tracks.

Following the discovery of medicinal waters in the Victorian period, Woodhall Spa developed into a small inland resort set in the pine and birch woods.

Mature conifer plantation near Holton le Moor.

In the 1930s the Forestry Commission began tree planting in the area as part of the government drive to boost UK home-grown timber supplies. Over the years many conifer plantations became established on former heathland sites as well as on the sites of many clear-felled ancient woodlands.

With the onset of the Second World War, several airfields were built, particularly in the southern half of the NCA, providing bases for Lancaster bombers, including Squadron 617, the 'Dambusters'. The airfield at Coningsby remains an RAF base to this day.

Agricultural productivity levels increased hugely after the War when large areas of pasture within the NCA were ploughed up to make way for greater arable crop production and many hedgerows were removed to increase field sizes with significant impacts on semi-natural habitats and biodiversity.
The Lincolnshire Limewoods became the focus of pioneering work in the 1970s by the woodland ecologist George Peterken who helped to transform understanding of ancient woodlands and English woodland history.

Recent years have seen some increase in woodland cover in the NCA while farmland has seen a change from mixed and general cropping to more cereal holdings. There has been a moderately high rate of build outside urban areas including the M180 corridor in the Brigg area, the area east of Lincoln, along the A46 to Market Rasen and around Woodhall Spa. Contemporary pressures for change come from sand and gravel extraction within the Fen Edge Gravels, wind turbines and some planned growth of Market Rasen and Brigg.

Ecosystem services

The Central Lincolnshire Vale 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 Central Lincolnshire Vale NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** This is an important area for farming, especially cereal production. Farmland covered 77 per cent of the total area in 2009 and three-quarters of this was under arable production. In recent decades a programme of agricultural improvement has led to an increase in the overall yield of food crops. In some situations this intensification has had an effect on the value of some ecosystem services such as biodiversity, water and soil quality. Farm businesses should seek to employ sustainable agricultural practices in the future to benefit both food provision and the natural environment over the long term.

- **Timber provision:** Total woodland cover in 2011 was 6,273 ha, 8 per cent of total area: of this, 4,074 ha was broadleaved, 1,646 ha coniferous, 51 ha mixed and 501 ha other. The main areas of woodland are Bardney Forest and on the sandy soils of the Coversands and the Fen Edge Gravels. Forestry Commission managed woodlands are significant in the NCA with large coniferous plantations on former heathland sites around Market Rasen and to a lesser extent by Woodhall Spa. There are also some coniferous and mixed Forestry Commission plantations within the Limewoods area on sites of former ancient woodland. Much of this resource is coming to harvesting age.

This is an important area for farming with a demand for water for crop irrigation as seen here from Claxby Moor.

- **Water availability:** The predominant boulder clay derived soils underlain by mudstone bedrock mean that soil water availability is generally naturally high. Numerous streams drain across the landscape from their source in the Wolds into the main rivers of the Ancholme and Witham. The Lincolnshire Limestone aquifer which underlies the mudstone across most of the Vale is also an important source of water. Water levels in the Ancholme and Witham rivers are artificially maintained by the transfer of water from the River Trent, to support public water supply. There is also a demand for water for irrigation of crops.

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

- **Regulating soil quality:** Given that the soils of the Vale support substantial agricultural production, regulation of soil quality is an important ecosystem service in this NCA. The main soil types, are the base-rich loamy and clayey soils (51 per cent of the NCA), which are easily damaged when wet so there is a need to minimise compaction and capping risk which can cause and exacerbate run-off problems with consequent impacts on water quality. Careful timing of activities is required to reduce this likelihood, while increasing organic matter levels can help to minimise problems. The next main soil types, are the very acid sandy and loamy soils (17 per cent) which have developed over the Coversands and the Fen Edge Gravels. These are easily worked but have a weak structure which can be easily damaged by cultivation making it vulnerable to wind and water erosion with consequent impacts on water quality. Additions of organic matter can increase stability where it is cultivated.

- **Regulating water quality:** Because the River Ancholme's catchment drains into the internationally important habitat of the Humber Estuary and because parts of the NCA, albeit small, are designated catchment sensitive areas, water quality regulation is an important ecosystem service. Current water quality ecological status of the Ancholme catchment is failing to achieve good, with diffuse pollution from arable agriculture sources one of the key reasons for water quality failures[8], while physical modification of the watercourses limit ecological potential. Erosion of soil, particularly the peaty soils of the upper Ancholme Valley, impacts on water quality; measures to reduce erosion and run-off of agro-chemicals from farmland will boost the capacity of the Vale to deliver this ecosystem service.

Cultural services (inspiration, education and wellbeing)

- **Sense of history:** Sense of history is ingrained in this landscape through the numerous deserted and shrunken medieval villages and the profusion of former monastic sites as well as the area's traditional buildings, the distinctive Tudor brick tower of Tattershall Castle and the old stone churches of the villages. The numerous ancient woodlands of the Vale also contribute to the sense of history, especially the Limewoods which may have been continuously wooded since the end of the last ice age. While the farming heritage of the Vale is strong, some of the impacts of agricultural improvements and modern commercial agriculture have been negative in terms of the historic character of the NCA, such as the removal of hedgerows and the neglect of farm buildings and other traditional farmland features.

- **Tranquillity:** The Vale's thinly scattered population, sparse network of quiet minor roads and general lack of urban development mean that tranquillity is significant, with 71 per cent of the area in 2007 classified as undisturbed from urban development, traffic noise and other sources of visual and auditory intrusion. The most tranquil areas are within parts of the Ancholme Valley and in the Bardney Limewoods area.

[8] *River Basin Management Plan:* Humber River Basin District, Environment Agency (2009)

The church at North Kelsey built of local ironstone.

- **Recreation**: The Vale's location in close proximity to Lincoln combined with its appealing attributes make its recreation appeal significant. Recreation assets include the Witham corridor green infrastructure link with Lincoln; close proximity of the Lincolnshire Wolds AONB and the Wolds scarp; the Viking Way long-distance footpath and the range of other walking routes; Woodhall Spa resort; the woodlands and heathlands; the suitability of the topography and network of quiet lanes for cycling; and the heritage assets.

- **Biodiversity**: Although the overall extent of semi-natural habitats is extremely limited, the Vale's remaining habitats support a high diversity of species. Habitats range from acidic grassland, heathland and ancient deciduous woodland to wetland habitats, while its farmland habitats are important to farmland birds. Recent habitat creation in parts of the Vale – such as wet grassland creation within the Ancholme flood plain and woodland creation and habitat linkages within the Limewoods area – are helping to improve biodiversity resource.

- **Geodiversity:** The Vale has a wide diversity of geology, especially its superficial geology and the soils that have arisen. This includes the clayey soils over the main part of the Vale, the sandy soils of the Coversands and Fen Edge Gravels, the lime-rich soils over the chalk of the Wolds and the peaty soils of the upper Ancholme Valley. Other assets include the Wolds scarp, the Lincolnshire Limestone aquifer, the rich fossil fauna of the bedrock mudstones and the sand and gravel deposits.

Statements of Environmental Opportunity

SEO 1: Restore natural watercourse and flood plain functionality within the Vale, ensuring no harm to archaeological assets, and seek habitat creation and linkages and land management changes through the area, to improve resilience and ecosystem capacity to regulate water quality, regulate water flow and reduce soil erosion. This will also enhance riverine character, recreational experience and ecological connectivity.

For example, by:

- Where feasible, creating areas of wet grassland and other wetland habitats along watercourses, such as in the Ancholme Valley, to improve water quality and support the wildlife of the Humber Estuary.
- Planning to adapt to the impacts of sea level rise which is likely to reduce the extent of freshwater habitat around the Humber in the longer term; and seeking opportunities to positively adapt by establishing a variety of wetland habitats within the Ancholme flood plain – where feasible – to partially compensate for loss.
- Protecting and expanding, where feasible, existing wet grassland habitats such as along the River Bain. Exploring the potential to restore the corridor of the old River Bain and enhance associated habitat networks to link with important heathland and acid grassland.
- Exploring the potential to convert some areas of arable land to other appropriate uses throughout the National Character Area (NCA) to enhance water quality, especially in the Ancholme Valley, including opportunities to re-wet areas and establish permanent vegetation.
- Expanding the network of semi-natural wetland habitats, woodland, hedgerows and grassland adjacent to watercourses, field drains and waterbodies to capture sediment and nutrients.
- Adapting existing drainage schemes and designing new sustainable drainage schemes to incorporate habitats to purify water and increase infiltration. Designing these in conjunction with green infrastructure.
- Seeking high-quality restoration of gravel extraction sites within the Fen Edge Gravels which includes the creation of a varied habitat network, including wetland and heathland, for landscape enhancement and for the recreational opportunities this brings.
- Promoting opportunities to encourage and enhance green infrastructure and access routes, along the rivers and streams to increase access to the countryside for public enjoyment.
- In partnership, seeking to make space for the action of natural riverine processes, where feasible, to increase flood resilience and capacity to adapt to climate change within the Ancholme Valley, which will be impacted by rising sea levels from the Humber.

SEO 2: Protect and enhance the rural character and tranquillity of the Vale, much valued for their contribution to sense of place, inspiration and recreation. Ensure that new development is informed by local assessments, opportunity and mapping studies to help to minimise impact and maximise environmental gain through good design and appropriate screening, and promote green infrastructure links to ensure that the surrounding settlements have access to the many recreation assets which contribute to the health and wellbeing of both residents and visitors.

For example, by:

- Developing well-designed green infrastructure informed by local evidence - such as biodiversity opportunity mapping and landscape character assessment - and sustainable tourism which enables access and enjoyment of the Vale while protecting it from greater traffic and development.
- Screening urban and industrial influences (such as gravel workings) with the use of substantial and appropriate woodland planting, and reducing the intrusion of development through means such as sensitive lighting and use of green roofs.
- Maximising funding obtained from planning gain from new development and the resulting S106 agreements so that they benefit the natural environment and are aligned with the objectives of landscape planning and enhancement initiatives.
- Ensuring that the location, form and design of new development are guided by Biodiversity Opportunity Mapping and Landscape Character Assessment objectives, village design guidance and design briefs, and use of local architectural styles and materials as well as sensitive lighting.
- Ensuring that new development is built to high design quality and environmental standards, including routine use of sustainable drainage schemes to increase the capacity of water provision and regulation services and the incorporation of green infrastructure.
- Planning for appropriate woodland planting around settlement fringes to help to integrate new and existing modern development into the landscape while combining with the development of green infrastructure, biomass, carbon storage and water flow and quality regulation. This could also provide additional benefits of reducing the potential negative visual impact of development such as lighting.
- Supporting the implementation of the Rights of Way Improvement Plan ambition to develop an integrated network of rights of way, increasing facilities for visitors and residents for walking and other recreational activities, which will improve people's health and wellbeing. The creation of circular footpaths and cycle paths that link with public transport and local communities will offer opportunities for sustainable transport and bring benefits to the rural economy and tourism.
- Encouraging the sensitive management (including interpretation) of geodiversity sites (particularly former clay, sand and gravel workings) to raise awareness of the importance of local geology in shaping the history and settlement of the area.

SEO 3: Manage the valuable ancient lime woodlands, enhance and increase the woodland and hedgerow network, and seek to restore and re-create heathland and acid grassland, where appropriate, to strengthen ecological diversity and connectivity, enhance landscape character, improve soil and water quality, reduce soil erosion, increase carbon storage, and bring opportunities for timber and biomass provision.

For example, by:

- Informed by Central Lincolnshire and Lincolnshire Limewoods Biodiversity Opportunity Mapping, protecting, expanding and linking up the ancient woodlands of the Vale, especially the Limewoods, improving their management and raising awareness of their importance. Increasing native woodland planting should also enhance landscape character and ecosystem services, including the storage of carbon.
- Enhancing Forestry Commission woodland sites to replace harvested conifer crops with native deciduous woodland as well as heathland/acid grassland habitats, where suitable.
- Seeking opportunities, where appropriate, to increase the extent of heathland/acid grassland habitat.
- Restoring and managing hedgerows where they have been lost to strengthen the historical field patterns as well as to help to regulate soil erosion and water quality, and use hedgerows to link up woodlands and semi-natural habitats.
- Enhancing management of the woodlands to improve biodiversity and also to provide woodland products and a sustainable biomass and timber resource.
- Enhancing the areas of coniferous plantation on the Coversands and Fen Edge Gravels, including planting broadleaved woodland along the edges to enhance their visual influence and to ensure that there is a balance between woodland and open heath.
- Planning for a landscape depleted of ash through ash dieback by planting replacement characteristic tree species.
- Maintaining the ecological value of the felled areas in the coniferous plantations which provide habitats for rare species such as woodlark, long-eared owl and nightjar, while ensuring that these areas do not have a negative impact on the landscape.
- Seeking opportunities for woodland planting within green infrastructure and relating to new development and the urban fringe, especially in relation to Lincoln.
- Seeking opportunities to incorporate tree planting in places where benefits to other ecosystem services will be maximised, such as within farmland areas to regulate soil and water quality and within flood plains to enhance water flow regulation.

SEO 4: Improve the environmental sustainability of agriculture within the Vale and enhance the capacity of natural ecosystems to support the long-term provision of food, improve soil quality, enhance water quality (especially in the Ancholme basin), provide habitat for pollinators, enhance farmland habitats and benefit climate regulation.

For example, by:

- Maximising take-up of environmentally sustainable farming practices and agri-environment schemes to enhance the landscape and ecosystem function and also support viable agricultural production.
- Informed by the Central Lincolnshire Biodiversity Opportunity Mapping, restoring and creating new habitats throughout the agricultural landscape, especially grassland and wetland habitats, to strengthen ecological linkages and wildlife networks and to benefit delivery of other ecosystem services.
- Reducing agricultural chemical inputs to minimise risk to water quality, for example through use of crops with low fertiliser and pesticide requirements.
- Maximising opportunities to sustainably use wetland habitats for food provision, such as flood plain grazing marsh for cattle grazing.
- Encouraging management measures that increase levels of organic matter in soils to increase fertility and drought resistance and the use of grass leys in arable crop rotations.
- Maintaining habitats associated with mixed farming which supports a range of species, including vulnerable farmland bird species such as skylark, tree sparrow and yellowhammer.
- Where possible, securing opportunities to convert some arable land to other appropriate uses throughout the NCA to enhance water quality, especially in the Ancholme Valley, including opportunities to re-wet areas and establish permanent vegetation.
- Increasing the use of nectar and forage mixes in arable land and planting of species-rich hedgerows as well as the take-up of agri-environment schemes which floristically enhance field margins and hedgerow habitats, to increase the availability of nectar sources in proximity to food crops requiring pollination.
- Carefully considering the timing and impact of agricultural activities on vulnerable soils and under vulnerable soil conditions, especially when wet. Also, encouraging the use of low-pressure machinery.

Buffer strip adjacent to an arable field by Chalmers Farm Wood providing a wildlife refuge and vital habitat link.

SEO 5: Protect and enhance the historic character of the Vale including the monastery sites, shrunken medieval villages, parklands and villages. Increase awareness of the richness of this resource, protect it from neglect and physical damage, and ensure that future development complements and enhances the sense of history.

For example, by:

- Protecting and appropriately managing existing historic assets.
- Protecting the medieval earthworks and remains of the monastic sites along the Witham, the deserted medieval villages and areas of ridge and furrow for their educational and historic value, and ensuring that they are open for public enjoyment where possible.
- Conserving areas of parkland for their historic value and ensuring that they provide access and recreation opportunities for public enjoyment where possible.
- Protecting existing pasture containing archaeological features, including ridge and furrow, from conversion to arable use.
- Reducing cultivation damage to archaeology and geomorphological features by encouraging best practice such as direct drilling and shallow tilling and conversion to permanent pasture.
- Protecting the historical settlement pattern and vernacular character through informed spatial planning processes to secure high-quality design standards in new development, including the appropriate use of traditional building materials.
- Ensuring that the restoration of traditional farm buildings and new in-fill developments use locally characteristic materials to protect the character of the built form.
- Protecting the sense of history in the landscape from inappropriate development, including that which adversely affects the setting of historic features.
- Positively managing and protecting the many listed buildings and Scheduled Monuments while promoting public awareness, accessibility and recreation value.
- Promoting wider awareness of the historic environment to encourage its enjoyment, understanding and protection and, where possible, providing improved public access to sites of historic interest.
- Protecting and enhancing elements of the historic farmland landscape, including the replanting of hedgerows, to restore historical field patterns and the restoration of traditional farm buildings.
- Planning sand and gravel workings carefully to ensure that valuable historical assets are protected and interpreted in order to increase understanding as to how local geodiversity has shaped the history and visual appearance of the landscape today.

Supporting document 1: Key facts and data

Area of Central Lincolnshire Vale National Character Area (NCA): 81,898 ha

1. Landscape and nature conservation designations

The Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB) covers 751 ha of this NCA which is 1 per cent of the NCA.

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)	Bardney Limewoods NNR	383	<1
	Site of Special Scientific Interest (SSSI)	A total of 18 sites wholly or partly within the NCA	1,152	<1

Source: Natural England (2011)

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

There are 256 local sites in the Central Lincolnshire Vales NCA covering 4,062 ha which is 5 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	15	1
Favourable	434	38
Unfavourable no change	2	<1
Unfavourable recovering	702	61

Source: Natural England (March 2011)

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

2. Landform, geology and soils

2.1 Elevation

Elevation ranges from just below sea level to a maximum of 148 m in the south of the NCA. The average elevation of the land is 19 m above sea level.

Source: Natural England (2010)

2.2 Landform and process

The area is divided into two parts by a central watershed. The northern half drains through the River Ancholme and into the Humber. The southern section of the vale drains to the River Witham and ultimately to the Wash. Much of the Vale comprises seasonally waterlogged loams and clay, grading to deeper calcareous loams, with fine calcareous loams towards Horncastle and the Lincolnshire Wolds. The resulting landform is very gently undulating. In the north, the artificially drained carrs, north and south of Brigg, much of the land is only a metre or so above sea level. A series of drains, dykes and the strongly embanked New River Ancholme drain this flat open landscape.

Source: Central Lincolnshire Vale Countryside Character Area Description

2.3 Bedrock geology

The solid geology of this area is composed almost entirely of Jurassic deposits and some lower Cretaceous rocks (87 per cent Mudstone, 7 per cent Chalk). However, most of the area has been overlain by glacial deposits of boulder clays, windblown sand and fluvio-glacial sands and gravels. The NCA is bordered to the west by the middle Jurassic Lincolnshire Limestone escarpment and to the east by the Chalk of the Lincolnshire Wolds. The NCA is underlain by Upper Jurrasic marine clays, silts and sands belonging to the Kellaways, Oxford Clay, West Walton, Ampthill Clay and Kimmeridge Clay formations which are largely concealed by superficial deposits. Active and disused quarries provide an opportunity to examine the bedrock geology, perhaps most notably at South Ferriby Chalk Pit SSSI at the northern-most edge of the NCA, which exposes the Upper Jurrasic clays overlain by Cretaceous Chalk.

Source: Central Lincolnshire Vale Countryside Character Area Description, Lincolnshire Coversands and Clay Vale Natural Area profile

2.4 Superficial deposits

Three different regions can be distinguished within this NCA. Windblown Coversands, the clay vales and the limestone plateau. In the Coversands the acidic, nutrient poor soils have a sandy texture. The clay vales are found along the River Ancholme and Barlings Eau and are divided by a watershed west of Market Rasen. The clay vales are derived from erosion of the soft upper Jurassic clays and sometime overlain by a deposition of chalky till from the Wolds. Much of the valley consists of heavy clay and loam soils which are often waterlogged in winter, although in parts there are sandy soils vulnerable to wind erosion. These soils are very fertile and consequently most of the land is farmed. The southern-most portion of the vales, mostly around the lower reaches of the River Bain, originate from glacial outwash sands and gravels creating free draining soils. Much of the Ancholme flood plain was formed from marine alluvium during the post-glacial period with smaller areas of peat inland. The limestone plateau, locally known as the Lincolnshire edge, runs from the Humber estuary through Lincolnshire to Stamford in the south. Most of the limestone bedrock is overlain with post-glacial boulder clay or thin layers of Coversand. However the higher ground often has a covering of shallow, well-drained brashy limestone, loam soil which makes fertile farm land.

Source: Central Lincolnshire Vale Countryside Character Area Description, Lincolnshire Coversands and Clay Vale Natural Area profile

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	1
National	Mixed Interest SSSI	0
Local	Local Geological Sites	8

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

Areas of windblown and fluvial sands occur in three locations at Elsham, Market Rasen and Woodhall Spa. Much of the vale comprises seasonally waterlogged loams and clays, grading to deeper calcareous loams, with fine calcareous loams towards Horncastle and the Lincolnshire Wolds.

Source: Central Lincolnshire Vale 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	81	<1
Grade 2	11,527	14
Grade 3	65,096	80
Grade 4	553	<1
Grade 5	0	0
Non-agricultural	4,158	5
Urban	483	<1

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.

New River Ancholme	31 km	River Bain	7 km
North Kelsey Beck	6 km	River Witham	8 km
Old River Ancholme	28 km	Steeping River	<1 km
Old River Bain	6 km	Horncastle Canal	16 km
River Ancholme	4 km	The Land Drain	8 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.

The River Ancholme is the most significant river and has been altered to form a straight course from Bishopbridge to Ferriby Sluice on the Humber. The watercourse is fed by a series of becks up to Brigg and then by the drained carrs. To the south, Barlings Eau and the River Bain drain to the River Witham. The area is a low-lying vale divided into two parts by a central watershed. The northern half drains through the River Ancholme into the Humber. The southern section of the vale drains to the River Witham and ultimately the Wash. The western boundary below Lincoln is formed by the River Witham and the fenland beyond. To the south, the catch-water drains for the Fens mark the limit of the Vale while to the east the Vale rises up towards the south-western edge of the Lincolnshire Wolds. In the north are the artificially drained carrs, north and south of Brigg, where much of the land is only a meter or so above sea level. A series of drains, dykes and the strongly embanked New River Ancholme drain this flat open landscape.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 81,898 ha; all 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 6,273 ha of woodland (8 per cent of the total area), of which 2,385 ha is ancient woodland.

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

4.2 Distribution and size of woodland and trees in the landscape

Woodland cover is variable with little in the central and northern clays apart from remnant blocks of carr woodland. Exceptions include coniferous plantations on both the coversands, and sands and gravels around Woodhall Spa and, most notably, the Central Lincolnshire Limewoods between Wragby and Bardney where there are a significant number of medium-sized woodlands known locally as the Bardney/Lincolnshire Limewoods. Some are ancient while others are more recent plantations. Some of the windblown sands across the NCA have been extensively planted with conifers.

Source: Central Lincolnshire Vale Countryside Character Area Description

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	4,074	5
Coniferous	1,646	2
Mixed	51	<1
Other	502	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	1,384	2
Planted Ancient Woodland (PAWS)	1,001	1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Hedgerows enclose most fields, most are hawthorn, but they are often more diverse at a distance from the road and those linking the limewoods are particularly dense with a rich variety of flora. In March 2011 the majority of Environmental Stewardship grant aid paid out for boundary features was spent on hedgerows. Over 1.5 million metres of hedgerow were included.

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

5.2 Field patterns

A regular pattern of medium-sized arable fields interspersed with pasture on heavy clays; variations include pre-enclosure hay meadows and pasture near Wragby, and the drained open flatlands to the north of Brigg. Much of the land had been enclosed by the early 18th century.

Source: Central Lincolnshire Vale 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

The total farmed area is 63,183 ha, composed of 576 holdings. All figures below relate to 2009 unless otherwise stated. There were 236 cereal farms in 2009 representing 41 per cent of the total. The next most numerous farm types were 'general cropping' (84 holdings) and 'grazing livestock' (80 holdings). The number of holdings has fallen from 600 in 2000. The number of farms classed as 'general cropping' fell from 143 in 2000, a fall of 41 per cent.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

Farms over 100 ha in size are the most numerous, with 197. This is followed by 119 farms between 5 ha and 20 ha in size. Farms over 100 ha in size account for 52,901 ha, or nearly 84 per cent of the farmed area in this NCA. The number of farms over 100 ha in size has fallen since 2000.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 68, 183 ha; owned land = 48, 228 ha
2000: Total farm area = 66, 247 ha; owned land = 48, 528 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

The most common land use is for cereal crops with 29,170 ha or 46 per cent of the farmed land. This is followed by land used for grazing with 12,646 ha or 20 per cent of the farmed land. The amount of land used for oilseed crops has increased from 5,174 ha in 2000 to 9,142 in 2009. This is an increase of nearly 77 per cent.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

In 2009 sheep were the most numerous livestock in this NCA, with 24,742 animals, a reduction of nearly 41 per cent since 2000. There were 22,977 pigs (a reduction of nearly 46 per cent since 2000) and 16,361 cattle were recorded in 2009.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

There were 824 principal farmers in 2009. This had decreased from 939 in 2000. The number of full time farm workers decreased from 439 in 2000 to 298 in 2009; a fall of 141.

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

Woodlands are widespread in this NCA with concentrations of ancient woods around Bardney and the Fen Edge Gravels, and more recent plantations on the Coversands. The concentration of woodlands around Bardney is the most important example of small-leaved lime woodlands remaining in Britain. Some of the surviving ancient woodlands support a vast array of plants, insects and birds. Lowland heath was once abundant on the Coversands, and to a lesser extent on the Fen edge gravels, but large areas have been lost through conifer plantation, conversion to arable, urban development and quarrying. Some of Britain's finest inland sand dunes can also be found on the Coversands. The vast majority of grassland has been agriculturally intensified and is of poor wildlife value. Neutral grassland is the most common, and there are a number of acidic and limestone grasslands depending on the underlying geology. 'Unimproved' grassland sites support a wide range of species.

Source: Lincolnshire Coversands and Clay Vale 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 woodland (broad habitat)	2,015	2
Lowland heathland	736	1
Lowland meadows	170	<1
Lowland dry acid grassland	60	<1
Coastal and flood plain grazing marsh	17	<1
Lowland calcareous grassland	16	<1
Reedbeds	15	<1
Fens	14	<1
Purple moor-grass and rush pasture	2	<1

Source: Natural England (2011)

7.3 Key species and assemblages of species

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

8. Settlement and development patterns

8.1 Settlement pattern

The settlement pattern is typically dispersed and sparse. Villages have remained small while a few small towns have grown including Brigg, Market Rasen and Horncastle. Settlements throughout the area are linked by straight east-west roads with abrupt right-angled turns. Enclosure roads with exceptionally wide verges and enclosing hedgerows are characteristic of the vale.

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

8.2 Main settlements

The main settlements within the Central Lincolnshire Vale NCA are: Brigg, Horncastle, Broughton, Market Rasen, and Woodhall Spa.

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

8.3 Local vernacular and building materials

Traditional building materials are predominantly brick, from local clay, and limestone from the adjoining Lincolnshire Edge. Most traditional buildings are constructed of brick and pantile. The dominance of brick is most distinctly portrayed at Tattershall Castle built in c. 1440 for Ralph Cromwell, Lord Treasurer of England. Local stone from the Lincolnshire Wolds including Claxby Ironstone and Tealby Limestone, is seen in some of the churches close to the Wolds around Market Rasen whereas Spilsby Sandstone is found in churches around Horncastle.

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

9. Key historic sites and features

9.1 Origin of historic features

The Appleby boat, and ancient longboat c.11,000 BC is the second oldest such vessel found in the world. The area is rich in ridge and furrow and deserted medieval villages such as Spridlington and Goltho. Brigg developed early as a river crossing point and was a prosperous market town by the 13th century. Horncastle, which originated as a Roman town, developed a nationally famous horse fair which ran from the 13th century to 1948. The vale is important for the study of the smaller iron-age and Romano-British settlements in the transition between the two periods. The principal archaeological remains of interest are the medieval sites, particularly the deserted and shrunken medieval villages, like Spridlington and the abbey ruins such as Bardney and Tupholme; the abbey sites along the River Witham being one of the greatest concentrations in England and closely linked to the adjacent limewoods. Extensive, though not entirely successful, land drainage took place in the Ancholme Valley in the 17th century. By the 18th century most of the land had been enclosed. Following the discovery of medicinal waters in the 19th century, Woodhall Spa developed into a small inland resort set in the pine and birch woods. Coningsby airfield provided a base for Lancaster bomber squadrons in the Second World War and RAF Woodhall Spa became the eventual home to 617 'The Dambusters' Squadron.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 2 Registered Parks and Gardens covering 261 ha
- 0 Registered Battlefields
- 69 Scheduled Monuments
- 686 Listed Buildings

Source: Natural England (2010)

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

10. Recreation and access

10.1 Public access

- 4 per cent of the NCA 2,945 ha is classified as being publically accessible.
- There are 513 km of Public Rights of Way at a density of 0.6 km per km^2.
- There are no National Trails within the NCA.

Sources: Natural England (2010)

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

The remains of Tupholme Abbey, a medieval monastry in the Lincolnshire Limewoods area.

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	0	<1
Common Land	1	<1
Country Parks	0	0
CROW Access Land (Section 4 and 16)	2,213	3
CROW Section 15	<1	<1
Village Greens	2	<1
Doorstep Greens	0	<1
Forestry Commission Walkers Welcome Grants	62	<1
Local Nature Reserves (LNRs)	3	<1
Millennium Greens	<4	<1
Accessible National Nature Reserves (NNRs)	383	<1
Agri-environment Scheme Access	92	<1
Woods for People	2,792	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 lowest value recorded is immediately to the west of Brigg, the highest value is north of Brigg on the New River Ancholme.

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

Category of tranquillity	Score
Highest value within NCA	115
Lowest value within NCA	-58
Mean value within NCA	11

Sources: CPRE (2006)

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

11.2 Intrusion

The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows that disturbed land occurs around the main towns of Market Rasen, Horncastle, Tattershall/Coningsby in the south and Brigg in the north. All major transport routes show some level of disturbance.

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

Category of intrusion	1960s (%)	1990s (%)	2007 (%)	% change (1960s-2007)
Disturbed	4	15	28	24
Undisturbed	96	85	71	-26
Urban	n/a	<1	2	2

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are a steady reduction in the area of 'undisturbed' land and a corresponding increase in 'disturbed'.

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

12. Data sources

- British Geological Survey (2006)
- Natural Area Profiles, Natural England (published by English Nature 1993-1998)
- Countryside Character Descriptions, Natural England (regional volumes published by Countryside Commission/Countryside Agency 1998/1999)
- Joint Character Area GIS boundaries, Natural England (data created 2001)
- National Parks and AONBs GIS boundaries, Natural England (2006)
- Heritage Coast Boundaries, Natural England (2006)
- Agricultural Census June Survey, Defra (2000,2009)
- National Forest Inventory, Forestry Commission (2011)
- Countryside Quality Counts Draft Historic Profiles, English Heritage (2004)*
- Ancient Woodland Inventory, Natural England (2003)
- 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

- The total woodland cover (over 2 ha) in 1999 was 5,075 ha or 6 per cent of the total NCA area.
- Between 1999 and 2003 an area equivalent to 4 per cent of the 1999 total stock was planted, that is 216 ha. Countryside Quality Counts (CQC) assessment concluded that this planting had significantly strengthened character in the areas of the Limewoods and the central clay vale.
- Cover of native woodland has increased further more recently within the Limewoods area. Between 2006 and 2010 approximately 135 ha of new native woodland was planted in the area enlarging existing woodlands and linking them up.
- Figures for 2011 show that total woodland cover across the NCA had increased to 6,273 ha, 8 per cent of total area (though this is partly due to greater accuracy in recording).

Boundary features

- While the estimated boundary length for the NCA in 2003 was around 5,073 km, the total length of agri-environment scheme capital agreements for linear features between 1999 and 2003 was equivalent to about 8 per cent of this total (406 km). Of this hedge management and hedge planting, restoration accounted for 152 km. CQC assessment concluded that during this period the boundary resource had probably just been maintained.

  Management of hedgerows has improved in recent years with over 2,000 km under agri-environment scheme hedgerow management and maintenance agreements (includes combined hedge and ditch management options) between June 2005 and August 2013. Hedgerows have also become fuller due to the single payment scheme which requires no cultivation within 2 m of their centre.

- While management has improved, planting and restoration of hedgerows remains limited. Between 1999 and 2003, 106 km were planted and/or restored under agri-environment capital agreements whereas between June 2005 and August 2013 this figure was 43 km, though, in addition to this, approximately 26 km of new hedgerows were planted within the Lincolnshire Limewoods area between 2005 and 2012[9] locally enhancing this part of the Vale.

Agriculture

- Countryside Quality Counts (CQC) assessment of data between 1999 and 2003 concluded that the overall agricultural character of the Vale had weakened but was stable with agri-environment scheme uptake above national average. It found that there had been some expansion in grassland whereas mixed and general cropping had declined at the expense of cereal holdings.
- Agricultural statistics for the Vale show that between 2000 and 2009 there were decreases in total farmed area from 66,247 ha to 63,183 ha; a decrease in the area of crops from 49,354 ha to 47,875 ha and a decrease in grass and un-cropped land from 14,331 ha to 12,646 ha. While cattle numbers changed little there was a 41 per cent drop in numbers of sheep and a 46 per cent drop in the number of pigs.

[9] Lincolnshire Limewoods Project Final Report 2012

- Decreases in farm labour also took place during the period with overall labour decreasing from 1,771 to 1,526 and the number of principal farmers dropping from 939 to 824.

- The growing of miscanthus energy crops has featured within the area in recent years.

Settlement and development

- There has been some wind turbine development in the NCA. Across most of the Vale it has not been a significant landscape change, the proximity of the Lincolnshire Wolds AONB may have deterred larger schemes and some applications have been refused on landscape grounds. Most installations have been of individual smaller scale farm based turbines.

- CQC assessment of data between 1999 and 2003 found that there had been a moderately high rate of build outside urban and fringe areas including commercial and residential development along the M180 corridor. There had also been residential expansion in the area east of Lincoln, along the A46 to Market Rasen, and also around Woodhall Spa. The assessment concluded that development was diverging from the character of the area.

- More recently, development has been limited. Larger settlements such as Brigg, Horncastle, Wragby and Market Rasen have seen in-fill development and some expansion, though none has been very extensive. Development in and around villages has been mostly limited to those close to Lincoln.

- There has been change in the extent to which the area is 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. In the 1990s around 15 per cent of the NCA was categorised as disturbed by intrusion whereas by 2007 this had increased to around 28 per cent.

Semi-natural habitat

- CQC assessment of data between 1999 and 2003 concluded that landscape character had probably enhanced with agri-environment scheme uptake for annual area features exceeding the national average after 2001. The most frequent agreements in 2003 were for lowland pastures on neutral/acid soils (528 ha) and regeneration of grassland/semi-natural vegetation (453 ha).

- Area of grassland under annual agri-environment management/maintenance agreements as of August 2013 totalled around 2,800 ha including management of permanent grassland with low inputs (1,042 ha) and management of permanent grassland with very low inputs (809 ha).

- The area of land under annual agri-environment grassland creation and restoration agreements as of August 2013 was around 1,500 ha including 326 ha of restoration of species rich semi-natural grassland and 487 ha creation of wet grassland for breeding waders. This latter option has resulted in the creation of some relatively large wet grassland sites in the Ancholme Valley.

- As of August 2013 the area under annual agri-environment lowland heathland maintenance agreements were 131 ha while 5 ha were under lowland heathland restoration.

Historic features

- Analysis of 1999 to 2003 data suggests that the character of important aspects of the historic landscape within the Vale had probably been maintained during this period.

- Analysis of agri-environment data shows that between January 2005 and January 2009 take up for of management of archaeological features on grassland totalled 169 ha while taking archaeological features out of cultivation totalled 93 ha. More recent data shows little change indicating

maintenance of features: between January 2009 and August 2013 management of archaeological features on grassland totalled 173 ha while taking archaeological features out of cultivation totalled 128 ha.

- Some enhancement of the historic parkland is indicated by the data with 114 ha under wood pasture and parkland maintenance options between January 2009 and August 2013 whereas between January 2005 and January 2009 there was none.

- The Lincolnshire Limewoods Project which ran from 2005 to 2011 has helped raised awareness of the heritage asset of these important woodlands.

Coast and rivers

- Biological river water quality and chemical water quality in 1995 was predominantly excellent according to CQC.

- It appears that water quality for at least some watercourses within the NCA has declined. In 2009 the chemical status of the Witham was good; however, the Ancholme was 'failing to achieve good[10]' with diffuse pollution from agriculture the key reason for failure[11].

Minerals

- Ongoing extraction of sand and gravel in the area of the Fen Edge Gravels has changed and continues to change local landscapes from the opencast mining infrastructure and activity of working sites to the increasing legacy of water-filled pits.

- Since 2007 production levels have dropped reflecting the impact of the economic downturn with consequentially reduced extraction and processing activity.

Drivers of change

Climate change

Potential pressures from climate change include the following:

- An overall increase in temperature as a result of the changing climate may lead to an increase in river temperatures which could adversely affecting existing cool water invertebrate and fish species.

- Rising sea levels and more frequent storm and heavy rain events may lead to changes to river morphological and hydraulic characteristics.

- Sea level rise is likely to reduce the extent of fresh water habitat around the Humber.

- A changing climate may lead to changes in species abundance and habitat preferences which could mean more non-native invasive species but also could mean increased range and population of some native species.

- The potential impacts of climate change may lead alternation in the timings of seasonal events (phenology), for example, tree budding and coming into leaf, eggs hatching, animals migrating, and a resulting loss of synchrony between species.

- Generalists species may benefit (through increased competitive advantage) over specialists - leading to a homogenisation of biodiversity.

[10] *River Basin Management Plan, Anglian River Basin District*, Annex A: Current state of waters, Environment Agency (2009)
[11] *River Basin Management Plan, Humber River Basin District*, Environment Agency (2009)

- Increased flooding and water-logging during wetter winters leading to a shift in community composition in wetland and lowland habitats.
- Changes in soil water, both increases and decreases, leading to loss of elements of soil biota reducing soil function leading to a loss of soil structure, and changes to nutrient cycling/fixing, and soil carbon storage.
- Increased episodic events – precipitation, flow rate, temperature – caused by extreme events with knock on effects on landscape character. Potential increased frequency of droughts for example could put some wetland sites at risk while the lowland heath of the NCA may become more prone to the risk of fires.

View across the Ancholme Valley above Worlaby with Scunthorpe steel works on the horizon.

- The introduction of new and different crops and techniques in response to changing climate which may have consequences for the natural environment and add to the pressure on soils, water and habitats. Changes in agriculture could also change the appearance of the landscape.
- Increased demands for food security and energy crops which may be in competition with extensive agriculture and habitat conservation.
- Re-intensification of agriculture due to longer growing seasons.
- There may be pressure for more flood defence schemes in response to increased flood risk, however the Environment Agency's plan to manage flooding in the Vale includes reducing bank and channel maintenance where appropriate to improve the flow between the rivers and their flood plains[12], and maximising the potential of the flood plain to retain water to benefit locations elsewhere in the catchments[13].
- The Environment Agency plan also includes proposals to reduce flood risk in Horncastle through storage of water in the flood plain upstream of the town outside of the NCA which will have benefits to water flow regulation along the River Bain. This approach to managing flooding will mean that away from settlements there will be opportunities for flood plain habitat creation as well as challenges to the farming community in adapting to managing land prone to more frequent flooding.

[12] *River Witham Catchment Flood Management Plan Summary Report,* Environment Agency (2009)
[13] *Grimsby and Ancholme Catchment Flood Management Plan Summary Report,* Environment Agency (2009)

Other key drivers

- Under the Central Lincolnshire Joint Planning Unit's Core Strategy (due for adoption in 2014) some residential growth and a new bypass is planned for the eastern fringe of Lincoln and some modest growth is planned for Market Rasen. Further north, Brigg has been identified for some housing growth within the North Lincolnshire Adopted Core Strategy 2011. Elsewhere within the Vale there is no major development planned and housing development is likely to be mainly in-fill within existing settlements.

- Green Infrastructure is likely to develop in the future, particularly in relation to the growth of Lincoln. The Green Infrastructure Strategy for Central Lincolnshire focuses on linking Lincoln with the wider countryside with the Witham corridor identified as a key link to the Lincolnshire Limewoods and the Woodhall Spa area.

- Pressure for further sand and gravel extraction continues in the Fen Edge Gravels at levels dependant on demand for these resources from the construction industry.

- There continues to be pressure for wind farms, particularly in the north of the NCA and further away from the Lincolnshire Wolds AONB. Pressure to reduce farm energy costs means smaller scale farm-based installations are likely to continue.

- Ash dieback caused by the fungus *Chalara fraxinea* could potentially have a significant impact as ash is a common species in the NCA.

- Forestry Commission managed woodlands and plantations are likely to see some changes: many conifers are coming to harvesting age and FC policy is to replace conifers with broad leaved trees and the reversion of areas back to heathland.

Kirkby Moor SSSI.

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.

View from Tattershall Castle showing flooded gravel pits.

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: Restore natural watercourse and flood plain functionality within the Vale, ensuring no harm to archaeological assets, and seek habitat creation and linkages and land management changes through the area, to improve resilience and ecosystem capacity to regulate water quality, regulate water flow and reduce soil erosion. This will also enhance riverine character, recreational experience and ecological connectivity.	↔	↗ ***	↑ ***	n/a	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	n/a	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***
SEO 2: Protect and enhance the rural character and tranquillity of the Vale, much valued for their contribution to sense of place, inspiration and recreation. Ensure that new development is informed by local assessments, opportunity and mapping studies to help to minimise impact and maximise environmental gain through good design and appropriate screening, and promote green infrastructure links to ensure that the surrounding settlements have access to the many recreation assets which contribute to the health and wellbeing of both residents and visitors.	↔ *	↑ **	↗ **	n/a	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **	n/a	↑ ***	↑ ***	↑ ***	↑ ***	↗ **	↗ **
SEO 3: Manage the valuable ancient lime woodlands, enhance and increase the woodland and hedgerow network, and seek to restore and recreate heathland and acid grassland, where appropriate, to strengthen ecological diversity and connectivity, enhance landscape character, improve soil and water quality, reduce soil erosion, increase carbon storage, and bring opportunities for timber and biomass provision.	↔ *	↑ ***	↗ **	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 4: Improve the environmental sustainability of agriculture within the Vale and enhance the capacity of natural ecosystems to support the long-term provision of food, improve soil quality, enhance water quality (especially in the Ancholme basin), provide habitat for pollinators, enhance farmland habitats and benefit climate regulation.	↗ **	↔ **	↗ **	n/a	↗ **	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	n/a	↑ ***	↑ ***	↗ **	↗ **	↑ ***	↗ **
SEO 5: Protect and enhance the historic character of the Vale including the monastery sites, shrunken medieval villages, parklands and villages. Increase awareness of the richness of this resource, protect it from neglect and physical damage, and ensure that future development complements and enhances the sense of history.	↔ **	↔ ***	↗ **	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 tranquil, rural and sparsely settled area with little major infrastructure or urban settlements.	■ The generally low levels of visual and auditory intrusion mean tranquillity is generally high. Settlements are thinly scattered, roads are generally quiet while the lack of urban development means night skies are relatively dark. Bardney Limewoods and parts of the Ancholme Valley are the most tranquil areas.
Woodlands including nationally important ancient limewoods.	■ Multiple and interconnecting benefits can be attributed to the woodlands of the Vale, especially the ancient woodlands and the Bardney Limewoods National Nature Reserve. They are important for timber provision, storage of carbon, sense of place and history, inspiration, biodiversity and recreation as well as benefitting water and soil regulation services.
Suitability for farming with land used mostly as arable farmland with pasture on the heavier clays and around villages.	■ The Vale has generally naturally fertile soils a gentle topography, a suitable climate and availability of water. Some of the impacts of modern commercial agriculture in the Vale, however, impact negatively on established character and the function of ecosystems such as removal of hedgerows for field amalgamation and extensive watercourse modification to maximise drainage and minimise inundation of arable land.
A landscape crossed by many streams flowing from the Wolds towards the heavily modified courses of the main rivers. High groundwater, flooded gravel sites, aquifers, and navigable waterways are important features.	■ Water retentive soils linked to mudstone bedrock geology means despite having relatively low rainfall, water is widely available in the soils. The Vale also has water available from aquifers especially the Lincolnshire Limestone aquifer, a profusion of streams flowing from the Wolds as well as navigable waterways and flooded gravel pits for recreation.
A landscape with a rich sense of history. Medieval sites with remnant ridge and furrow, deserted medieval villages, and a cluster of monastic sites close to the River Witham.	■ Sense of history comes from the monastic sites, the ancient woodlands especially the Limewoods, the historic villages, towns and farmsteads and their characteristic vernacular architecture, the parklands as well as the Tudor Tattershall castle. The tranquillity of the landscape also enhances this attribute of the Vale. ■ Lincoln Cathedral, although just outside the NCA in the west, provides a landmark across much of the area.

Landscape attribute	Justification for selection
A landscape offering recreational opportunity associated with its natural and cultural heritage.	■ The Vale's location in close proximity to Lincoln combined with its appealing attributes makes its recreation appeal significant. Recreation assets include the Witham corridor green infrastructure link with Lincoln, close proximity of the Wolds AONB and the Wolds scarp, the Viking Way long-distance footpath and the range of other walking routes especially those around the Lincolnshire Limewoods, Woodhall Spa resort, the woodlands and heathlands, the suitability of the topography and network of quiet lanes for cycling and the heritage assets.
Semi-natural habitat is limited due to past land use, however significant remnants of lowland heath survive on the Coversands and Fen Edge Gravels and the wider Lincolnshire Limewoods including Bardney Limewoods NNR represents England's biggest concentration of ancient small-leaved lime-dominated woodland.	■ Although overall extent of semi-natural habitats is extremely limited the Vale's remaining habitats display a high diversity. This ranges from heathland to ancient deciduous woodland to wetland habitats while its farmland habitats are important to farmland birds. Recent habitat creation in parts of the Vale such as wet grassland within the Ancholme flood plain and woodland creation within the Lincolnshire Limewoods area has boosted this attribute.
A very varied geology with bedrock of Jurassic mudstones, almost entirely covered by a variety of superficial deposits, largely of glacial till and with the Wolds scarp providing an often prominent boundary to the east.	■ The Vale has a wide diversity of geology especially its superficial geology and the soils that have arisen. This ranges from the clayey soils over the main part of the Vale, the sandy soils of the Coversands and Fen Edge Gravels, the lime-rich soils over the chalk of the Wolds and the peaty soils of the upper Ancholme Valley. Other assets include the Wolds scarp, the Lincolnshire limestone aquifer, the rich fossil fauna of the bedrock mudstones and the sand and gravel deposits.

Landscape opportunities

- Protect tranquillity through development of well designed green infrastructure which enables access and enjoyment of the Vale while protecting it from the potential negative impact of increased use.
- Protect sense of place through raising the design quality and appearance of new and existing development and screen urban and industrial influences with the use of substantial and appropriate woodland planting (such as gravel workings) as well as other means such as use of green roofs.
- Enhance the woodlands of the Vale through expansion and linking up of ancient woodlands especially the Lincolnshire Limewoods, through the enhancement of Forestry Commission woodland sites to replace harvested conifer crops with native deciduous woodland as well as heathland habitats where possible.
- Enhance the hedgerow network, especially within the main agricultural areas. Restore and manage hedgerows where they have been lost to strengthen the historical field patterns, as well as to help regulate soil erosion and water quality, and use hedgerows to link up woodlands and semi- natural habitats.
- Plan to significantly improve the capacity of natural ecosystems to support the long-term viability of farming in the Vale through creation of networks of semi-natural habitat network across the agricultural landscape through take up of agri-environment grants and environmentally sustainable farming practices.
- Restore and re-connect watercourses and flood plains to enhance their natural functionality to improve regulation of water quality and flow, reduce soil erosion and to create wetland habitats and strengthen ecological connectivity. Restore gravel extraction sites to wetland habitats.
- Enhance sense of history through the protection and appropriate management of historic assets, protecting pasture containing archaeological features (including ridge and furrow) from conversion to arable use, reducing cultivation damage to protect archaeology by encouraging best practice such as direct drilling and shallow tilling and conversion to permanent pasture.
- Protect the historical settlement pattern and vernacular character through informed spatial planning processes to secure high quality design standards in new development including the appropriate use of traditional building materials.
- Enhance recreation provision without impacting adversely on tranquillity, especially in relation to green infrastructure links from Lincoln, the footpath network, accessible woodlands and the development of sustainable tourism.
- Enhance and expand heathland and associated habitats including grassland on the Fen Edge Gravels and the Coversands. Plan to restore and create new habitats throughout the agricultural landscape, especially grassland and wetland habitats to strengthen ecological linkages and wildlife networks and to benefit delivery of other ecosystem services.
- Manage the exploitation of sand and gravel deposits carefully so that damage to landscape character, archaeology and existing habitats is minimised and that landscape, access, geodiversity and biodiversity enhancements are maximised in well designed restoration schemes such as through the creation of new wetland, woodland and other habitats.

Ecosystem service analysis

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

Please note that the following analysis is based upon available data and current understanding of ecosystem services. It does not represent a comprehensive local assessment. Quality and quantity of data for each service is variable locally and many of the services listed are not yet fully researched or understood. Therefore 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	Water availability Soils	This is an important area for food crops especially cereals. Water availability is generally naturally high and available for supporting spray irrigation of crops. Farmland covered 77 per cent of the total NCA area in 2009. Arable agriculture predominates with 46 per cent of farmland used for cereal production and 30 per cent for other crops particularly oil seed, which has increased significantly in recent years, while 20 per cent is grass and uncropped land. Less than 1 per cent of soils are classed as Grade 1, 14 per cent is Grade 2 and 80 per cent is classed as Grade 3 and less than 1 per cent is Grade 4.	Regional	Arable production remains the mainstay of agricultural activity across the area. While water availability is generally high there is still the need to plan for the long-term availability of this resource through management measures such as rainwater harvesting and water storage. Agri-environment schemes can enhance a range of ecosystem services of benefit to agricultural production[14]. Raising the organic matter content within some soil types can improve their ability to retain nutrients and make them available to food crops. An increased organic content can also benefit soil structure for some soil types, increasing drought resilience and increasing the value of the niche for many soil-dwelling fauna.	Encouraging uptake of sustainable agricultural practice and agri-environment schemes which benefit the natural environment and which help to maintain viable agricultural production. Carefully considering the timing and impact of agricultural and land management activities on vulnerable soils and under vulnerable soil conditions especially when wet. Also encourage the use of low pressure machinery. Encourage measures which secure the use of water storage and rainwater harvesting. Encourage management measures that increase organic matter levels in soils to increase fertility and drought resistance and the use of arable leys in arable crop rotations.	**Food provision** **Sense of place / inspiration** **Sense of history** **Regulating soil quality** **Regulating water quality** **Biodiversity** **Climate regulation**

[14] *Ecosystem services from Environmental Stewardship that benefit agricultural production,* Natural England Commissioned Reports, Number 102, Food and Environment Research Agency (2012)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Woodland and plantations Trees	Total woodland cover in 2011 was 6,273 ha, 8 per cent of total area. 4,074 ha was broadleaved and 1,646 ha coniferous. The main areas of woodland are Bardney Limewoods and on the sandy soils of the Coversands and the Fen Edge Gravels. Forestry Commission managed woodlands are significant in the NCA with large coniferous plantations on former heathland sites around Market Rasen and to a lesser extent by Woodhall Spa. There are also some coniferous and mixed Forestry Commission plantations within the Lincolnshire Limewoods area on sites of former ancient woodland. Much of this resource is approaching harvesting age.	Regional	New woodland planting in the NCA would increase opportunities for timber provision. Planting would need to be sensitively carried out to enhance sense of place and biodiversity, retain rare species of flora and fauna and minimise conflict with food production. Woodland opportunity mapping guidance has been produced for the East Midlands which provides detailed guidance on woodland creation opportunities within the area. Tree planting can benefit other ecosystem services including those which underpin food provision. For example tree planting on soils vulnerable to erosion and alongside watercourses will help regulate soil quality, water quality, flow and availability.	Increase native woodland planting to provide a potential source of commercial timber as well as to enhance landscape character and ecosystem services. Seek opportunities for woodland planting within green infrastructure and relating to new development and the urban fringe, especially in relation to Lincoln. Seek opportunities to incorporate tree planting in places where benefits to other ecosystem services will be maximised such as within farmland areas to regulate soil and water quality and within flood plains to regulate flood flows.	**Timber Provision** **Climate regulation** **Water regulation** **Biodiversity** **Sense of place / inspiration** **Biomass energy** **Sense of history** **Regulating soil quality** **Regulating water quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Geology – soils and aquifers Rivers and watercourses Waterbodies	The Lincolnshire Limestone aquifer underlies most of the NCA. It is regionally important for supply of water in the area, mostly for public water supply, but also for spray irrigation, other farm use and industry as well as supporting the base flow of watercourses and surface water features. Large demands are placed on the aquifer to meet public water supply demands and resources are fully committed to existing users and the environment[15]. The predominant boulder clay derived soils underlain by mudstone bedrock mean soil water availability is generally naturally high. On average, abstraction may be available for 222 days per year from the River Witham and the River Bain[16] and for 135 days per year from the River Ancholme. **Continued on next page...**	Regional	Low flow levels are detrimental to the biodiversity of the rivers. Rainfall within the NCA is relatively low – much current land uses persist because of abstraction while rainwater collection and storage and changes in farming systems and land use can reduce the need for abstraction and would better enable farms to deal with increased temperatures and droughts and reduced abstraction availability. Increases in semi-natural habitats, grassland and woodland will improve water infiltration increasing ground water stocks. Availability of water within the Lincolnshire Limestone aquifer is dependent on rainwater recharging where it outcrops west of the NCA. The TWA scheme has a major impact on water availability in the Ancholme catchment, helping meet the needs of a number of large abstractions and maintaining water levels. Anglian Water Services abstract water from the river at	Maintain ecological flow levels in watercourses by managing abstractions carefully. Seek to reduce existing levels of licensed abstraction by working with licensees to manage abstraction needs and encourage uptake of sustainable approaches to help reduce demand through for example in-situ rainwater harvesting, in-field water conservation and less water demanding agriculture and generally through more efficient use of water in all uses. Seek opportunities where feasible to create new habitat areas to slow the flow of water across the landscape to increase infiltration and ground water stocks. In both rural and urban areas, adapt existing drainage schemes and design new sustainable drainage schemes to maximise infiltration and recharge aquifers and ground water to help maintain river levels.	**Water availability** **Biodiversity** **Regulating water flow** **Regulating water quality** **Food provision** **Regulating soil erosion** **Regulating soil quality** **Recreation** **Sense of place / inspiration** **Geodiversity**

[15] *Grimsby, Ancholme and Louth Catchment Abstraction Management Strategy,* Environment Agency (2013)
[16] *Witham Catchment Abstraction Management Strategy,* Environment Agency (2013)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability cont.		**... continued from previous page** The Trent Witham Ancholme Surface Water Transfer Scheme (TWA) transfers water from the Trent to the Witham via the Fossdyke and into the Ancholme via pumping at Short Ferry into Toft Newton Reservoir. This meets demand for public water supply and industrial uses within the Ancholme Valley as well as spray irrigation licences. The Fen Edge Gravels provide a locally important groundwater resource with potential opportunities for consumptive abstraction.		Cadney for public water supply while Brigg power station uses significant amounts. Employing sustainable measures to enhance water availability within the Ancholme catchment while reducing abstraction needs will reduce reliance on this scheme.	Work with the Environment Agency and others to plan for more sustainable availability of water within the NCA such as encouraging water storage and rainwater harvesting.	
Genetic diversity	N/A	N/A	N/A	N/A	N/A	N/A

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biomass energy	Woodlands Miscanthus Short rotation coppice (SRC) Soils Grassland	Existing woodland coverage at 8 per cent means there is some potential for biomass energy production. The yield potential for miscanthus is high throughout the area and it is currently grown at several locations. The yield potential for SRC is generally medium throughout the area.	Local	There is potential for the biomass provision through bringing woodlands into management, particularly coppice management of deciduous woodland and as a by-product of commercial timber production. Care is required in the siting of energy crops to avoid adverse impacts on landscape character and biodiversity; however the gently undulating topography of the NCA means plantings of SRC and miscanthus can be sensitively accommodated. Planting of miscanthus, SRC as well as trees in flood plains can help alleviate flood risk. There may be potential for using silage cropped from grassland to generate biogas[17].	Expand the area of native woodland and bring woodlands into coppice management, generating a local supply of biomass. Plant biomass crops where they do not adversely impact on semi-natural habitats and the character of the NCA, for example where they can complement existing riverside vegetation or around urban areas where they can help screen urban intrusion. Incorporate growing of biomass crops and woodland with the reinstatement of active flood plains. Seek opportunities for grassland harvesting to produce biogas.	**Biomass energy** **Climate regulation** **Biodiversity** **Regulating water flow** **Regulating water quality** **Regulating soil erosion** **Regulating soil quality** **Water availability**

[17] *Wetlands West Annual Report 2009/10,* Appendix C

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Soils, especially peaty soils and those established under permanent vegetation. Trees and woodland	The soils over most of the NCA have a low carbon content (0–5 per cent) especially under continuous arable farming where cultivation and drainage has led to loss of organic content. There are scattered pockets with a high carbon content (5–50 per cent) are associated with heathland areas and areas once covered by wetland habitat in the valley floors including the area of 'loamy and sandy soils with naturally high groundwater and a peaty surface' which cover 4 per cent of the NCA in the upper Ancholme valley. These thin remnants of former peat coverings have largely oxidised away as a result of drainage and cultivation, although some pockets of deeper peats may remain. These soils are at high risk of further peat loss (therefore soil carbon loss) through wind erosion. Higher soil carbon content is found under remaining semi-natural habitats, woodlands and areas of permanent pasture where organic-rich soils have been able to develop under the undisturbed vegetation. Carbon will also be locked up in the woodlands of the NCA.	Local	Cultivation of undisturbed habitats results in a rapid loss of soil carbon. For the loamy and sandy soils with a peaty surface in the upper Ancholme Valley, soil carbon loss can be reduced through changes in land management, including establishing permanent vegetation, raising water levels and reducing tillage. Use of nurse crops and windbreaks can reduce wind erosion on cultivated land. Reducing drainage and tillage, increases soil capacity to store carbon while land managed under organic arrangements tends to have higher soil organic carbon content. Raising soil organic matter also increases the water holding capacity of soils and thus resilience to drought conditions. **Continued on next page...**	Protect remaining undisturbed habitats and permanent vegetation from cultivation. Encourage management measures which will protect loss of soil carbon especially from the peaty soils of the upper Ancholme Valley and generally encourage agricultural management measures that increase soil organic matter levels on all soils. Where appropriate seek to increase the cover of permanent vegetation including woodlands, semi-natural habitats, permanent pasture and other non cultivation agricultural land uses to improve the capacity of the NCA to store carbon.	**Climate Regulation** **Biodiversity** **Regulating water flow** **Regulating water quality** **Biomass energy** **Regulating soil erosion** **Regulating soil quality** **Water availability** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation cont.				**... continued from previous page** Increasing the cover of permanent vegetation in the NCA including pasture, woodland and semi-natural habitats will increase soil organic matter content and carbon storage while more carbon will be stored within the timber of increased woodland cover.	Plan for opportunities for carbon sequestration through the restoration of former mineral extraction sites and elsewhere through creation of suitable wetland and other habitats. Promote the role of the natural environment in helping to secure a low carbon economy.	

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Woodlands and woodland soils Permanent grassland and semi-natural habitats, especially where they lie close to watercourses Hedgerows	The whole of the NCA is within a nitrate vulnerable zone. Priority catchment sensitive farming zones extend into the far north east and far south of the NCA though no rivers are included. The River Ancholme and its tributaries have generally poor ecological status/potential, though the Rase is of moderate status. The chemical status of the Ancholme is 'failing to achieve good'. The Witham and its tributaries have generally moderate ecological status/potential though the Barlings Eau is poor. The chemical status of the Witham is good.[18] The chemical status for groundwater for most of the NCA has largely been unassessed due to unproductive strata but in the west of the NCA status is generally good[18].	Regional	Arable agriculture is the main land use across the NCA. Diffuse pollution from agriculture is considered to be one of the issues for water quality failures in the Ancholme catchment[19]. Furthermore physical modification of natural watercourses profile has limited their ecological potential. Regulation of the water quality of the River Ancholme is especially important as it drains directly into the internationally important habitat site of the Humber Estuary. The main soil type of the NCA can pose a risk to water quality due to poor water infiltration potentially causing run-off from farmland and diffuse pollution to water courses from applied manures and agrochemicals. Within the Ancholme Valley there is generally low run-off risk but the prevalence of watercourses, drainage ditches and localised flooding means there is a risk of diffuse pollution from applied manures, fine sediment or agrochemicals. Also the susceptibility of the cultivated peaty soils in the upper Ancholme Valley to wind erosion means there is a pollution risk to watercourses from organic matter, sediment and agrochemicals.	Work with the farming community to ensure in-field soil analysis on a landscape scale affords a reduction in rates of phosphate transferred into the NCA's watercourses while also reducing the current expenditure of farm businesses. Also seek to reduce agrochemical inputs through greater use of crops with lower requirements, conversion of arable to pasture (especially alongside watercourses). Seek opportunities where feasible to re-naturalise sections of the River Ancholme and its flood plain to improve its ecology and enhance water quality. Seek opportunities where feasible to convert arable land to other appropriate uses throughout the NCA to enhance water quality especially in the Ancholme Valley including opportunities to re-wet areas and establish permanent vegetation. **Continued on next page...**	**Regulating water quality** **Regulating soil erosion** **Biodiversity** **Regulating soil quality** **Sense of place / inspiration** **Geodiversity**

[18] *River Basin Management Plan, Humber River Basin District, Annex A: Current state of waters,* Environment Agency (2009)
[19] *River Basin Management Plan, Humber River Basin District*, Environment Agency (2009)

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** Expand the network of semi-natural wetland habitats, woodland, hedgerows and grassland adjacent to watercourses, field drains and waterbodies to capture sediment and nutrients. Adapt existing drainage schemes and design new sustainable drainage schemes to incorporate habitats to purify water. Design these in conjunction with green infrastructure.	

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Rivers and river channels Functioning flood plains and their wetland habitats Geomorphology and generally gentle topography Other semi-natural habitats Woodlands, tree belts and dense hedgerows Extensively grazed permanent grasslands Soils with high organic matter	The NCA is crossed by many streams flowing from the Wolds towards the heavily modified courses of the main rivers: the straight course of the canalised River Ancholme which flows north into the Humber and River Witham which flows south to The Wash. The current extent of semi-natural habitats and permanent vegetation cover within the catchments is very limited which limits water infiltration rates however, the woodland cover of 6,273 ha or 8 per cent of the NCA area in 2011 will provide some benefit. Precipitation rates are relatively low in this NCA compared to the national average, however because most of it is underlain by non-porous mudstones, rainwater infiltration is limited, surface run-off and surface water flooding can be issues and surface water and sewer flooding has occurred in Middle Rasen and Market Rasen[20]. **Continued on next page...**	Local	The main soil type of the NCA tends to have poor water infiltration due to clay subsurface layers with potential for rapid water run-off. It requires management techniques to maintain good structure and improve water infiltration on farmland such as careful planning of cultivations, minimum tillage, sensitive grazing and techniques to avoid compaction and to build up organic matter levels. Creating permanent vegetation including semi-natural habitat, woodland and grassland benefits water flow regulation by increasing infiltration, in intercepting run-off flows from arable land and built up areas and in slowing down the flow of flood waters. Low population levels mean relatively few people and properties are at direct risk of flooding; however, much agricultural land is within the Ancholme flood plain. Current flood protection measures primarily protect large areas of arable farmland from regular inundation though this approach has impacted on natural river and flood plain ecology and function. EA's preferred strategy is to reduce bank and channel maintenance where appropriate and help to improve the flow between the river and its flood plain[21]. This will mean an increase in the frequency of future flooding and there will be a need to ensure future land management is able to adapt to these conditions.	Where feasible seek opportunities to re-store and re-naturalise some sections of the rivers, watercourses and flood plains of the NCA in conjunction with changes in farming practices and environmental enhancement. Explore opportunities to sustainably use wetland habitats for food provision. For example, using flood plain grazing marsh for cattle. Reduce run-off from agricultural land and where feasible instigate measures to slow flood flows at times of flooding to reduce flood risk downstream while reducing erosion from the peaty soils in this area to benefit water quality (see below). Seek opportunities where appropriate to enhance woodland creation, tree belts and dense hedgerows as well as semi-natural habitats and areas of grassland to increase water infiltration and impede cross land flows.	**Regulating water flow** **Biodiversity** **Regulating water quality** **Regulating soil erosion** **Regulating soil quality** **Climate regulation** **Recreation** **Geodiversity** **Sense of place / inspiration**

[20] *Grimsby and Ancholme Catchment Flood Management Plan Summary Report,* Environment Agency (2009) [21] *River Witham Catchment Flood Management Plan Summary Report,* Environment Agency (2009)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow cont.		**... continued from previous page** The main sources of flood risk within the Ancholme's catchment are from river flooding from the Rasen in Market Rasen, the Ancholme in Brigg, and the impact of the Ancholme not being able to flow freely to the sea at high tide at South Ferriby while the breaching of the Ancholme's embankments could cause rapid flooding across its flood plain. Currently the main sources of flood risk within the Witham's catchment in the NCA include river flooding from the Bain in Horncastle.		In the upper Ancholme valley EA's aim is to manage flood risk by maximising the potential of the flood plain to retain water to benefit locations elsewhere in the catchment. Measures proposed to reduce flood risk in Horncastle include storage of water in the flood plain upstream of the town and outside of the NCA. This will have benefits to water flow regulation along the River Bain in the NCA.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Soil type, geological processes Organic matter Permanent vegetation and semi natural habitat. Woodland and hedgerows	There are eight main soilscape types in this NCA, the most significant by area being: ■ Soil A - Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (51 per cent), the main soil type which has developed from the underlying boulder clay. This soil has impeded drainage, is of moderate natural fertility and has a loamy texture. The types of semi-natural habitats which develop on this soil include seasonally wet pastures and woodlands. ■ Soil B - The naturally wet very acid sandy and loamy soils (17 per cent) which have developed over the Coversands and the Fen Edge Gravels. This soil has very low fertility and has a sandy texture. The type of semi-natural habitats which develop on this soil includes mixed dry and wet lowland heath habitats.	Regional	Soil quality is closely linked to organic matter content. Allowing permanent vegetation to establish and minimising cultivation enables organic matter build up and soil quality to be maintained and enhanced. The organic matter content of soils under cultivation can be built up using techniques which include the addition of organic waste and the use of green manure crops combined with minimum tillage techniques. Exploring ways to increase the cover of permanent vegetation where feasible in the NCA including pasture, woodland and semi-natural habitats will increase soil organic matter content. Soil A is easily damaged when wet so there is a need to minimise compaction and capping risk which can cause and exacerbate run-off problems. Careful timing of activities is required to reduce this likelihood. Increasing organic matter levels can help reduce these problems. Soil B is easily worked but has a weak structure which can be easily damaged by cultivation and grazing. Topsoil compaction can occur as well as cultivation pans. Depletion of organic matter through cultivation can reduce the stability of this soil type and make it more vulnerable to wind erosion and water erosion with consequent impacts on water quality. Additions of organic matter can increase stability where cultivated.	For soil A, employ land management practices which minimise the negative impacts of soil structural deterioration to avoid compaction, poaching or puddling soils. Also employ management techniques to maintain or improve water infiltration and build up organic matter levels. For soil B, ensure that good structural conditions are maintained where under cultivation by employing practices which build soil organic matter levels. Also consider use of wind breaks and other wind erosion control measures. Seek opportunities to convert arable land to permanent vegetation especially where benefits to other ecosystem services can be maximised. Work with land managers to improve the timing of agricultural activities on vulnerable soils and under vulnerable soil conditions especially when wet. Also encourage use of low pressure machinery. **Continued on next page...**	**Regulating soil quality** **Food provision** **Climate regulation** **Regulating water flow** **Regulating soil erosion** **Biodiversity** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality cont.					**... continued from previous page** Encourage management measures that increase soil organic matter levels and measures to reduce levels of cultivation, such as direct drilling, to protect soil structure and conditions for soil fauna and to increase water infiltration.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Semi- natural habitats, woodland, riparian margins, hedgerows Gentle topography Permanent pasture on sloping land	While the majority of the soils within this NCA are not susceptible to erosion soil B of the Coversands and Fen Edge Gravels is at risk of wind erosion when dry and is also easily eroded if heavily trafficked or after heavy rain. Lime-rich loamy and clayey soils in the Horncastle area (covering 7 per cent of the NCA) have impeded drainage and are easily compacted by machinery or livestock if accessed when wet, increasing risks of water erosion. In the upper Ancholme Valley are found loamy and sandy soils with naturally high groundwater and a peaty surface (covering 4 per cent of the NCA) which are at low risk of water erosion but high risk of wind erosion and peat erosion with consequent soil carbon loss. The steep slopes of the Wolds escarpment are generally covered in shallow lime-rich soils which are sometimes unstable and prone to loss through erosion particularly where cultivated or bare soil is exposed.	Local	The erosion of soil impacts on many other ecosystem services particular to the water services, soil quality and climate change. Assets that assist in combating soil erosion are very similar to those that assist in water infiltration and reducing cross land water flows. Better management of soils to combat erosion will lead to improvements in water quality and water flow. Erosion of organic matter from soils reduces soil carbon levels impacting on climate regulation. Soil B and the peaty soils of the upper Ancholme are particularly at risk of this. Woodlands, tree belts and dense hedgerows increase water infiltration, impede cross land flows, and shelter from wind erosion. Semi-natural habitats and grassland also serve to reduce soil erosion. Grass buffer strips in areas of arable production intercept surface water run-off thereby reducing soil erosion risk. Wind erosion to peaty soils can also be controlled by rewetting. Building up organic matter in soils reduces the chance of compaction and therefore erosion on susceptible soils.	Seek opportunities to re-wet areas of peaty soils and establish permanent vegetation cover such as wet grassland to prevent wind erosion. For lime-rich loamy and clayey soils with impeded drainage- work with landowners and managers to improve the timing of agricultural activities under wet conditions. Also encourage use of low pressure machinery. For the shallow lime-rich soils of the wolds escarpment – seek to protect existing pasture and permanent vegetation cover, seeking opportunities to convert existing land under cultivation to permanent pasture (avoiding overgrazing), woodland or semi- natural habitat. Generally promote good soil management to minimise risk and impacts of erosion such as by establishing sensitive grazing regimes and by avoiding cultivating steep slopes, reducing the intensity of cultivation, establishing permanent ground cover, increasing field margins and buffer strips, increasing soil organic matter and avoiding compaction.	**Regulating soil erosion** **Regulating water quality** **Biodiversity** **Sense of place / inspiration** **Regulating soil quality** **Food provision** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Semi-natural habitats Hedgerows and field margins Roadside verges Gardens	There are 1,030 ha of non woodland semi-natural priority habitat within the NCA including 736 ha of lowland heathland and 170 ha of lowland meadow. These provide important habitats for pollinating insects, as do the small-leaved lime-dominant ancient woodlands, species rich hedgerows, road verges, field margins and gardens. Semi-natural habitats tend to be restricted to particular areas (such as heathland within the Coversands and Fen Edge Gravels where crop growing is not so significant), and are not interspersed within the agricultural landscape. In the main crop growing areas the habitats for pollinating insects are likely to be very limited. Most farmland is used for growing crops, most of which is for cereal production not requiring insect pollination, however there are significant areas of crops grown which do require pollinators including oilseeds which covered 9,142 ha in 2009, 11 per cent of total NCA area.	Local	Pollinators play a vital role in food provision in this area, in the pollinating of oilseed rape for example, but research shows significant declines in the abundance, range and diversity of many pollinator species nationally[22]. A strong and widespread pollinator population will support production of a wide variety of food products and productivity levels in this NCA sustaining a diversity of food provision into the future. Away from the localised concentrations of semi-natural habitats and the ancient lime woodlands the network of pollinator habitats is very limited within the agricultural landscape and this limits the ability for pollinators to supply this service to a significant level. Increases in habitat for pollinators in arable areas through creation of semi-natural habitats, increases in floristically enhanced field margins, new and enhanced hedgerows and appropriate road verge management will increase delivery of this service. Some traditional farming systems can benefit pollinators such as bumble bees because they use rotations involving legumes such as clover.	Enhance habitat networks for pollinator species within the agricultural landscape with particular emphasis on increasing the network of unimproved flower rich grasslands across the bulk of the clay vale. Encourage use of nectar and forage mixes in arable land and planting of species rich hedgerows as well as the take up of agri-environment schemes which floristically enhance field margins and hedgerow habitats, to increase the availability of nectar sources in proximity to food crops requiring pollination. Work with landowners to protect, manage and enhance existing pollinator habitats including road verges and green spaces. Manage them for structural diversity and allow flowering plants to flower and set seed. Encourage the principles of organic management of land to favour pollinators.	**Pollination** **Pest regulation** **Biodiversity** **Sense of place / inspiration** **Food provision**

[22] *Bees and other pollinators: their value and health in England. Review of policy and evidence,* Defra (2013)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pest regulation	Semi-natural habitats Hedgerows and field margins Roadside verges Gardens	The habitats in the area support a variety of species, such as beetles, which can regulate the populations of pests such as aphids, however, as above, these habitats are very limited across the agricultural landscape and consequently the diversity and spread of pest regulating species and the capacity for natural pest regulation will be limited.	Local	Natural pest predation and regulation is an important ecosystem service for food provision. A healthy diversity and network of habitats which support pest regulating species such as invertebrates, birds and mammals throughout the agricultural landscape will reduce reliance on pesticides in crop production with knock on benefits to biodiversity and pollination services. Improving the network of semi-natural habitats and linkages between them through creation of new areas of habitat, hedgerow planting and appropriate management of existing habitats and hedgerows will benefit pest regulating species. Pesticides and tillage can reduce the abundance and diversity of natural enemies of pests which require refuges free from disturbance.	Protect semi-natural habitats and seek opportunities to create new semi-natural habitats, species rich hedgerows and wider field margins close to areas of agricultural production to create a network of habitats for pest regulating species. Encourage take up of agri-environment schemes especially those to enhance field margins and hedgerow habitats and support management and creation of meadows. Encourage land management which reduces pesticide use and cultivation such as organic farming and pasture.	**Pest regulation** **Pollination** **Biodiversity** **Food provision** **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 tranquil rural landscape Woodlands Historic assets, traditional buildings, farmsteads and villages Landform Semi-natural habitats	Elements of the Vale landscape that help give it its sense of place which visitors and residents are likely to value and gain inspiration from most include: ■ Its rural tranquillity and lack of urban influence with its sparse settlement pattern linked by the network of quiet lanes. ■ The woodlands, especially the ancient woodlands of the Lincolnshire Limewoods including Bardney Limewoods NNR, the Forestry Commission woodlands and well-managed publicly accessible plantations. ■ The sites of ancient abbeys and deserted medieval settlements. ■ The brick and pantile villages and farmsteads. ■ The Wolds escarpment and the extensive views over the Vale it provides.	Local	Habitats and landscape features have been lost through modern commercial agricultural practices which dominates the landscape of the Vale, diminishing established sense of place. The settlement pattern and tranquil qualities of the Vale can be protected through the careful control and design of new development. The intrinsic sense of place of the Coversands and Fen Edge Gravels can be enhanced through the managed conversion of coniferous plantations back to heathland and native woodland habitats. The former natural character of the watercourses and flood plains has been almost completely lost through the very extensive modifications with consequent impacts on other ecosystem services. A small part of the inspiring landscape of the adjoining Wolds AONB crosses into the NCA. Its proximity is likely to help preserve the deeply rural character of the Vale and keep major development at bay. Building on the links the Vale has with the Wolds is likely to strengthen public appreciation of its landscape. **Continued on next page...**	Maximise uptake of agri-environment schemes to protect, manage and enhance historic and landscape features thereby protecting and enhancing sense of place. Carefully control new development by locating it within existing settlements. Ensure the location, form and design of new development be guided by landscape character assessment objectives, village design guidance and design briefs including use of characteristic materials. Work with the Forestry Commission to maximise opportunities for heathland and native woodland restoration on plantation sites. Seek opportunities for re-creating active flood plains and flood plain habitats, including appropriate restoration of sand and gravel extraction sites, to help define the rivers, the flood plains and strengthen sense of place.	**Sense of place / inspiration** **Tranquillity** **Biodiversity** **Recreation** **Sense of history** **Regulating water flow**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
A sense of place/ inspiration cont.				**... continued from previous page** Ash dieback *Chalara fraxinea* may have a significant impact on sense of place with ash being a common species in the Vale.	Raise awareness of the Vale's assets and links with the AONB, to raise the value people place on them to help protect and enhance the area. Plan for a landscape depleted of ash by planting replacement characteristic tree species.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Archaeological and historic features The widespread medieval earthworks of former villages and religious establishments The villages and towns, churches and the local vernacular Ancient woodlands	The aspects of history that are likely to be most evident to the general public are the numerous deserted and shrunken medieval villages like Spridlington, and the profusion of former monastic sites such as Tupholme and Barlings as well as the area's traditional buildings with a local vernacular of brick and clay tile, the distinctive Tudor red brick tower of Tattershall Castle and the old stone churches of the villages. The numerous ancient woodlands of the Vale also contribute to the sense of history, especially the Bardney Limewoods and wider Lincolnshire Limewoods which may have been continuously wooded since the end of the last ice age.	Regional	The earthworks of the shrunken villages and monasteries as well as ridge and furrow provide a tangible link to the medieval landscape but are highly vulnerable to ploughing while management under permanent pasture will help preserve them. Ancient woodlands are important parts of the historic landscape, forming much of the remaining fragments of land which has seen permanent vegetation cover and undisturbed soils for hundreds, even thousands of years with some, like the Bardney and Lincolnshire Limewoods, providing a link back to the original wildwood that covered the UK. They are reservoirs of archaeology, economic history and wildlife, and a source of inspiration for local culture and folklore. Care is needed in the planning of new development in the villages and settlements of the Vale to prevent erosion of sense of history. Some of the impacts of modern agriculture have been negative on the historic character of the NCA; such as the removal of hedgerows, neglect of farm buildings and other traditional farmland features. **Continued on next page...**	Protect existing pasture with archaeological features, including ridge and furrow, from conversion to arable use, seek opportunities to protect buried archaeology through reversion of arable land to pasture and reduce cultivation damage by encouraging direct drilling and shallow tilling. Protect and enhance ancient woodlands, improve their management and raise awareness of them. Protect the historic settlement pattern and vernacular architectural character through informed planning and development control including requiring the use of traditional building materials and architecture in new developments. Protect and enhance elements of the historic farmland landscape including existing hedgerows, replanting hedgerows where they have been lost to strengthen historical field patterns and restoring traditional farm buildings.	**Sense of history** **Recreation** **Sense of place / inspiration** **Tranquillity** **Biodiversity** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history cont.				**... continued from previous page** Promotion and interpretation of the historic assets of the NCA such as will raise awareness and understanding and lead to greater demand for their protection. The extraction of sand and gravel resources of the Fen Edge Gravels enables discovery of buried archaeology but also permanently destroys historical features.	Promote wider awareness of the historic environment to encourage its enjoyment, understanding and protection and where possible provide improved public access to sites of historic interest. Plan sand and gravel workings carefully to ensure that valuable historical assets are protected.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Thinly scattered population Deeply rural character Sparse network of quiet minor roads Dark night skies	Tranquillity is a significant feature of this NCA, with 71 per cent of the area in 2007 classified as undisturbed – from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. The most tranquil areas are within the Ancholme Valley and in the Bardney Forest area. The Vale still retains a sense of remoteness, shared with much of Lincolnshire, and it is valued for its peace and tranquillity. This is provided by its thinly scattered population, sparse network of quiet minor roads and general lack of urban development. In turn skies are largely unaffected by light pollution at night. Intrusion in the NCA comes from the M180 and Brigg power station in the north, the A-roads that cross the area further south, while there is further local disturbance around the mineral extraction sites of the Fen Edge Gravels. Also in the north some visual intrusion comes from Scunthorpe's steelworks and the cement works by the Humber.	Regional	Tranquil countryside is highly valued by the public with safeguarding tranquillity levels being important for well-being, quality of life and the rural economy. The main threats to tranquillity include urban and peri-urban development and road traffic. A sense of tranquillity is most likely to be associated with the areas of ancient woodland that occur around Bardney, as well as along the undeveloped stretches of rivers and streams and within and surrounding the area's more remote villages. The AONB seeks to keep the Vale tranquil and ensure major development does not have negative impact of the landscape character through its management and Management Plan policies. There has been change in the extent to which the area is 'intruded on'. In the 1960s only 4 per cent of the area was categorised as disturbed. By the 1990s this had risen to around 15 per cent and by 2007 to around 28 per cent. Visual intrusion from sand and gravel extraction works and other development can be mitigated through careful design, planning and woodland screening.	Protect and enhance tranquillity through influencing land use, transport and development decisions in the NCA. Promote the value of the Vale's tranquillity to help protect it. Promote the use of measures that reduce noise and light pollution and visual intrusion in new and existing developments. Protect tranquillity by focussing new residential development within existing settlements. Plan new developments carefully to minimise car use and seek development not dependent on car use. Screen urban and industrial influences such as gravel extraction sites with woodland, building links with other woodlands, hedgerows and semi-natural habitats.	**Tranquillity** **Sense of history** **Recreation** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	High levels of tranquillity Historic sites and nature reserves Accessible woodlands Access land and access network The Wolds AONB Villages and towns Waterways and river corridors Topography Quiet network of minor roads Long distance cycling and walking trails Existing suite of promoted routes	The Vale has a considerable area of accessible woodland, much of which is of considerable interest to visitors such as that of the Limewoods. The River Witham corridor provides an important recreational asset and a key sustainable transport link for residents of Lincoln to access the Bardney Limewoods, the monastic sites and the Woodhall Spa/Tattershall area. The River Ancholme has a multiuser trail which provides a key north south link from the Humber to Bishopbridge. The quiet minor road network combined with the gentle topography is an asset for cycling and two national cycle network routes pass through the Vale. Recreation assets also include the proximity of the Wolds AONB, the Viking Way, Woodhall Spa inland resort, the National Trust managed Tattershall Castle and some of the nearby lakes of former gravel extraction sites. Permissive access on pasture land on the Wolds scarp at Horkstow provides expansive views across the Ancholme Valley.	Regional	The generally high tranquillity levels will be valued by visitors to the NCA. Recreation has strong links to health and wellbeing including both physical and mental health and reducing isolation. Nationally, walking is the most popular way that people engage with the natural environment accounting for three quarters of all visits. Public access is limited in this NCA with a total of 513 km of Rights of Way (a density of 0.63 km per km2) and a mere 54 ha of open access land. The Lincolnshire Rights of Way Improvement Plan (ROWIP) has identified the need to strengthen the network. A small part of the Wolds AONB extends into the NCA around Claxby. The Central Lincolnshire Joint Planning Unit has produced a green infrastructure strategy which is mainly focussed on linking Lincoln with the wider countryside. There is scope to enhance access and increase scope of existing suite of promoted routes across the NCA.	Support the implementation of the Lincolnshire ROWIP to develop an integrated network of rights of way increasing facilities for visitors and residents for walking and other recreational activities which will improve people's health and wellbeing. Promote the tranquillity and other recreational assets of the Vale and work with local authorities and local partnerships to develop sustainable tourism strategies which build on these assets while protecting the tranquil and rural qualities of the NCA. Build on the links to the Wolds AONB to encourage sustainable recreation in the Vale. Work with local authorities and others to promote and develop green infrastructure, especially key links from Lincoln into the NCA, to maximise sustainable transport provision and its use to help minimise adverse impacts of greater visitor numbers in the Vale.	**Recreation** **Sense of place / inspiration** **Sense of history** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Lowland deciduous woodland including ancient woodland such as Bardney Limewoods Wet woodland Lowland heathland/ acid grassland	There are over 2,814 ha (3 per cent of the NCA area) of priority habitats within the NCA including 1,242 ha of lowland mixed deciduous woodland, 874 ha of wet woodland, 350 ha of lowland heathland, and relatively small areas of lowland meadow, flood plain grazing marsh, reedbed and lowland calcareous grassland. 1,152 ha (approximately 1 per cent of total area) is nationally designated as SSSI covering 18 sites most of which are in the southern half of the NCA. As of March 2011, 61 per cent of SSSI area was in unfavourable recovering condition whereas 38 per cent was favourable. There are 256 local sites covering 4,062 ha (5 per cent of the NCA). **Continued on next page...**	Regional	Distribution and extent of semi-natural habitats tends to be a reflection of the value of the land for agricultural production. The sandy infertile soils of the Fen Edge Gravels has enabled a cluster of habitat sites to remain while on the Coversands much former heathland has been converted to conifer plantation. Other than within the Lincolnshire Limewoods area, semi-natural habitats are extremely limited across the rest of the NCA. Extent and condition of heathland sites could be enhanced through appropriate management of Forestry Commission sites. Biodiversity opportunity mapping has been carried out across the area. A network of connected habitat features supports biodiversity and enables species movement through the landscape boosting related ecosystem services such as pollination and pest regulation (however, non-native invasive species may also benefit). Reinstating lost hedgerows throughout the Vale will help achieve this. There is considerable scope to improve biodiversity within the farmed landscape through agri-environment schemes. For example grants have been used to target farmland birds to ensure the provision of winter food resource, summer chick rearing habitats and nesting habitats.	Protect, enhance and expand semi-natural habitats across the NCA. Use biodiversity opportunity mapping to identify how this can be achieved within the landscape and at a landscape scale. Strategically plan areas of habitat creation to maximise connections between existing biodiversity rich sites to enable greater movement of species through the landscape while seeking to address issues of invasive non-native species. Continue enhancement and linkages of habitat within the Lincolnshire Limewoods. Work with landowners and farmers to ensure biodiversity features are incorporated into the farmed landscape to maximise value for biodiversity, pest regulation and pollination. Encourage land management practices that benefit farmland birds.	**Biodiversity** **Sense of place / inspiration** **Tranquillity** **Regulating soil erosion** **Regulating soil quality** **Pest regulation** **Recreation** **Sense of history** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity cont.		**... continued from previous page** The 384 ha Bardney Limewoods National Nature Reserve incorporates several of the ancient limewoods of the Vale. The Vale is one of the top ten NCAs in the country for the following species of principal importance for the conservation of biodiversity in England (S41 species): skylark, tree sparrow and yellowhammer.		Sand and gravel extraction has potential to provide new opportunities for wetland habitat creation and increased habitat connectivity through good quality restoration of sites within the Fen Edge Gravels however these need to be planned carefully to minimise impacts on existing biodiversity and archaeology.	Seek opportunities to sustainably use wetland habitats for food provision such as flood plain grazing marsh for cattle grazing. Maximise biodiversity gains from the restoration of sand and gravel extraction sites while respecting established landscape character.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Superficial deposits – glacial till, Coversands and Fen Edge Gravels Soils Topography Bedrock geology Geomorphological features Local clay for brick and tile building materials Stone from the bedrock of adjacent areas The Lincolnshire Limestone aquifer	The land use of the NCA relates strongly to its superficial geology and the soils that have developed. This is most markedly seen in the contrast between the areas of glacial till and the areas of Coversands and the Fen Edge Gravels. The scarp slope of the chalk wolds is a prominent and distinctive topographical feature. There is one nationally important geological site in the NCA: South Ferriby Chalk Pit SSSI which provides good sections of Upper Jurassic and Lower Cretaceous rocks. Fossils in the mudstone bedrock provide a very valuable record of the fauna of the Jurassic period of earth's history. The sand and gravel deposits of the Fen Edge Gravels are an important resource for the construction industry. The mudstones of the Vale have provided clay for the brick and tile local building materials while stone hewn from the bedrock of adjacent NCA's feature widely in the churches and more substantial buildings. The Lincolnshire Limestone which dips beneath the younger mudstone bedrock of the Vale forms an important aquifer.	Regional	Landforms and geological exposures are valued both directly for their educational use and as defining features in the landscape as well as underpinning the overall landscape character. Extensive lengths of the river systems throughout the NCA have been artificially manipulated and natural geomorphological processes are severely impaired. Re-naturalisation of rivers would enable natural geomorphological processes to take place again as well as benefitting other ecosystem services. The several open water lagoons within the Fen Edge Gravels are a legacy of this demand for the sand and gravel resources here.	Protect and improve the condition and accessibility of geological and geomorphological sites that help in the understanding of the area's geodiversity. Seek opportunities to re-naturalise sections of watercourses to provide more opportunities to understand geomorphological processes and also enhance their riverine character, wetland habitats and associated ecosystem services. Seek opportunities to raise awareness of geodiversity and relate geodiversity to the character and development of the NCA's landscapes, agriculture, settlement pattern, buildings and industries.	**Geodiversity** **Sense of history** **Sense of place / inspiration** **Recreation** **Regulating soil quality** **Biodiversity**

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