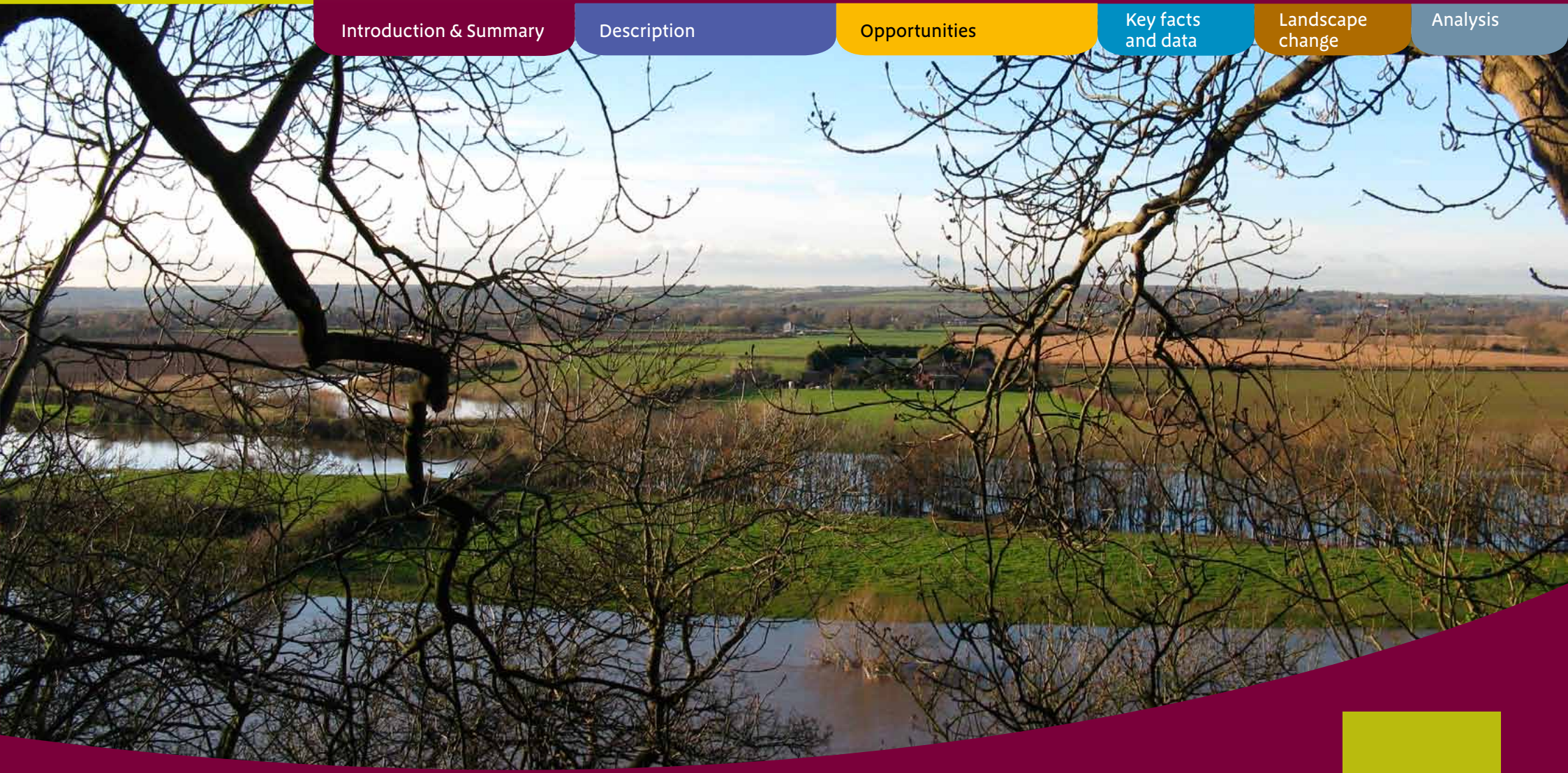
National Character Area profile:

48: Trent and Belvoir Vales

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.

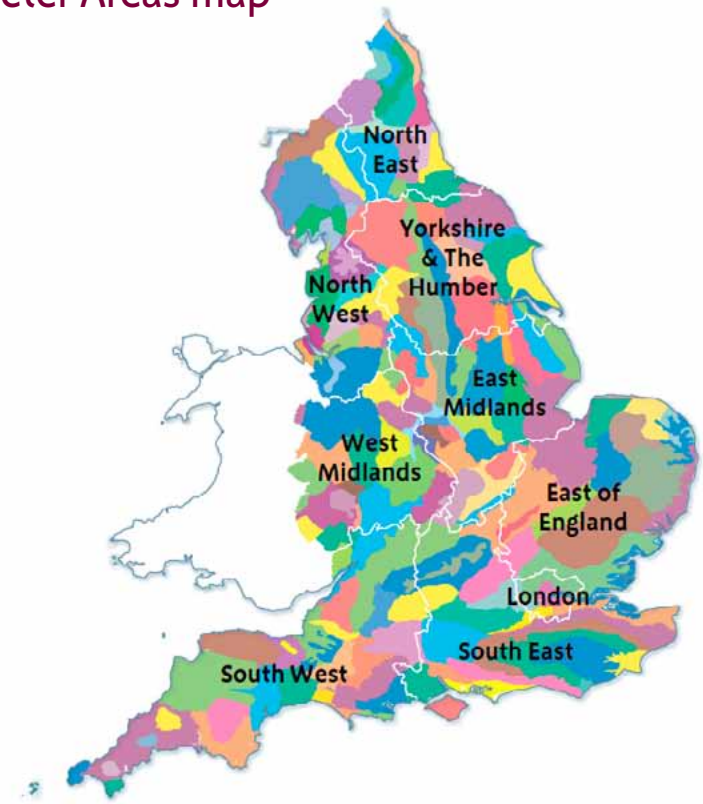
NCA profiles are guidance documents which can help communities to inform theirdecision-making about the places that they live in and care for. The informationthey contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and encourage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

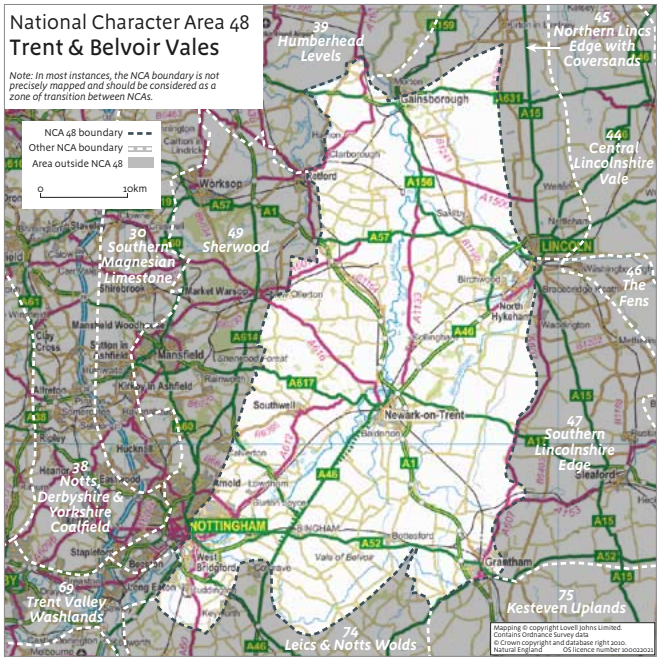


[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: www.official-documents.gov.uk/document/cm80/8082/8082.pdf)
[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf)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

Summary

The Trent and Belvoir Vales National Character Area (NCA) is characterised by undulating, strongly rural and predominantly arable farmland, centred on the River Trent. A low-lying rural landscape with relatively little woodland cover, the NCA offers long, open views. Newark-on-Trent (generally referred to as Newark) lies at the centre with Grantham, Nottingham, Lincoln and Gainsborough on the peripheries. The southern and eastern edges of the Vales are defined by the adjoining escarpments of the Lincolnshire Edge and the Leicestershire and Nottinghamshire Wolds NCA. To the west, the escarpment of a broad ridge of rolling landscape defines the boundary with the neighbouring Sherwood and Humberhead Levels NCAs. The area's generally fertile soils and good quality agricultural land have supported a diversity of farming over a long period but, because of this, little semi-natural habitat remains. The powerful River Trent and its flood plain provide a strong feature running through the landscape. It is the greatest biodiversity resource, being a major corridor for wildlife moving through the area and supporting a variety of wetland habitats. It also provides flood storage as well as large amounts of cooling water for local power stations.

Cultural heritage is evident in the Trent and Belvoir Vales NCA with the overall settlement pattern little changed since medieval times. The gravel terraces along the Trent have been the focus of human activity for many thousands of years. The enclosure and reorganisation of the landscape in the 18th and 19th centuries can be seen in the regularly shaped hawthorn hedged fields and the distinctive red brick and pantile building style of the villages and farmsteads. Traditionally a mixed farming area, its intrinsic landscape character has been weakened by modern agricultural practices and development. Much pasture has been converted to arable use, hedgerows have been removed to create larger fields and the historical environment has been put at risk. Rural tranquillity is still a feature over much of the area; however, significant residential and infrastructure development pressures exist from the main settlements and major roads that traverse the area. Managing the ongoing extraction of the extensive sand, gravel and other mineral resources presents challenges as well as opportunities. Habitats created after the extraction of sand and gravel provide regionally important sites for wildlife as well as major recreational assets to the area.



Click map to enlarge; click again to reduce.

Statements of Environmental Opportunities:

SEO 1: Maximise the use of sustainable agricultural practices that protect and enhance ecological networks in order to help safeguard the long-term viability of farming in the area while benefiting biodiversity, landscape character, carbon storage as well as water quality, availability and flow.

SEO 2: Enhance the woodland and hedgerow network through the planting of small woodlands, tree belts, hedgerow trees and new hedgerows to benefit landscape character, habitat connectivity and a range of ecosystem services, including the regulation of soil erosion, water quality and flow.

SEO 3: Enhance the rivers and their flood plains for their ecological, historical and recreational importance, their contribution to biodiversity, soil quality, water availability and in regulating water flow and the important role they play in underpinning the character of the area.

SEO 4: Maintain and enhance the character of this gently undulating, rural landscape. Promote and carefully manage the many distinctive elements that contribute to the overarching sense of place and history of the Trent and Belvoir Vales.

The Trent flood plain near East Stoke showing new hedge planting with uncultivated margins linking to the tree-lined banks of the river in the distance.

Description

Physical and functional links to other National Character Areas

The National Character Area (NCA) borders seven other NCAs: Humberhead Levels, Northern Lincolnshire Edge with Coversands, Southern Lincolnshire Edge, Sherwood, Trent Valley Washlands, Leicestershire and Nottinghamshire Wolds and Kesteven Uplands

The southern and eastern edges of the NCA are well defined by the adjoining escarpments of the Northern Lincolnshire Edge with Coversands, the Southern Lincolnshire Edge and the Leicestershire and Nottinghamshire Wolds NCAs. These provide enclosed borrowed views which frame the Trent and Belvoir Vales landscape. The western escarpment of the broad ridge of rolling landscape found in the west of the NCA defines the boundary between it and the neighbouring Sherwood and Humberhead Levels NCAs. This escarpment and boundary becomes more distinct north of Ollerton as the land of Sherwood drops away to the Humberhead Levels. Key views are to and from these areas of higher ground.

The Trent is the main river of this NCA, providing a functional, recreational and environmental link with the NCAs upstream and downstream through which it flows. Its source is Biddulph Moor in Staffordshire (Potteries and Churnet Valley NCA) and its main tributaries include the rivers Tame, Soar, Derwent and Dove. Its catchment extends over 10,000 km as far and wide as the Dark Peak NCA and Birmingham (Arden NCA). At Gainsborough, the Trent flows through a narrow section of the Northern Lincolnshire Edge with Coversands NCA into the Humberhead Levels and then on to its confluence with the River Ouse to form the

The River Trent in high flow near Hoveringham. The river links the area to upstream and downstream NCAs.

River Humber (Humber Estuary NCA). Downstream of Cromwell Lock (5 km north of Newark) the Trent becomes tidal and thus links with the marine environment. The Trent Valley Way provides a long-distance recreational route linking NCAs following the course of the river from near its source all the way to the Humber Estuary 166 miles away.

The other notable river of the NCA is the Witham – much of the upper part of its

catchment lies within the NCA. It rises in the adjoining Kesteven Uplands NCA and flows north through Grantham. Together with its tributary the River Brant, it flows through its shallow vale towards Lincoln where it is joined by the River Till and then flows east through the Lincoln Gap and on into The Fens NCA where it eventually drains into The Wash beyond Boston.

Large volumes of water flow into the NCA from the upstream catchment of the River Trent, supplying water for agricultural and industrial use (for example, for power stations). Trent water is also used to supply the rivers Witham and Ancholme in neighbouring NCAs to support abstractions there. Water is pumped into the Fossdyke Navigation at Torksey to flow into the River Witham at Lincoln.

The transport infrastructure of the NCA also provides links to other areas, most notably the A1 and A46 roads and the East Coast main line railway.

Distinct areas

- The dumbles and becks.
- The Sandlands to the west of Lincoln

The view west from Hough on the Hill.

Key characteristics

- A gently undulating and low-lying landform in the main, with low ridges dividing shallow, broad river valleys, vales and flood plains. The mature, powerful River Trent flows north through the full length of the area, meandering across its broad flood plain and continuing to influence the physical and human geography of the area as it has done for thousands of years.
- The bedrock geology of Triassic and Jurassic mudstones has given rise to fertile clayey soils across much of the area, while extensive deposits of alluvium and sand and gravel have given rise to a wider variety of soils, especially in the flood plains and over much of the eastern part of the NCA.
- Agriculture is the dominant land use, with most farmland being used for growing cereals, oilseeds and other arable crops. While much pasture has been converted to arable use over the years, grazing is still significant in places, such as along the Trent and around settlements.
- A regular pattern of medium to large fields enclosed by hawthorn hedgerows, and ditches in low-lying areas, dominates the landscape.
- Very little semi-natural habitat remains across the area; however, areas of flood plain grazing marsh are still found in places along the Trent.
- Extraction of sand and gravel deposits continues within the Trent flood plain and the area to the west of Lincoln. Many former sites of extraction have been flooded, introducing new waterbodies and new wetland habitats to the landscape.
- Extensive use of red bricks and pantiles in the 19th century has contributed to the consistent character of traditional architecture within villages and farmsteads across the area. Stone hewn from harder courses within the mudstones, along with stone from neighbouring areas, also feature as building materials, especially in the churches.
- A predominantly rural and sparsely settled area with small villages and dispersed farms linked by quiet lanes, contrasting with the busy market towns of Newark and Grantham, the cities of Nottingham and Lincoln, the major roads connecting them and the cross-country dual carriageways of the A1 and A46.
- Immense coal-fired power stations in the north exert a visual influence over a wide area, not just because of their structures but also the plumes that rise from them and the pylons and power lines that are linked to them. The same applies to the gas-fired power station and sugar beet factory near Newark, albeit on a slightly smaller scale.

Some of the key characteristics are displayed in this view near East Stoke: arable farmland, the meandering River Trent, gently undulating topography. The plumes in the distance rise from Staythorpe gas fired power station and Newark sugar beet factory.

Trent and Belvoir Vales today

The Trent and Belvoir Vales offer a gently undulating and low-lying landform with low ridges dividing shallow, broad river valleys and flood plains. The landscape follows a strong north–south pattern due to the orientation of the underlying Triassic and Jurassic geology. A lot of the area is overlain by much younger material deposited through the action of glaciers, rivers and, in places, the wind. The boundary between the mudstones runs roughly north–south through the centre of the NCA.

The Triassic-age Mercia Mudstone Group forms the rolling landscape west of the Trent and the subtle escarpment that runs along the Sherwood NCA boundary. The land and underlying geology dip east towards the Trent flood plain. Following a slight rise on the east side of the flood plain, where the river has undercut it, the land dips sharply again to the broad low-lying vales of the rivers Till and Witham and the River Devon in the Vale of Belvoir. The views beyond are contained by the modest but abrupt bordering Lower Jurassic Lincolnshire Limestone escarpment, which runs along the eastern boundary, and the Jurassic Marlstone-capped Belvoir ridge to the south.

Woodland cover is low. On the higher ground west of the Trent, small broadleaved, ancient semi-natural woodlands of oak and ash are frequently found, often as narrow strips alongside incised watercourses. There are a number of large coniferous and deciduous plantations on the sandy soils west of Lincoln.

Most of the area contains productive farmland, the majority of which is used for commercial arable production while grazing land for sheep, cattle and horses is locally significant in places. The sandy soils west of Lincoln have low natural fertility, but with fertiliser inputs these also provide very useful farmland, particularly for root crop production. Because of the value of the land for agriculture, the area has retained little semi-natural habitat. What remnants survive include flood plain grazing marsh such as The Holmes near Sutton on Trent, lowland meadows and some small areas of heathland, for example on the windblown sand deposits north of Collingham. Throughout the area, broadleaved woodlands, copses and the networks of hedgerows provide important habitats for farmland species.

The village of Shelford in the Trent flood plain, looking towards the higher ground of the Dumbles.

The pattern of field enclosure, bounded almost invariably with hawthorn hedgerows, plays an important part in creating the character of the Trent and Belvoir Vales NCA. Throughout, hedgerow trees are few and limited to oak and ash, with willow along watercourses. In the east, hedgerows become fewer and the division of fields by dykes becomes more common, giving the landscape a fen-like character.

The flood plains are distinctive features, especially that of the Trent; however, the rivers themselves are not visually prominent in the wider landscape and are often completely hidden from view by levees. They flow largely unnoticed, marked only by a fringe of scattered trees and riparian vegetation. The Trent is in its mature form as it meanders slowly but powerfully through the area. For ease of navigation and flood prevention, the channel has been deepened and, particularly in its lower reaches, tightly confined by levees. The Trent and its flood plain act as a major corridor for wildlife through the area and provide a variety of wetland habitats. Habitats created after sand and gravel extraction provide regionally important sites for wildlife and have allowed for the re-colonisation of species in the NCA.

In the west, the many eastward-flowing tributaries of the Trent have formed small well-defined valleys in the impermeable Mercia Mudstone. These streams, locally known as dumbles and becks, have cut narrow ravines up to 10 m deep in places.

Human history is long in this landscape; locations beside the Trent have been used for thousands of years. The Romans were active in the area and the medieval period established much of the settlement pattern seen today. At Laxton, an almost complete picture of the medieval landscape is preserved with the only surviving continuously farmed open field system in Europe.

Ancient hedgerows are still evident in many places, often as sinuous belts of trees and shrubs, occasionally defining ancient parish boundaries. Evidence of the dramatic landscape change brought about by the geometric enclosure of fields through hedge planting in the 18th and 19th centuries is extensively preserved in the landscape.

The settlement pattern is characterised by compact villages and dispersed farmsteads linked by a network of small, quiet country lanes, contrasting with the busy market towns and cities and the major roads that connect them. Building styles vary but are unified in rural areas by red brick and pantiles. In the south, Nottingham exerts a strong influence on the settlement pattern, exacerbated by urban fringe development spreading from outlying commuter settlements. The city of Lincoln and the historic market towns of Grantham and Newark share similar characteristics. Lincoln Cathedral and Belvoir Castle are prominent landmarks on the skyline as are the substantial church spires of Newark and Bottesford. Gainsborough is Britain's most inland port with its historic wharfs and warehousing. Lincoln and Southwell have developed as important centres of Christianity.

Major industrial developments are mainly focused along the Trent flood plain corridor, including power stations and associated overhead power lines, a sugar beet factory, industrial estates, sewage treatment works and active sand and gravel extraction sites. However, other than at Nottingham and Newark, the character of the flood plain is predominantly rural. The two power stations near Gainsborough have a very dramatic visual impact in the north of the area, their prominence undiminished in the low-lying open landscape. The impermeable Mercia Mudstone has trapped reservoirs of oil and several wells are in operation over the Gainsborough and Beckingham oil field. The Mercia Mudstone also provides clay for brick making and gypsum for the manufacture

of plaster, plasterboard and cement. Brick clay is dug and processed into bricks at Kirton, while gypsum is mined south of Newark and processed at the plaster works at Balderton. Major infrastructure routes traverse the area, notably the A1, A46 and the East Coast main line railway. Road infrastructure is visually prominent around the towns and cities and in some other places such as the A46 around Bingham and along parts of the A1. Traffic noise and light pollution from the major roads have a significant impact on the tranquillity of what is otherwise a relatively quiet rural area.

The Landscape through time

Both the ancient bedrock geology and more recent surface or superficial geology exert a strong influence over the character of this area. In the west, the NCA is dominated by Triassic sandstones and mudstones about 248–206 million years old which dip gently to the east. The Sherwood Sandstone Group fringes the western edge of the NCA while east of this lies the Mercia Mudstone Group, deposited in a more arid desert environment and which includes dune, lake bed and evaporite sediments. The arid conditions of the Triassic Period caused the oxidisation of iron compounds leading to the characteristic red colourisation of the rocks and the soils that derive from them. Lower Jurassic rocks, about 206 to 165 million years old, dominate the east side of the NCA – rises in the warm tropical shallow sea which covered much of central England at the time lead to the deposition of a mix of marine mudstone, siltstone, limestone and sandstone. This Jurassic Lias Group includes thin beds of harder rocks such as marlstone which in places have slowed the weathering of the underlying mudstones, resulting in escarpments such as the one above the Vale of Belvoir. Underlying these Triassic and Jurassic rocks are found the Carboniferous mudstones, siltstones and coal seams of the Nottinghamshire coal field.

All Saints Church Hough on the Hill is Grade I listed and built of ironstone and limestone. The stair turret and lower tower are 11th century; the upper tower is 15th century.

In the last two million years (the Quaternary Period), the landscape has been shaped by a series of glaciations and associated widespread erosion and deposition of materials. There is evidence of an early glacial advance (the Anglian) which covered the area approximately 400,000 years ago. The NCA, however, is dominated by sediments associated with the last glaciation – the Devensian – which ended around 11,000 years ago. The tundra-like environment of the Devensian and eventual ice melt led to extensive sand and gravel river terrace sediments. The substantial area of sand and gravel deposits found west of Lincoln give an indication of the size of the ancestor of the Trent which was unable to drain north and instead eroded a route east through the limestone ridge of the Lincolnshire Edge, today known as the Lincoln Gap.

After the ice age, the area became largely covered in forests of oak, alder and lime and human activity was focused on the Trent. The sand and gravel deposits alongside the river tend to be in the form of low terraces slightly above floodwater level, thus providing areas of dry land. For this reason, and due to the proximity of the reliable water source and transport route of the Trent, the gravel terraces became the focus of human activity for many thousands of years. Evidence of this activity comes from a wide range of archaeological discoveries, including layers of settlement showing up as crop marks, as found at sites between South Muskham and Cromwell dating from the Iron Age.

With the arrival of the Romans, major settlements were established at Newark and Lincoln along with several important roads including the Fosse Way linking Exeter and Lincoln. Woodland clearance was almost certainly as extensive in the Roman period as today, suggesting a well-settled and farmed landscape. The Fossdyke Navigation, considered to be Roman in origin, was built to link the River Witham with the Trent for the easy movement of goods.

The re-emergence of settlement following the post-Roman collapse is indicated by some early English place names. In the 6th century, under the rule of the Saxon chieftain Snotta, Snottingaham, later Nottingham became established on the site now known as the Lace Market.

The pattern of compact villages seen today across much of the area is thought to have become established from the 10th century, with villages tending to be located on slightly raised land where drainage and agricultural productivity were better. The area is one of the heartlands of the Midland open field system, developed in the late Saxon period, which resulted in great open fields farmed in rotation from nucleated settlements. A unique working remnant of this system is found at Laxton. Farming was essentially mixed. Dairying was important, particularly near towns, with cheese being produced throughout the Vale of Trent and the Vale of Belvoir. In the 14th century, the Black Death took its toll and evidence of deserted medieval settlements remains around some villages.

Between 1643 and 1646, Newark witnessed major conflict during the Civil War and the earthwork remains of fortifications built during the prolonged sieges of the town are still visible.

This is one of the areas of England most profoundly affected by the enclosure of open fields and remaining blocks of common land in the late 18th and 19th centuries. While piecemeal enclosure took place before 1750, its pace greatly accelerated thereafter and by 1800 less than 10 per cent of the land remained unenclosed. Enclosure and reorganisation usually resulted in a change from arable to pasture for fattening and dairying. Many of the hedgerows seen today date from this period, with more mature hedgerows and semi-regular fields indicating the early piecemeal enclosures. A dispersed pattern of farmsteads

and farm buildings became established with the later enclosures.

The increased mechanisation of agriculture from 1810 onwards, particularly after the 1850s, led to the gradual depopulation of the countryside. Rebuilding of many villages took place in the late 18th and early 19th centuries with the use of clay brick and pantile roofing widespread and characteristic to this day. Mapperley, which lies on the western escarpment of the Mercia Mudstone in Nottingham, was for a long time a focus for brick making. Many older timber-framed cottages and farm buildings were encased in these more durable materials or demolished.

The impact of the Industrial Revolution was mostly confined to Nottingham where the exploitation of coal led to the rapid growth of mechanised lace making, textiles, engineering and chemical industries and a big increase in population with an expansion of the city outwards and even across the Trent flood plain. Collieries on the edge of the NCA opened at Bilsthorpe, Gedling and Cotgrave between the late 19th and mid-20th centuries and continued operating until the 1990s. The lace industry, for which Nottingham became famous, expanded rapidly in the 19th century using cotton imported from America via the Trent. The Grantham Canal, completed in 1797, was built primarily to transport coal from Nottingham but competition from the railway, which opened in 1850, led to its eventual demise. Newark's role as a market town and junction of major routes was enhanced by the construction of the Midland and Great Northern railways which met there. Newark became a major centre for the refining of sugar from sugar beet when its factory began operating in 1921. Today it is supplied by around 1,000 growers.

A second revolution in agriculture took place after the Second World War when productivity levels increased hugely through the use of new mass-produced agro-chemicals and much greater mechanisation, made possible through the rapid expansion of the oil industry. Traditionally a mixed farming area, 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.

The Grantham Canal alongside the remnant flower-rich meadow land of Muston Meadows National Nature Reserve which contains medieval ridge and furrow cultivation features. The canal was built primarily to transport energy in the form of coal from Nottingham. Nowadays energy is transported across it via modern electricity pylons.

The proximity of the River Trent to nearby coal fields and the availability of large quantities of water for cooling made it a prime location for electricity generation after the war; several coal-fired power stations were constructed, dominating the local landscape. Later, with the greater use of gas for energy generation, power stations were demolished at Staythorpe and High Marnham and a new gas-fired power station built on the Staythorpe site.

Since the 18th century, people have attempted to control the natural dynamics of the River Trent. Engineered solutions to minimise flooding, such as concrete flood walls and levees, are common. For ease of navigation, the river has also been controlled through canalisation, particularly by deepening the channel and constructing locks and weirs. Many of the other watercourses of the area have also been engineered, resulting in the loss of active flood plains, associated habitats and wet pastures and a reduction in the visual quality of the river valley landscapes.

During the Second World War, several airfields were built over the south and east of the area as bomber and troop carrier bases. Some still have aircraft use, including RAF Syerston, while others have been put to alternative uses such as vehicle racing, for industry and as showgrounds, as at the former RAF Winthorpe on the edge of Newark.

The extensive sand and gravel deposits along the Trent and west of Lincoln were exploited in the 20th century to provide materials for the construction industry. While reserves continue to be exploited, former workings have been flooded to create wetland habitats and recreational sites, and these manmade waterbodies have a significant impact on the landscape in several locations, for example around Holme Pierrepont.

Recent development pressure has led to the residential expansion of Radcliffe on Trent, Bingham and North Hykeham as well as to retail and business park developments along the south-western edge of Lincoln. A drive for development and growth of the main settlements remains strong in the area. Pressure to increase road capacity has led to a major upgrade of the A46 along its route within the NCA.

Ecosystem Services

The Trent and Belvoir Vales 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 Trent and Belvoir Vales NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** The area's generally fertile and versatile soils and agricultural land have supported a diversity of farming over a long period of time. Most farmland is used for arable production with crops of autumn-sown wheat, winter and spring barley as well as break crops of oilseed rape, field beans and grass leys. Root crops, in particular sugar beet, peas and potatoes, are grown on lighter soils. Land for grazing is still significant in places, though the long-term trend has been for conversion to arable use. The Vale of Belvoir has a long-established reputation for the production of high-quality milk and cheese, in particular Stilton. Sugar beet is processed at Newark in the only British Sugar factory left in the East Midlands. Newark is also the home of one of the main livestock markets in the country.

- **Water availability:** The rivers of the NCA provide water for industrial and agricultural use. The River Trent supplies large amounts of water to industry – particularly for cooling purposes in the power stations. It also supplies water via the Fossdyke Navigation to the River Witham catchment, which includes the rivers Till and Brant, to support abstractions there, mostly for agricultural spraying. Water in the Witham catchment is available for abstraction at high and medium flows, and restricted at medium/low flows, but no water is available for abstraction at low flows. Abstractions are usually possible for only 61 per cent of the year. Within the Trent catchment, the rivers Devon and Trent have water available for consumptive abstraction subject to flow restriction conditions, whereas there is no water available for abstraction from the Dover Beck or the River Greet. The Trent, the Fossdyke Navigation and the extensive network of waterbodies created from flooded sand and gravel extraction sites provide a large recreational water resource used extensively for boating, fishing and wildlife watching.

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

- **Regulating soil quality:** Some 78 per cent of the area's soils are Grade 3 quality (good to moderate quality agricultural land) and 14 per cent are Grade 2 (very good quality agricultural land). It is this inherent quality that underpins the agricultural productivity of the NCA. Quality is regulated by the geology of the area and the geomorphological processes at work, including the deposition of sediments in active flood plains. Quality is also regulated by organic matter content which is higher under non-cultivated land such as permanent pasture and semi-natural habitats. Management measures that increase organic matter levels in an arable farming system include the sowing of grass leys as part of a crop rotation.

The inherent quality of the soil underpins the provision of food in the area while the rivers provide water and the flood plains regulate flow. View over receding Trent flood waters from East Bridgford.

- **Regulating water flow (flooding):** The River Trent has a long history of flooding, and its channel and flood plain are important resources for storing and regulating flood flows. Development and land use in the Trent catchment upstream of the NCA will have a significant impact on water flows into the NCA. The Environment Agency flood risk map indicates a high risk of flooding along the river and in and around Lincoln. Major

embankments protect the larger settlements while minor ones protect arable farmland from frequent flooding. Engineered solutions to flooding have meant that, in many places, the flood plain is no longer active for most of the time and much riverside pasture has been ploughed for arable use.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** Higher ground defines the edges of the NCA from where there are extensive views across the vales. The powerful River Trent and its flood plain is a major feature running through the landscape. Villages are unified by the dominant rural vernacular style of red brick and pantile. The main settlements have strong associations with the area. Distinctive landmarks include Lincoln Cathedral, Belvoir Castle, Bottesford and Newark church spires and the power stations on the Trent. Southwell is an attractive small town with a highly distinctive Minster and is also the home of the original Bramley apple tree which still grows there and from which all Bramleys descend. Gainsborough is the most inland port in the area and its Ashcroft Mill inspired George Eliot's novel The Mill on the Floss. The Vale of Belvoir is the home of Stilton cheese. The rolling farmland in the west of the NCA is closely associated with the broad belt of Triassic Mercia Mudstone, the impermeable nature of which has led to the land becoming heavily dissected by numerous streams in well-defined valleys. In places these streams have created ravines up to 10 m deep, locally known as dumbles and becks, which often harbour narrow remnants of ancient woodland. Greater tree cover along with the more undulating landform gives this part of the NCA a more intimate character.

- **Sense of history**: The gravel terraces along the Trent have been the focus of human activity for many thousands of years. Traces of the Bronze and Iron Ages as well as Roman influence remain in the landscape. The medieval settlement pattern of small compact villages and larger market towns remains broadly intact. Medieval ridge-and-furrow cultivation features can still be seen on land uncultivated since. At Laxton the medieval open field system of farming has been retained to the present day. Enclosure and reorganisation of the landscape in the 18th and 19th centuries is seen in the regular shaped fields bounded by hawthorn hedgerows and the red brick and pantile building style of farmsteads and villages. Lincoln Cathedral, Belvoir Castle, Bottesford and Newark church spires are prominent historical landmarks in the landscape. The Nottingham Lace Market site

Belvoir Castle adds to the sense of place and history of the Vale of Belvoir

of the original Saxon settlement of Snottingaham and the prominent medieval church of St Mary's lie just within the NCA. Southwell has a strong sense of history with its highly distinctive Minster and many old buildings. Newark contains Civil War remains, a prominent castle and an historic town centre. The marks of the Industrial Revolution are found in the main settlements, including terraces of brick and slate housing, Nottingham's Lace Market factory buildings and the Grantham Canal. St Ann's Allotments in Nottingham is the oldest and largest area of Victorian detached town gardens in the country.

- **Tranquillity:** The landscape has a strong rural character, with wide areas retaining a sense of tranquillity and self-containment. The NCA has 44 per cent of land classified as undisturbed, a fall from over 70 per cent since the 1960s but nevertheless still a significant amount. Tranquillity is associated with the areas of farmland and winding lanes away from the major towns, the industrialised sections of the Trent corridor and the major roads.

- **Recreation:** Recreation is provided by numerous small country lanes and public rights of way, especially along the Trent corridor, including the Trent Valley Way. It is also provided by country parks such as Cotgrave and Hartsholme. The disused Grantham Canal is a key green infrastructure link in the area. The restoration of the numerous disused sand and gravel extraction sites to wetlands, along with the River Trent and the Fossdyke Navigation, provide a wide range of recreational opportunities for boating, water sports, fishing, walking and experiencing wildlife, for example Holme Pierrepont and Whisby Nature Park. Landscape-scale projects such as the Trent Vale Landscape Partnership and the Witham Valley Country Park initiative aim to link communities with the landscape and offer increased recreation and educational opportunities within the NCA.

- **Geodiversity:** The ancient River Trent eroded a course through the limestone to create the Lincoln Gap. It also deposited huge amounts of sand and gravel, the quarrying of which provides continual geological exposures. Colwick Cutting Site of Special Scientific Interest displays a section of the Triassic Mercia Mudstone Group overlaying the Sherwood Sandstone Group. Streams flowing on these impermeable mudstones have cut into the bedrock to create the distinctive incised dumbles and becks. Stone hewn from harder courses within the mudstones feature in many local buildings, especially the churches, as does Sherwood Sandstone and Lincolnshire Limestone. The Trent flood plain displays meanders, relict channels and cut off meander lakes; however, the rivers of the NCA have been artificially manipulated to such an extent that natural geomorphological processes are severely impaired.

Statements of Environmental Opportunity

SEO 1: Maximise the use of sustainable agricultural practices that protect and enhance ecological networks in order to help safeguard the long-term viability of farming in the area while benefiting biodiversity, landscape character, carbon storage as well as water quality, availability and flow.

For example by:

- Working with farmers and landowners to encourage sustainable farming practices, including the take up of conservation, organic and agri-environment schemes.
- Seeking diversification of agriculture which requires fewer inputs and which helps to sustain ecological systems.
- Enhancing soil condition through good soil management techniques that reduce erosion, improve productivity and have a positive effect on water quality, including by creating grass margins in arable fields and restoring hedgerows.
- Protecting and expanding areas of pasture and grassland habitats to counter the shift away from mixed farming, which has had an impact on local character, biodiversity and ecosystem services such as carbon storage, regulating soil erosion and regulating water quality, and also to protect remnants of medieval ridge-and-furrow cultivation patterns and other historical features.
- Working with farmers and landowners to protect and enhance habitat networks through the farmed landscape to enhance ecosystem services, such as intercepting surface water to improve water quality and provide more habitats for pollinator and pest-regulating species.
- Seeking to protect and improve soil quality by raising soil organic matter through, for example, reversion of arable land to pasture, reducing cultivation, increasing amounts of fallow rotational land and increasing the use of organic farming methods.
- Increasing the area and network of habitats for pollinators and pest-regulating species throughout the farmed landscape, for example by increasing the amount of flower-rich field margins, hedgerows and species-rich grasslands, and increasing the take up of organic methods such as the use of clover to increase soil fertility and to provide habitat for bees.
- Seeking opportunities for sustainable use of wetland habitats for food provision, such as flood plain grazing marsh for cattle grazing.

SEO 2: Enhance the woodland and hedgerow network through the planting of small woodlands, tree belts, hedgerow trees and new hedgerows to benefit landscape character, habitat connectivity and a range of ecosystem services, including the regulation of soil erosion, water quality and flow.

For example by:

- Protecting existing hedgerows and enhancing them through appropriate management, and planting new hedgerows to restore historic field patterns and create habitat linkages where they have been lost.
- Considerably increasing the number of hedgerows trees, even though these are not a significant feature at present, to enhance landscape diversity and ecosystem services including carbon storage and to counteract the threat to landscape character and biodiversity from tree diseases such as ash dieback.
- Expanding existing woodlands and planting new woodlands to increase carbon sequestration and storage and the provision of biomass, following the guidance produced for the area, while taking care that this does not have an adverse effect on other habitats and species.[5]
- Protecting, enhancing and expanding ancient woodlands across the area, including sites of ancient replanted woodland, seeking to link these with other woodlands, hedgerows and semi-natural habitats to benefit the movement of species.
- Protecting and enhancing the belts of waterside trees and riparian habitats to distinguish watercourses, and planting trees and replacing lost hedgerows in flood plains to improve landscape character and attenuate flood flows.
- Restoring traditional orchards, once a distinctive feature on the edges of settlements, which contribute to the area's sense of place, for example the Bramley apple.
- Using native, preferably local provenance stock for all new plantings and species characteristic of the National character Area (NCA).

[5]For example, where woodland has been planted or has developed on former heathland sites, it would be appropriate to remove trees and return land to heathland habitat.

SEO 3: Enhance the rivers and their flood plains for their ecological, historical and recreational importance, their contribution to biodiversity, soil quality, water availability and in regulating water flow and the important role they play in underpinning the character of the area.

For example by:

- Protecting and enhancing existing flood plain habitats such as flood plain grazing marsh and maximising opportunities to expand these habitats and their connections to rivers for the ecosystem services and landscape character they provide.
- Managing and enhancing the Trent flood plain for its flood storage capacity and identifying areas where bank and channel management can be altered to improve flow between the river and flood plain to restore natural flood plain function and improve landscape character.
- Managing extraction of the sand and gravel resource in the Trent flood plain to minimise damage to existing habitats, geodiversity features and archaeological sites by the use of policies within the Minerals Local Plan and by carefully worded planning conditions.
- Continuing to restore mineral extraction sites along the Trent to a variety of wetland habitats and to open water, where appropriate, for their multiple benefits for nature conservation, recreation and landscape interests.
- Protecting the rich archaeology in the Trent flood plain, including the gravel terraces, from ploughing damage by re-creating non arable uses such as pasture and grazing marsh and other grassland habitats.
- Enhancing and promoting the access network within, and connecting to, river corridors for biodiversity, geodiversity, recreation and health benefits.

Grazing land beside the River Trent near Shelford.

SEO 4: Maintain and enhance the character of this gently undulating, rural landscape. Promote and carefully manage the many distinctive elements that contribute to the overarching sense of place and history of the Trent and Belvoir Vales.

For example by:

- Raising the profile of the area by promoting the Trent and Belvoir Vales 'brand', which includes distinctive features such as the powerful River Trent, the medieval farming system at Laxton, the dumbles and becks landscape and the historic buildings and settlements as well as its deeply rural and tranquil character.
- Promoting local traditions and products including, for example, Stilton cheese from the Vale of Belvoir and the Bramley apple from Southwell, to raise the profile of the area and its mixed farming heritage.
- Protecting settlement pattern and character in the historic market towns and network of small villages, following good design guidance found in landscape and historic character assessments and supplementary planning documents and through the use of traditional architectural styles and materials.
- Managing and further enhancing the access and recreation opportunities, which centre on enjoyment of the tranquil and deeply rural countryside via the network of quiet lanes, villages, footpaths and watercourses.
- Ensuring that new developments incorporate well-designed green infrastructure providing enhanced access and recreation opportunities for local communities and visitors as well as the health and economic benefits that access to good quality green space affords.
- Supporting the rural economy to ensure that the prevailing character of the area is able to remain predominantly rural and tranquil.
- Protecting and promoting the archaeological and geodiversity value of the River Trent and its flood plain, including its gravel terraces.
- Conserving the tranquillity of the area through the careful planning and design of new development which minimises road construction, car use and disturbance, and provides sustainable transport options and well-designed green infrastructure.
- Conserving and interpreting historic features in the landscape, including traditional farmsteads and buildings, archaeological earthworks including remnant ridge and furrow and sub-surface archaeology, while recognising the potential for undiscovered remains.
- Conserving and enhancing the network of geological sites that help in understanding the area's geology, in particular the disused quarries and pits.
- Looking for opportunities to interpret geodiversity and relate geodiversity to the character and development of the NCA's landscapes, settlement pattern, buildings and industries.

Supporting document 1: Key facts and data

Total area: 177,604 ha

1. Landscape and nature conservation designations

There are no national landscape designations within this 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)	Muston Meadows NNR	20	<1
National	Site of Special Scientific Interest (SSSI)	A total of 33 sites wholly or partly within the NCA	685	<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 718 local sites in the Trent and Belvoir Vales NCA covering 7,915 ha, which is 4 per cent of the NCA.

Source: Natural England (2011)

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

1.1.1 Condition of designated sites

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

SSSI condition category	Area (ha)	% of SSSI land in category condition
Unfavourable declining	9	1
Favourable	139	20
Unfavourable no change	175	26
Unfavourable recovering	361	53

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 close to sea level in the lowest points of the Trent flood plain where the river is tidal to 148 m above sea level where the land rises up to the adjoining Kesteven Uplands in the south-east. Elevation is generally higher west of the Trent and towards the boundaries of the NCA.

The average elevation of the landscape is 30 m above sea level.

Source: Natural England (2010)

2.2 Landform and process

Overall the Trent and Belvoir Vales have a gently undulating low-lying landform with smooth low ridges dividing shallow, broad river valleys (vales) and flood plains. In general the landform has a north south pattern following the orientation of the underlying geology and the course of the River Trent. In contrast, land west of the Trent is generally more steeply undulating where the drainage has formed several small well defined valleys with a west–east orientation.

Source: Trent and Belvoir Vales Countryside Character Area Description

2.3 Bedrock geology

In the west the NCA is dominated by Triassic rocks about 248 to 206 million years old which dip gently to the east. The Sherwood Sandstone Group fringes the western edge while east of this lies the Mercia Mudstone Group, deposited in an arid desert environment and which includes dune, lake bed and evaporite sediments. Lower Jurassic Lias Group rocks about 206 to 165 million years old dominate the east side of the NCA; sea level rise leading to the deposition of a mix of marine mudstone, siltstone, limestone and sandstones in a warm tropical shallow sea which covered most of central England at the time.

Within the NCA the Triassic Mercia Mudstones are generally more resistant to weathering than the Jurassic Lias Group resulting in generally higher ground in the west. The influence of bedrock geology on the visible landscape east of the Trent is limited due to extensive superficial deposits; however, thin beds of harder rocks within the Lias Group, such as Marlstone, in places have slowed the weathering of underlying mudstones resulting in escarpments such as above the Vale of Belvoir.

Source: Trent and Belvoir Vales Countryside Character Area Description

2.4 Superficial deposits

Along the Trent corridor and across the east, the NCA is dominated by sediments associated with the last glaciation – the Devensian – which ended around 11,000 years ago. The tundra-like environment and eventual ice melt led to extensive sand and gravel river terrace sedimentation. The substantial area of sand and gravel deposits found west of Lincoln give an indication of the size of the ancestor of the Trent which was unable to drain north and instead eroded a route east through the bordering limestone ridge of the Lincolnshire Edge, today known as the Lincoln Gap.

Source: Trent and Belvoir Vales Countryside Character Area Description

2.5 Designated geological sites

Designation	Number of Sites
Geological Site of Special Scientific Interest (SSSI)	1
Mixed interest SSSI	0

There are 21 Local Geological Sites within the NCA.

Source: Natural England (2011)

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

2.6 Soils and Agricultural Land Classification

The Mercia Mudstones give rise to slightly acid loamy and clayey soils with impeded drainage covering 31 per cent of the area. The Lias Group mudstones give rise to slowly permeable base-rich loamy and clayey soils covering 25 per cent of the area. West of Lincoln extensive superficial deposits have given rise to much sandier soils of low natural fertility classified as naturally wet very acid sandy and loamy soils. These cover 13 per cent of the area. Beside the rivers

especially along the Trent and in the River Devon catchment there are generally loamy and clayey flood plain soils with naturally high groundwater, which covers 13 per cent of the area. Covering 9 per cent of the area, and focussed on the Vale of Belvoir, are lime-rich loamy and clayey soils with impeded drainage.

Most land within the area is of classified as Grade 3 meaning it is good to moderate quality agricultural land.

Source: Trent and Belvoir Vales Countryside Character Area Description; National Soil Resources Institute

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

Agricultural Land Classification	Area (ha)	% of NCA
Grade 1	180	<1
Grade 2	24,116	14
Grade 3	139,310	78
Grade 4	2,771	2
Grade 5	0	0
Non-agricultural	3,874	2
Urban	7,354	4

Source: Natural England (2010)

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

3. Key water bodies and catchments

3.1 Major rivers/canals

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

River Name	Length (km)
River Trent	96
River Witham	53
River Till	23
River Brant	22
River Devon	22
Fairham Brook	12
Foston Beck	12
Dover Beck	10

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 drainage generally has a north south orientation and is split between the catchment of the River Trent and that of the River Witham.

The dominant river of the area is the River Trent. It is in its mature stage as it flows northwards through the NCA from Nottingham to Gainsborough, meandering slowly but powerfully across its flood plain. At Newark the Trent is joined by the River Devon which drains the Vale of Belvoir. Many small tributaries drain east from the higher ground of the Mercia Mudstones to join the eastern side of the Trent throughout its course.

Subtle undulations in the landform mean the eastern side of the NCA lies within the River Witham's catchment. The Witham rises in the adjoining Kestevan Uplands, flows north through Grantham and then on towards Lincoln where it is

joined by its tributary the Brant and then by the River Till at Lincoln to then flow east through the Lincoln Gap to eventually drain into The Wash beyond Boston.

The NCA also features three canals: the 18 km long Fossdyke Navigation which links the Trent and Witham rivers, The Grantham Canal and The Chesterfield Canal. The disused Grantham Canal linked the Trent at Nottingham to Grantham and 45 km lies within the south edge of the area. The Chesterfield Canal links to the Trent and a small part of it skirts in and out of the north-west edge of the NCA.

Source: Natural England (2010)

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 177,605 ha forming 100 per cent of the NCA.

Source: Natural England (2010)

3.3 Water Framework Directive

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

4. Trees and woodlands

4.1 Total Woodland Cover

The NCA contains 7,738 ha of woodland, 4 per cent of the total area, of which 1,996 ha is ancient woodland. Part of the Greenwood Community Forest, one of twelve Community Forests established to demonstrate the contribution of environmental improvement to economic and social regeneration, lies within the area and covers 3,735 ha of this NCA, which is 2 per cent of the area.

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

4.2 Distribution and size of woodland and trees in the landscape

There are typically low levels of woodland cover and very low levels of surviving ancient woodland in this NCA, due to the longstanding agricultural use of this land. Wet woodland is also now scarce in the area. Willow holts used to be a feature of the area but the only remaining one is at Farndon nature reserve. The area between Nottingham and Southwell, where small streams have created steep valleys known locally as 'the dumbles', contains small- to medium-sized broadleaved woodland of oak and ash, found in long narrow strips along the river banks. Large plantations of conifers and blocks of deciduous woodland occur on the broad ridge west of Lincoln. Moderately sized game coverts, mixed plantations and shelter belts are dotted through the agricultural uses. While not common, hedgerow trees, notably oak and ash add to the overall treed character of the landscape. Areas close to settlements or on former gravel extraction sites are notable for a higher level of woodland cover.

Source: Trent Valley and Rises Natural Area Profile, Trent and Belvoir Vales 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	5,592	3
Coniferous	1,259	1
Mixed	273	<1
Other	614	<1

Source: Forestry Commission (2011)

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

Woodland type	Area (ha)	% of NCA
Ancient semi-natural woodland	1,005	<1
Ancient re-planted woodland (PAWS)	991	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Boundaries are almost exclusively hedgerows, predominantly of hawthorn, although some species-rich hedgerows are found in places. Throughout, hedgerow trees are few and limited to oak with some ash and with willow along watercourses. In the sandy areas west of Lincoln, birch and pine occur in the hedgerows and along roadsides together with gorse and bracken. Towards the north-east, the landscape becomes more fen-like and hedgerows are fewer, with the fields divided by drainage dykes and drains. Hedgerows, which were previously often gappy or excessively trimmed are now slowly becoming taller and wider, benefiting wildlife and landscape character in response to a different management approach though agricultural stewardship schemes.

Source: Trent and Belvoir Vales Countryside Character Area description; Countryside Quality Counts (2003)

View north from Hough on the Hill across large geometric fields in the eastern part of the NCA. Most farmland in the Trent and Belvoir Vales is in arable production, with grazing land in places.

5.2 Field patterns

The open field systems which dominated the area until the 18th century have left numerous traces in the landscape. Remnant ridge and furrow in the vales and elsewhere reflect the various stages at which cultivation succumbed to pasture from the later medieval period to late 18th century. The greatest example is Laxton - a unique working open field landscape, recognisably still as it was when mapped in 1635 and still maintained by the traditional Court Leet. Elsewhere the traces are less complete and reflect the persistence of earlier demarcations in later boundary systems. Patterns of enclosure adopting the curvilinear characteristics of open field furlongs are widespread across the Vale and farmlands, and particularly concentrated along the washlands north of the A57. Remnant cultivation patterns (ridge and furrow) under grassland are important indications of former open fields. The piecemeal semi-regular enclosures of the 16th, 17th and early 18th centuries are widespread and highly varied in composition, with the greatest survivals in the south Nottinghamshire farmlands, and Vale of Belvoir, where their antiquity

is reflected in the maturity of the wooded hedgerows. Broad geometric patterns of enclosure, both private and parliamentary, dating from the late 18th and early 19th centuries, are found mainly on the sandlands and the mid Nottinghamshire farmlands. The thorn hedgerows of this period, and the dispersed pattern of farm buildings related to the late enclosures, have been significantly altered by arable intensification and farm expansion in the late 20th century.

Source: Trent and Belvoir Vales 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 farming character of this landscape is shown in the breakdown of main farm types (2009) with 607 cereal cropping holdings (43 per cent), 123 general cropping farms (9 per cent), 30 horticultural units (2 per cent), 50 specialist poultry units (4 per cent) and 49 dairy holdings (3 per cent). Farms classified as 'other' are also numerous accounting for 238 holdings (17 per cent). Notable changes seen in the census data from 2000 to 2009 show a decrease of 6 dairy farms (11 per cent), a decrease by 78 in general cropping holdings (39 per cent) and a reduction in horticultural units by 22 or 42 per cent. Specialist pig units also declined in number from 25 to 19 units, or by 24 per cent.

Source: Agricultural Census, DEFRA (2010)

6.2 Farm size

Farms over 100 ha in size are the most numerous with 426 holdings (30 per cent), followed by 326 holdings between 5 and 20 ha (23 per cent). The farms over 100 ha cover the vast majority of the farmed environment in the NCA with 106,933 ha, or 79 per cent of land. There has been a slight reduction in farmed area since 2000, with just less than 9,000 ha no longer used for agriculture.

Source: Agricultural Census, DEFRA (2010)

6.3 Farm ownership

Sixty-seven per cent of the farmed land (91,178 ha) is owner occupied; a total that has remained steady since 2000. There has been a reduction of tenanted farmland since 2000 of 5,644 ha.

2009: Total farm area = 135,826 ha; owned land = 91,178 ha
2000: Total farm area = 144,801 ha; owned land = 91,354 ha

Source: Agricultural Census, DEFRA (2010)

6.4 Land use

Forty-five per cent of the farmed land is under cereals, a reduction of over 12,000 ha since 2000. There has been a significant increase in the land used to grow cash root crops, up by 14,477 ha since 2000, a 174 per cent increase. The area contains some high quality and productive agricultural lands, in particular on the mudstones east of the Trent. Most of the area is thus under arable crops of autumn sown wheat, winter and spring barley as well as break crops of oil seed rape, field beans and grass leys. Root crops, in particular sugar beet, peas and potatoes, are grown on lighter soils. The Vale of Belvoir has a long history of dairying and the production of high quality milk and cheese.

Source: Agricultural Census, DEFRA (2010)

6.5 Livestock numbers

Pigs are the most numerous livestock with 61,800 animals within this landscape, followed by sheep (58,400) and cattle (45,100). Numbers of pigs and sheep have fallen significantly since 2000, with 62,500 fewer pigs in 2009 (-50 per cent) and 25,800 fewer sheep (-31 per cent). The number of cattle also fell by 17 per cent or 9,300 animals.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

The number of owner farmers fell by 267 between 2000 and 2009, a fall of 12 per cent. During this time the number of full time farm workers also fell by 452 or 44 per cent. The number of casual farm workers increased by 43 per cent or 157 workers.

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

Farming is by far the principal land use in the area and while its value to wildlife is limited farmland contains features such as hedgerows, field margins, ponds, 'unimproved' grassland, and copses which provide habitat for species such as farmland birds.

The rivers, streams and associated habitats are a significant feature of the NCA. Important species include water vole, spined loach, white-clawed crayfish, and otter.

There are numerous gravel pits along the River Trent and its main tributaries, as well as between Newark and Lincoln on the prehistoric route of the Trent. Some have been restored to provide habitat for breeding and wintering birds. This includes Langford Lowfields near Collingham - a major RSPB habitat creation project on a working gravel extraction site where reedbed has been planted to attract bitterns to breed.

Flood plain grazing marsh is the most extensive semi-natural habitat of the NCA and is focussed along the Trent, for example at Sutton on Trent.

The small amount of lowland meadow in the area is mainly focused on land west of the Trent, for example near Laxton. In addition some fragments of lowland dry acid grassland and lowland heathland are found on the sandy soils west of Lincoln. There are also a small number of lowland calcareous grassland sites such as Muston Meadows NNR and on the disused railway east of Torksey.

Ancient woodland and ancient re-planted woodland provides the next largest semi-natural habitat left in the NCA. These woodlands tend to be focussed within the rolling 'dumbles' landscape west of the Trent. There are some sizeable tracts of ancient re-planted woodland between Newark and Lincoln, such as Stapleford Wood, that are now coniferous or mixed plantations but which could have their wildlife value enhanced.

While woodland cover is very limited, hedgerows provide an important substitute woodland and woodland edge habitat for many species as well as being significant linear features in the landscape.

The NCA still has a scattering of traditional orchards which tend to be concentrated west of the Trent and with much fewer east of the river.

Source: Trent Valley and Rises Natural Area Profile, Natural England (2011)

7.2 UK Biodiversity Action Plan (BAP) priority habitats

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

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

UK BAP priority habitat	Area (ha)	% of NCA
Coastal and flood plain grazing marsh	2,421	1
Lowland meadows	226	<1
Lowland heathland	119	<1
Lowland calcareous grassland	49	<1
Reedbeds	20	<1
Purple moor grass and rush pasture	10	<1

Source: Natural England (2011)

7.3 Key species and assemblages of species

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

8. Settlement and development patterns

8.1 Settlement pattern

The settlement pattern is typical of the Midlands with villages of medieval origin, interspersed with more recent farmsteads in open countryside. Settlements are scattered, compact villages linked by a network of small, quiet country lanes. These contrast with the busy market towns of Lincoln, Southwell, Grantham, Newark and Gainsborough, and the major roads that traverse the area, notably the A1 and the A46. In the east, villages of mostly red brick and pantile roofs tend to lie along the escarpment between Langer and Stainton. In the south, Nottingham exerts a strong influence on the settlement pattern, with urban fringe effects exacerbated by development spreading from outlying commuter settlements such as Woodborough and Burton Joyce.

Source: Trent and Belvoir Vales Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main towns and cities within the NCA are: Newark-on-Trent, Nottingham, Lincoln, Gainsborough and Grantham. The total estimated population for this NCA (derived from ONS 2001 census data) is: 458,779.

Source: rent and Belvoir Vales Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

Red clay brick and pantiles became characteristic materials across rural areas of the NCA following the rebuilding of many villages in the late 18th and early 19th centuries. Many older timber framed cottages were encased in these more durable materials or demolished. The historic cores of villages, many of which were established during the Early Medieval period, can be identified by the survival of old brick and pantile buildings. This vernacular style is strongly present in surviving traditional farm buildings in particular, such as at Laxton.

The rocks of the Jurassic Lias series have provided stone building material for villages in places such as the south-east of the area. Blue Lias stone features in medieval church walling, dwellings barns and other walling. Marlstone 'Ironstone' outcrops north and west of Grantham where it features especially in churches. Sherwood Sandstone and Lincolnshire Limestone from adjoining areas also feature as building materials.

Source: Trent and Belvoir Vales Countryside Character Area description; Countryside Quality Counts (2003); British Geological Survey/English Heritage Strategic Stone Study

9. Key historic sites and features

9.1 Origin of historic features

A number of historical routes run through the area including the Roman road, Fosse Way, and the Great North Road, indicating that these gentle and low-lying areas provided convenient routes through the hills and wetlands. They meet at Newark which has long been a strategic river crossing. Place name evidence suggests settlement by both Saxon and Norse communities. The pattern of existing villages across the NCA seems relatively unchanged since Domesday (1086). Remaining ridges and furrows of the open fields are preserved beneath areas of pasture, although the resource is declining in both quality and quantity. At Laxton an almost complete picture of the medieval landscape survives, with the castle, manorial earthworks, fishponds, open strip fields and riverside meadows. Earth works from the civil war can still be seen around Newark.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 13 Registered Parks and Gardens covering 385 ha
- 1 Registered Battlefield covering 269 ha
- 168 Scheduled Monuments
- 3,226 Listed Buildings

Source: Natural England (2010)

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

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

10. Recreation and access

10.1 Public access

- 1.4 per cent or 2,435 ha of the NCA is classified as being publically accessible.
- There are 1,937 km of public rights of way at a density of 1 km per km2.
- There are no national trails within the NCA.

Sources: Natural England (2010)

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

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	0	0
Common Land	351	<1
Country Parks	239	<1
CROW Access Land (Section 4 and 16)	970	<1
CROW Section 15	167	<1
Village Greens	15	<1
Doorstep Greens	5	<1
Forestry Commission Walkers Welcome Grants	235	<1
Local Nature Reserves (LNR)	261	<1
Millennium Greens	20	<1
Accessible National Nature Reserves (NNR)	20	<1
Agri-environment Scheme Access	86	<1
Woods for People	1,347	1

Sources: Natural England (2011)

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

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of Tranquillity (2006) there are some large patches of rural landscape with high tranquillity ratings in this NCA. The infrastructure corridors introduce disturbance and lower the scores across the area and the towns and cities have low tranquillity ratings.

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

Tranquillity	Tranquillity score
Highest value within NCA	39
Lowest value within NCA	-81
Mean value within NCA	-2

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 the amount of disturbed land has almost doubled since the 1960s. Consequently, there has been a reduction in the amount of undisturbed land, although compared to some neighbouring NCAs, the total amount of undisturbed land remains relatively high.

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

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	26	48	51	25
Undisturbed	71	49	44	-27
Urban	3	3	5	2

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are the great increase in the area experiencing disturbance, by over a third, and the doubling of the urban area. The M5 motorway was constructed through this area in the period up to 1977.

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

The Grantham Canal in the Vale of Belvoir. Large parts of the NCA still have high levels of tranquillity.

12 Data sources

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

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

Supporting document 2: Landscape change

Recent changes and trends

Trees and woodlands

- Assessment of 1999 to 2003 data indicates some enhancement in the levels of woodland cover in the NCA.
- Between 1999 and 2003 an area equivalent to 6 per cent of the 1999 total stock was approved for new planting under a woodland grant scheme agreement (304 ha). Most of this new planting was in scattered blocks on the sandy soils west of Lincoln.
- The total woodland area in 1999 was 4,962 ha. This had increased to 7,738 ha by 2011; however, part of this increase is due to greater accuracy in the recording of woodland.

Boundary features

- Assessment of hedgerows between 1999 and 2003 concluded that poor hedgerow condition has been commonplace across the area with hedgerows often excessively trimmed and gappy and that the few surviving trees were often in poor condition.
- Between 1999 and 2003 only 61 km of hedgerows within the NCA were under hedgerow management agri-environment scheme agreements.
- Management of hedgerows has improved in recent years with 3,814 km under agri-environment scheme hedgerow management and maintenance agreements as at January 2013.
- While management of existing hedgerows has improved, planting of new hedgerows and restoration of hedgerows remains limited. Between 1999 and 2003 only 107 km of hedgerows were planted and/or restored under agri-environment agreements and between 2006 and January 2013 this had dropped to just 70 km.

Agriculture

- Agricultural changes that took place in the NCA between 2000 and 2009 are quantified in Defra's Agricultural Census data. Changes include the total number of farm holdings in the NCA dropped from 1,491 to 1,407 and total farmland area decreased from 144,801 ha to 135,826 ha. The area of farmland under cereals decreased from 72,658 ha to 60,523 ha oilseeds increased from 13,928 ha to 22,976 ha. The area of farmland classified as 'grass and uncropped land' decreased from 36,131 ha to 32,009 ha (24 per cent of all farmland). Note that the 2000 figures include set aside land whereas the 2010 figures do not. The number of cattle decreased from 52,465 to 45,138; number of sheep decreased from 84,179 to 58,393; and number of pigs decreased from 124,287 to 61,776. The total farm labour force in the NCA decreased from 4,358 to 3,447.
- The Vale of Belvoir has seen a steady decline in permanent pasture and conversion to arable uses. Increases in horse ownership across the NCA have led to some permanent pasture being used as horse paddocks. There has been pig and poultry unit expansion and upgrade across the NCA.

The dramatic visual impact on the landscape of West Burton power station. Two similar coal fired power stations have been demolished since 1995.

Settlement and development

- The A46 has had a major upgrade from a single carriageway to a dual carriageway along its route through the NCA. It has included the construction of bridges, embankments, large roundabouts and associated infrastructure and has resulted in some considerable visual intrusion in places along the route such as in the Bingham area.
- North Hykeham on the south-west edge of Lincoln has seen much recent residential and business development, often associated with the A46 bypass. Similarly the eastern fringes of Nottingham have seen retail park development and residential expansion of Radcliffe on Trent and Bingham.
- Between the 1990s and 2007 the NCA has become more disturbed by noise and visual intrusion. The CPRE intrusion mapping shows that in 2007 51 per cent of the NCA was disturbed compared with 48 per cent in the 1990s. The figures also show that the urban area increased from 3 to 5 per cent.
- Power station cooling towers are not as prominent in the landscape as they used to be; both Staythorpe and High Marnham have been demolished (in 1995 and 2012 respectively).

Semi-natural habitat

- The area of SSSI land within the NCA has changed little between 2003 and 2011 (from 681 ha to 685 ha) and its condition remains predominantly unfavourable with only 20 per cent of SSSI area in favourable condition in 2011 – a slight rise from 18 per cent in 2003.
- In 2003 agri-environment scheme uptake for semi-natural habitats were consistently below the national average. The most extensive annual agreements in 2003 were for lowland pastures on neutral/acid soils (613 ha) and regeneration of grassland/semi-natural vegetation (461 ha).
- January 2013 figures show that 2,742 ha of permanent grassland with low and very low inputs were under agri-environment agreements.

- While intensification of agriculture has led to extensive loss of grassland habitats across the area, some creation of habitats has also taken place. Between February 2006 and January 2013, 316 ha of wet grassland for breeding waders had been created under agri-environment schemes as had 147 ha of species-rich semi-natural grassland.

- Pressure on the land for arable agriculture means that flood plain habitats have become diminished and fragmented. Restoring the network of habitats across the flood plains would benefit biodiversity and landscape and reduce flooding further downstream.

- The exploitation of the extensive sand and gravel mineral resources along the Trent flood plain and in the area to the west of Lincoln continues to provide opportunities for the creation of new wetland habitats.

Historic features

- Countryside Quality Counts 1999 to 2003 data suggests that the character of important aspects of the historic landscape is continuing to weaken.

- Destruction of remnant ridge and furrow is a particular concern around fringes of settlements and in areas of arable expansion into longstanding pasture.

- For most scheduled ancient monuments within the NCA on English Heritage's register of heritage at risk, the principal vulnerability is from arable ploughing for example the iron-age settlement at South Muskham and the site of a medieval town at Torksey.

- Gravel extraction in the Trent Valley and elsewhere is a concern for both earthworks and archaeological sites visible from cropmarks. The South Muskham site is protected from mineral extraction under the Nottinghamshire minerals local plan however it remains vulnerable to ploughing damage.

Coast and rivers

- Assessment of rivers in the NCA between 1999 and 2003 found limited evidence of management agreements for riparian features suggesting neglect of the resource.

- The construction of flood banks and flood protection works has accelerated the move from pasture to arable. Such flood prevention works have also confined the rivers and reduced the extent of wet meadow.

- Chemical water quality has improved. In 1995 it was predominantly poor throughout the NCA; however, according to Environment Agency information on the state of waters in December 2009 surface water chemical status for the River Witham was good and also good for the Trent in the northern part of the NCA, though it failed to achieve good status between Nottingham and Newark.

Minerals

- Nottinghamshire is one of the largest producers of sand and gravel in the country with the richest and most extensive deposits occurring in the Trent valley through the NCA.

- Since 2007 production levels have dropped quite dramatically reflecting the impact of the economic downturn on the construction industry. Production near Nottingham especially has seen a major decline following closure of Holme Pierrepont and Hoveringham quarries in 2004 and 2007. Production since has been focussed to the north of Newark.[5]

[5] Nottinghamshire Minerals Local Plan

Drivers of change

Climate change

Potential threats from climate change could include the following[6]:

- Increases in river temperatures adversely affecting existing cool water invertebrate and fish species.
- Changes to river morphological and hydraulic characteristics.
- 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.
- Changes to the timings of seasonal events, 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.
- Increased flooding and waterlogging 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.
- The introduction of new and different crops and techniques in response to changing climate within the United Kingdom.
- 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.

Other key drivers[7]

- There is on-going pressure for urban development in and around the main settlements of the NCA – they have been earmarked for accommodating significant levels of growth.
- 3,000 new homes on the south side of Newark and 1,700 homes on the north-west side of Grantham are planned.
- The Central Lincolnshire Joint Planning Unit's (West Lindsey, North Kesteven and Lincoln City councils) emerging Local Plan proposes in the region of 40,000 homes to be built - the majority in Lincoln and Gainsborough (as well as Sleaford which is outside of the NCA).
- There are local green infrastructure strategies in place which are helping to identify better targeting of biodiversity enhancement and delivery in the NCA.

[6]Natural England's Climate Change Risk Assessment and Adaptation Plan 2012

[7]Trent Vale website; Natural England staff; East Midlands Woodland Opportunity Mapping Guidance: Nottinghamshire Minerals Local Plan Background Paper: Sand & Gravel; Gypsum; Brick Clay. Nottinghamshire County Council Minerals Local Plan Website (accessed 1/3/12). Lincolnshire Preferred Minerals and Waste Strategies 2010.

- The Witham Valley Country Park is a key strategic green infrastructure site focused on the Whisby Nature Park and its surrounds.
- Landscape-scale projects in the area such as those delivered by the Trent Vale Landscape Partnership, are working to enhance access, biodiversity and the natural character of the River Trent's flood plain. RSPB's Trent and Tame Futurescape project seeks to create important wildlife habitats along the Trent corridor within the area.
- The NCA has been identified through the East Midlands Woodland Opportunity Mapping Guidance as being suitable for accommodating woodland creation, particularly the area of higher ground west of the Trent.
- Ash dieback caused by the fungus Chalara fraxinea could potentially have a significant impact as ash is a common and characteristic tree species of the NCA.
- Restoration of former gravel workings and other mineral sites is a major driver for biodiversity gain, providing opportunities for priority habitats to be created
- Biodiversity offsetting is being piloted in the NCA. The Trent Valley and Sherwood have been put forwards as locations for enhancement.
- Significant pressure for sand and gravel extraction remains along the Trent Valley and in the area to the west of Lincoln though it is very dependent on demand from the construction industry. Present demand is relatively low and there are currently (December 2012) two active sand and gravel quarries on the Trent, to the north of Newark, and four in the area to the west of Lincoln.
- Nottinghamshire estimates between 700 and 900 ha of land over and above existing permitted reserves will be needed to meet demand for sand and gravel between 2010 and 2030 assuming full economic recovery of the country. Through Nottinghamshire's call for sites in 2012, nine extensions to existing sand and gravel quarries and nine new quarries were put forward within the NCA. Through Lincolnshire's call for sites in 2009/10, seven extensions to existing quarries and three new quarries were put forward within the NCA.
- There is also pressure for further opencast quarrying of the gypsum deposits south of Newark with a proposed extension to the Bantycock quarry there.
- Pressure also continues for the further excavation of brick clay in the NCA with a proposed extension to the workings at Kirton and a new site put forward to the east of Bilsthorpe.
- There is pressure to accommodate wind energy schemes across the NCA.

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 towards Gedling church spire and across the Vales from Mapperley on the edge of Nottingham. The higher ground in the far distance is the escarpment above the Vale of Belvoir and marks the edge of the NCA where it abuts the Leicestershire and Nottinghamshire Wolds.

Statement of Environmental Opportunity	Ecosystem service																		
	Food provision	Timber provision	Water availability	Genetic diversity	Biomass provision	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place / Inspiration	Sense of history	Tranquillity	Recreation	Biodiversity	Geodiversity
SEO 1: Maximise the use of sustainable agricultural practices that protect and enhance ecological networks in order to help safeguard the long-term viability of farming in the area while benefiting biodiversity, landscape character, carbon storage as well as water quality, availability and flow.	↗ ***	↔ **	↗ ***		↔ **	↗ ***	↑ **	↗ ***	↗ **	↗ **	↑ **	↑ **		↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↔ ***
SEO 2: Enhance the woodland and hedgerow network through the planting of small woodlands, tree belts, hedgerow trees and new hedgerows to benefit landscape character, habitat connectivity and a range of ecosystem services, including the regulation of soil erosion, water quality and flow.	↗ ***	↗ ***	↗ *		↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***		↑ ***	↑ **	↔ ***	↑ **	↑ **	↔ **
SEO 3: Enhance the rivers and their flood plains for their ecological, historical and recreational importance, their contribution to biodiversity, soil quality, water availability and in regulating water flow and the important role they play in underpinning the character of the area.	↘ *	↔ ***	↗ **		↔ **	↗ **	↑ ***	↑ ***	↗ **	↗ **	↗ **	↗ **		↑ ***	↑ **	↔ ***	↑ ***	↑ ***	↑ ***
SEO 4: Maintain and enhance the character of this gently undulating, rural landscape. Promote and carefully manage the many distinctive elements that contribute to the overarching sense of place and history of the Trent and Belvoir Vales.	↗ *	↔ ***	↔ ***		↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***		↑ ***	↑ ***	↑ ***	↑ ***	↗ *	↗ *

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

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

Landscape attributes

Landscape attribute	Justification for selection
The bedrock and superficial geology of the NCA has produced a gentle topography and diversity of soil types which, along with an equitable climate, are suited to a wide range of agricultural uses.	■ An important area for agriculture; the predominance of this land use has helped maintain the overall rural character of this NCA. ■ Traditionally a mixed farming area where a wide variety of productive agriculture is possible. ■ A strong agricultural and cultural heritage which has given rise to internationally known local produce such as Stilton cheese and the Bramley apple
The River Trent and its network of tributaries, valleys, corridors and flood plains along with the other rivers and watercourses are key features in this undulating landscape.	■ The waterways, the Trent especially, provide strong features through the landscape with much of the intrinsic character of the area coming from the riverine landscape. ■ The incised dumbles watercourses are frequently fringed by ancient woodland providing distinct landscape character and wildlife networks through the countryside. ■ The Trent flood plain contains areas of grazing marsh habitat and provides important habitats for several species of important farmland bird species including lapwing, snipe and redshank. ■ The high volume of water provided by the Trent as it passes through the NCA supports extractions for agriculture and industry.
Extensive sand and gravel deposits.	■ The ancient River Trent provided much of the sand and gravel deposits so important to the construction industry. ■ The creation of important new wildlife habitats and recreational sites is made possible by the transformation of former extraction sites. ■ Lagoons created following the extraction of sand and gravel provide regionally important habitats for overwintering wildfowl and breeding bird populations. ■ The River Trent's gravel terraces are particularly important for archaeological remains. ■ Exposures of deposits in former and working extraction sites provide geodiversity interest.

Landscape attribute	Justification for selection
A strong sense of history and time depth throughout the landscape.	■ The overall settlement pattern of compact villages and an extensive network of minor roads across much of the NCA has changed little since medieval times. ■ The dominant rural vernacular style of red brick and pantile remains characteristic across the area. ■ The rich history of the main settlements and associated ridge-and-furrow remains around settlements. ■ The Trent and its flood plain are particularly rich in important historic features associated with human use and occupation over several thousands of years. ■ The unique working remnant of the medieval open field system at Laxton. ■ The enclosure period field pattern landscape preserved across many parts.
The overall rural character and undisturbed pockets of tranquillity in the landscape.	■ A large proportion of the NCA is still undisturbed (44 per cent in 2007). ■ There are many tranquil places for people to enjoy – both for recreation and also for residents. ■ Tranquil experiential qualities are strong in many places.
Hedgerows and field patterns	■ The hedgerows are a major landscape feature and the predominant boundary type. ■ The hedgerow network provides substitute woodland habitat and provides linkages for habitats across the landscape. ■ The hedgerows of the area provide a link to the past, some marking ancient boundaries and many dating from the period of enclosure and reorganisation of the landscape in the 18th and 19th centuries.
The traditionally farmed, managed landscape.	■ Much of the character of the NCA comes from its mixed farming heritage. ■ The field and rural settlement pattern of the area reflect a long history of agricultural land use and management. ■ The rural settlement pattern of small nucleated villages is a result of the medieval open field system of managing the land. ■ The dispersed farmsteads and much of the field pattern and hedgerow network reflect the changes in agricultural land management that commenced during the enclosure and reorganisation of the landscape in the 18th and 19th centuries. ■ Despite the erosion of traditional character and ecosystems through post-war agricultural intensification and practises, much stewardship of the rural landscape still takes place.

Landscape opportunities

- Conserve the rural settlement pattern by ensuring that new development is complementary to intrinsic local character.
- Conserve rural settlement character by using traditional materials in new developments especially the use of matching red brick and pantiles. Conserve the strongly nucleated character of settlements by encouraging new development to take place within the existing curtilage of settlements.
- Protect the tranquillity of the area by planning new developments carefully to minimise car use and accessible to sustainable transport. Ensure new developments are integrated well with adequate, well designed, green infrastructure. Resist new road development which threatens tranquillity.
- Protect archaeological remains from plough damage by adopting best land and soil management practices or, where opportunities arise, by creating areas requiring minimal cultivation, such as pasture and grazing marsh and other grassland habitats. Also seek to conserve organic remains by raising ground water levels in places such as the Trent flood plain.
- Restore and manage hedgerows, where they have been lost, to strengthen the historical field patterns, improve wildlife networks and enhance landscape character.
- Seek to ensure that farming remains the predominant use of the land but plan for sustainable agriculture which does not detract from existing character and enables landscape and habitat enhancement. Enhance the character and the mosaic of habitat networks in the farmed landscape by maximising agriculture diversity.
- Enhance tree cover throughout the NCA following the recommendations of the East Midlands Woodland Opportunity Mapping Guidance for each of the sub areas within the NCA through, for example, extensive planting of hedgerow trees. This is particularly important in view of the threat from ash dieback disease as ash is a characteristic species in the NCA. Protect and enhance the sinuous belts of trees and riparian habitats that demarcate watercourses, create new woodland on former sand and gravel extraction sites, and extend and link up existing ancient woodland sites. Plan for a landscape depleted of ash by planting replacement hedgerow tree species such as oak which is also characteristic of the area.
- Reconnect rivers with their flood plains and restore and create a mosaic of wetland and flood plain habitats including grazing marsh, pastures, fens, reedbeds, wet woodland and eutrophic standing waters. Link and extend existing habitats to reverse the fragmentation that has taken place over the years. Make space for the natural development of rivers.
- Carefully manage the exploitation of sand and gravel deposits so that damage to archaeology and existing habitats is minimised and that biodiversity enhancements are maximised through the creation of new wetland habitats.
- Conserve protected areas and other high quality habitats, the range and ecological variability of habitats and species. Create and plan to create new and better managed semi-natural habitats which are characteristic of the area for example flood plain grazing marsh, reedbeds, lowland meadows, lowland dry acid grasslands and heathland,and lowland calcareous grassland. Link and extend these existing habitats to maximise benefits to landscape character and biodiversity.
- Encourage land management methods which protect and enhance those ecosystems which benefit agricultural production in order to secure the long term viability and character of the farmed, productive landscape.

Ecosystem service analysis

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

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

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Food provision	Fertile and versatile soils Climate Topography Cereals, root crops and oil seed rape Some livestock grazing	78 per cent of the area's soils are Grade 3 quality (good to moderate quality agricultural land) and 14 per cent are Grade 2 (very good quality agricultural land) In 2009 the total farm land area was 135,826 ha accounting for 76 per cent of the total area of the NCA. In 2009, 68 per cent of farmland (52 per cent of the total NCA area) was used for growing cereals, oilseeds and other arable crops. Grass and uncropped land accounted for 32,009 ha (24 per cent of farm land) in 2009. In 2009 there were 45,138 cattle in the NCA 58,393 sheep and 61,776 pigs. Changes between 2000 and 2009 include: A slight decrease in total farmed area; a slight decrease in area of cereals; an increase in area of oilseeds; a slight decrease in grass and uncropped land; decreases in livestock numbers especially pigs which more than halved	Regional	The area has a long history of food production which relates to the quality and versatility of the soils, suitable climate and gentle topography. Traditionally a mixed farming area there has been a steady decline in the amount of pasture with much of it converted to arable use. Habitats and landscape features have been lost through agricultural intensification leading to a reduction in distinctiveness and reduced ecosystem functionality. This includes drainage of flood plains, conversion of pasture to arable, removal of hedgerows, loss of old farm buildings and damage to historic remains. Intensive agriculture can have negative impacts on the viability of the natural elements that underpin food provision services such as water quality and availability, soil quality, pollination. **Continued over...**	Encourage holistic farming practices which benefit ecosystems and maintain viable agricultural production such as organic farming and many agri-environment scheme options. Encourage management measures that increase organic matter levels in soils such as conversion from arable to pasture, organic farming methods and the use of grass leys in arable crop rotations. Retain existing pasture and seek opportunities to convert arable land to create more pasture especially where it will enhance landscape character and ecosystem services and protect historic remains such as alongside the rivers and in the flood plains. **Continued over...**	**Food provision** **Sense of place / inspiration** **Sense of history** **Regulating soil quality** **Regulating water quality** **Biodiversity** **Regulating soil erosion** **history** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Food provision continued				**...Continued from previous.** Increasing organic matter in soils results in better retention of nutrients, lower drought stress, better soil structure and more energy sources for soil organisms. Organic farming benefits soil organic matter. Conversion from arable to grassland use allows organic matter to build up. Environmental Stewardship has the potential to enhance a range of ecosystem services of benefit to agricultural production.[8]	**...Continued from previous.** Seek opportunities to adapt to alternative crops or change the use of land to alleviate losses of current agricultural production in response to climatic changes and changes in flood risk. Seek opportunities to expand food production sustainably without negatively impacting on ecosystem services. Seek opportunities to sustainably utilise wetland habitats for food provision such as flood plain grazing marsh for cattle grazing. Encourage land managers to use management techniques which prevent erosion and loss of soil.	

[8]Ecosystem Services from Environmental Stewardship that Benefit Agricultural Production, Natural England Commissioned Reports 102, Food and Environment Research Agency (2012)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Timber provision	Conifer plantations Broadleaved woodland	Total woodland cover is 4 per cent of the area. Woodland is generally limited to small and medium-sized broadleaved woodlands, although there are some large conifer and broadleaved plantations on the sandier soils west of Lincoln.	Local	New woodland planting in the NCA would increase opportunities for timber provision. Planting would need to be sensitively carried out to increase 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 ecosystem services that underpin food production. For example tree planting on steep slopes, on soils vulnerable to erosion and alongside watercourses will help regulate soil quality, water quality, flow and availability.	Increase native woodland planting to enhance timber provision as well as enhancing landscape and biodiversity. Seek opportunities for woodland planting within green infrastructure and relating to new development and the urban fringe. Encourage better management of ancient woodlands and the creation of new woodlands, prioritising planting to increase, buffer and link existing patches of habitat. Seek opportunities to incorporate tree planting within farmland areas where it will improve ecosystem services underpinning food production	**Timber provision** **Climate regulation** **Water regulation** **Biodiversity** **Water availability** **Regulating water quality** **Sense of place / inspiration** **Biomass energy** **Regulating soil erosion** **Regulating soil quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Water availability	Rivers and watercourses Waterbodies Soils	The NCA does not overlay any major aquifers nor does it have any major reservoirs. Water availability principally comes from its network of watercourses especially the River Trent. At Torksey, Trent water is transferred via a pumping station into the Fossdyke navigation from where the water is passed into the Witham to support abstractions downstream In the Witham catchment which includes the rivers Till and Brant, There is water available for abstraction at high and medium flows, restricted water available at medium/ low flows, but no water available for abstraction at low flows. Abstractions are likely to only be possible for 61% of the year (approximately 222 days).[9] Within the Trent catchment the River Devon and the Trent have water available for consumptive abstraction subject to flow restriction conditions. There is no water available for consumption abstraction from the Dover Beck and the Greet.[10]	Regional	The majority of water licensed to be abstracted from the Trent is for use in the power stations and is mostly returned near the point of abstraction. Trent water is also used for spray irrigation of crops. The most numerous abstraction licences in the Witham catchment are for agricultural spraying with very little water returned to the catchment. The Trent, the Fossdyke Navigation and the extensive network of waterbodies created from flooded sand and gravel extraction sites provide a large recreational water resource used extensively for boating, fishing and experiencing wildlife. Infiltration of water to re-charge groundwater can be improved through creation of areas of grassland and woodland, through suitably designed drainage schemes and through reductions in stocking densities.	Seek opportunities to increase storage of water on farms and sympathetic land management practices in agricultural areas to better enable farms to deal with potential increased temperatures and drought conditions and reducing levels of abstraction. Seek opportunities for agricultural diversification to encourage agriculture which needs less water. For over-abstracted catchments seek opportunities to create new habitat areas, such as flood plain grazing marsh and woodland, to increase infiltration and increase ground water stocks. In rural and urban areas, adapt existing drainage schemes and design new sustainable drainage schemes to maximise infiltration levels and re-charge ground water.	**Water availability** **Biodiversity** **Regulating water flow** **Regulating water quality** **Climate regulation** **Food provision**

[9]Witham Catchment Abstraction Management Strategy, Environment Agency (February 2013)

[10]Lower Trent and Erewash Abstraction Licensing Strategy, Environment Agency (February 2013)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Biomass provision	Woodlands Miscanthus Short rotation coppice (SRC) Soils	Demand for biomass fuel comes from the power stations. Some miscanthus and short rotation coppice is grown in the area. Woodland cover is low at only 4 per cent.	LocalLocal	There is a high potential yield for miscanthus over the vast majority of the NCA. Good soil management practices during planting can prevent soil erosion There is generally a medium potential yield for SRC in the NCA, with some areas of high potential yield in the north of the area. Planting of miscanthus, SRC as well as trees in flood plains can help alleviate flood risk Impacts of miscanthus and SRC planting on landscape features within the NCA can be found on the Natural England website.	Seek opportunities for incorporating growing of biomass crops with the re-instatement of active flood plains while avoiding adverse impacts on the provision of other ecosystems and ensuring that management practices to prevent soil erosion at planting time are carried out. Improve management of woodlands to make them more productive for yielding biomass in the form of local wood fuel without impacting on the provision of other services. Maximise opportunities for new woodland planting including planting within flood plains to assist with water flow regulation.	**Biomass provision** **Climate regulation** **Regulating water flow** **Sense of place / inspiration** **Biodiversity** **Regulating soil erosion**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Climate regulation	Soil Pasture and other uncultivated agricultural land Semi-natural habitats Woodlands and trees	There is generally a low soil carbon content of 0 to 5 per cent throughout the NCA. Higher soil carbon content will be found under remaining semi-natural habitats, woodlands and areas of permanent pasture. Soils in the NCA currently provide low carbon storage partly due to cultivation and drainage leading to loss of organic content. Nitrous oxide is emitted when nitrogen-based synthetic fertilisers are added to the soil. This is a much more powerful greenhouse gas than CO2.	LocalLocal	In the second half of the 20th century the conversion of much permanent pasture to arable cultivation has reduced the limited carbon storage capacity of the area. Some of this may be offset by the creation of wetland areas following mineral extraction and subsequent deposition of organic matter in reed beds. Reducing drainage and tillage and establishing permanent vegetation on soils increases organic matter content and capacity to store carbon. Land managed under organic arrangements tends to have higher soil organic carbon content. Increased woodland and tree planting, combined with better management of woodland sites would increase carbon sequestration and storage. Nitrous oxide emissions can be reduced by reducing nitrogen-based fertiliser applications and applying more efficiently.	Seek opportunities to increase tree cover, expand woodlands and semi-natural habitats such as flood plain grazing marsh to increase carbon sequestration and storage. Seek opportunities to increase the amount of permanent pasture and other non-cultivation agricultural land uses to increase soil organic carbon content. Encourage agricultural management measures that increase soil organic matter levels including promotion of organic farming techniques. Seek to minimise use of nitrogen-based synthetic fertilisers to minimise nitrous oxide emissions for example by greater use of crops with lower fertiliser requirements; good in-field analysis to ensure correct application levels; adoption of relevant organic farming principles.	**Climate regulation** **Biodiversity** **Regulating water flow and quality** **Biomass** **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 service offered by opportunities
Regulating water quality	Semi-natural habitats Woodlands Pasture and other uncultivated agricultural land Soils Watercourses and waterbodies	The whole NCA falls within a nitrate vulnerable zone (NVZ). There are no priority catchments under the Catchment Sensitive Farming Delivery Initiative in the NCA. The groundwater chemical status is generally good in the south and east of the NCA but generally poor in western areas. The surface water chemical status for the River Trent is good in the northern part of the NCA but fails to achieve good status between Nottingham and Newark. The surface water chemical status for the River Witham is good. The ecological status of surface waters in the NCA generally ranges between moderate and poor for the main rivers, for example the River Trent and River Witham have moderate ecological potential whereas the ecological status for the River Devon is poor.	Regional	Too much nitrate in fresh water can cause a wide range of harmful effects to rivers, streams and lakes. Most of the nitrate pollution in fresh water in this area is likely to come from agricultural sources. Soil compaction reduces infiltration and increases the risk of runoff, soil erosion and nutrient loss leading to pollution of watercourses. All the main soil types in this NCA are likely to suffer from compaction. Runoff from uncultivated land including woodland and semi-natural habitats is likely to be of higher water quality than from arable land as inputs and soil exposure are generally lower. Root crops generally have high soil exposure. Agri-environment schemes as well as organic farming techniques can have beneficial effects on water quality and ecological status of watercourses. Actions anywhere within the River Trent and River Witham catchments have potential to impact on water quality downstream. The use of pesticides is greatly reduced through the conversion from arable to grassland and therefore the risk to water quality is also reduced.	Maximise awareness of and compliance with nitrate regulations to minimise nitrate pollution. Seek opportunities to diversify and/or adapt field management where risks to water quality are high, for example root crop fields, cultivated steep slopes, areas adjacent to watercourses, prone soil types and where soil compaction is a problem, to reduce runoff, soil erosion and therefore improve water quality. Create grassland and other habitats adjacent to field drains, watercourses and waterbodies to intercept nitrates and other nutrients (as well as sediments in those areas prone to erosion) to improve water quality. Also resist conversion of pasture to arable, especially alongside watercourses. Seek to minimise fertiliser and chemical inputs to minimise risk to water quality for example through: greater use of crops with lower fertilisers and pesticides requirements; good in-field analysis to ensure correct application levels; conversion of arable to pasture; and use of appropriate organic farming principles.	**Regulating water quality** **Regulating soil erosion** **Biodiversity** **Regulating soil quality** **Food provision** **Regulating soil erosion**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Regulating water flow	Rivers and flood plains Wetland and flood plain habitats Semi-natural habitats Woodland and hedgerows Permanent pasture Soils	The River Trent has a long history of flooding. The Environment Agency flood risk map indicates a high risk of flooding along the river and in and around Lincoln. Major embankments protect the larger towns while minor ones protect farmland from frequent flooding. The Trent flood plain is an important resource in storing and regulating flood flows. At times of flood the volume of water increases ten-fold, spilling onto the flood plains. Urban areas also suffer from the more general risks from surface water and sewer flooding under storm conditions. Proposed actions under the River Witham Catchment Flood Management Plan include investigating the feasibility of creating natural storage areas along the river corridor upstream of Lincoln to manage future flood risk. The River Trent Catchment Flood Management plan 2010 actions include looking at options for removing, abandoning or breaching sections of embankments where they provide little flood protection benefit.	Regional	Re-naturalisation of flood plains can dissipate energy from water flow and increase the ability of areas to retain floodwaters upstream of flood risk areas. Semi-natural flood plain habitats including flood plain grazing marsh and flood plain woodlands can reduce the flow of flood waters. Planting of biomass crops, trees and hedgerows in flood plains can help alleviate flood risk by holding back water in peak flow events. Woodlands, tree belts and dense hedgerows increase water infiltration and impede cross land flows, including the flow of flood waters. Semi-natural habitats and extensively grazed permanent grasslands allow water infiltration. Actions anywhere within the River Trent and River Witham's catchment have potential to impact on water flow downstream. Re-naturalisation of watercourses and reconnection with their flood plains would impact on the viability of the current type of arable farming within the flood plains. Good soil management can improve infiltration of water and reduce flooding.	Seek opportunities to restore a more naturally functioning flood plain and river morphology. Create and expand wetland and flood plain habitats to increase water storage within the flood plains to reduce flood water flows. Seek opportunities to expand semi-natural habitats and extensively grazed permanent grassland to increase water infiltration and reduce cross land flows. Seek opportunities to regulate water flow by enhancing the hedgerow network and tree cover of the NCA: planting of new hedgerows where they have been lost and planting of tree belts and small woodlands to intercept cross land flows and to slow flood plain flood water flow. Use sustainable drainage techniques to reduce run-off and increase water infiltration thereby slowing down the rate which water enters the system. Seek opportunities for growing of miscanthus and short rotation coppice with the re-instatement of active flood plains while avoiding impacts on the provision of other services. Encourage land managers to use soil management techniques which improve water infiltration.	**Regulating water flow** **Biodiversity** **Regulating water quality** **Regulating soil erosion** **Regulating soil quality** **Climate regulation** **Food provision**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Regulating soil quality	Triassic and Jurassic mudstones Geomorphological processes Superficial deposits of sands, silts, gravels and clays Alluvium along river valleys Pasture and other uncultivated agricultural land Semi-natural habitats	There are 9 main soilscapes in this NCA: Slightly acid loamy and clayey soils with impeded drainage (covering 31 per cent of NCA); Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (25 per cent); Naturally wet very acid sandy and loamy soils (13 per cent); Loamy and clayey flood plain soils with naturally high groundwater (13 per cent); Lime-rich loamy and clayey soils with impeded drainage (9 per cent); Loamy soils with naturally high groundwater (2 per cent); Freely draining slightly acid loamy soils (1 per cent); Freely draining slightly acid but base-rich soils (1 per cent); Freely draining flood plain soils (1 per cent). All the main soil types in this NCA are likely to suffer from compaction.	Regional	Soils 1 and 2 are easily damaged when wet through compaction. Soil 1 has wet upper layers in winter and is at risk of poaching. Timing will be important in terms of winter water logging limiting access onto land. Soil 2 suffers from winter water-logging and its soil structure is easily damaged if cultivated when wet. Excess water will move as overland flow with potential erosion and diffuse water pollution consequences. Compaction will reduce water infiltration with the same consequences. Management measures that increase organic matter levels, including the use of grass leys, can help reduce these problems. Soil type 3 can have a weak structure and topsoil compaction and cultivation pans can occur. Wetness and flood risk means soil type 4 tends to have low bearing strength and therefore is at increased risk of compaction. Soil is fundamental to agriculture and thus protection of its quality by maintaining and enhancing organic matter content, avoiding compaction and preventing loss through erosion is essential for future food production. Where watercourses have been engineered to reduce flood risk regular deposition of silts in the flood plain ceases, reducing one of the natural processes that maintains soil quality.	Support the farming community to time agricultural activities on vulnerable soils carefully especially avoiding those times when the soil is very wet and easily damaged. Encourage management measures that increase soil organic matter levels such as conversion from arable to pasture, use of organic farming techniques and the use of grass leys in arable rotations. Work with the farming community to seek opportunities to reduce compaction of vulnerable soils through changes in land management such as reduced stocking densities at times of the year when potential soil damage is greatest. Seek opportunities to re-connect existing flood plain pastures with river flooding and create new flood plain pastures subject to river flooding to re-establish the natural deposition processes that maintain soil quality.	**Regulating soil quality** **Regulating water quality** **Climate regulation** **Regulating soil erosion** **Regulating soil quality** **Food provision**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Regulating soil erosion	Semi-natural vegetation cover Woodland and hedgerows Permanent pasture Low lying, flat and gently undulating topography Climate	Broadly the soils of this NCA divide into three types with regards to erosion characteristics. 41 per cent of the soils of the NCA are generally not subject to erosion. These include slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (25 per cent); loamy and clayey flood plain soils with naturally high groundwater (13 per cent); and loamy soils with naturally high groundwater (2 per cent); and freely draining flood plain soils (1 per cent). While all the main soil types are likely to suffer from compaction, 41 per cent are particularly prone. These include: the slightly acid loamy and clayey soils with impeded drainage (31 per cent); the lime-rich loamy and clayey soils with impeded drainage (9 per cent); and the freely draining slightly acid but base-rich soils (1 per cent).14 per cent of the soils of the NCA are light soils and particularly at risk of erosion These are the naturally wet very acid sandy and loamy soils (13 per cent) and the freely draining slightly acid loamy soils (1 per cent).	Regional	The high level of agricultural land use means that soil erosion on vulnerable soils is an important issue in this NCA. Those soils especially prone to compaction are easily compacted by machinery or livestock if accessed when wet, increasing the risks of soil erosion by surface water run-off, especially on steeper slopes. The naturally wet very acid sandy and loamy soils can be easily eroded if heavily trafficked or after heavy rain. For both light soil types soil erosion potential is exacerbated where organic matter levels are low after continuous arable cultivation or where soils are compacted and where the land is sloping. Managing the land to reduce soil erosion may, in the short term, be a constraint to increasing food provision levels but will, in the long term help maintain the productivity of the land. Better management of soils to combat erosion will lead to improvements in water quality and water flow in watercourses and a likely corresponding improvement in biodiversity.	Work with farmers and land managers to seek changes in management practices (such as those encouraged by catchment sensitive farming including the use of cover crops), especially on areas of light, sandy soils to improve soil structure and drainage, increase levels of organic matter and reduce rates of soil loss. Encourage a reduction in the frequency and intensity of cultivation, increase field margins and grassland habitats, use green manure crops and winter stubble. Work with farmers and land managers to ensure stocking regimes are appropriate and reduce compaction in areas where grazing is currently high in order to reduce poaching and compaction. Seek and realise opportunities to increase areas of permanent pasture and semi-natural habitats particularly on soils subject to erosion and on steep slopes. Time agricultural activities and livestock movements avoiding times when the soil is very wet. Create habitats, tree belts and hedgerows in places to intercept and reduce rates of surface water and particulate runoff.	**Regulating soil erosion** **Regulating water quality** **Biodiversity** **Sense of place / inspiration** **Regulating soil quality** **Food provision**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Pollination	Semi-natural habitats Hedgerows and field margins Roadside verges Traditional orchards	Existing meadows, heathland and calcareous grassland total just 394 ha, less than1 per cent of the NCA area. These provide very limited and isolated nectar sources for pollinating insects Nectar sources will also be provided by hedgerows, field margins, traditional orchards and road verges as well as by the gardens of the settlements across the NCA.	LocalLocal	Poor networks of pollinator habitat limit the ability for pollinators to supply this service to a significant level in this NCA. Increases in habitat for pollinators through creation of semi-natural habitats, increases in floristically enhanced field margins, new hedgerows and improvement of existing hedgerows, traditional orchards and appropriate management of road verges will increase the delivery of this service. A strong pollinator population supports production of a wider variety of food products and supports food production in the future. Organic management favours pollinators such as bumble bees because they depend heavily on rotations involving legumes such as clover. Organic farms are also more likely to contain unimproved grassland, which is ideal habitat for pollinators.	Enhance habitat networks for pollinator species within the agricultural landscape. Encourage take up of agri-environment schemes especially those to floristically enhance field margins and hedgerow habitats Increase the area of habitat favoured by pollinators through creation of semi-natural habitats especially meadows, heathland and calcareous grassland. Also through increasing field margins, planting new hedgerows, improvement of existing hedgerows, protection and management of traditional orchards and suitable management of road verges. Encourage the principles of organic management of land to favour pollinators such as the use of rotations involving clover	**Pollination** **Biodiversity** **Regulating water quality** **Food provision** **Climate regulation** **Regulating soil erosion** **Pest regulation** **Sense of place / inspiration** **Sense of history**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Pest regulation	Existing semi-natural habitats Field margins Roadside verges Hedgerows	The areas of semi-natural habitat are very limited and fragmented. Hedgerow quality tends to be low - often tightly trimmed, gappy and species-poor. The predominance of arable cropping in the area means farmland habitats for natural predators of pests are limited.	LocalLocal	Increasing diversity in species and structure of field margins and hedgerows will increase the ability for these areas to support populations of pest regulating species such as invertebrates, birds and mammals. 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.	Seek opportunities to create 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 floristically enhance field margins and hedgerow habitats Encourage land management which reduces pesticide use and cultivation such as organic farming and pasture Seek to increase diversity of structure and composition within semi-natural habitats to support a variety of pest-regulating species.	**Pest regulation** **Pollination** **Biodiversity** **Sense of place / inspiration** **Food provision**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Sense of place/ inspiration	River corridors and flood plains Predominately rural character Extensive views The field patterns and hedgerows Ancient woodlands and semi-natural habitats River Trent Vale of Belvoir The dumbles and becks Network of waterbodies on former gravel extraction sites The red brick and pantile villages and the network of minor roads **Continued over...**	The Countryside Quality Count's overall assessment of the area was that the character of the area has diverged from the suggested vision - caused particularly through agricultural changes and through new development. In addition boundary features, semi-natural habitats, historical features and riverine environments have been neglected Despite the importance of the rivers in this area, they are frequently hidden from view by engineered flood defences. In places the scale of major roads dominates the landscape and overpowers the sense of place; for example the upgraded A46 in the vicinity of Bingham. While the power stations and sugar beet factory provide a sense of place, their scale – especially the coal-fired power stations – is very dominant. Urban sprawl on the edge of the main settlements has eroded the predominantly rural character.	lRegional	Habitats and landscape features have been lost through agricultural intensification diminishing sense of place. This includes drainage of flood plains, conversion of pasture to arable, removal of hedgerows, loss of old farm buildings and damage to historical remains. In many places flood plains are no longer active most of the time and much riverside pasture has been ploughed up for arable use. Conservation and restoration of historic features contribute to protection of sense of place. Improved interpretation and accessibility will improve visitor experience and the value placed on such features. Sensitive planning and design of new development which respects local distinctiveness and character will protect sense of place and can even enhance it. Agri-environment schemes can be used to protect, manage and enhance historic and landscape features thereby protecting sense of place.	Seek opportunities to retain and restore field patterns through improved management of hedgerows and planting of new hedgerows where they have been lost to restore the historical hedgerow network and traditional character. Seek opportunities for re-creating active flood plains, riverside pasture and other flood plain habitats to help define the rivers, the flood plains and strengthen sense of place. Raise awareness of the distinctive features and sites of interest of the NCA to raise the value that people place on them to help protect and enhance the area. New developments and infrastructure should be sensitively planned so as not to diminish the sense of place. For example developments within settlements should reflect the historic settlement pattern, scale of buildings and use of the characteristic materials. Manage urban expansion sensitively to avoid prominence in the landscape to preserve the rural character and fully integrate green infrastructure.	**Sense of place / inspiration** **Recreation** **Sense of history** **Tranquillity** **Biodiversity** **Regulating water flow** **Pollination flow** **Pollination**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Sense of place/ inspiration continued	**...continued from previous.** The historic market towns and cities of Nottingham and Lincoln. Landmark buildings Bramley apple Stilton cheese Ashcroft Mill - The Mill on the Floss					

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Sense of history	Ancient monuments and remains The rich archaeology along the River Trent Medieval settlement pattern Enclosure period field patterns and building materials and stylesHistoric landmarks Historic Nottingham, Lincoln, Newark, Southwell Ancient woodlands Traditional orchards	The NCA has the following historic designations: 13 registered parks and gardens covering 385 ha, 1 registered battlefield/s covering 269 ha, 168 scheduled monuments and 3,226 listed buildings. Traces of the Bronze and Iron Ages as well as the Romans, remain in the landscape. The medieval settlement pattern of small compact villages and larger market towns remains broadly intact. Medieval ridge and furrow cultivation features can still be seen unploughed land. At Laxton the medieval 'open field' system of farming has been retained to the present day. The ancient woodlands provide rare connections to the past. The enclosure and reorganisation of the landscape in the 18th and 19th centuries is seen in the regular shaped fields bounded by hawthorn hedgerows and the red brick and pantile building style of farmsteads and villages. The main settlements provide a rich sense of history which includes Nottingham's medieval St Mary's Church and the 19th-century Lace Market factory buildings; Southwell's medieval minster and its 19th-century workhouse; Newark's castle, its prominent spired church and its Civil War remains.	National	The varied historical features within the NCA are an important part of its character. The NCA has a high number of both upstanding and buried heritage assets. Some of the effects of the intensification of agriculture have been negative, impacting on the historic character of the NCA; such as the removal of hedgerows and other traditional farmland features. Ploughing up of pasture with medieval ridge-and-furrow cultivation patterns permanently removes these historical features. Loss of traditional village patterns and use of non-traditional building materials from new development has been seen to some extent across the NCA. Major infrastructure development such as the dualing of the A46 adversely impacts on the historic human scale of the landscape. Drainage of flood plain grazing land and conversion to arable uses puts ancient archaeological remains at risk as a result of both desiccation and direct plough damage. The principle vulnerability to most scheduled ancient monuments at risk is from ploughing. **Continued over...**	Conserve, protect and enhance the sense of history in the landscape. Also raise awareness of the history of the NCA to encourage its protection. Reduce damage to archaeology from cultivation by encouraging farmers and land managers to adopt best practice such as, direct drilling and shallow tilling, which will also protect crop marks and ground features. Seek opportunities to protect archaeology through reversion to permanent pasture and raising water tables to preserve features. Seek opportunities to protect remaining pasture, especially that with medieval ridge and furrow. Protect and enhance existing hedgerows and replant hedgerows where they have been lost to strengthen historical field patterns Protect the historic settlement pattern and vernacular architectural character through informed planning and development control **Continued over...**	**Sense of history** **Recreation** **Sense of place / inspiration** **Tranquillity** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Sense of history continued				**...continued from previous.** Traditional orchards were once a distinctive feature on the edges of settlements but many have been lost to other land uses or are neglected. 60 per cent of Nottinghamshire's remaining orchards are in poor condition.[11]	**...continued from previous.** Promote the use of traditional building materials and architecture in new developments to maintain the distinctive historical style of the area. Protect and enhance ancient woodlands, improve their management and raise awareness of them. Restore and replant traditional orchards. Protect and restore traditional farm buildings	

[11]Traditional Orchard Project in England: The creation of an inventory to support the UK Habitat Action Plan, Natural England Commissioned Reports 77, A.E. Burrough, C.M. Oines, S.P. Oram and H.J. Robertson (2010)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Tranquillity	Relatively low population Predominantly rural agricultural landscape	The 2006 CPRE map of tranquillity provides a benchmark. It shows that levels of tranquillity are highest in those areas which are outside major settlements and away from main roads. There are some relatively large patches of rural landscape with high tranquillity ratings in this NCA such as within the Vale of Belvoir. The main settlements, especially Nottingham and Lincoln, have low tranquillity scores	Regional	The main threats to tranquillity include urban expansion and road traffic. Safeguarding areas of tranquillity is important for well being, quality of life and the rural economy.	Protect and enhance tranquillity through influencing land use, transport and development decisions in the NCA. Protect tranquillity by focussing new residential development within existing settlements. Plan new developments carefully to minimise car use and seek development which is not dependent on car use. Protect the most tranquil areas of the NCA by resisting development, including new road development, which would introduce high levels of noise, light and visual intrusion. Promote the use of measures that reduce noise and light pollution and visual intrusion in new and existing developments. Protect and enhance the viability of a variety of rural land uses that do not negatively impact on ecosystem services to protect character, the rural economy and tranquillity over the long term.	**Tranquillity** **Sense of history** **Recreation** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Recreation	Public rights of way network Publically accessible land Waterways and network of waterbodies including canals Quiet lanes and minor rural road network. Villages, their pubs and teashops.	The NCA offers a network of rights of way totalling 1,937km at a density of 1.09km per square km. 1.4 per cent of the NCA, 2,435 ha, is classified as being publically accessible. This includes accessible woods, common land, Local Nature Reserves and country parks. The River Trent, its flood plain and the large number of waterbodies created from sand and gravel extraction is a major recreational resource providing a range of opportunities including boating, water sports, fishing, walking and experiencing wildlife. There are multi-user trails along the River Trent and the Grantham Canal providing cycling and walking opportunities. Cycling opportunities are also provided by National Cycle Network routes as well as the extensive network of minor roads. Current initiatives promoting recreation and access in parts of the area include the Trent Vale Landscape Partnership and the Greenwood Community Forest.	Regional	Much of the area ranks as having low levels of non-road access based on 2009 Super Output Area (SOA) data. 200 ha of riverside meadows near Sutton-on-Trent are classified as open access land.Access tends to be very restricted in rural areas where large worked fields limit access with the rights of way network providing the main non-road access means. Extension of the non-road network, especially where it can link people to woodlands and river corridors should be a priority. Green infrastructure initiatives will be developed in association with new developments and mineral extraction	Seek to increase recreation opportunities within the NCA including where there are natural features and historical elements to draw interest from residents and tourists. Seek opportunities to extend the access network, especially where it can link people to woodlands and river corridors. Seek opportunities to maximise new green infrastructure, links to the countryside and ways to minimise car use. Seek opportunities to promote increased access and educational visits to farms. Seek opportunities to diversify the rural economy by promoting recreation and tourism to help sustain traditional farming practices and land uses benefitting ecosystems.	**Recreation** **Sense of place / inspiration** **Sense of history**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Biodiversity	Semi-natural habitats Priority habitats River corridors Hedgerows and field margins Agri-environment schemes Wetland habitats	Due to the intensively farmed nature of landscape, the biodiversity resource of the NCA is very limited. Semi-natural habitats are scarce and very fragmented and there are no internationally designated sites There are 33 SSSI in the NCA totalling 685 ha (less than 1 per cent of the area). In 2011 20 per cent of were in 'favourable' condition; while 53 per cent were in 'unfavourable recovering' condition and 26 per cent were in 'unfavourable' condition. There are 718 Local Sites covering 7,915 ha (4 per cent of the NCA). 1,996 ha (just over 1 per cent) is ancient semi-natural woodland or ancient re-planted woodland. The most significant priority habitat within the NCA in terms of area is flood plain grazing marsh which covers 2,421 ha (1.4 per cent of the area) mostly located in the Trent flood plain. Numerous new wetland habitat sites have been created on the sites of former sand and gravel extraction.	LocalLocal	Patches of semi-natural habitat create important features in the landscape, making it more permeable for species movement than it would be otherwise, however much of this habitat resource is fragmented and disconnected. The waterways provide important habitats and wildlife corridors; however much of their flood plain habitats have been lost to agricultural intensification and conversion to arable uses. The farmed environment includes ditches, hedgerows, copses and field margins dispersed through the landscape providing important connections across it and providing habitats for farmland birds. There is considerable scope to improve biodiversity by working with land managers through agri- environment schemes. The extensive sand and gravel deposits of the area continue to be exploited providing new opportunities for wetland habitat creation and increased habitat connectivity.	Maximise opportunities to protect, enhance and expand semi-natural habitats across the NCA. Strategically plan areas of habitat creation to maximise connections between existing biodiversity-rich sites to enable greater movement of species through the landscape. Maximise opportunities to expand flood plain habitats along the river corridors. 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, such as overwintering stubble for winter food sources particularly for seed eating birds such as linnet and reed bunting. Seek opportunities to sustainably utilise wetland habitats for food provision such as flood plain grazing marsh for cattle grazing. Seek opportunities to maximise biodiversity gains from the restoration of sand and gravel extraction sites while respecting intrinsic landscape character.	**Biodiversity** **Sense of place / inspiration** **Tranquillity** **Regulating soil erosion** **Regulating soil quality** **Pest regulation** **Recreation** **Sense of history**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Geodiversity	Topography Bedrock geology and the deeper Carboniferous coalfield deposits Superficial deposits; sand and gravel Exposed rock formations Designated geological sites Minerals and oil Soils Building materials Geomorphological features Disused quarries and pits	The landform expresses the link to the underlying geology and to the superficial river-borne and glacial deposits. Jurassic and Triassic geology overlain by subsequent deposits from the action of glaciers, water and wind produce a diversity of agriculturally versatile soil types. Quaternary sand and gravel deposits provide significant resources for the construction industry. Gypsum, present in the Mercia Mudstone formation, is used to produce plaster and plasterboard . There is one nationally designated geological site in the NCA; Colwick Cutting SSSI displaying a section of the Triassic Mercia Mudstone and underlying Sherwood Sandstone. There are 21 local (non-statutory) sites including Gibbet Hill River Cliffs at Radcliffe on Trent where the river has cut into the Mercia Mudstone and exposed the Triassic rock. The Mercia Mudstone provides clay suitable for brick making. The Jurassic Lias series has provided stone building material for villages in the south-east of the area. Blue Lias stone features in medieval church walling, dwellings barns and other walling. Marlstone 'Ironstone' outcrops north and west of Grantham where it features especially in churches. **Continued over...**	Regional	Sand and gravel extraction continues at sites north of Newark in the Trent flood plain and west of Lincoln. The remaining sand and gravel resource is very extensive – one of the largest in the country. Extensive lengths of the river systems throughout the Vales have been artificially manipulated to such an extent that natural geomorphological processes are severely impaired. Re-naturalisation of rivers would have benefits for other ecosystem services and would provide more opportunities to witness natural geomorphological processes. However, the viability of the current type of arable farming within the flood plains would be affected. The superficial deposits have strongly influenced the settlement pattern, land use and character of the NCA such as the establishment of early settlements on the Trent river terraces and the distribution of habitats, such as heathland associated with windblown sands. The Mercia Mudstone continues to provide brick clay and gypsum for local factories Geological sites provide important and accessible sections allowing the interpretation, understanding and research into the geology and geomorphology of the NCA and our understanding of past climate. **Continued over...**	Protect and improve condition and accessibility of geological and geomorphological sites that help in understanding the area's geology. 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 service. Seek opportunities to enable appropriate small-scale extraction of Marlstone and Blue Lias to provide material for repair of existing buildings for use in new development to maintain the vernacular character. Raise awareness and understanding of the geological assets, the quarrying and mining heritage and the geological history of the NCA. Seek opportunities to interpret geodiversity and relate geodiversity to the character and development of the NCA's landscapes, settlement pattern, buildings and industries.	**Geodiversity** **Sense of history** **Sense of place / inspiration** **Recreation** **Regulating soil quality** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal service offered by opportunities
Geodiversity continued		**...continued from previous.** Sherwood Sandstone and Lincolnshire Limestone from adjoining areas also feature as building materials. The Trent flood plain displays meanders, relict channels and cut off meander lakes. The Lincoln Gap was created by the course of the ancient Trent. The impermeable Mercia Mudstone traps reservoirs of oil. Duke's Wood was the site of Britain's first oil field. Coal was mined within the NCA from the deeper Carboniferous coal field deposits. Streams on the Mercia Mudstone have eroded into the bedrock and created the distinctive incised dumbles and becks geomorphological features.		**...continued from previous.** Interpretation about the history of the Nottinghamshire oil fields is found at Duke's Wood. Many of the Local Geological Sites in the NCA are in disused quarries and pits. This reflects both the importance of quarrying in the area and the value of these sites in understanding the geological history of the NCA.		

Photo credits

Front cover: Looking out over the Trent flood plain from near East Bridgford. © Bill Tomson

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