National Character Area profile:

84. Mid Norfolk

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Introduction

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

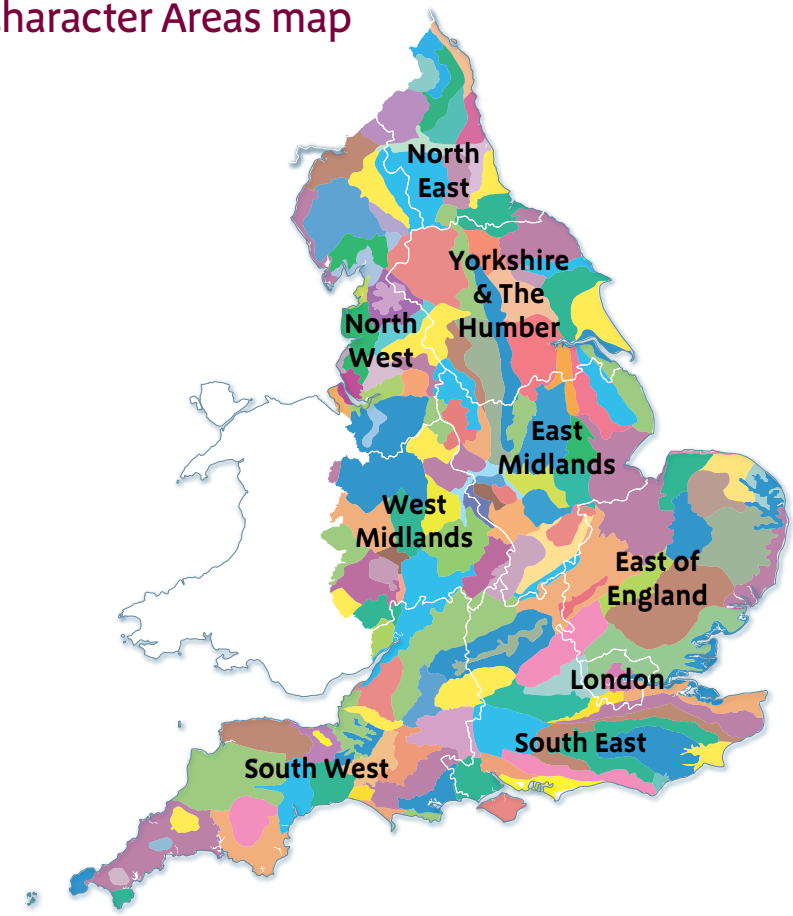
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

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

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

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

National Character Areas map



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

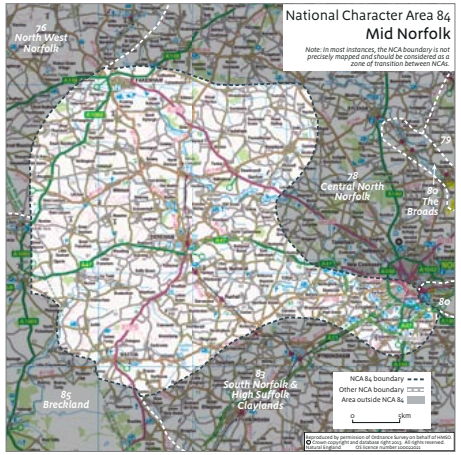
Summary

The broadly flat, rural landscape of the Mid Norfolk National Character Area (NCA) occupies the northern section of the East Anglian Plain, becoming more undulating to the north where it merges with the Central North Norfolk NCA in a curving line across the Wensum Valley, and more rolling towards Norwich to the east. This is ancient countryside with a long-settled agricultural character, where arable land is enclosed by winding lanes and hedgerows, interspersed with woodland and heath and dissected by lush pastoral river valleys. A patchwork of cultivated land, numerous church spires, distant wooded horizons and big skies dominate the landscape.

This is a tranquil place, with isolated market towns, and scattered villages and farmhouses, their red brick and flint walls and pantile roofs an intrinsic component of Norfolk character. The area is rich in 18th-century estates and medieval churches, and the city of Norwich provides a cultural and economic centre. The many public rights of way (including the Peddars Way and Norfolk Coast Path National Trail and long-distance footpaths), country estates and parklands provide recreational opportunities.

Norfolk's river valleys contain an important mosaic of habitats and species, with the entire length of the chalk-fed River Wensum designated as a Special Area of Conservation. The Norfolk Valley Fens are important for their rare lowland alkaline fen communities. Woodland and remnant heathland are important for their biodiversity, and were once much more extensive in the area.

The main pressures for change to the area are posed by growth and a need to accommodate increased development, especially around Norwich. The potential for further agricultural intensification and a need for sustainable approaches to commercial farming practices are also key challenges. Maintaining the traditional farmed landscape of Mid Norfolk NCA – through sustainable land management practice to help protect its important natural processes and resources, its areas of high tranquillity and enhance the natural landscape for recreational opportunity, geodiversity and biodiversity – is also presenting further challenges into the future.



Click map to enlarge; click again to reduce

Statements of Environmental Opportunities:

- **SEO 1:** Work with the local farming community to safeguard future food production, while conserving and enhancing the traditional rural character, long views and strong sense of tranquillity in this area of long-settled, ancient countryside. Manage and enhance farmland habitats – including hedgerows and woodland, field margins and pastoral river corridors – to enhance the area for farmland species (including pollinators), improve water quality and availability in the rivers and aquifer, manage soil erosion and quality, and address the impacts of climate change.

- **SEO 2:** Maintain, enhance and restore priority habitats including woodlands, areas of remnant heathland, and the nationally and internationally important Norfolk Valley Fens and chalk river systems (including the River Wensum), and seek opportunities to connect fragmented sites, improving the area for biodiversity, geodiversity and recreation, and enhancing landscape character and resilience to climate change.

- **SEO 3:** Encourage a sympathetic approach to development that maintains traditional Norfolk character and improves sustainable recreational use, while protecting historic assets, geodiversity and biodiversity.

Country lane looking towards Stanfield - hedge with new standard trees.

Description

Physical and functional links to other National Character Areas

A curving line across the Wensum Valley marks a transition from the Mid Norfolk National Character Area (NCA) to the slightly more undulating and enclosed Central North Norfolk NCA to the north. The two NCAs share many landscape characteristics and features and are closely linked.

The Mid Norfolk NCA covers the northern section of the East Anglian Plain, a broadly flat plateau dissected by streams and river valleys that stretches from the South Suffolk and North Essex Claylands NCA through the South Norfolk and High Suffolk Claylands NCA and into Mid Norfolk. The whole area is underlain by Cretaceous Chalk, which forms a Principal Aquifer serving a much wider area.

Three major tidal rivers – the Bure, Wensum and Yare – provide ecological and hydrological links between the NCA and the surrounding area. All three rivers supply the adjoining Broads NCA. The rivers Wensum and Tud begin in the Mid Norfolk NCA and flow through the southern part of Central North Norfolk NCA before converging with the major valley of the River Yare, just south of Norwich. The Bure begins its journey in the area where Mid Norfolk joins Central North Norfolk and flows in to the Broads just south of Aylsham. The far east of the NCA contains the headwaters of the rivers Nar and Wissey which continue their journey through the adjacent North West Norfolk and The Brecks NCAs and on to The Fens NCA.

The general flatness of the topography means that long views are possible within the NCAs of the East Anglian Plain, with prominent features including church spires and Cromer Ridge, visible from a distance.

An A road network links the market towns of Fakenham and East Dereham with Norwich and with Cromer and Aylsham in Central North Norfolk NCA and Swaffham in The Brecks NCA. The A11 provides the main road transport link between Norwich and the south. A 13-km section of the Peddars Way and Norfolk Coast Path National Trail – which stretches from The Brecks NCA to the coast and Hunstanton in North West Norfolk NCA, and then along the North Norfolk Coast NCA to Cromer in Central North Norfolk NCA – runs through the far west of the NCA near Swaffham. The rail network links Dereham with Norwich and The Brecks NCA to the east via the South Norfolk and High Suffolk Claylands NCA.

Key characteristics

- Broadly flat, glacial till plateau dissected by river valleys which create a more intricate landscape to the west of Norwich.
- Chalk bedrock overlain by gravels, sands and glacial till left behind by the retreating ice of Anglian glaciations, and the resulting complexity of soils, determine natural vegetation patterns.
- Underlying chalk aquifer; small, fast-flowing chalk streams and biodiversity-rich, wide, lush river valleys with wooded valley slopes, including the internationally important chalk-fed River Wensum.
- Tranquil agricultural landscape with extensive areas of arable land, dominated by cereals with break-cropping of sugar beet and oilseed rape, and some pastures along valley floors.
- Ancient countryside, much of it enclosed in the 14th century, with a sporadically rationalised patchwork field system, sinuous lanes and mixed hedges with hedgerow oaks.
- Largely fragmented, isolated mixed deciduous and pasture woodlands, with a notable area of ancient woodland at Foxley Wood.
- Important alkaline valley fen communities and areas of remnant heathland.
- Large number of 18th-century estates with their associated parkland, and a great density and stylistic variety of churches which are prominent features in the landscape.
- Coherent vernacular architecture – marked by distinctive red brick and flint buildings with pantiled roofs, much dating from the 17th and 18th centuries, with some earlier timber frame – is an inherent component of the area's character.
- A mix of villages and many isolated farmsteads within a complex minor road network, with a traditional pattern of market towns connected by main roads, and the city of Norwich providing a centre for cultural and economic activity.
- Dense network of public rights of way including bridleways and the Peddars Way and Norfolk Coast Path National Trail.

A tranquil agricultural landscape with extensive areas of arable land.

Mid Norfolk today

Mid Norfolk NCA is a rural area, with a long-settled agricultural character, with gently undulating arable land, interspersed with woodland and heath, and enclosed by winding lanes and hedgerows. It is a terrain of gentle variation which becomes more rolling within the Wensum Valley close to Norwich. Elsewhere it is flat to gently undulating, so that the land cover becomes more or less dominant as the relief changes, with distant wooded horizons and prominent church spires giving way to spectacular big skies.

Chalk bedrock underlies the NCA and forms an extensive Principal Aquifer which stretches far to the south under the East Anglian Plain. Gravels, sands and glacial till left behind by the retreating ice of Pleistocene glaciations have resulted in a complexity of soils and varying land cover. River terrace sediments provide an important archive of Pleistocene information along with the stone tools indicative of the presence of our earliest ancestors.

The rivers Wensum and Tud begin in Mid Norfolk NCA and flow through the southern part of Central North Norfolk NCA before converging with the major valley of the River Yare, just south of Norwich. The Bure begins its journey in the area where Mid Norfolk joins Central North Norfolk and flows in to The Broads NCA just south of Aylsham. The far east of the NCA contains the headwaters of the rivers Nar and Wissey which continue their journey westwards. The river valleys of the Wensum and Yare create a wide, lush pastoral landscape, which is partly enclosed by woodland on the valley slopes. Watermeadows divided by reed-filled dykes and poplar plantations are common on valley floors. The extraction of sand and gravels has produced lakes with reeded margins in places on the River Wensum. The Wensum is especially rich in biodiversity with over 100 plant species and a diverse invertebrate fauna, including the bullhead, brook lamprey, white-clawed crayfish, Desmoulin's whorl snail, water crowfoot and water starwort. The Nar is a small chalk stream with intermittent flows which is designated as a Site of Special Scientific Interest (SSSI) for its characteristic chalk stream community, with starwort and reed sweet-grass in particular found within the NCA. All of the rivers in the area have been modified and straightened over the centuries and contain numerous mills, weirs and sluices. The mosaic of wetland, woodland and grassland habitats found in the NCA's river valleys provides a tranquil haven for biodiversity.

The NCA contains a variety of woodland types with mixed deciduous or pasture woodlands (oak and beech) on the heavier soils and conifers on the lighter sands, especially to the north and west. Woods are variable in size and generally fragmented, and reflect the development of the area in the 18th century into small-to-medium-sized estates, especially north of the Wensum where the larger areas of woodland are generally found. This includes ancient Hockering Wood (SSSI) which is noted for its small-leaved lime trees. The NCA contains the largest stand of ancient woodland now remaining in Norfolk, Foxley Wood (SSSI), which is thought to be 6,000 years old and is mentioned in Domesday Book. The wood is exceptionally rich in flora with over 250 species recorded, including herb paris, early purple orchid and lily-of-the-valley, and is particularly noted for its swathes of bluebells in the spring.

Land cover is predominately agricultural with extensive areas of arable land and some pastures along the valley floors. Cereals dominate, with break-cropping of sugar beet and oilseed rape. Much of the land was enclosed by the 16th century, and only 20th-century agricultural rationalisation has

changed it. Fields are variable in size and the small scale and irregularity of early enclosure has given way, in many areas, to a larger, more regular pattern. Some areas of regular enclosure mark the 18th- and 19th-century improvement for agriculture of the blocks of heathland that characterised the area. The change is also seen in the contrast between mixed hedgerows with frequent hedgerow oaks in areas with less rationalisation, and areas of poor or remnant hedgerow in the more intensively farmed areas. Cereal field margins and hedgerows are important refuges for wildlife with key species found in farmland areas including the barbastelle bat, brown hare, corn bunting, grey partridge, skylark, tree sparrow and turtle dove. Rare arable wild flowers, including the cornflower, are also an important feature. Sporting interests in the NCA are reflected in the large number of pheasants in fields and along road verges.

The NCA has three sites designated as part of the wider Norfolk Valley Fens Special Area of Conservation (SAC): Booton Common to the east of Reepham, and Badley Moor and Potter and Scarning Fens just south of Dereham. These sites are designated for their alkaline valley fen habitat which supports an exceptionally diverse plant community, including rare bryophytes and a number of uncommon mosses and liverworts. Scarning Fens is the only site in England which supports the Norfolk flapwort. The fens are also of great importance for their invertebrate communities and support rare species of damselfly including the small red damselfly. Breeding birds include snipe, woodcock, grasshopper warbler and lesser whitethroat. Norfolk was formerly (pre-18th century) probably one of the major heathland areas of Britain. However, much was easy to reclaim to agriculture and the remaining small areas are now highly fragmented and in poor condition. The NCA contains less heath than its neighbour, Central North Norfolk NCA, and the remainder

Agricultural landscape, oilseed rape crop, near Swaffham.

is generally associated with the river valleys of the Nar, Wissey and Wensum, and in the area around Dereham.

A large number of 17th- and 18th-century country house estates of various sizes can be found throughout the area, frequently accompanied by parkland and their own church and village, as at Heydon. This idyllic isolated village, with its central village green and well, church, pub and cluster of cottages, sits just outside the gates to the Heydon Hall estate, and has remained unchanged by new buildings since 1887. The area, like Central North Norfolk NCA, is also unusually rich in medieval churches, with a particularly notable cluster in the middle of the area, near Reepham. Salle has been pronounced, by C.L.S. Linnell, to be 'not only the most marvellous church in a county of marvellous churches but one of the most beautiful in all England'. Nearby Booton excels as a dressed flint and stone Victorian frolic, be-pinnacled wherever possible in a spectacular flight of fancy by the then vicar. These churches dominate the landscape, especially on the flatter land, and in an area of close-packed villages it is often possible to see two or three towers at once.

Mid Norfolk NCA looks to Norwich for cultural and economic activity. The city has an interesting mix of medieval, Georgian and modern architecture, a large market square and intriguing alleyways and streets, and the impressive Norman castle and cathedral look out over a city of surprising topographical variety, which is caused by the Wensum Valley. There are no other large centres of population but, rather, a traditional pattern of market towns, such as Dereham and Fakenham, which still largely retain their central historic character but have been subject to development on the outskirts in recent years. Settlement is more nucleated to the north while in the south it generally consists of clusters of villages. Mid Norfolk is an area of dispersed villages and isolated farmsteads, generally of the 17th and 18th centuries, and of 18th-century estates and country houses. Flint, red brick and frequently black-glazed pantiles are inherent components of the area's vernacular character. Innate conservatism has ensured that the local vernacular style has been preserved into the 20th century, so there are few examples of later periods. There are some rare survivals of earlier timber frame.

The agricultural landscape is extremely tranquil away from main roads and settlements and along river valleys. Less tranquil areas are mainly around market towns and A roads and close to Norwich, especially along the A47 and A1067, where urbanisation creeps westwards with a string of commuter villages of 19th- and 20th-century origin.

Mid Norfolk NCA has limited recreational opportunities but is well served by the public rights of way network, which includes extensive bridleways. A 13-km section of the Peddars Way and Norfolk Coast Path National Trail – which extends from The Brecks NCA, north-east to the coast and Hunstanton in North West Norfolk NCA and then along the North Norfolk Coast NCA to Cromer in Central North Norfolk NCA – runs through the far west of the NCA near Swaffham.

The landscape through time

The chalk bedrock which underlies the Mid Norfolk NCA was deposited during the Cretaceous period, some 80 million years ago, during a period when East Anglia was submerged by the sea. Successive Quaternary (the last 2.6 million years) glaciations have eroded the chalk bedrock, and the flint nodules contained within it, redistributing them as chalk-rich till and flint-rich gravel throughout the NCA. The Anglian glaciation (around 450,000 years ago) laid down a particularly extensive and characteristically chalky till deposit – the Lowestoft Till – as well as overlying this with sand and gravel outwash deposits.

River gravels occurring underneath the Lowestoft Till provide important evidence of pre-glacial river channels which were disrupted by glacial action. During cold periods between ice sheets periglacial freeze thaw action mobilised soil and surface layers and modified slopes, and meltwater rivers deposited gravel and sand sequences in valleys such as the Wensum providing an important river terrace archive of glacial information.

An important site for East Anglian geology and the stratigraphy of this NCA is Caistor St Edmund Chalk Pit SSSI. This site displays the best exposure of late Campanian Beeston Chalk, as well as being famous for its large flints, known as potstones and paramoudras, with their remarkable contained burrow systems. The chalk bedrock is overlain by shallow marine Crag deposits, early Thames deposits (Kesgrave Sands and Gravels), palaeosols demonstrating features associated with both temperate and Arctic conditions as well as glacial Arctic soils. Further evidence for the last 125,000 years is preserved in fossiliferous fluvial and lacustrine deposits at Saham Toney that provide an insight into the ancient landscapes of this NCA.

First evidence of humans in Norfolk is provided by flint tools dated at around 400,000 BC. The area was well settled by the Roman period. Venta Icenorum, situated just outside what is now Norwich, was laid out in around 70 AD. The remains of a Roman villa and other settlements exist further to the west. Peddars Way was an important Roman, and possibly pre-Roman, route linking Essex and The Wash. Norwich, situated to the east of the NCA at the

Norwich market square, with St Peter Mancroft Church in the background.

confluence of the Yare and the Wensum, was founded during Saxon times and was well settled at the time of William the Conqueror. The large flocks of sheep noted throughout the county in Domesday Book suggest that it was a prosperous farming and wool-producing area by this time.

By the 13th century, Norwich was one of the largest cities in England, together with London, Bristol and York. The cloth industry sustained its exports and wealth right up until the 19th century. Medieval and later settlement is mixed, with well-separated market towns including East Dereham and Fakenham and large villages such as Reepham and Hingham, and their associated numerous churches. Surrounding these settlements and still a dominant element of the settlement pattern today, is a pattern of dispersed hamlets, farmsteads and manorial complexes.

Much of the early medieval landscape of heaths and wood pasture was enclosed between the 14th and 17th centuries, creating a pattern of small-scale, irregular fields with areas of open field and common land, farmed by a range of holdings, settlements and estates. The resulting small-scale, irregular field patterns, high hedges and a meandering road network are still in evidence today. Medieval deer parks were largely converted to farmland in the 16th and 17th centuries. It appears to have been an area of mixed farming on relatively small landholdings which became fairly wealthy during the 17th century, as shown by the large number of fine flint and pantile farmhouses of the period. These largely comprise timber-frame farmhouses and barns with some mass walling including brick. Major improvements in crop rotation from the late 17th century used winter feed crops (notably turnips) and artificial grasses. The economy was arable-based, but access to meadow and grass enabled the stocking of large numbers of bullocks and milking cattle.

Rationalisation and further enclosure of fields and boundary patterns in the later 18th century added another layer of historic interest by subdividing areas of common land and heath. Woodland plantations were commonplace, but rarely of great size, and usually the product of 18th-century estate management and later sporting interests.

Medieval manors, associated with warrens and deer parks, formed the basis of 17th- and 18th-century country house estates of various sizes, frequently accompanied by parkland. Such estates often had their own church and village, as at Heydon, which lends a paternalistic, not to say feudal, character to the landscape.

The arrival of the railways in the mid 1800s connected Fakenham and Dereham to London, Great Yarmouth and King's Lynn. Dereham especially grew rapidly during this time and a new industrial area developed near the station. A number of railways closed due to economic restructuring and the Beeching axe in the 1950s and 60s, including the main line of the Midland and Great Northern Joint Railway and Great Eastern Railway which had previously linked East Dereham and Fakenham with Norwich, Wymondham and King's Lynn. Twentieth-century rationalisation has changed the agricultural landscape with larger fields and the removal of many hedgerows, and Norfolk is now England's most important producer of wheat, barley, sugar beet and many vegetables. Historic parkland has seen a significant loss of 48 per cent to arable conversion since the First World War. A string of commuter villages were built close to Norwich in the 19th and 20th centuries, especially along the A47 and A1067. Pressure to accommodate modern built development associated with growth continues with increasing urbanisation of areas around Norwich and the market towns.

Ecosystem services

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

Provisioning services (food, fibre and water supply)

- **Food provision**: Extensive areas of high-quality farmland under agricultural management, predominately for arable cultivation. Cereal crops dominate, with some cash root crops and oilseed production.

- **Water availability:** Extensive abstraction for public water supply and agriculture (spray irrigation) from rivers and the underlying principal chalk aquifer, with some water available for licensing at high flows.

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

- **Regulating soil erosion:** 70 per cent of soils are at risk of erosion. Priority catchments under the England Catchment Sensitive Farming Project all identify soil erosion as a particular issue. The re-establishment of hedges and provision of uncropped wildlife strips, conservation headlands, targeted arable reversion to grassland and winter stubble through agri-environment schemes have limited soil erosion.

- **Regulating soil quality:** The soils are a combination of slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soils. However, the addition of chemical fertilisers combined with the irrigation of these easily worked soils has enabled highly productive agriculture to prevail across the NCA. The more fertile, slightly acid loamy and clayey soils with impeded drainage are found typically around the river valleys.

- **Regulating water quality:** Agriculture has a large part to play in regulating water quality. Water quality is generally poor due to diffuse pollution from agriculture (resulting in high nitrate and phosphate levels), sedimentation, point source pollution from sewage treatment works and industry, over-abstraction, invasive species and physical modification of river systems. The role of soil quality in water filtration to the aquifer and water pollution is of significance to groundwater quality and the remnant biodiversity.

- **Pollination:** The grassland and flower-rich meadows provide important nectar sources supporting an array of pollinating invertebrates. This resource contributes to the viability and security of local food production. Grassland may come under threat due to changes in land management, for example through intensification, or changes in land use practices such as the breaking up of traditional farm units for use as pony paddocks. Pollination is essential for the agricultural industry.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** Traditional, gently undulating, agricultural landscape with winding lanes and hedgerows, prominent medieval churches, 18th-century country house estates and parklands, ancient woodlands and remnant heathlands, rolling river valleys, and the city of Norwich in the south-east. A sense of place is created by the evidence for a long-settled agricultural character, dominated by enclosed arable land and a traditional settlement pattern based around small market towns, and isolated villages and farmsteads built with Norfolk red brick and flint with pantile roofs.

- **Sense of history:** The distinctive landscape of this NCA is underpinned by a geodiversity that contains evidence of ancient landscapes and palaeo-ecologies. The area's fine churches testify to a well-settled and prosperous medieval landscape, a sense of prosperity which is enhanced by the fine vernacular architecture, medieval manors and the country house estates with their associated parkland. An imposing cathedral, prominent castle and historic mix of architecture are provided by Norwich.

- **Biodiversity:** The most extensive priority habitat in the NCA is deciduous woodland (4,016 ha) which includes significant areas of wet woodland. The largest SSSI ancient woodland is Foxley Wood, which is well known locally. These woodlands are generally small and fragmented. The NCA contains one Special Protection Area and two SAC, including the River Wensum which is one of the most important chalk rivers in the country. Some 816 ha of the NCA is nationally designated as SSSI. Just over 7 per cent of the NCA is covered by priority habitats.

- **Geodiversity:** This NCA contains important geological evidence of East Anglian stratigraphy with key deposits being conserved within Caistor St Edmund Chalk Pit SSSI and the one Local Geological Site. The underlying chalk aquifer is an important water source for this and adjoining NCAs.

Historic church of Bradenham, showing alterations over the centuries.

Statements of Environmental Opportunity

SEO 1: Work with the local farming community to safeguard future food production, while conserving and enhancing the traditional rural character, long views and strong sense of tranquillity in this area of long-settled, ancient countryside. Manage and enhance farmland habitats – including hedgerows and woodland, field margins and pastoral river corridors – to enhance the area for farmland species (including pollinators), improve water quality and availability in the rivers and aquifer, manage soil erosion and quality, and address the impacts of climate change.

For example, by:

- Managing the agricultural landscape in a sustainable way to improve the long-term viability of agriculture and yields, while protecting the natural assets of the area.
- Working with farmers to reduce the loss of sediment and associated phosphates from agricultural land through appropriate changes in land management, including the use of buffer strips adjacent to watercourses.
- Reducing soil compaction by encouraging the careful timing of land management activities, including reducing unnecessary machinery use in wet conditions.
- Working with farmers through agricultural stewardship schemes to increase organic matter in soils through promoting management interventions including the use of grass leys, introducing fallow into rotations and over-winter stubbles.
- Working with farmers to reduce sources of nitrate leaching to groundwater and run-off to surface waters by promoting the adoption of best practice measures, including the more efficient use of organic manures and fertilisers.
- Maintaining water availability by using integrated water and land management practices to slow run-off and increase infiltration to the underlying chalk aquifer by reducing soil compaction and increasing soil organic matter on agricultural land.
- Strengthening the characteristic hedgerow network by protecting, managing and reinstating hedgerows and hedgerow trees, thereby connecting fragmented habitats, improving biodiversity and reducing wind erosion.
- Seeking opportunities to increase field margins, species-rich hedgerows and beetle banks to encourage a network of habitats for pest-regulating species close to areas of agricultural production.
- Encouraging sympathetic management for pollinator species by enhancing the floristic diversity of hedgerow banks and increasing the areas of pollen and nectar margins on arable farms.
- Maintaining the traditional landscape character of patchwork fields enclosed by hedgerows with hedgerow oaks and quiet country lanes with wide verges.
- Maintaining the tranquillity of agricultural areas by limiting development, especially of major road networks.
- Encouraging an increase in farmland bird, mammal and invertebrate species by promoting wildlife-friendly farming practices and enhancing arable field margins and hedgerows.
- Reducing risk and promoting the positive management of designated (and non-designated) heritage assets though the use of stewardship schemes and beneficial agricultural practices.

SEO 2: Maintain, enhance and restore priority habitats including woodlands, areas of remnant heathland, and the nationally and internationally important Norfolk Valley Fens and chalk river systems (including the River Wensum), and seek opportunities to connect fragmented sites, improving the area for biodiversity, geodiversity and recreation, and enhancing landscape character and resilience to climate change.

For example, by:

- Maintaining the protected sites network, ensuring continued protection of priority habitats and species including the Norfolk Valley Fens SAC and River Wensum SAC, and SSSI including Foxley Wood.
- Maintaining and enhancing areas of ancient semi-natural woodland and planting new areas of broadleaved woodland to address fragmentation.
- Bringing local woodlands into traditional coppice management, to improve structural diversity and species composition and increase biomass.
- Increasing the biodiversity of conifer plantations by re-introducing native broadleaved trees.
- Maintaining and enhancing existing areas of heathland in the river valleys of the Nar, Wissey and Wensum, and investigating opportunities to connect fragmented sites and restore heathland habitat in other areas.
- Increasing the biodiversity of river valleys by restocking poplar plantations with native wet woodland.
- Investigating opportunities to improve biodiversity and geodiversity by re-naturalising river systems, removing structures and reconnecting rivers to their natural flood plains.
- Restoring wet grassland, fen and carr habitats in the Wensum river corridor as part of a whole river restoration project to improve the biodiversity of the river corridor.
- Modifying or removing barriers on river systems, where possible, to allow migrating fish passage.
- Conserving areas with high organic content in soils, including wetlands, heathland and woodland, to improve resilience to climate change.
- Seeking opportunities to link fragmented habitats with other semi-natural habitats to enable species to move in response to climate change.
- Restoring and creating new areas of wetland habitats, including wet grassland, fen and carr, to aid aquifer recharge.
- Maintaining and enhancing the floristic diversity of lowland meadow and lowland heathland, and other semi-natural habitats, to increase the area of habitat suitable for pollinators.
- Raising awareness of the problem of invasive species and adopting appropriate management for their control.
- Increasing areas of natural flood plain vegetation and hedgerows in agricultural areas to reduce the risks of soil erosion.
- Seeking opportunities to improve access to wildlife-rich areas, where feasible, and increasing interpretation and education to help connect the local community to their natural heritage.

SEO 3: Encourage a sympathetic approach to development that maintains traditional Norfolk character and improves sustainable recreational use, while protecting historic assets, geodiversity and biodiversity.

For example, by:

- Ensuring that development plans are sensitive to conserving the historic character of the landscape and promote the use of traditional vernacular and building materials, as well as conserving and enhancing heritage assets and traditional buildings and settlement.
- Conserving the traditional character of country house estates with their associated woodlands, parklands and villages, encouraging their use as a recreational and tourist attraction, while maintaining their biodiversity and geodiversity value.
- Ensuring the protection of designated and non-designated heritage assets, including medieval churches, while seeking opportunities to enhance interpretation and, where appropriate, improve access.
- Ensuring the protection of the historic assets of Norwich, including its Norman, medieval and Georgian architecture and surrounding Roman historical sites.
- Minimising the effects of new development by avoiding areas with high tranquillity, incorporating green infrastructure and woodland buffers, and minimising new sources of light pollution.
- Improving and promoting the use of sustainable transport, including the bus network, cycling and footpath routes.
- Promoting the Quiet Lanes project and investigating opportunities to expand the network and improve its effectiveness.
- Enhancing sustainable access through the public rights of way network and National Trails, improving recreation and the health of the local community, and protecting agricultural management practices, habitats and wildlife.
- Ensuring that local development plans include the sustainable management of water resources and promote measures to reduce adverse impacts on water quality in the future, including the use of sustainable urban drainage systems, sewage treatment options and reducing nutrients from diffuse pollution.
- Investigating opportunities to create and enhance green infrastructure and public access by creating additional linkages between existing public footpaths, settlements, amenities and transport links.
- Creating new areas of greenspace in conjunction with new developments and identifying locations for new recreational sites such as country parks.
- Conserving and interpreting archaeological earthworks and sub-surface archaeology, while recognising the potential for undiscovered remains.
- Investigating opportunities to enhance awareness and appreciation of underlying geodiversity.

Supporting document 1: Key facts and data

Mid Norfolk National Character Area (NCA): 90,881 ha

1. Landscape and nature conservation designations

The Mid Norfolk NCA contains 2 ha of the Broads National Park.

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Designated site(s)	Area (ha)	% of NCA
International	Ramsar	n/a	0	0
European	Special Protection Area (SPA)	Breckland SPA	4	<1
	Special Area of Conservation (SAC)	River Wensum SAC; Norfolk Valley Fens SAC	220	<1
National	National Nature Reserve (NNR)	Foxley Wood	125	<1
National	Site of Special Scientific Interest (SSSI)	A total of 24 sites wholly or partly within the NCA	816	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.

In summary, land covered by international nature conservation designations totals 224 ha (0.2 per cent of the total land area). In total, 816 ha of the NCA are nationally designated. Foxley Wood NNR is also designated as a SSSI.

There are 262 local sites in the Mid Norfolk NCA covering 2,486 ha, which is 3 per cent of the NCA.

Source: Natural England (2011)

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

1.1.1 Condition of designated sites

Condition category	Area (ha)	% of SSSI land in category condition
Unfavourable declining	11	1
Favourable	218	25
Unfavourable no change	90	11
Unfavourable recovering	483	60

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

Topography is variable with notably vigorous minor undulations and some flat areas. Elevation within Mid Norfolk NCA ranges from just above sea level (2 m) to a maximum elevation of 96 m. Generally the NCA is low lying with a mean elevation of 51 m.

Source: Natural England 2010

2.2 Landform and process

Mid Norfolk forms a glacial till plateau, broadly flat with very little variation in height. The plateau is dissected by streams and lush pastoral river valleys particularly of the rivers Wensum and the Yare which have locally pronounced effects that create an intricately rolling landscape to the west of Norwich.

Source: Mid Norfolk Countryside Character Area description

2.3 Bedrock geology

The bedrock geology is composed principally of Late Cretaceous Chalk, which underlies 96 per cent of the NCA area. The remainder consists of sand and gravel. During the Anglian glaciation, four hundred thousand years ago, ice sheets moving across the area deposited a layer of boulder clay up to tens of metres thick over the chalk. Fragments of chalk in the clay give a more or less calcicolous feel to the vegetation across the whole area. As the climate warmed and the ice melted, fast-flowing streams carried sands and gravels, depositing them in valleys where they can be found today.

Source: East Anglia Clay Natural Area Profile, Natural England (2010)

2.4 Superficial deposits

Superficial deposits of gravels, sand and mixed soft clayey sediments resulting from glaciations are found throughout the NCA.

Source: East Anglian Plain Natural Area Profile.

2.5 Designated geological sites

Designation	Number
Geological Site of Special Scientific Interest (SSSI)	2
Mixed interest SSSI	0

There is 1 Local Geological Site within the NCA.

- 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

Soilscapes maps identify the soils to be a combination of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils and more fertile slightly acid loamy and clayey soils with impeded drainage, found typically around the river valleys.

Source: National Soil Resources Institute Soilscapes Maps

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	0	0
Grade 2	12,930	14
Grade 3	68,196	76
Grade 4	4,673	5
Grade 5	0	0
Non-agricultural	2,826	3
Urban	2,256	3

Source: Natural England (2010)

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

3. Key water bodies and catchments

3.1 Major rivers/canals

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

Name	Length in NCA (km)
River Wensum	46
River Yare	45
River Tud	17
River Wissey	15
River Nar	10
River Bure	2
River Stiffkey	2

Source: Natural England (2010)

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

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 81,543 ha or 90 per cent of the NCA.

Source: Natural England (2010)

3.3 Water Framework Directive

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

4. Trees and woodlands

4.1 Total woodland cover

The total area of woodland within Mid Norfolk NCA is 6,224 ha (7 per cent of the NCA).

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

4.2 Distribution and size of woodland and trees in the landscape

Woodland is generally scattered throughout the NCA with notable aggregations occurring north of Dereham.

Source: Mid Norfolk Countryside Character Area Description, Natural England (2010)

4.3 Woodland types

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

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

Woodland type	Area (ha)	% of NCA
Broadleaved	4,500	5
Coniferous	1,126	1
Mixed	231	<1
Other	367	<1

Source: Forestry Commission (2011)

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

Type	Area (ha)	% of NCA
Ancient semi-natural woodland	334	<1
Ancient re-planted woodland (PAWS)	456	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Boundaries within Mid Norfolk NCA area typically hedgerows but with significant areas with fencing also notable. The estimated boundary length for the NCA is 4,939 km.

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

5.2 Field patterns

Fields in general are variable in size and the 14th century small-scale and irregular enclosure has given way, in many areas, to a large, more regular pattern of 20th century rationalisation. The river valleys which have not been planted with poplars display a wide, lush pastoral landscape with water meadows.

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

6. Agriculture

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

6.1 Farm type

In 2009 there were 692 commercial holdings in Mid Norfolk. Farms in Mid Norfolk are mainly arable with just over half (388) of commercial holdings recorded under arable and horticulture within the agricultural census. Since 2000 a shift towards cereal production has been recorded with a 28 per cent increase in cereal farms with a corresponding decrease in general cropping and mixed farming. During this period numbers of livestock farms have remained stable.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

A large proportion, almost a third, of the NCA's 692 commercial holdings are more than 100 ha in size. However the majority of holdings (55 per cent) remained under 50 ha in 2009. This pattern has seen little change since 2000.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 74,028 ha; owned land = 56,767 ha
2000: Total farm area = 77,125 ha; owned land = 58,050 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

In 2009, 44 per cent of the total area of commercial holdings was recorded as being under cereals, with 9 per cent under cash root and oil seed production respectively. Grass and uncropped land represented 23 per cent of the total farmed area. The remaining area is largely used for horticulture. Patterns of land use remain similar to 2000 with a slight decrease in area under cereal (-10 per cent) and cash roots production. Oilseeds have more than doubled over the last decade.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

In 2009 the Mid Norfolk NCA supported an estimated 16,500 cattle, 17,800 sheep and 91,600 pigs. The numbers of sheep and pigs decreased dramatically between 2000 and 2009 with a 40 per cent reduction in sheep recorded and a 25 per cent reduction in pigs during this period.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

There were 938 principal farmers making up 51 per cent of recorded farm labour, with 107 salaried managers and 406 full-time workers in 2009. There was a 10 per cent decrease in farm labour in this NCA over the period 2000 to 2009. The most notable trend was a reduction in the number full-time workers, falling from 609 to 406 during this period.

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

The river valleys contain a variety of intermingled habitats based around their rivers including wet unimproved grassland, drained grassland, arable land on the flood plain, carr woods, scrub and fens. The rivers Wensum and Nar are notified for their range of diverse aquatic plant communities.

Source: East Anglian Plain Natural Area Profile

7.2 Priority habitats

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

Ditch and hedgerow trees near Carbrooke.

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

Priority habitat	Area (ha)	% of NCA
Coastal and flood plain grazing marsh	1,237	1
Fens	833	1
Reedbeds	382	<1
Lowland heathland	259	<1
Lowland meadows	206	<1
Purple moor grass and rush pasture	58	<1
Lowland calcareous grassland	13	<1

Source: Natural England (2011)

Maps showing locations of priority habitats are available at

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

7.3 Key species and assemblages of species

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

8. Settlement and development patterns

8.1 Settlement pattern

The area has relatively few towns, but those that there are, such as East Dereham and Fakenham, form active centres with their own identity. Large villages such as Hingham and Reepham contain more facilities than usual because of their relative isolation. The nucleated pattern of settlement is seen most clearly in the area north of the Wensum, while to the south the settlement pattern consists of a cluster of villages.

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

8.2 Main settlements

The main settlements in Mid Norfolk NCA are; the city of Norwich (south-western quarter), the market town of East Dereham and in the north-west, Fakenham. The total estimated population for this NCA (derived from ONS 2001 census data) is: 169,899.

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

8.3 Local vernacular and building materials

The city of Norwich contains a mix of medieval, Georgian and modern architecture styles. Red brick and frequently black-glazed pantiled farmhouses of the early 18th century are a component of the Norfolk character. Orange and red bricks dominate pre 19th century buildings. The use of light coloured bricks was only widely used, and then mainly in the major towns for example Fakenham and Norwich, following the spread of the rail network in the middle decades of the 19th century. Country houses built during this period, mostly in red brick, but later in white or grey brick, are also typical. Clay lump or clay 'bat' (large blocks of unfired clay and straw which is rendered to make it waterproof), has been commonly used for cottages, some farmhouses and farm buildings dating from the middle of the 19th century. Innate conservatism has ensured that the local vernacular style has been preserved into the 20th century, so there are few examples of later periods.

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

Venacular buildings in Carbrooke.

9. Key historic sites and features

9.1 Origin of historic features

Mid Norfolk is unusually rich in medieval churches, with a particularly notable clutch in the middle of the area, near Reepham. Culturally the area has always looked to Norwich. The Saxon settlement became the major market town for East Anglia and by the Middle Ages was the third largest town in England, after London and York.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 15 Registered Parks and Gardens covering 1,237 ha
- No Registered Battlefields
- 81 Scheduled Monuments
- 1,963 Listed Buildings

Source: Natural England (2010)

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

10. Recreation and access

10.1 Public access

- 0.4 per cent of the NCA or 355 ha is classified as being publically accessible.
- There are 440 km of public rights of way at a density of 0.5 km per km2.
- There is 1 National Trail, the Peddars Way and Norfolk Coast path extending along 15 km within the NCA).

Source: Natural England (2010)

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

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	0	0
Common Land	35	<1
Country Parks	0	0
CROW Access Land (Section 4 and 16)	111	<1
CROW Section 15	2	<1
Village Greens	3	<1
Doorstep Greens	0	0
Forestry Commission Walkers Welcome Grants	25	<1
Local Nature Reserves (LNR)	2	<1
Millennium Greens	0	0
Accessible National Nature Reserves (NNR)	1	<1
Agri-environment Scheme Access	3	<1
Woods for People	152	<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) it appears that the lowest scores for tranquillity are associated with the city of Norwich, and the market towns of East Dereham, Fakenham and Watton. Disturbance can also be seen to be associated with the main transport routes linking these centres; the A47, A1065, A1067 and A1075. The highest scores for tranquillity are within the agricultural land to the north-east of the A1067 as well as to the north and south of Dereham.

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

Category of tranquillity	Score
Highest	38
Lowest	-100
Mean	1

Sources: CPRE (2006)

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

11.2 Intrusion

The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows that disturbance is associated with the 'A' roads that run through the area including the A47, A1065, A1067 and A1075. Intrusion also occurs in and around the city of Norwich and the towns of East Dereham and Fakenham. A breakdown of intrusion values for this NCA is detailed in the following table.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	6	21	31	25
Undisturbed	92	77	66	-26
Urban	2	2	3	1

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are an increase in notably disturbed or intruded land by nearly 25 per cent which is matched by a reduction of around 26 per cent of undisturbed or un-intruded land over the same timescale.

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

Ancient woodland with bluebells in Foxley Wood.

12. Data sources

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

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

Supporting document 2: Landscape change

Recent changes and trends

Trees and woodlands

- Countryside Quality Counts (CQC) data suggests that the woodland resource was enhanced between 1999 and 2003 with an area equivalent to 5 per cent of the 1999 total stock approved for new planting under a Woodland Grant Scheme (WGS) agreement (166 ha), and the proportion of ancient woodland sites covered by a WGS increasing from 18 per cent to 39 per cent.

- Overgrazing of woodland through expansion of deer populations, invasion of ancient woodlands by non-native species (especially rhododendron), the cessation of traditional management practices and the loss of oak through sudden oak death are all thought to have led to a recent reduction in structural diversity in Norfolk woodlands.[4]

- Around 1 per cent of the NCA is covered in coniferous woodland. Replacement of native trees with planted conifers occurred mainly in the 1960s and 1970s. While this threat has receded large scale felling and modification of the composition of woodland, by intensive replanting, even of native broadleaved species, may still be contributing to the impoverishment of diversity in some woods.

Boundary features

- Hedgerow and hedgerow tree loss was locally severe in the late 20th century but this trend now appears to have stabilised, although further positive management to address the continuing hedgerow removal would bring further benefits.

- Dutch elm disease in the 1970s and, more recently, premature die-back of other tree species have caused significant losses of mature trees in boundary features.

- Between 1999 and 2003 Countryside Stewardship agreements for linear features included fencing (95 km), hedge management (55 km), hedge planting and restoration (128 km), restored boundary protection (15 km). Total length of agreements between 1999 and 2003 is equivalent to about 7 per cent of the total boundary length.

- There are currently approximately 317 km of ditch, 0.5 km of earth banks, 2,000 km of hedgerow and 0.4 km of woodland boundary features in the NCA.

[4] Norfolk Biodiversity Action Plan – Lowland Mixed Deciduous Woodland, Norfolk County Council (2006; URL: www.norfolkbiodiversity.org/actionplans/habitatactionplans/lowlandmixed.aspx)

Agriculture

- There has been a slight decrease in the total area of land under cereal production (-5 per cent) and cash root crops (-4 per cent) between 2000 and 2009, with oilseed production increasing from 4 per cent of the total area to 9 per cent.

- There has been a dramatic reduction in livestock numbers in the NCA with a decrease in cattle of 12 per cent, sheep of 41 per cent and the most numerous livestock, pigs, have decreased by 25 per cent (30,700).

- Countryside Stewardship uptake for annual area features is consistently above national average, with the most extensive annual agreements in 2003 for lowland pastures on neutral/acid soils (715 ha) and regeneration of grassland/semi-natural vegetation (619 ha).

Pigs, with adjacent belt of poplars providing shelter for them.

Settlement and development

- There is limited development across the NCA, but there are some concentrations which are locally significant to the west of Norwich, and around East Dereham and more generally north of the A1067 between Foulsham, Hindolveston and Corpusty.

- Norwich is the major growth point for Norfolk and there is likely to be significant development in this area. Developments would be associated with the infrastructure provided by main roads, and are likely to have considerable impact on the NCA both directly through actual housing development, and indirectly through increases in traffic and demands on resources, especially water.

Semi-natural habitat

- The most extensive annual Countryside Stewardship agreements in 2003 were for lowland pastures on neutral/acid soils (715 ha) and regeneration of grassland/semi-natural vegetation (619 ha).

- The loss of heathland to arable cultivation and conifer plantation in the early to mid 20th century has been significant within this area. There is a need for restoration and re-creation of heathland, to connect and support existing heathland habitats, and opportunities to manage remnant heathland through appropriate grazing. In 2003 Countryside Stewardship annual agreements included re-creating heath (27 ha) and enhancing existing lowland heath (18 ha).

- A whole river restoration project is currently under way in the Wensum (see 'Coast and rivers' below).

Historic features

- CQC data suggests that there is a future need for restoration of historic parklands. Countryside Stewardship coverage for management of historic landscapes cover about 20 ha. Around 33 per cent of the remaining parkland is covered by a Historic Parkland Grant, and about 33 per cent is included within an agri-environment scheme. About 72 per cent of historic farm buildings remain unconverted and around 94 per cent are intact structurally. Developments are likely to impact on the historic environment.

Coast and rivers

- In 2003 Countryside Stewardship annual agreements included restoration or conservation of fen, reedbed and carr (18 ha) and Environmental Stewardship agreements included those for river valley grass (50 ha).

- The ecological condition of the River Wensum (SAC, SSSI) declined at four out of five survey sites between 1980 and 2002, and the river was assessed as being in unfavourable condition due to water quality, siltation and physical modification issues. A whole river restoration strategy is currently under way to restore a more natural measure of hydrological functioning so it can sustain characteristic wildlife and fisheries.[5]

- There has been a loss of traditional, historic contrast between uplands and river valleys due to poplar plantations on valley floors and loss of wet woodland habitat due to restocking with poplar trees, both of which have impacted on valley character.

Minerals

- The NCA is a significant minerals (sands and gravels) producing area due to its superficial geology deposits with the main sites being to the north-west of Dereham.

- The distribution of new mineral extraction facilities in Norfolk will be aligned with growth and regeneration areas, due to the increased need to supply local aggregates for growth-related infrastructure.

- All new mineral workings will be covered by progressive restoration schemes and the enhancement of Norfolk's biodiversity and geodiversity and the creation of new, high-quality distinctive landscapes will be strongly supported.[6]

- Currently active mineral sites near Dereham have restoration plans mainly for agricultural land (129 ha) and also lake and woodland at Bittering (21 ha) and woodland at Beetley (11 ha). Sites near Norwich are due to be restored to amenity grassland (24 ha) and conservation grassland and woodland (12.5 ha) at Easton, and housing at Costessey (12 ha).[7]

[5] River Wensum restoration strategy, Natural England (2009)
[6] Norfolk Minerals and Waste Local Development Framework. Core Strategy and Minerals and Waste Development management Policies Development Plan Document 2010–2026, Norfolk County Council (2011)
[7] Nature After Minerals website (accessed 17 January 2014; URL: http://afterminerals.com/index.aspx)

Drivers of change

Climate change

- Climate change is likely to result in warmer, wetter winters and hotter, dryer summers in the east of England. This could increase the length of the growing season but also cause increased drought stress which may necessitate changes to agricultural crops.
- Increased droughts during summer months would impact on water availability, affecting spray irrigation of crops, public water supplies and wetland habitats. Reduced flows in the NCA's important river systems would adversely affect their biodiversity.
- Increasing storm events and increased seasonality of rainfall may impact on river and wetland systems in the NCA with greater flood risk in areas of Norwich and along river corridors.
- Agricultural land is at risk from soil erosion and nutrient loss as the soil becomes more susceptible to wind erosion in the predicted hotter and drier periods and water erosion in the wetter, colder periods.
- Climate change may result in changes in the species composition of semi-natural habitats with a general northward movement of species. It will therefore be important to ensure connectivity between fragmented habitats to facilitate this northern migration.
- Heathland habitats and valley mire systems would be susceptible to increasing periods of drought with possible change in species composition as a consequence.
- A change in species composition may occur in woodlands as drought tolerant trees from southern Europe, such as the Holm oak, out-compete native species. In addition climate change may make trees more vulnerable to disease such as ash dieback and sudden oak death.

Other key drivers

- Major new development and associated infrastructure is likely to have considerable impact on the NCA both directly through actual housing development and indirectly through increases in traffic and demands on resources, especially water and minerals.
- New mineral sites will be needed to meet the demands of development. The restoration of mineral and waste sites offers opportunities to enhance biodiversity and geodiversity and the character of the landscape.
- The creation of areas of greenspace and planting broadleaved woodland as part of new developments may help to reduce their impact while providing new sites for recreation, improvements to biodiversity and linkages for fragmented habitats.
- Greater demands on agriculture to produce higher yields could put pressure on the remaining areas of semi-natural grassland and other semi-natural habitats. It may also lead to deterioration in water quality, through the run-off of soil nutrients and increased use of herbicides and pesticides.

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.

Expansive arable fields and plantation woods, south of Fakenham.

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: Work with the local farming community to safeguard future food production, while conserving and enhancing the traditional rural character, long views and strong sense of tranquillity in this area of long-settled, ancient countryside. Manage and enhance farmland habitats – including hedgerows and woodland, field margins and pastoral river corridors – to enhance the area for farmland species (including pollinators), improve water quality and availability in the rivers and aquifer, manage soil erosion and quality, and address the impacts of climate change.	↗ **	↑ **	↗ **	n/a	↗ *	↗ **	↑ ***	↗ *	↑ ***	↑ ***	↑ ***	↑ **	n/a	↗ **	↔ **	↗ *	↔ **	↗ **	↗ **
SEO 2: Maintain, enhance and restore priority habitats including woodlands, areas of remnant heathland, and the nationally and internationally important Norfolk Valley Fens and chalk river systems (including the River Wensum), and seek opportunities to connect fragmented sites, improving the area for biodiversity, geodiversity and recreation, and enhancing landscape character and resilience to climate change.	↔ **	↘ *	↔ **	n/a	↘ **	↗ ***	↗ ***	↗ **	↔ *	↗ **	↑ ***	↗ **	n/a	↗ ***	↔ **	↑ **	↗ **	↑ ***	↔ **
SEO 3: Encourage a sympathetic approach to development that maintains traditional Norfolk character and improves sustainable recreational use, while protecting historic assets, geodiversity and biodiversity.	↔ **	↗ **	↔ *	n/a	↗ *	↗ *	↗ **	↗ *	↔ **	↔ **	↔ **	↔ **	n/a	↗ **	↗ **	↗ *	↑ ***	↗ **	↔ *

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

National Importance; Regional Importance; Local Importance

Landscape attributes

Landscape attribute	Justification for selection
Gently undulating to flat terrain with variable glacial soils, dissected by wide river valleys.	■ Wide open views with wooded horizons and big skies. ■ Gravels, sands, reworked chalk and glacial till were deposited by the ice of Anglian glaciations. ■ Varied land cover is a reflection of mixed glacial soils, which determine natural vegetation patterns. ■ Sediment deposits provide an archive of information on the environmental and climatic history of the area. ■ Mineral extraction of glacial deposits mainly occurs to the south of Holt and towards Norwich.
Ancient countryside with a long-settled agricultural character.	■ A sporadically rationalised patchwork field system, sinuous lanes and mixed hedges with hedgerow oaks. ■ Predominately arable land use. ■ Land use patterns have remained relative unchanged from the 14th century until 20th-century rationalisation resulted in larger fields and the removal of hedgerows in some areas. ■ High levels of tranquillity are found away from main roads. ■ Hedgerows and set-aside in arable land provide important refuges for wildlife and link fragmented semi-natural habitats.
Relatively well-wooded landscape.	■ Relatively well-wooded landscape with a variety of woodland types with ancient woodland largely confined to small isolated pockets. ■ The loss of traditional coppice management has reduced structural diversity of woodlands. ■ Areas of ancient woodland have been supplemented with plantations of broadleaved and conifers. ■ Poplar plantations have altered the traditional landscape on river valley floors.
Important areas of remnant heathland.	■ Heathland was historically more extensive but important remnant habitat still remains. ■ Species-rich valley mire systems are associated with heathland areas. ■ Heathland is particularly associated with river valley corridors.
Important chalk rivers and tranquil river valleys.	■ The River Wensum SAC is one of the most important chalk rivers in Britain. ■ River valleys support an important mosaic of wetland, woodland and grassland habitats and species. ■ Tranquillity is generally high in river valleys.
Historic settlement pattern with traditional building vernacular and materials and numerous prominent churches.	■ A historic pattern of interspersed villages and isolated farmhouses within complex minor road network, with a traditional pattern of market towns including East Dereham and Fakenham. ■ A cohesive 17th- and 18th-century vernacular architecture has preserved into the 20th century. ■ Distinctive red brick and flint buildings with pantiled roofs are an inherent component of Norfolk character. ■ Unusually rich density of medieval churches which are prominent features of the flat landscape.
Large number of 18th-century estates with their associated parkland.	■ Medieval manors formed the basis of 17th- and 18th-century country house estates of various sizes. ■ Many estates have accompanying parkland and frequently have their own church and village, such as at Heydon.

Landscape opportunities

- Protect the historic enclosed field pattern, with its characteristic winding lanes and boundary hedges, from agricultural rationalisation.
- Manage and enhance existing arable farmland for wildlife by reinstating hedgerows, increasing areas of set aside and adopting wildlife-friendly land management practices.
- Manage and enhance woodlands through replacing conifer and poplar plantations with native tree species, re-introducing traditional coppice management creating new woodlands and connecting fragmented habitats.
- Manage and enhance heathland habitats, restoring remnant areas and connecting fragmented habitats.
- Manage chalk rivers to improve biodiversity and geodiversity by restoring a naturally functioning system where possible, removing obstructions and barriers and reconnecting rivers to their flood plain.
- Protect the historic settlement pattern by ensuring that new development maintains traditional character, building vernacular and materials.
- Protect historic farmsteads, traditional farm buildings and the numerous prominent churches that form distinctive landmarks in the landscape.
- Protect 18th-century estates and parkland from development and enhance their wildlife and recreational value.
- Plan green infrastructure including areas of broadleaved woodland to screen new developments, improving biodiversity, recreational opportunities and making a positive contribution to climate change.
- Plan strategic and local networks of sustainable transport and public access linkages to improve recreational opportunities and mitigate for increased visitor pressure.

Snipe hunting for invertebrates in well-vegetated wetland.

Ecosystem service analysis

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Extensive arable farmland Fertile soils	Extensive areas of high quality arable farmland. Over 81 per cent (74,028 ha) of the NCA is under agricultural management, predominately for arable cultivation. Cereals crops dominate, with some cash root crops and oilseed production. Grass and uncropped land represent 23 per cent of the farmed area. The remainder is largely used for horticulture. Pigs are the most common livestock in the NCA. Numbers of all livestock have declined in the last decade with a 40 per cent decrease in sheep numbers, 25 per cent in pigs and 12 per cent in cattle. Predominately Grade 3 soils.	National	The NCA is a rich and productive agricultural area that is a major producer of arable crops, including wheat, potatoes and sugar beet, which are sown on rotation with break crops of barley and oil seed rape. The high quality of the arable land has tended to restrict animal husbandry. There are increasing pressures in the agricultural landscape on water availability, water quality, soil quality and erosion. Sustainable land management practices will help to address these issues while maintaining, and potentially enhancing yield.	Work with the local farming community to safeguard future food production while enhancing key ecosystem services such as biodiversity, water quality, water availability, soil erosion and quality and pollination services, and addressing climate change. Manage the agricultural landscape in a sustainable way to improve long-term viability of agriculture and yields, while protecting the natural assets of the area.	**Food provision** **Biodiversity** **Geodiversity** **Sense of place/ inspiration** **Regulating soil erosion** **Regulating water quality** **Pollination**
Timber provision	Existing woodland Hedgerows	The existing woodland cover (just over 4 per cent) is mostly associated with woodland found along the river valleys, although there are also some large plateau woodlands on higher land, for example, those at Hockering, Foxley and Bintree. The NCA has little commercial timber production. Poplar plantations are a feature of river valley floors. Some areas of the NCA are densely planted with hedgerows and hedgerow oaks.	Local	Semi-natural ancient woodland within the NCA is generally confined to isolated small pockets. Planting additional areas of broadleaved woodland linking these areas could address this habitat fragmentation, improve biodiversity and increase carbon storage, and if sustainably managed could provide a source of timber. There is scope within the NCA to reinstate hedgerows and hedgerow trees, including boundary oaks, which would help to strengthen landscape character. Management of hedgerows could provide a source of local wood fuel. Areas of poplar plantation in river valleys could be restocked with native wet woodland to improve the biodiversity value of river flood plains. There is also some scope for mixed deciduous planting on valley sides. This would provide limited scope for timber production.	Maintain and enhance areas of ancient semi-natural woodland and plant new areas of broadleaved woodland to address fragmentation and provide sustainable sources of timber. Strengthen the characteristic hedgerow network by protecting, managing and reinstating hedgerows and hedgerow trees. Increase the biodiversity of river valleys by restocking poplar plantations with native wet woodland.	**Timber provision** **Biomass energy** **Tranquillity** **Sense of place / inspiration** **Biodiversity** **Climate regulation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Rivers Chalk aquifer Geomorphology	The main rivers in the NCA are the Nar, Yare, Wissey, Wensum and Tud. There is a principal chalk aquifer underlying the NCA which covers a large area of the East Anglian Plain and therefore also supplies water to adjoining NCAs. Abstraction is mainly for public water supply, agriculture (including spray irrigation) and in the Nar for fish farming. The River Nar has an 'over-abstracted' Catchment Abstraction Management Strategy (CAMS) status although there is some water available for licensing at high flows.[8] The rivers Yare, Wensum and Tud have no water available for licensing at low flows but some available at medium to high flows.[9] The River Wissey only has water available for licensing at high flows.[10] There is no groundwater available for licensing in the west of the NCA (rivers Nar and Wissey). In the Broadland CAMS the status of the surface waterbody also applies to the groundwater (aquifer) status.	Regional	Water within the NCA is extensively abstracted for public water supply and for spray irrigation of agricultural crops. There are increasing demands for water abstraction and this is set to increase due to new development, especially in the area towards Norwich, and in response to climate change. Integrated management of the water resource, including rivers and the underlying aquifer, including the adoption of measures to improve aquifer recharge and targeted drainage management to increase water availability in periods of low rainfall, would ensure future water supplies for public use and agriculture. Restoring and creating new areas of wetland habitats including wet grassland, fen and carr habitats would aid recharge of the underlying aquifer, contributing to the amount of water available for use. The River Wensum SAC is one of the most important chalk river habitats in the country and the Nar (SSSI) is also designated for its chalk river features. The Yare, Wensum and Tud provide a main source of freshwater for the Broads (Ramsar, SPA and SAC). Sustainable management of water in the NCA would ensure that river flows and aquifer levels are maintained at levels necessary to sustain the geomorphological and ecological interest of river systems and associated wetland habitats.	Seek, where possible, to increase the water retention ability of soil, and reduce the rate of water loss from the area through the establishment of rough vegetation and targeted drainage management to increase water availability in periods of low rainfall. Work with abstraction licence holders to develop options to improve sustainability of the water resource. Promote integrated water management to slow run-off and increase infiltration to aquifers (reduce soil compaction, increase soil organic matter, create semi-natural habitats adjacent to watercourses on agricultural land) and targeted drainage management where possible to increase water availability in periods of low rainfall. Restore and create new areas of wetland habitats, including wet grassland, fen and carr, to aid aquifer recharge. Ensure that the freshwater resource for internationally important river and wetland habitats is protected through the management of water abstraction levels, and through sustainable land and water management.	**Water availability** **Geodiversity** **Regulating water quality** **Regulating soil quality** **Biodiversity** **Sense of place/ inspiration** **Regulating soil erosion**
Genetic diversity	n/a	n/a	n/a	n/a	n/a	**n/a**

[8] The North West Norfolk Abstraction Licensing Strategy, Environment Agency (2013)
[9] The Broadland Abstraction Licensing Strategy, Environment Agency (2013)
[10] The Cam and Ely Ouse Abstraction Licensing Strategy, Environment Agency (2013)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biomass energy	Woodland Limited commercial timber production	The NCA has an existing woodland cover of 4 per cent and limited commercial timber production. Generally the potential short rotation coppice (SRC) yield in the NCA is medium, although there is an area with low potential yield to the south of Norwich. The potential miscanthus yield in the NCA is high.	Local	There is some potential for biomass production by bringing unmanaged and undermanaged woodlands back under management and as a by-product of the limited commercial timber production and hedgerow management. The NCA offers opportunity for SRC and miscanthus in most areas apart from river valley floors. Care should be taken to avoid adverse impacts on the existing landscape including obscuring characteristic hedgerow and field patterns. SRC may offer opportunities to extend and connect existing woodlands and soften the boundaries of new settlements.	Bring local woodlands into traditional coppice management, generating a local supply of biomass. Similarly the arisings from hedgebank management could supply a local demand for biomass. Opportunities to plant SRC, in association with existing woodland and new development, and miscanthus should be investigated, taking care to ensure no adverse impacts on existing landscape character.	**Biomass energy** **Climate regulation** **Tranquillity**
Climate regulation	Peaty and alluvial soils River valleys Wetland, heathland and woodland habitats	The mineral soils over most of the NCA have a low carbon content (0–5 per cent) especially where they have been under continuous cultivation. There are small pockets of soil with a high carbon content (5–20 per cent) associated with the peat and alluvial soils, and wetland habitats of the numerous small tributary valleys of the rivers Yare, Nar, Wissey and Wensum. Carbon storage and sequestration will also be associated with the limited woodland cover of the NCA (covering just over 4 per cent) and with the carbon-rich soils beneath the remnant areas of lowland heathland.	Local	Carbon sequestration and storage can be increased in soils with low carbon content by increasing organic matter content and by reducing the frequency and area of cultivation. Organic topsoils, found in wetland habitat and areas of lowland heathland and woodland, are important to conserve, due to their high levels of carbon storage and sequestration. Reinstating and creating new wetland habitat in areas such as the Wensum Valley could enhance the organic content of associated soils. Sustainable management of the freshwater resource across the NCA is needed to ensure the future of its wetland and river habitats in the face of increasing pressure. There may be the potential for increasing carbon sequestration by planting new broadleaved woodland, by reinstating and creating hedgerows, and by restoring areas of heathland. Creating new areas of semi-natural habit within the NCA, including hedgerows, field margins and hedgerows, and re-naturalising river valleys would link fragmented habitats and provide wildlife corridors enabling species to move in response to climate change.	Work with land managers to increase organic matter in soils through management interventions including the use of grass leys, introducing fallow into rotations and over-winter stubbles where possible, using agricultural stewardship schemes. Conserve areas with high organic content in soils, including wetlands, heathland and woodland. Maintain, enhance and create new areas of freshwater wetland habitat, and sustainably manage the freshwater resource to ensure its future sustainability. Plant sustainably managed broadleaved woodland and reinstate and create new hedgerows where feasible. Maintain and enhance existing areas of heathland, and restore heathland habitat where possible. Seek opportunities to link fragmented habitats with other semi-natural habitats to enable species to move in response to climate change.	**Climate regulation** **Biodiversity** **Regulating soil quality** **Regulating soil erosion** **Regulating water quality** **Timber provision** **Sense of place / inspiration** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Rivers Chalk aquifer Semi-natural habitat	The NCA has mostly poor water quality. The River Wensum generally has 'bad' ecological status with some tributaries showing 'moderate' ecological potential and 'poor' status. The Nar and Tud have 'moderate' ecological potential and the Wissey has 'poor' ecological status. The Yare has 'moderate' and 'good' status close to its source but falls to 'poor' closer to Norwich. The surface water chemical status of the River Wensum is 'failing to achieve good' quality (this is the only main river in the NCA that has been tested for its surface water chemical status). The groundwater chemical status across the majority of the NCA is also 'poor'.[11] There are five priority catchments under the England Catchment Sensitive Farming Project in the NCA; the Yare, the Little Ouse (Thetford Ouse), the Nar, the Wensum and a small section of the Bure, Ant and Muckfleet. The main causes of the poor status of many of the NCA's rivers have been identified as; diffuse pollution from agriculture (resulting in high nitrate and phosphate levels), sedimentation, point source pollution from sewage treatment works and industry, over-abstraction, invasive species and physical modification of river systems.	Regional	Catchment Sensitive Farming schemes are working with farmers to adopt land management practices to improve water quality by reducing pollution from agricultural sources and reducing sedimentation of rivers from soil erosion. Enhancing semi-natural habitats adjacent to watercourses, including woodland on valley slopes, hedgerows in arable land, and grassland and riparian habitats on valley floors, would improve water quality through capturing sediment run-off before it reaches river systems. There is some point source pollution from sewage treatment works and industry and diffuse pollution through run-off in urban areas. Encouraging the adoption of best practice measures to reduce pollution incidents and the use of sustainable urban drainage systems (SUDS) would reduce risks of contamination of the water resource. Development within the NCA is likely to increase pressures on the water environment, and increase potential sources of pollution, especially in more urban areas towards Norwich, but there is potential to mitigate for this by including measures to ensure the sustainable management of water resources. Invasive species, including signal crayfish and pennywort are present in a number of the NCA's rivers. Measures should be adopted to avoid the spread of invasives to areas where they are not present, and to remove them for the river environment where possible. Physical modifications to rivers contribute to the poor ecological status or potential in the NCA, for example by acting as barriers to fish passage, including breeding brown trout and eels, on rivers including the Glaven, Stiffkey and Nar. Removing or modifying these barriers to allow fish passage would contribute to the ecological health of the NCA's river systems.	Work with farmers to reduce sources of nitrate leaching to groundwater and run-off to surface waters by promoting the adoption of best practice measures, including the more efficient use of organic manures and fertilisers. Work with farmers to reduce the loss of sediment, and associated phosphates from agricultural land through appropriate changes in land management, including the use of buffer strips adjacent to watercourses. Maintain and enhance semi-natural habitats adjacent to watercourses and along river valley slopes to reduce sediment run-off. Ensure local development plans include the sustainable management of water resources and promote measures to reduce adverse impacts on water quality in the future, including the use of sustainable urban drainage systems, sewage treatment options and reducing nutrients from diffuse pollution. Raise awareness of the problem of invasive species and adopt appropriate management for their control. Modify or remove barriers on river systems, where possible, to allow migrating fish passage.	**Regulating water quality** **Regulating water flow** **Biodiversity** **Regulating soil erosion** **Geodiversity**

[11] River Basin Management Plan: Anglian River Basin District, Environment Agency (2009)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Rivers and river flood plains Operation of natural processes Wetland habitats including wet grassland, fen and carr	There is a long history of river flooding in parts of the NCA associated mainly with the rivers Yare and Wensum when heavy rainfall or melting snow has resulted in high water levels in the river channels. In the past many thousands of properties have flooded in Norwich, with notable events in 1878 and 1912 and more recently in 1992. High concentrations of impermeable surfaces within the city also increase the risk of surface water flooding. Currently flood protection is offered by flood walls which are in good condition and which will continue to be maintained.[12] There is a risk of flooding in the village of Necton from the River Wissey[13] but for the majority of the remaining areas in the NCA the risk of fluvial flooding is generally low.	Local	The main approach to managing future flood risk in Norwich will be to investigate opportunities for increasing flood storage upstream of the city along the River Wensum corridor by maximising the potential of the flood plain to retain water at the same time as re-naturalising the river course and its habitats, while limiting flooding in settlements including Fakenham, Worthing, Lyng and Lenwade. There is considerable potential to reinstate the wet grassland, fen and carr habitats of the Wensum's upper catchment (which would also aid recharge of the underlying aquifer). Where flood risk is generally low the proposed approach is to investigate options to cease or reduce current maintenance of channels, banks and flood defences so as to increase the natural flow of water between the rivers and their flood plains, offering the potential for the recreation of valuable wetland habitats as part of wider flood alleviation proposals.	Investigate the most appropriate options and locations for flood plain storage in the River Wensum flood plain. Restore wet grassland, fen and carr habitats in the Wensum river corridor (SAC, SSSI). Recreate wetland habitats to reduce flood risk, where appropriate, as part of flood alleviation proposals. Investigate opportunities to re-naturalise river systems by removing structures and reconnecting rivers to their natural flood plains.	**Regulating water flow** **Biodiversity** **Sense of place / inspiration** **Geodiversity**

[12] Broadland Rivers Catchment Flood Management Plan. Summary Report, Environment Agency (2009)
[13] Great Ouse Catchment Flood Management Plan. Summary Report, Environment Agency (2009)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Freely draining soils Soils with impeded drainage	There are six main soilscape types in this NCA: Slightly acid loamy and clayey soils with impeded drainage (43 per cent of NCA) are the most fertile and are typically found in and around the river valleys. ■ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (29 per cent). ■ Loamy and sandy soils with naturally high groundwater and a peaty surface (10 per cent). ■ Freely draining slightly acid loamy soils (8 per cent) ■ Freely draining slightly acid sandy soils (7 per cent). ■ Shallow lime-rich soils over chalk (2 per cent). The main causes of the poor status of many of the NCA's rivers have been identified as; diffuse pollution from agriculture (resulting in high nitrate and phosphate levels), sedimentation, point source pollution from sewage treatment works and industry, over-abstraction, invasive species and physical modification of river systems.	Local	The slightly acid loamy and clayey soils with impeded drainage and the slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils are easily damaged through poaching by livestock and compaction by machinery when the soil is wet. In turn this may lead to increasingly poor water infiltration and diffuse pollution as a result of surface water run-off. Management measures that increase organic matter levels and careful timing of activities can help reduce these problems. The loamy and sandy soils with naturally high groundwater and a peaty surface are at risk of continuing organic matter loss where drained and cultivated, and may suffer from topsoil loss as a result of wind erosion. Some soils may be locally prone to extreme acidity. Many of these soils are thin remnants of former peat coverings which have oxidised away as a result of drainage and cultivation. Changing management practices to reduce damage to soil quality could provide increases in food production in the long term. Increases in soil quality will reduce negative impacts from farming on the natural environment through reduction in run-off pollution; this will improve water quality and biodiversity.	Reduce soil compaction by careful timing of activities, including reducing unnecessary machinery use in wet conditions. Work with the farming community to ensure best practice in soil management to improve structure and quality of soils. Increase organic matter in soils through management interventions including the use of grass leys, introducing fallow into rotations and over-winter stubbles	**Regulating soil quality** **Regulating soil erosion** **Food provision** **Biodiversity** **Geodiversity** **Regulating water quality**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Soils under agricultural management	The majority of soils in this NCA (70 per cent) are at risk of soil erosion. The slightly acid loamy and clayey soils with impeded drainage (43 per cent of the NCA) are prone to compaction and capping/slaking, leading to increased risk of erosion by surface water run-off, especially on steeper slopes. The freely draining slightly acid soils (15 per cent) and the shallow lime-rich soils over chalk (2 per cent) have enhanced risk of erosion on moderately or steeply sloping land from surface water run-off where cultivated or bare soil is exposed, particularly along footpaths and tracks or as a result of outdoor pig rearing. There is the potential for wind erosion on some coarse textured cultivated variants of these soils, which is also a characteristic of loamy and sandy soils with naturally high groundwater and a peaty surface (10 per cent) which may also suffer from peat wastage.	Regional	There are parts of four priority catchments under the England Catchment Sensitive Farming Project covering this NCA which all identify soil erosion as a particular issue. Soil erosion is particularly associated with run-off on steep slopes and with vulnerable soils under agricultural management, and is exacerbated where organic matter levels are low after continuous arable cultivation or where soils are compacted. There is a high risk of erosion of soils where the timing of operations results in land being left bare during periods of high rainfall, for example with high risk crops including spring sown cereals, field vegetables, sugar beet, maize and potatoes, and outdoor pig rearing and poultry farming. Buffer strips along watercourses and the recreation of natural flood plain habitats would help reduce erosion by capturing sediment run-off. Cattle poaching on the banks of rivers is a particular problem in some areas including the River Nar. In the south-west of the NCA, soil erosion is associated with steep slopes and light soils and areas of heavier soils under maize and root cropping in the headwaters of the Wissey, while sand blows can occur when soils are dry and there is a lack of crop cover. Wind erosion of soils can be reduced by planting hedgerows in areas at high risk.	Work with farmers to increase organic matter in soils through promoting management interventions including the use of grass leys, introducing fallow into rotations and over-winter stubbles. Reduce soil compaction by encouraging the careful timing of land management activities, including reducing unnecessary machinery use in wet conditions. Create buffer strips adjacent to watercourses and where possible recreate natural flood plain habitat. Plant hedgerow boundaries where appropriate to protect soil against wind erosion.	**Regulating soil erosion** **Regulating water quality** **Food provision** **Biodiversity** **Geodiversity** **Regulating water quality**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Lowland meadow and heathland habitats Field margins Hedgerow banks	The NCA contains small areas of lowland meadow and lowland heathland habitats which support a variety of nectar sources. Field margins and hedgerow banks in agricultural land provide important foraging sources for pollinator species.	Local	The NCA contains large areas of agricultural land with some food crops which are dependent on insect pollination, and its semi-natural habitats provide an important refuge for pollinator species. Pollen and nectar margins on arable farms (through agri-environment schemes) can provide important foraging habitat for pollinators. These should be increased where possible. Hedgerow banks can be managed to provide important nectar sources and may act as wildlife corridors between semi-natural habitats.	Maintain and enhance the floristic diversity of lowland meadow and lowland heathland, and other semi-natural habitats, to increase the area of habitat suitable for pollinators. Work with the farming community to encourage sympathetic management for pollinator species and to increase the areas of pollen and nectar margins on arable farms. Maintain and enhance the floristic diversity of hedgerow banks, where possible, to increase nectar sources and provide corridors between semi-natural habitats.	**Pollination** **Biodiversity** **Food provision** **Sense of place/ inspiration**
Pest regulation	Semi-natural habitats Field margins	Semi-natural habitats adjacent to arable farmland support populations of pest regulating invertebrate, bird and mammal species.	Local	Increasing diversity in species and structure of field margins will increase the ability for these areas to support populations of pest regulating species. There may be opportunities to improve the network of semi-natural habitats across the NCA through appropriate management of existing habitats and creation of new habitat.	Seek opportunities to increase field margins, species-rich hedgerows and beetle banks to encourage a network of habitats for pest regulating species close to areas of agricultural production. Manage semi-natural habitats to increase diversity of structure and composition and increase populations of pest regulating species.	**Pest regulation** **Pollination** **Biodiversity** **Food provision**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Long-established rural character Historic settlement patterns, local vernacular and traditional building materials Isolated towns and villages Gently undulating arable land Woodland and river valleys Prominent medieval churches Country estates and parklands	Senses of inspiration and escapism are likely to be particularly associated with the undeveloped river valleys, the remaining areas of parkland, and the more remote villages of traditional vernacular with views to medieval church towers, as well as with Norwich to the east with its cathedral and the Norwich School of artists of whom Crome and Cotman are perhaps the best-known exponents. Sense of place is provided by the long tradition of agriculture and a settlement pattern that is based around small market towns including East Dereham and Fakenham. Variety in the landscape comes from the contrast between the traditional small-scale fields bounded by hedgerows and narrow lanes more commonly associated with the wide pastoral river valleys and the modern larger fields associated with the dominant arable land use of the rolling farmland. Remnants of parkland on 18th-century estates and blocks of mixed deciduous woodland on valley sides contrast with the otherwise predominantly un-wooded landscape. The area has relatively few towns and large villages, which form active centres with their own identity because of their relative isolation. This nucleated pattern is seen most clearly in the area north of the Wensum, while to the south the settlement pattern consists of clusters of villages. Mid Norfolk is unusually rich in medieval churches, including notable examples at Salle and Booton, which dominate the landscape. The red brick, unknapped flint and frequently black glazed pantiled farmhouses of the early 18th century are another quintessential component of the character of the NCA.	Regional	The overriding character of the landscape is provided by its traditional agricultural landscape and settlement pattern. Intensification of farming activities and increasing pressures from development, including increases in traffic, may adversely affect the agricultural landscape. Restoring and enhancing semi-natural habitats within the NCA, especially woodlands and river valley systems would strengthen character. Conserving country houses and their parkland estates will retain their contribution to sense of place and inspiration while providing recreational and tourism opportunities.	Ensure development plans are sensitive to preserving the traditional character of the landscape and promote the use of traditional vernacular and building materials. Restore and enhance semi-natural habitats. Conserve country houses and parkland estates, and encourage their use as a recreational and tourist attraction, while maintaining their biodiversity value.	**Sense of place / inspiration** **Tranquillity** **Sense of history** **Biodiversity** **Recreation** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Mixed medieval settlement pattern Medieval churches Farmsteads and traditional farm buildings Traditional vernacular and building materials 17th- and 18th-century estates and parklands	The history of the landscape can be reconstructed from its underlying geodiversity. The mixed medieval settlement pattern of dispersed hamlets, villages, farmsteads, manor complexes and country house estates and a few market towns, with Norwich to the east providing the historical associations likely to be most evident to the general public, with its cathedral, castle, walls and towers, parish churches and mix of medieval, Georgian and modern architecture. Other particularly prominent historical associations are provided by the rich concentration of medieval churches that dominate the flatter landscapes, where it is often possible to see two or three towers from one location, as well as the traditional 18th-century red brick farmhouses and the remnants of 18th-century parkland and country houses of medium-sized estates.	Regional	Development throughout the NCA could negatively impact on the sense of history through altering the settlement pattern. Development is likely to occur close to existing centres of population, expanding market towns and resulting in the loss of some of their historic character. The use of traditional building materials in new buildings may help to retain landscape character. The conversion of traditional farm buildings to housing is occurring in the NCA. Conserving country houses and their parkland estates will retain historic character while providing recreational and tourism opportunities.	Ensure development plans consider the conservation of historic character of the landscape and promote the use of traditional vernacular and building materials. Conserve country houses and parkland estates, and encourage their use as a recreational and tourist attraction, while maintaining their biodiversity value. Ensure the protection of heritage assets, including medieval churches and the historic features of Norwich, while seeking opportunities to enhance interpretation and, where appropriate, improve access.	**Sense of history** **Sense of place/ inspiration** **Geodiversity** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Agricultural land River valleys Parkland Remote villages	This NCA encompasses some of the less tranquil areas in Norfolk, notably around Norwich to the east and the surrounding dormitory settlements, as well as Fakenham, East Dereham and Watton and the road network linking these settlements. The landscape away from the roads and settlements experiences higher levels of tranquillity, although slightly less so than much of the rest of the county due to the relative higher density of settlement, especially towards Norwich. Overall around 66 per cent of the NCA is classified as 'undisturbed', representing a decline from 92 per cent in the 1960s.	local	High levels of tranquillity in the NCA are predominantly in evidence due to the large areas of agricultural land, but are also particularly associated with the undeveloped river valleys, parklands and the more remote villages and hamlets. River valley habitats should be maintained and where appropriate enhanced and extended to increase tranquillity levels, and parklands and remote villages should be protected from the intrusive effects of development, including increased light levels and road traffic. Long term, the tranquillity throughout the NCA may be compromised by increases in road traffic (traffic levels are projected to increase by 30 per cent by 2015) and development, particularly close to the main centres of population. Using semi-natural habitats, for example broadleaved woodland, to buffer new developments may help to retain tranquillity levels. Increases in road traffic, particularly during peak holiday season, has a significant impact on tranquillity. Improving sustainable transport and promoting its use, for example bus and cycle routes may help to reduce these impacts.	Protect, enhance and where feasible extend tranquil river valley habitats and parklands. Minimise the effects of new development by avoiding areas with high tranquillity, incorporating green infrastructure and woodland buffers, and minimising new sources of light pollution. Improve and promote the use of sustainable transport, including the bus network, cycling and footpath routes.	**Tranquillity** **Biodiversity** **Sense of place/ inspiration** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Public rights of way Mid-Norfolk Railway NNRs Angling	The NCA has around 440 km of rights of way (at a density of 0.48 km per km^2), and 355 ha of open access land (covering under 1 per cent of the NCA). This area does not have as significant a number of recreational resources as adjoining NCAs, although it does offer a relatively dense network of public footpaths and bridleways in comparison with other parts of the county. There are some minor recreational routes (for example. the Nar Valley Way, Boudicca's Way and the Upper Tas Valley Walk), which are well used by local people. The Mid Norfolk Railway runs from Wymondham to North Elmham, while Sustrans National Route 1 runs through the area from Fakenham to Norwich and National Route 13 runs from Watton to Fakenham. Pensthorpe NNR, part of the River Wensum SAC near Fakenham, and Foxley Wood NNR provide recreational opportunities for visitors to enjoy the natural environment. The River Wensum is of regional and national importance for its angling and a large number of clubs have fisheries interests on the river.	Local	There is the potential to increase areas of greenspace for recreational use in association with new developments towards Norwich. Encouraging local communities to connect with their natural environment by visiting natural green spaces is important for mental and physical health. Both physical activity and exposure to nature have separately been demonstrated to provide benefits for mental wellbeing.[14]	Manage public access to avoid adverse impacts on agricultural management, landscape, habitats and wildlife. Create and enhance green infrastructure and opportunities for public access by creating additional linkages between existing public footpaths, settlements, amenities and transport links. Create new areas of greenspace in conjunction with new developments and identify locations for new recreational sites such as country parks.	**Recreation** **Sense of place / inspiration** **Biodiversity** **Sense of history** **Tranquillity**

[14] The mental and physical health outcomes of green exercise. International Journal of Environmental Health Research 15(5): 319–337, J Pretty, J Peacock, M Sellens and M Griffin (2005); Vitalizing effects of being outdoors and in nature. Journal of Environmental Psychology 30: 159–168, RM Ryan, N Weinstein, J Bernstein et al. (2010)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Designated sites Woodlands Heathland River valleys Agricultural land	The NCA contains one SPA and two SAC, and 816 ha (approximately 1 per cent of the NCA area) is nationally designated as SSSI. Just over 7 per cent of the NCA (6,757 ha) is covered by priority habitats. The most extensive priority habitat in the NCA is deciduous woodland (4,016 ha) which includes significant areas of wet woodland. These woodlands are generally small and fragmented. The NCA also contains 1,288 ha of coastal and flood plain grazing marsh, 459 ha of good quality semi-improved grassland, 513 ha fens, 286 ha of lowland meadows, 92 ha lowland heathland, 42 ha of traditional orchards, 36 ha of reedbeds, 27 ha rush pastures, and 2 ha of lowland dry acid grassland. River valleys contain a mosaic of priority habitats based around their rivers including wet and drained grassland, carr woods, fens and reedbeds. The rivers Wensum and Nar are notified for their range of diverse aquatic plant communities. The Norfolk Valley Fens SAC contain concentrations of lowland alkaline fens, which vary in structure according to the intensity of their management and contain a rich flora including grass-of-Parnassus, common butterwort, marsh helleborine and narrow-leaved marsh-orchid.	National	Ancient woodlands in the NCA have been supplemented with plantations of broadleaved trees and conifers, and the cessation of traditional management practices has changed species composition. Poplar plantations altering the traditional landscape and reducing biodiversity on river valley floors are a particular problem. Improvements to management, restoring woodland habitat, connecting fragmented sites and replacing conifer and poplar plantations with native trees would improve biodiversity. The River Wensum SAC is one of the most important chalk rivers in the country, and a comprehensive river restoration project is currently underway to restore a more naturally functioning system and improve biodiversity. The NCA supplies water to the Broads (Ramsar, SAC) so integrated management of the resource quality and availability through land management practices and improvements to river systems within the NCA is important to maintain the biodiversity value of these adjacent sites. The Norfolk Valley Fens SAC require continuing management to maintain variation in their structure and floral diversity. Heathland in the NCA was historically more extensive and is now fragmented and enclosed by deciduous woodland or conifer plantations. There are opportunities to improve management of existing heathland sites and to recreate areas of heath. The NCA is largely covered by agricultural land and so adopting wildlife friendly land management practices within these areas, including restoring and enhancing hedgerows and increasing species composition of field margins, could have a significant impact on biodiversity. Habitats within the NCA are largely fragmented and improving connectivity through habitat creation and restoration would improve their resilience for biodiversity, especially in the face of climate change.	Manage, enhance and restore priority habitats, including heathland, woodland, fens, rivers and river valley habitats to increase connectivity, improve biodiversity and increase resilience to climate change. Ensure integrated management of the water resource to maintain quality of habitats both within the NCA and in adjacent protected sites. Encourage the adoption of wildlife friendly land management practices in agricultural areas to improve biodiversity, including enhancing the hedgerow network and increasing areas and species composition of set aside. River Wensum is one of the nine chalk rivers included in the Norfolk Chalk Rivers Project, let by the Norfolk Rivers Trust. This co-ordinated approach to the enhancement of the Norfolk chalk rivers should be beneficial.	**Biodiversity** **Pollination** **Climate regulation** **Sense of place/ inspiration** **Sense of history** **Recreation** **Tranquillity** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Glacial deposits River terrace sediments Geomorphology	The NCA contains one geological SSSI. The Chalk bedrock which underlies the Mid Norfolk NCA was deposited during the Cretaceous period, some 80 million years ago, when East Anglia was submerged by the sea. Repeated Quaternary glaciations have deposited glacial till and outwash sand and gravel deposits throughout the NCA. The Anglian glaciation (around 450,000 years ago) laid down a particularly extensive and characteristically chalky till deposit – the Lowestoft Till – as well as sand and gravel outwash deposits. The legacy of the Anglian glaciation and the Devensian Glaciation some 30,000 to 10,000 years ago still dominates the landscape throughout the NCA. The gravels, sands, chalk erratics and glacial tills left behind by the retreating ice still determine the natural vegetation patterns. An important site for East Anglian geology is Caistor St Edmund Chalk Pit SSSI. This site displays the best exposure of late Campanian Beeston Chalk, as well as being famous for its large flints, known as potstones and paramoudras, with their remarkable contained burrow systems. The Chalk bedrock is overlain by shallow marine Crag deposits, early Thames deposits (Kesgrave Sands and Gravels), and palaeosols demonstrating features associated with both temperate and Arctic conditions as well as glacial Arctic soils. Palaeo-environmental evidence of the last 125,000 years is preserved in fossiliferous fluvial and lacustrine deposits at Saham Toney that provide an insight into the ancient landscapes of this NCA. The Wensum Valley contains important river terrace sediments which provide an important post-Anglian geological archive.	Regional	There is an opportunity to improve access to and enhance interpretation of geodiversity in the NCA, including important river terrace sediments, to help connect the local community to their underlying geological history. The underlying geodiversity provide the evidence to reconstruct ancient landscape and climates very different to today. These evidences may provide insights into the potential impacts of future climate change. Geodiversity should be considered so that opportunities can be exploited during mineral restoration schemes.	Maintain and enhance the geological resource by identifying and improving opportunities for enhanced access to sites and improving understanding of geodiversity through interpretation and education. Protect important geological sites from mineral extraction including river terrace sediments. Continue to research, monitor and record geomorphological processes to improve our understanding of them and to inform management decisions. Improve access and information about sites of geological and geomorphological interest and provide interpretation of the dynamic processes as well as the importance of underlying geological deposits, to improve understanding and enjoyment.	**Geodiversity** **Sense of place/ inspiration** **Sense of history** **Biodiversity** **Tranquillity** **Recreation**

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