



Introduction

As part of Natural England's responsibilities as set out in the Natural Environment White Paper,¹ Biodiversity 2020² 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.

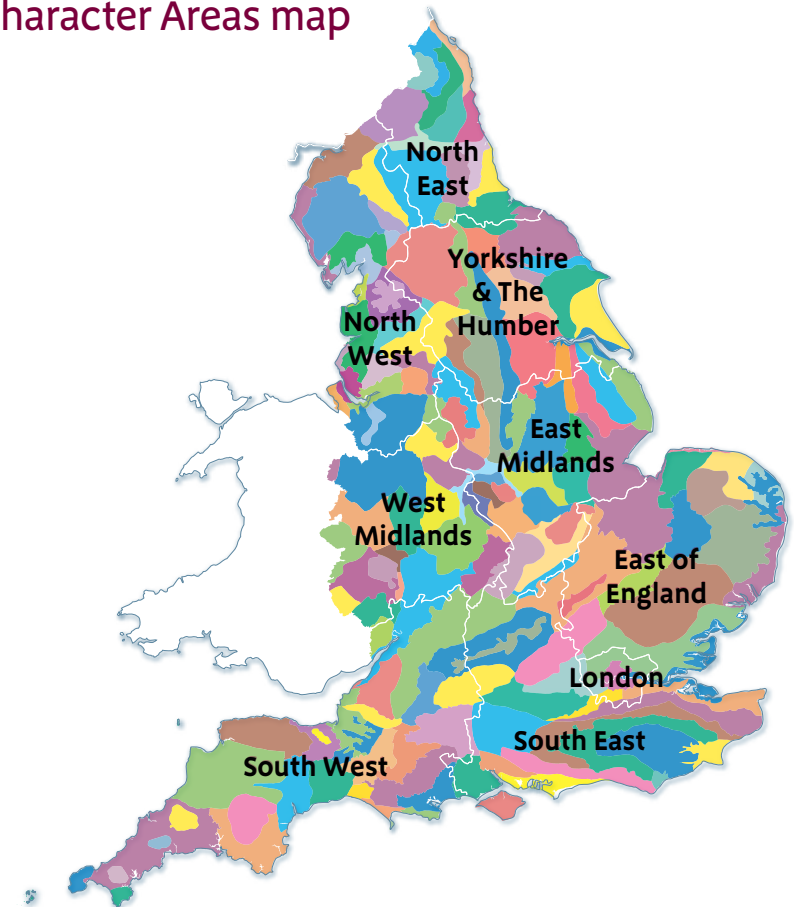
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and 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 Greater Thames Estuary National Character Area (NCA) is predominantly a remote and tranquil landscape of shallow creeks, drowned estuaries, low-lying islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh that lies between the North Sea and the rising ground inland. It forms the eastern edge of the London Basin and encompasses the coastlines of South Essex and North Kent, along with a narrow strip of land following the path of the Thames into East London.

Despite its close proximity to London, the NCA contains some of the least settled areas of the English coast, with few major settlements and medieval patterns of small villages and hamlets on higher ground and the marsh edges. This provides a stark contrast to the busy urban and industrial areas towards London where population density is high and development pressures are increasing. Sea defences protect large areas of reclaimed grazing marsh and its associated ancient fleet and ditch systems, and productive arable farmland. Historic military landmarks are characteristic features of the coastal landscape.

The coastal habitats of the NCA are internationally important for their biodiversity interest and support large numbers of overwintering and breeding wetland birds, rare plant and invertebrate species, and diverse marine wildlife. The vast majority of the coastline and estuaries are designated as Ramsar sites and Special Protection Areas, while the Essex Estuaries are a Special Area of Conservation. Brownfield sites support priority open mosaic habitat and its associated nationally rare invertebrate species. The coastline is also of major geomorphological interest for the study of

estuarine and coastal processes, and for its nationally and internationally important deposits of London Clay fossils and Pleistocene sediments.

There is a marked contrast between the wild and remote coastal marshes, and the industrial and urban developments which are highly visible in the low-lying landscape. A key challenge is to accommodate increasing development pressure in the area with the protection and enhancement of the natural landscape and its internationally important coastal habitats and species, and nationally important open mosaic habitat. Rising sea levels due to climate change present a major threat to coastal areas in the NCA through coastal squeeze, the alteration of coastal processes and increased flood risk – and the integrated management of these issues provides a major challenge.

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Statements of Environmental Opportunities:

- **SEO 1:** Maintain and enhance the expansive, remote coastal landscape – with its drowned estuaries, low islands, mudflats, and broad tracts of tidal salt marsh and reclaimed grazing marsh – maintaining internationally important habitats and their wildlife, and underlying geodiversity, while addressing the impacts of coastal squeeze and climate change and considering dynamic coastal processes.
- **SEO 2:** Work with landowners and managers to incorporate measures to improve biodiversity, geodiversity, pollination, water quality, soil quality and climate adaptation and to prevent soil erosion in this important food-providing landscape, while maintaining its historic character.
- **SEO 3:** Ensure that the tranquil and remote character of the estuary is maintained by conserving and enhancing important coastal habitats and distinctive historic and geological features, while providing increased opportunities for recreation and enjoyment of the landscape.
- **SEO 4:** Encourage a strategic approach to development that is informed by and makes a positive contribution to local character, incorporates green infrastructure which provides ecosystem services where they are needed most, and promotes recreation and addresses climate change, while maintaining important open mosaic and coastal habitats, and historic and geological features.



Coastal saltmarsh habitat at Hamford Water in Essex.

Description

Physical and functional links to other National Character Areas

The Greater Thames Estuary National Character Area (NCA) forms the eastern edge of the London Basin, and its extensive underlying geology of London Clay provides links with the Northern Thames Basin NCA and, further west, the Inner London NCA.

The NCA lies between the North Sea and the rising ground of the adjacent North Kent Plain and Northern Thames Basin NCAs which provide a backdrop to the extensive flat open spaces of the estuary. Uninterrupted, far-reaching views out across the Thames to the opposite banks are possible from this higher ground, and industrial and historic military landmarks are highly visible in this predominantly low-lying marshy coastal landscape.

The Thames is one of the major estuaries of the eastern English coast and drains over 16,000 km² of land, from the source of the River Thames in Gloucestershire to the west, and the southern reaches of the River Medway in the High Weald of Sussex. To the north the NCA includes the estuaries of the rivers Crouch, Roach, Blackwater, Colne and Stour and the embayment⁴ of Hamford Water, which together reach far into the Northern Thames Basin NCA and beyond into the South Suffolk and North Essex Claylands NCA. There is hydrological continuity between Tertiary deposits of Thanet Sands in the far west of the NCA and the underlying principal London Basin Chalk

aquifer, which stretches through the Northern Thames Basin NCA and into the Chilterns NCA to the north and the North Downs NCA to the south.

Coastal processes of erosion, transportation and deposition provide a functional link between the Greater Thames Estuary NCA and the contrasting coastlines of the adjacent North Kent Plain NCA and Suffolk Coast and Heaths NCA, with littoral drift occurring southwards along the coast. The marshes were created from the material carried by the sea from the north, and a continued supply of sediment is needed to sustain them. Functional connectivity is also provided by the continuation of coastal habitats into adjacent NCAs, with the Stour, Orwell, Debden and Alde–Ore estuaries occurring on the Suffolk coastline, and large areas of grazing marsh habitat behind coastal defences in the North Kent Plain NCA.

The River Thames itself provides a major transport link to the Inner London NCA with jetties, wharfs and docks occurring throughout. An extensive network of road and rail bridges spans the NCA's western reaches, including the M25 Dartford crossing, as it follows the Thames path winding through the eastern part of Inner London. The Saxon Shore Way stretches 257 km along the Kent coastline from Gravesend to Hastings in East Sussex, linking the North Kent Plain, North Downs, Wealden Greensand and Romney Marshes NCAs. The Thames Path National Trail follows the path of the Thames from its source in the Cotswolds, to Greenwich in the East London part of the NCA.

⁴ A recess in a coastline forming a bay

Key characteristics

- Predominantly flat, low-lying coastal landscape where extensive open spaces are dominated by the sky, and the pervasive presence of water and numerous coastal estuaries extend the maritime influence far inland.
- Eastern edge of the London Basin with its underlying geology of the extensive London Clay, containing important sites for geodiversity including fossiliferous deposits, and overlain by productive loamy soils derived from intertidal alluvial muds.
- Geological contrast and variety along the coastline provided by Sheppey, a long, low island rising from a stretch of very flat marsh along the Swale Estuary in Kent with low, steep clay cliffs facing towards Essex, and Mersea Island in the Blackwater Estuary in Essex.
- Coastline of major geomorphological interest for its coastal processes. Accretion of material carried by the sea from the north recharges intertidal coastal habitats, which are subject to coastal squeeze from rising sea levels.
- Open grazing pastures patterned by a network of ancient and modern reed-fringed drainage ditches and dykes, numerous creeks and few hedges or fences, with tree cover a rarity.
- Traditional unimproved wet pasture grazed with sheep and cattle combined with extensive drained and ploughed arable land protected from floods by sea walls, with some areas of more mixed agriculture on higher ground.
- Strong feelings of remoteness and wilderness persist on extensive salt marshes, mudflats and reclaimed farmed marshland, which support internationally important plants, invertebrates and populations of breeding and overwintering birds, notably overwintering Brent geese.
- Open mosaic habitats on brownfield sites support nationally important invertebrate assemblages and key populations of rare invertebrate species.
- Distinctive landmarks of coastal military heritage including Napoleonic military defences, forts and 20th-century pillboxes.
- Some of the least settled parts of the English coast with numerous small villages and hamlets on higher ground and marsh edges reflecting medieval patterns and the coastal economy.
- Highly urbanised areas within London and on marsh edges subject to chaotic activity of various major developments including ports, waste disposal, marine dredging, housing regeneration, mineral extraction and prominent power stations plus numerous other industry-related activities.
- Increasing development pressures around major settlements and especially towards London, with urban, industrial and recreational sites often highly visible within the low-lying marshes.
- Major historical and current transport link to Inner London provided by the River Thames, with an extensive network of road and rail bridges spanning its reaches within the city.

Greater Thames Estuary today

The Greater Thames Estuary NCA follows the banks of the Thames as it extends from East London, through the activity of urban life and major industrial developments, and along the predominantly remote and wild coastlines of Essex and North Kent into the North Sea. As the Thames drains out to the sea the city gradually loses its hold and the estuary widens into a landscape of shallow creeks, drowned estuaries, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh where the extensive open spaces are dominated by the sky and the pervasive presence of water.

The NCA is a predominantly flat, low-lying, narrow, deeply indented strip of soft coastline. It forms the eastern edge of the London Basin, and the shape of its branching estuaries is determined by the glacial and fluvial sands and gravels that overlie London Clay. The confined principal London Basin Chalk aquifer, which underlies the eastern most part of the NCA as it stretches into London, is overlain by Tertiary deposits of Thanet Sands which provide a hydrological continuity with the Chalk. Drained loamy soils derived from intertidal alluvial muds provide fertile, productive land. Contrast and variety along the coastline is provided by low islands such as Sheppey, which rises from a stretch of very flat marsh along the Swale Estuary in Kent and has low, steep clay cliffs facing towards Essex, and Mersea Island in the Blackwater Estuary in Essex. Accretion of material carried by the sea from the north occurs along the coast, although the marshes in front of sea defences are subject to loss from coastal squeeze due to rising sea levels. The coastline is of major geomorphological interest for the study of estuarine and coastal processes. The NCA also contains important geological sites with fossiliferous deposits of London Clay and Pleistocene sediments.

Several of these sites are of importance both nationally and internationally as type sites for fossils and archaeology.

The coastal landscape mainly consists of a maze of winding, shallow creeks, drowned estuaries, mudflats and broad tracts of tidal salt marsh with sand and shingle beaches along the coast edge. The relatively permanent, branching, meandering creeks which dissect the salt marshes fill and empty with the tide and provide an interesting temporal variation within the marsh landscape. The area holds an extensive tract of important coastal habitat and this is reflected in the vast majority of its coastline and estuaries being



Industry is highly visible in the low-lying reclaimed grazing marsh on the Isle of Grain in Kent.

designated as a Ramsar site and the Essex Estuaries as a Special Area of Conservation. The ebb of the tide uncovers large areas of mudflats, with shingle and shell banks and offshore islands also occurring in the intertidal zone, while large tracts of salt marsh (the most extensive of any NCA) occur above the intertidal range in front of sea defences. Behind the sea walls are large areas of reclaimed grazing marsh and its associated fleet-and-ditch systems. The salt marsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates, and the surrounding rich mosaic of terrestrial habitats supports nationally rare plants and invertebrates.

The NCA is of national importance for its flower-rich and open sward brownfield habitats that have developed on post-industrial sites, particularly in south Essex, the Colchester area and the north Kent coast, including Canvey Wick Site of Special Scientific Interest. These scarce open mosaic habitats support nationally important invertebrate assemblages and key populations of rare species, including the brown-banded carder bee and shrill carder bee.

The Estuary is of international importance for bird species and large swathes of its semi-natural coastal habitat are designated as a Special Protection Area. Hundreds of thousands of wintering waterfowl – including grey plover, dunlin and black-tailed godwit – provide a birdwatching spectacle as they add movement and variety to the open landscape. The estuary also provides some of the best breeding sites for rare wetland birds in southern England, including avocets and marsh harriers. The estuary is notable for its overwintering population of dark-bellied Brent geese, which rely on the surrounding arable farmland as a food source.

Commercial arable production is the dominant type of agriculture here following the conversion of much of the grazing marsh to arable during the second half of the 20th century. Hedgerows are absent from the large, rectilinear fields, with open pastures grazed with sheep and cattle patterned by a network of ancient and modern reed-fringed drainage ditches and dykes. Some areas of more mixed agriculture occur on higher ground. Trees are scarce within the open landscape, and are largely restricted to pockets of higher land surrounding isolated farms and churches and larger settlements along the marshland fringe.

The NCA includes some of the least settled parts of the English coast, though there are also numerous small villages and hamlets located on higher ground and on the edge of the marshes, reflecting medieval patterns and a traditional coastal economy. The local vernacular is predominantly of red brick and weatherboarded houses, including a large number of pre-1750s buildings. Nucleated villages occur, but the historic settlement pattern was largely dispersed with small hamlets, isolated farmsteads and church/manorial hall complexes providing focal points. Some settlements, such as Clacton, Southend and Frinton, have developed as popular seaside resorts.

Industry and its infrastructure – including waste disposal and mineral extraction sites, transport routes, ports and prominent power stations – and urban development, including housing and caravan sites, now occupy what are often highly visible sites within the low-lying marshes. The NCA encompasses the highly urbanised areas alongside the River Thames in East London, including the Isle of Dogs development, East and West Ham, and London City Airport. The historical East End of London, which is an especially busy and varied part of the nation's capital, provides a direct contrast to

the overriding sense of isolation of the estuary marshes and farmland. Large areas of marsh still exist within London, at Rainham and Crayford, and these provide important areas of tranquillity and recreation within the highly populated and urban parts of the NCA. Links to the sea are present throughout in the dynamic ebb and flow of the tidal waters of the Thames which, along with the busy movement of a range of vessels and the large and varied bird population, adds movement to the landscape.

Development is occurring in the NCA, especially in the west around London, directed by initiatives such as the Thames Gateway. Existing urban areas are being regenerated and new industry and housing constructed. Major port developments and other proposed nationally important infrastructure projects may further impact on character. A strategic approach to green infrastructure has been taken with initiatives such as the All London Green Grid, Greening the Gateway Kent and Medway, and Essex Green Grid guiding the development of a network of green infrastructure throughout the NCA. National trails along both sides of the estuary provide recreational opportunities and green infrastructure links from London along the Thames and out into the rural landscape. Heavy recreational use of estuary waters and beaches occurs in some more accessible areas of the NCA.

Historic associations are rich within the landscape and reflect the longstanding importance of the estuary as a main access point into London. They include rare Neolithic causeway enclosures, bronze-age funerary monuments, iron-age defended enclosures, and most notably the prominent military associations along the coastline such as Napoleonic military defences (the Martello towers), a number of distinctive forts and 20th-century pillboxes.

Charles Dickens used Cooling Marshes on the North Kent coast as the setting for the beginning of *Great Expectations* and his evocative description of the marshes, written 150 years ago, still holds true today: "... the dark flat wilderness beyond the churchyard, intersected with dykes and mounds and gates, with scattered cattle feeding on it, was the marshes; and that the low leaden line beyond, was the river; and that the distant savage lair from which the wind was rushing, was the sea..."



The Queen Elizabeth II Bridge joining the M25 as it crosses the River Thames at Dartford, seen from Rainham Marshes.

The landscape through time

The NCA typically represents the eastern edge of the London Basin, a geological formation of Palaeogene sediments predominantly comprised of sands and clays deposited between 65 and 23 million years ago and folded to their current structure during the Alpine Orogeny (mountain-building episode). These Palaeogene sediments contain fossils of both national and international importance including very well-preserved flora and fauna that are the basis for defining the stratigraphy of the London Clay as well as diverse fossil bird assemblages that includes several 'type' taxa as well as evidence of fossil families only recorded in Britain.

Covering most of the underlying Tertiary geology is made up of glacial and fluvial sands and gravels, deposited by successive Quaternary (ice-age) glaciations. A major glacial event – the Anglian glaciation which occurred some 450,000 years ago – saw an ice sheet reach the outskirts of present-day London. This was responsible for shifting the course of the Thames to its present-day route. Within this NCA, there are also sites that preserve evidence of past climates, landscapes and biodiversity as well as early human stone tools and evidence of the landscapes they lived in, around 400,000 years ago. The NCA also contains important geomorphological sites demonstrating a range of landforms and active processes.

Surface deposits are largely recent estuarine sediments, ranging from the fine silts of the salt marsh, grazing marsh and much of the foreshore, to coarser sands and gravels on the more exposed parts of the coast. These have resulted in fertile stoneless, clayey, silty and loamy soils, much of which have been extensively drained to give fertile arable land.

The physical development of the Greater Thames Estuary has been dominated by the relative levels of land and sea. In the 11,500 years since the end of the last glaciation and the onset of the Holocene (our present interglacial) epoch, the sea has risen some 30 m to its present level. The marshes themselves have been created and sustained by material carried by the sea from the north, a natural process of accretion that has added many thousands of hectares to the marshes of Kent and Essex since Anglo-Saxon times.



Aerial view of Darnet Fort in the Medway, Kent.

Evidence of early exploitation, including rare causewayed enclosures, comes from Neolithic times when sea levels rose to around the present-day level. Areas of submerged land surface with Neolithic settlement evidence survive in the intertidal zone, and are particularly extensive in the Blackwater Estuary. Late bronze-age settlement evidence is widespread and associated with a wide range of field systems and funerary monuments. Abundant iron-age remains from the Essex Marshes are related to a local salt-making industry. Later medieval evidence of salt-making sites, in the form of mounds, is to be found on the edge of the Kent Marshes, in particular on the Isle of Sheppey.

At the end of the Iron Age, sea levels fell and the arrival of the Romans in Britain marked a period of settlement made possible by their knowledge of wetland drainage. Farmsteads were developed on the higher ground and reclaimed marshland was cultivated. Roman settlement, however, was short lived. The sudden rise in sea level during the late Roman period, combined with poor drainage maintenance, caused them to abandon the marshes but evidence of their fields is still visible today.

By the early Middle Ages, sea banks had been built to protect grazing marsh from the rising sea. Foulness Island on the Essex coast was mainly enwalled during this period. Following the later Middle Ages there are numerous records of surges and breaches. A major use of Essex woodland at this time was as underwood for thatching sea walls. At West Thurrock, the sea walls were made of chalk transported from Purfleet specifically for that purpose.

Medieval settlement was a mixture of nucleated villages and isolated manorial complexes set back from the marshes on the rising claylands. The network of minster churches founded by Saxon Christians is still evident

in the landscape and they form the basis of several settlements including Minster on Sheppey and Hoo St Werburgh. The presence today of many Saxon fishing traps in the Blackwater/Colne Estuary is evidence of the importance of the sea and shoreline to early medieval economies.

During the post-medieval period, numerous small villages and hamlets developed related to the coastal economy of fishing (at Mersea) and boatbuilding, as did the important coastal cargo transport network of the 'Thames Barges'. During this period further marshland was progressively reclaimed by the process of 'inning'. Coastal defences were constructed resulting in wet, sheep-grazed marsh within the sea walls and salt marsh without. Between the late 17th century and today, further areas were enwalled as agricultural land at the expense of the salt marshes. Many small innings were also lost, and then rebuilt anew, as periodic surges breached both ancient and new sea banks. Sparse settlement remained the norm during this period until the expansion of the railway system in the mid 19th century, which stimulated the growth of seaside resorts such as Southend, Clacton and Frinton. This ultimately led to the development of plotland settlements⁵, the most striking of which is Jaywick.

Military establishments, built from the 17th century onwards to face the threat of invasion by sea and defend London, and the Royal Navy dockyards at Deptford, Chatham and Sheerness, provide some of the most distinctive landmarks of the estuary coastline and make up one of the finest collections of historic military architecture in the world. These include Tilbury Fort (built

⁵ The 'plotlands' consisted of small plots of land sold in the first half of the 20th century to people who built weekend cottages, holiday bungalows or smallholdings there. Many became permanent residences and have been incorporated into new urban developments.

in 1670), the defences of the military dockyards at Chatham and Sheerness, the Martello towers built in the early 1800s during the Napoleonic Wars, together with the Medway forts and the later granite-faced Royal Commission forts of the 1860s, and anti-invasion works from the two World Wars.

In the latter half of the 20th century, extensive drainage and fertilisation of the estuary marshes for arable cropping and improved pasture, and to a lesser extent for industry, led to widespread fragmentation and the loss of 64 per cent per cent of the area's traditional wetland character. The recent and past conversion of the Estuary to arable use is today a declining trend, while the risk of periodic flooding has led to the construction of hundreds of kilometres of sea wall defences. As sea level rises (at an estimated 2 mm a year) salt marsh, which provides a natural defence against the sea by dissipating wave energy, is being lost at a rapid rate to coastal squeeze against these hard engineered defences. In some areas defences have been removed or managed realignment or foreshore recharge has taken place to sustain and create natural defences against the rise in sea level. The largest managed coastal realignment project in Europe was carried out in 2002 on the Blackwater Estuary to create 80 ha of new coastal grazing marsh, salt marsh and mudflats. Large elm trees along hedgerows on higher ground were a prominent feature of the NCA, especially on the Isle of Sheppey, and their loss through Dutch elm disease in the 1970s had a major impact on the landscape.

Industrial development of the Thames Estuary has a long history.⁶ During the medieval period the estuary was a focus for the munitions industry and the

Royal Arsenal at Woolwich, founded in the late 17th century, played a central role for the production and storage of munitions until the end of the Second World War. London's dockyards formed the focus of much industrial activity, including the pioneering construction of steam-powered and iron ships through the 18th and 19th centuries. In the 1880s the estuary was the site of the world's first long-distance electricity transmission station and the first UK oil shipment. There has been an increasing demand since 1945 for waste disposal sites, with the impacts of dredging also a major issue within the Estuary. Oil refineries, chemical works, power stations, mineral extraction and cement works form prominent features within the predominantly low-lying landscape.

Since the early 1980s the riverside of East London has been transformed by the construction of Canary Wharf, the O2 Arena and London City Airport on the site of the old dockyards. Current development of the Thames Gateway through the regeneration of existing urban conurbations and brownfield sites and the construction of new housing and industry is occurring, mainly on the fringes of London and the Medway towns. Major projects include a new super-port at the old Shell Haven oil refinery site in Thurrock. New green space in association with Thames Gateway development is being created, and waste and mineral sites are being restored, including the Thurrock Thameside Nature Park at Mucking which lies on top of a former major landfill site. The Parklands Project has created a number of new parks in Kent and Essex. Away from major settlements, the intrinsic open, remote character of the agricultural and coastal landscape persists.

⁶ Thames Gateway Historic Environment Characterisation Project: Final Report, English Heritage (2005) (accessed May 2013; URL: www.english-heritage.org.uk/publications/thames-gateway-historic-environment-characterisation-project-final-report/)

Ecosystem services

The Greater Thames Estuary 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 Greater Thames Estuary NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** The NCA contains extensive areas of land (49 per cent per cent) under agricultural management with cultivation of cereal crops dominating extensive areas of ploughed, drained former marshland to produce wheat and barley. Traditional wet pasture is grazed with sheep and cattle and more mixed agriculture occurs on higher ground. Estuarine waters support an important commercial fishing industry including shellfish.
- **Water availability:** Large areas of the Kent coastline have surface water available for abstraction, including the Isle of Sheppey and the northern reaches of the Medway. Water is more limited on the Essex side of the Estuary with no water available during low flows, but water available in some systems during median and high flows. Within London, some water is abstracted from the principal London Basin Chalk aquifer. Water is mainly used for commercial purposes but also for industry and farming.

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

- **Climate regulation:** Significant carbon storage is provided by extensive areas of salt marsh, reedbeds, mudflats and grazing marsh.
- **Regulating soil quality:** The dominant loamy and clayey soils of the coastal flood plain provide fertile arable land when adequately drained, although they are increasingly under threat from loss due to sea level rise. Compaction of seasonally wet soils may reduce water infiltration and increase surface water run-off.
- **Regulating water quality:** Chemical status is mixed with the north of the NCA classed as good, and the Greater London and Kent areas as failing, and this is reflected in the status of coastal and estuarine waters. The ecological quality of the area's rivers is generally moderate, although some towards London are poor and the ecological potential of the estuary waters again reflects this assessment, apart from the mouth of the Colne Estuary and Hamford Water which have achieved good status. The quality of water in the NCA is highly dependent on waters upstream.
- **Pollination:** The NCA is important for some of the UK's rarest bumblebees and three priority species are strongly associated with its dry, flower-rich habitat: the shrill carder bee, brown-banded carder bee and moss carder bee. Coastal habitats (including grazing marsh) and open mosaic habitat on brownfield sites provide important nectar sources and nesting opportunities for pollinators.

- **Regulating coastal flooding and erosion:** The major risk of flooding in the area comes from the sea, with large areas of reclaimed arable land and grazing marsh below sea level and maintained by sea defences. Flood defence structures occur all along the estuary coastline. The extensive coastal habitats, especially salt marsh, provide an important natural defence against flooding by reducing the impact of wave action on the coastline and its defences. Coastal habitats are, however, being lost at a rapid rate due to coastal squeeze. Shoreline Management Plans assess coastal processes and the management of the coastline. Areas of the estuary have also been identified as potential sites to store tidal waters during very large surge tides to help prevent increased flooding of the River Thames. There is the opportunity to create compensatory coastal habitat arising from losses identified in plans such as TE2100 (the Environment Agency's strategic plan for managing flood risk in the Thames Estuary)⁷.
 - **Sense of history:** The distinctive military associations along the coastline, including the naval dockyards, provide the most evident sense of the historical importance of the area in protecting London from invasion by the sea. Other important archaeological features include ancient sea walls, iron-age/Roman salt mounds, bronze-age funerary monuments and the Saxon minster churches. London itself provides a rich source of history.
 - **Tranquillity:** High levels of tranquillity remain in the parts of the NCA which are not in proximity to London. Tranquil areas are generally associated with the expansive and remote mudflats and coastal marshes.
 - **Recreation:** Recreational opportunities are provided by the Thames Path National Trail, Saxon Shore Way and 1,136 km of public footpaths. This will be enhanced by the current development of the Thames Estuary Path. Recreation is also provided by popular beach resorts, fossil-hunting sites and various water-based recreational activities including fishing and boating. The internationally important coastal habitats also attract many visitors for their birdwatching opportunities.
 - **Biodiversity:** The estuary is of international importance for its coastal habitats and over 15,000 ha are covered by international designations including one Special Area of Conservation, ten Special Protection Areas and ten Ramsar sites. The estuary contains significant areas of salt marsh (the largest remaining area in England), intertidal sand and mudflats, sand dunes, shingle, shell and sand banks, subtidal sand and mud, and extensive areas of coastal grazing marsh. The salt marsh and grazing marsh habitats are internationally important for their diverse assemblages of wetland plants and invertebrates, such as pedunculate sea-purslane.
- Cultural services (inspiration, education and wellbeing)**
- **Sense of place/inspiration:** A sense of place is provided by the flat, open and expansive estuarine landscape where distinctive shallow creeks, drowned estuaries, low islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh provide a strong sense of remoteness and skylines dominate the views. Historic settlement and field patterns and coastal military landmarks add a human aspect, and a large and varied bird population adds movement to the landscape. The close proximity of the highly urbanised and industrial areas of East London provides a marked contrast to the remoteness of the coastal marshland.

⁷ <http://www.environment-agency.gov.uk/homeandleisure/floods/125045.aspx>

The estuary supports hundreds of thousands of wintering waterfowl and breeding wetland birds, notably dark-bellied Brent geese. Intertidal and subtidal coastal habitats support a variety of marine wildlife. Arable land within the NCA provides important bird foraging and breeding habitat and its field margins support invertebrate species. Brownfield sites contain a rich mosaic of habitats supporting nationally important invertebrates, some found only in this area of England.

- **Geodiversity:** The NCA contains geological sites of significant importance both nationally and internationally. The Tertiary sediments of sands and clays that comprise the eastern edge of the London Basin contain fossils of both national and international importance. The NCA also contains important stratigraphic evidence of a major glacial event 450,000 years ago which was responsible for the shift in the course of the River Thames, and sites that preserve evidence of past climates, landscapes and biodiversity along with evidence of early humans and the landscape they lived in around 400,000 years ago. The NCA coastline is of major geomorphological interest for its system of estuaries characterised by a maze of winding, shallow tidal creeks that dissect islands, mudflats, sandflats and salt marsh where natural active coastal processes can be observed.



Tertiary sediments at the Naze SSSI in Essex, which contain fossils of international importance.

Statements of Environmental Opportunity

SEO 1: Maintain and enhance the expansive, remote coastal landscape – with its drowned estuaries, low islands, mudflats, and broad tracts of tidal salt marsh and reclaimed grazing marsh – maintaining internationally important habitats and their wildlife, and underlying geodiversity, while addressing the impacts of coastal squeeze and climate change and considering dynamic coastal processes.

For example, by:

- Responding to the threat of rising sea levels due to climate change by identifying areas for managed realignment of coastal defences where appropriate, creating new intertidal habitats to mitigate for any losses caused by coastal squeeze, while maintaining natural coastal processes.
- Effectively managing the mosaic of coastal, freshwater and terrestrial habitats to maintain their biodiversity value, while seeking opportunities to re-link fragmented habitats to create a robust wildlife network with enhanced adaptation to climate change.
- Protecting intertidal and subtidal habitats to maintain their importance for marine wildlife.
- Supporting and ensuring the continuation of the natural dynamic coastal processes of accretion and erosion that shape the estuary, encouraging natural regeneration of intertidal habitats.
- Maintaining areas of intertidal habitat as a buffer between wave action and sea defences to reduce flooding and protect inland areas.
- Continuing to support, monitor and research coastal geomorphological processes to improve our understanding and inform future coastal management decisions.
- Improving sustainable public access to areas of biodiversity, geological and geomorphological interest, incorporating interpretation to raise awareness, increase understanding and enhance visitor enjoyment, while protecting habitats and species that are vulnerable to disturbance.
- Protecting the existing designated area network and working in partnership with existing local projects, initiatives and organisations, including the Nature Improvement Area, to deliver integrated, effective conservation management on a landscape scale.
- Enabling carbon storage provided by extensive areas of salt marsh, reedbeds, mudflats and grazing marsh by maintaining their good condition through sustainable management.
- Recognising the need for, and identifying sites for the creation of, compensatory habitat to mitigate for losses identified in Shoreline Management Plans including TE2100 (the Environment Agency's strategic plan for managing flood risk in the Thames Estuary).
- Supporting projects and programmes that seek to secure the future of species limited to and closely associated with the marshland, coastal and estuarine habitats of the area, for example the recovery programme for the pedunculate sea-purslane.

SEO 2: Work with landowners and managers to incorporate measures to improve biodiversity, geodiversity, pollination, water quality, soil quality and climate adaptation and to prevent soil erosion in this important food-providing landscape, while maintaining its historic character.

For example, by:

- Working with the local farming community to sustainably manage the agricultural landscape, safeguarding future food production and the long-term viability of agriculture and yields, while enhancing key ecosystem services.
- Working with the fishing industry to ensure the sustainable future management of fishing and shellfish grounds.
- Working with the farming community to ensure the sustainable management of internationally important grazing marsh habitat, and the sympathetic management of arable land to benefit wildlife, including the use of field margins, conservation headlands, and pollen and nectar margins for pollinator species.
- Ensuring that land outside designated areas used by bird populations for foraging and roosting is adequately protected and managed.
- Improving the area for important pollinators, including rare bumblebee species, by sympathetic habitat management, habitat creation and strategic conservation of flower-rich brownfield sites.
- Maintaining water availability by using integrated water and land management practices to slow run-off and increase infiltration to aquifers by reducing soil compaction and increasing soil organic matter on agricultural land, and using targeted drainage management where possible to increase water availability in periods of low rainfall.
- Protecting aquifer water quality by adopting land management practices and integrated water management policies to minimise risks through pollution, contamination, saline intrusion and run-off.
- Increasing carbon storage capacity by creating new wetland habitats including reedbeds, and by increasing organic matter in soils using land management practices such as including fallow within rotations, overwintering stubbles, and pollen and nectar strips.
- Managing the network of drainage ditches and drains in flood plain areas to provide effective floodwater management during storm events, thereby decreasing flood risk while improving the habitat for freshwater species.
- Creating permanent buffer strips along ditches and watercourses to reduce soil erosion and help prevent deterioration in water quality caused by high nutrient levels by slowing run-off and capturing sediment.
- Conserving the historic character of the area, and features of heritage interest, including the ancient patterns of reed-filled drainage ditches that crisscross reclaimed farmland and the medieval settlement patterns of isolated farms and villages on higher land.

SEO 3: Ensure that the tranquil and remote character of the estuary is maintained by conserving and enhancing important coastal habitats and distinctive historic and geological features, while providing increased opportunities for recreation and enjoyment of the landscape.

For example, by:

- Conserving the wild and remote character of the estuary by maintaining the extent and quality of the semi-natural coastal habitats and creating new habitat where feasible.
- Protecting, interpreting and promoting heritage and archaeological assets and, where appropriate, increasing access to the distinctive military landmarks along the coastline, reflecting the historical importance of the area in protecting London from invasion by the sea, connecting communities with their local heritage and encouraging tourism.
- Encouraging opportunities for people to connect with the natural landscape and its wildlife through local nature reserves, volunteering, working with local schools and community groups, and activities such as birdwatching and visiting the internationally important coastal habitats of the estuary.
- Encouraging sustainable recreational opportunities within the estuary by encouraging access to characteristic features of the landscape, including internationally important coastal habitats and species, estuary waters and historic assets, and incorporating interpretation to raise awareness, increase understanding and enhance visitor enjoyment.
- Encouraging the development of new public rights of way networks where appropriate, to connect urban communities to rural areas and increase recreational opportunities.
- Managing increasing visitor pressure by promoting the sustainable recreational use of appropriate areas while protecting fragile habitats, species, geological and historic features and taking recreation disturbance issues into account.
- Conserving and interpreting archaeological earthworks and sub-surface archaeology, while recognising the potential for undiscovered remains.
- Continuing to research, monitor and record coastal geomorphological processes that shape the estuary, to improve our understanding and inform future management.
- Protecting and providing access to and interpretation of important geological sites, including exposures of fossils, as a source of recreation.



Tollesbury saltings in the Blackwater Estuary in Kent.

SEO 4: Encourage a strategic approach to development that is informed by and makes a positive contribution to local character, incorporates green infrastructure which provides ecosystem services where they are needed most, and promotes recreation and addresses climate change, while maintaining important open mosaic and coastal habitats, and historic and geological features.

For example, by:

- 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 and sewage treatment options, reducing nutrients from diffuse pollution to improve water quality and increasing groundwater recharge.
- Planting sustainably managed broadleaved woodland, and potentially miscanthus, to screen new and existing urban and industrial developments and to help protect the tranquillity of the estuary, while taking care not to impact on its open, expansive views.
- Ensuring that new developments adequately incorporate features to make a positive contribution to biodiversity and climate change, including increasing the areas of green space in more developed parts of the estuary through initiatives such as Green Grids.
- Conserving and managing disused mineral and landfill sites to benefit biodiversity and increase recreational opportunities, while retaining important biodiversity and geological features.
- Raising awareness of the importance of brownfield sites in the Thames Gateway for biodiversity, and conserving key open mosaic habitats and species through site protection, mitigation and habitat creation.
- Limiting development, including increases in light and noise pollution, in more remote parts of the NCA that currently score highly for tranquillity.
- Implementing sustainable Shoreline Management Plans to reduce flood risk from climate change, including managed realignment schemes, identifying and safeguarding areas of functional flood plain needed for strategic flood storage in the Thames Estuary in local development plans, ensuring a catchment-scale approach to flood risk management.
- Recognising the need for, and identifying sites for the creation of, compensatory habitat to mitigate for losses identified in Shoreline Management Plans including TE2100 (the Environment Agency's strategic plan for managing flood risk in the Thames Estuary).



Jaywick holiday plotland development in Essex.

Supporting document 1: Key facts and data

Greater Thames Estuary National Character Area (NCA): 83,675 ha

1. Landscape and nature conservation designations

There are no designated landscapes within the NCA.

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	The Swale Thames Estuary and Marshes; Blackwater Estuary (Mid-Essex Coast Phase 4); Colne Estuary (Mid-Essex Coast Phase 2); Medway Estuary and Marshes Foulness (Mid-Essex Coast Phase 5); Crouch and Roach Estuaries (Mid-Essex Coast Phase 3); Hamford Water Dengie (Mid-Essex Coast Phase 1); Benfleet and Southend Marshes	15,322	18

Tier	Designation	Designated site(s)	Area (ha)	% of NCA
European	Special Protection Area (SPA)	The Swale SPA; Thames Estuary and Marshes SPA; Blackwater Estuary (Mid-Essex Coast Phase 4) SPA; Medway Estuary and Marshes SPA; Foulness (Mid-Essex Coast Phase 5) SPA	14,640	17
	Special Area of Conservation (SAC)	Crouch and Roach Estuaries (Mid-Essex Coast Phase 3) SAC; Hamford Water SAC; Dengie (Mid-Essex Coast Phase 1) SAC; Benfleet and Southend Marshes SAC; Essex Estuaries SAC	3,773	5
National	National Nature Reserve (NNR)	Elmley NNR; Hamford Water NNR; Blackwater Estuary NNR; Colne Estuary NNR; The Swale NNR; Leigh NNR; Dengie NNR; High Halstow NNR	2,875	3
National	Site of Special Scientific Interest (SSSI)	A total of 32 sites wholly or partly within the NCA	16,834	20

Source: Natural England (2011)

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

There are 199 local sites in the Greater Thames Estuary covering 4,871 ha or 6 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	370	2
Favourable	10,087	60
Unfavourable no change	272	2
Unfavourable recovering	6,105	36

Source: Natural England (March 2011)

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



The ex-industrial site of Canvey Wick in Essex has been designated as a SSSI for its invertebrate interest.

2. Landform, geology and soils

2.1 Elevation

Elevation ranges from just below sea level (-0.02 m) around the reclaimed areas of marshland by the coast to a maximum of 81 m inland, with the highest land found on the Isle of Sheppey and on the northern side of the estuary around Rayleigh and Hadleigh. The average elevation of the landscape is 9 m above sea level.

Source: Natural England 2010

2.2 Landform and process

The Estuary lies between the North Sea and the rising ground inland. It is situated on one of the major estuarine embayments of southern England, and it is deeply indented. The coastline presents a marked contrast with that of neighbouring NCAs in Kent and Suffolk. In Kent, the Estuary abuts the North Kent Plain while in Essex it borders the Essex Wooded Hills and Valleys to the north and the London Clay Lowlands further inland (both of which are sub areas of the Northern Thames Basin NCA). Further west, the Greater Thames Estuary extends finger like into Inner London.

In the 9,000 years since the end of the last ice age, the sea has risen from 30 m below its present level and is currently rising at an estimated 2 mm per year. This is due to the combined effects of isostatic adjustment and eustatic change.

The coastal marshland areas are low-lying. The marshes themselves have been created and sustained from material carried by the sea from the north. This natural process of accretion has added thousands of hectares to the marshes of Kent and Essex since Anglo-Saxon times. It is now reduced by man-made sea defences.

The tidal stream flows south on the flood and north on the ebb. Littoral drift is southwards down the coast. The intertidal area is broken by a series of dominant estuaries which are characterised by a maze of winding, shallow tidal creeks that dissect islands, mudflats, sand flats and salt marsh.

Dengie Flat at the eastern end of the Dengie peninsula comprises a large remote area of tidal mudflat and salt marsh which is of major coastal geomorphological interest. The foreshore is a continuous mudflat and salt marsh structure that stretches almost 13 kilometres and is particularly unusual for an open coastal site.

Maplin Sands is predominantly an open coast estuarine site between the Crouch-Roach estuary and Southend-on-Sea. Rising sea levels are causing the migration of the offshore islands, inshore.

Shingle spits such as those at the mouth of Hamford Water, (a shallow, sheltered basin on the most easterly part of the Essex coastline, the north-eastern tip of the NCA) are low and topped by sand dunes and shell banks and are gradually spreading inland over the salt marsh due to the action of wind and storm waves.

Source: Greater Thames Estuary Countryside Character Area description; Greater Thames Estuary Coastal Natural Area Profile; (Natural England 2010)

2.3 Bedrock geology

The area represents the eastern edge of the London Basin with Tertiary sediments predominantly comprised of sand and clays deposited between 65 and 23 million years ago. The most extensive sediment is the London Clay, which is thick marine clay notable for its fossils. A breakdown of solid geology as a proportion of total land area is as follows: 63 per cent clay, silt

and sand; 19 per cent clay and silt; 7 per cent chalk; 6 per cent sand, silt and clay and 4 per cent sand.

Source: Greater Thames Estuary Countryside Character Area description; Natural England (2010)

2.4 Superficial deposits

Covering most of the underlying geology are glacial and fluvial deposits (sands, gravels and clays) associated with an advancing ice sheet four hundred thousand years ago and the associated shift in the course of the Thames. The surface deposits are largely recent estuarine sediments, ranging from the fine silts of the salt marsh, grazing marsh and much of the foreshore, to coarser sands and gravels on the more exposed parts of the coast. Coast sediment is abundant with a relatively small grain size. The shingle banks are composed of small shell fragments and while they are larger than the sand grains they lie at the lower end of the scale for shingle deposits. Occasional shell banks are scarce but a characteristic feature of the coast. Off shore the sea bed is also covered with deposits of sand, sand-and-mud or smaller pockets of gravel. These were mostly deposited during the Quaternary period.

Source: Greater Thames Estuary Countryside Character Area description;

2.5 Designated geological sites

Designation	Number
Geological Site of Special Scientific Interest (SSSI)	8
Mixed interest SSSI	4

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

Present day soils are derived largely from intertidal alluvial muds which give rise to stoneless, clayey, silty and loamy soils. These productive loams have been extensively drained to give fertile arable land.

Source: Greater Thames Estuary Countryside Character Area description;

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

Agricultural Land Classification	Area (ha)	% of NCA
Grade 1	5,051	6
Grade 2	8,021	10
Grade 3	29,485	35
Grade 4	16,063	19
Grade 5	1,464	2
Non-agricultural	6,000	7
Urban	14,490	17

Source: Natural England (2010)

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

3. Key water bodies and catchments

3.1 Major rivers/canals

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

Name	Length in NCA (km)
River Lea or Lee	2
River Chelmer and Blackwater Navigation	2
Blackwater	<1
Grand Union Canal	<1
Roman River	<1
River Colne	<1
River Crouch	<1
River Thames	<1
River Medway	<1
River Swale	<1

Source: Natural England (2010)

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

The rivers are predominantly estuarine in character with the drowned estuaries (from north to south) of the Hanford Water, the Colne, the Blackwater, the Crouch, the Thames, the Medway and the Swale comprising the area's dominant inlets.

The Colne and Blackwater and their tributaries rise in the clay plateau area of the South Suffolk and North Essex Claylands NCA to the north-west and flow south-eastward to their extensive estuaries. The Crouch flows due east across undulating low land, and is joined by the Roach to form an estuary complex

with low-lying Wallasea, Potton and Foulness islands. The area is also crossed by the Chelmer and Blackwater Navigation (2 km) and the Grand Union Canal (less than 1 km).

Agricultural 'improvement' has led to the straightening of numerous meandering creeks into dykes and ditches in arable areas.

Along the coast a maze of winding, shallow tidal creeks dissect islands, mudflats, sand flats and salt marsh.

The Colne Estuary has large areas of associated mudflats that are exposed at low tide and a very large area of salt marsh that is unusual for its size. Shingle spits are also present at Colne Point on the eastern shore where they enclose a large area of saltings.

The Blackwater is one of the largest estuary complexes in East Anglia. A large proportion of the intertidal area is mudflats, particularly away from the main tidal flow. Deposition of shingle, shell banks and exposed gravel beds are features of the tidal flats. The Strood Channel of the Blackwater is separated from the Pyefleet Channel of the Colne by the road to Mersea Island. Osea and Northey islands are located in the Heybridge Basin towards the head of the estuary. There are docks at Brightlingsea, Rowhedge and Hythe as well as other jetties for exporting goods, although industrial activity is not intensive.

The Crouch-Roach Estuary is comprised of the River Crouch and the River Roach and their tributaries. The Crouch is long and narrow while the Roach takes the form of a number of narrow creeks sheltered by the island of Foulness. The Crouch has only very narrow intertidal mudflats. Extensive

areas of marsh have developed at Fambridge and Bridgemarsh Island. This estuary has a relatively dense network of road and rail bridges, causeways, fords and ferry crossing sites.

The Thames is a long, sinuous estuary. The outer reaches are adjacent to the Southend-on-Sea and South Thames Marshes Estuary sites. It is a highly urbanised estuary, with an extensive communications network of road and rail bridges. There are a large number of docks, jetties and wharfs along its upper reaches. Much of the original estuary was claimed in historical times; today it has very narrow upper sections with little intertidal flat exposed at low tide. Some small discrete areas of salt marsh survive on the lower reaches at Crayford Ness, along the Inner Thames marshes at Pearfleet, Coalhouse Fort, Higham and Cliffe.

The Medway Estuary lies on the outer reaches of the Thames Basin, between the South Thames Marshes site to the north and the Swale Estuary to the east. The Isle of Grain dominates the mouth of the estuary. The Medway has the largest area of intertidal flats on the southern shore of the Greater Thames Estuary area with large areas of salt marsh some of which has become isolated and occurs principally as islands. There are five docks including the major docks at Chatham, Grain and Sheerness.

The Swale Estuary separates the Isle of Sheppey from the mainland. The estuary has extensive intertidal mudflats.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 28,061 ha or 34 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



Grain Coastal Park on the Isle of Grain in Kent, looking across the Thames Estuary towards Southend-on-Sea, Essex.

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 1,797 ha of woodland (2 per cent of the total area), of which 249 ha is ancient woodland.

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

4.2 Distribution and size of woodland and trees in the landscape

Trees are a rarity, with small clumps restricted to pockets of higher land surrounding isolated farms and churches and larger settlements along the marshland fringe. Orchards are an occasional feature of the higher ground. Some localised scrub encroachment occurs along road verges, railway embankments and some sea walls.

Source: Greater Thames Estuary Countryside Character Area description;

4.3 Woodland types

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

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

Woodland type	Area (ha)	% of NCA
Broadleaved	1,581	2
Coniferous	98	<1
Mixed	24	<1
Other	94	<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	212	<1
Ancient re-planted woodland (PAWS)	37	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Reed-fringed drainage ditches and dykes form the main field boundaries of the open grazing pastures, with hedgerows largely absent.

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

5.2 Field patterns

Field patterns are frequently extremely ancient in origin, with strong linear systems running tangentially to rivers (for example the grid-like field system of the Dengie peninsula, considered to be over 2,000 years old). Regular medieval field systems associated with villages and small settlements are similarly aligned towards the coast and estuaries, with frequent 20th century enlargement (notably around Tilbury, Rochford and Tillingham). Medieval or earlier irregular drained fields are characteristic of Sheppey, the Cliffe marshes, Foulness and the Dengie marshes, interspersed with later more regular drained enclosure of the 18th or 19th century.

Source: Greater Thames Estuary 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

More than half the farms in this area are arable, with the 107 cereal farms accounting for 32 per cent of all holdings. Between 2000 and 2009 the number of farms decreased by 6 per cent. Arable farms declined by 19 per cent and mixed farms by 12 per cent. Livestock grazing farms increased by 10 per cent from 58 in 2000 to 64 in 2009 and other types increased by 28 per cent from 61 to 78 (23 per cent of all farms).

Source: Agricultural Census, Defra (2010)

6.2 Farm size

Most of the farmed area (85 per cent) is in the largest farm sizes (>100 ha). These 118 farms account for 35 per cent of the total number of units. The smallest farms (<5 ha) account for only 11 per cent of the number of farms and cover only 46 ha combined.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 41,263 ha; owned land = 26,840 ha

2000: Total farm area = 45,127 ha; owned land = 28,708 ha

Nearly 64 per cent of the agricultural land (26,840 ha) is farmed by the owner.

Source: Agricultural Census, Defra (2010)

6.4 Land use

Grass and uncropped land covers 16,182 ha (39 per cent) of the farmed area, and 34 per cent of the farmed area is used cereal crops (13,942 ha). Between

2000 and 2009 there was a 25 per cent (4,330 ha) decrease in the area farmed for cereals and a 75 per cent (773 ha) decrease in cash root crops. The areas farmed for oilseeds increased by 31 per cent (1,076 ha), other arable crops by 18 per cent (465 ha) and stock feed almost quadrupled (295 per cent), although in absolute terms the increase is modest at 126 ha.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

Sheep are the most numerous livestock within this landscape (a total of 27,600 animals) compared to a total of 4,900 pigs and 10,700 cattle. There was a dramatic decline in the number of pigs, reducing by more than half (59 per cent), and in sheep (28 per cent) since 2000. Cattle numbers have remained steady as has the area of grassland.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

There were 460 principal farmers (which include spouses and business partners) who account for 33 per cent of all farm labour. Only 5 per cent of farm labour is by salaried managers (68). Full time workers account for 16 per cent of the total, part time workers for 8 per cent, but by far the largest proportion of the workforce is casual / gang labour at 516 (38 per cent). Trends over the last decade show a 4 per cent increase in the total farm labour force. This is largely made up of casual / gang labour (209 more since 2000) whereas full time workers (100 less) and principal farmers (50 less) have decreased substantially.

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

Grazing marsh, a freshwater-brackish habitat created from reclaimed areas of salt marsh, and its associated habitats, including sea walls, reedbeds, ditches and saline lagoons, forms the dominant semi-natural habitat within the NCA, notably in Kent where extensive tracts remain. These estuarine habitats support national scarce and rare flora and fauna.

Intertidal sand flats and mudflats occur within the estuaries and provide substrates for algae and a wide range of marine invertebrate fauna that in turn support significant populations of breeding waders and wintering wildfowl. Cockle bank systems are also present; for example, The South Thames Marshes has one of the largest intertidal habitats in Kent, composed of the extensive intertidal flats of Blyth Sands.

Salt marsh occurs within the estuaries above the intertidal range in front of sea defences, and supports a much specialised group of species. The NCA has a larger area of salt marsh than any other, though it is disappearing rapidly due to coastal squeeze. The salt marshes and adjacent grasslands provide high tide roosts for wintering waterfowl.

Coastal sand dunes occur in outer estuarine areas, notably at the Walton Backwaters, with shingle, shell and sand banks along the seaward edge of some salt marshes and offshore islands, notably the Foulness Bund, and support a number of rare and scarce plants. Remnant sand dunes with wet slacks also occur at Shoeburyness.

Areas of subtidal sand and mud support rich communities of marine wildlife.

Arable farmland surrounding the estuaries supports internationally important populations of breeding and overwintering birds, notably Brent geese. It also supports nationally important assemblages of farmland birds.

Source: Greater Thames Estuary Coastal Natural Area Profile



Mudflats on the Leigh foreshore in Essex.

7.2 Priority habitats

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

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

Priority habitat	Area (ha)	% of NCA
Coastal and flood plain grazing marsh	12,729	15
Reedbeds	9,957	12
Lowland meadows	860	1
Mudflats	818	1
Purple moor grass and rush pasture	784	1
Broadleaved mixed and yew woodland (broad habitat)	716	1
Maritime cliff and slope	499	1
Saline lagoons	220	<1
Lowland dry acid grassland	138	<1
Fens	48	<1
Coastal vegetated shingle	30	<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 541 species are available at: <http://data.nbn.org.uk/>



Sea wall flood defences in the Swale, with saltmarsh in front and grazing marsh behind.

8. Settlement and development patterns

8.1 Settlement pattern

There is a lack of major settlement within the NCA and so includes some of the least settled parts of the English coast. Numerous small villages and hamlets are located on higher ground within and on the edge of the marshes reflecting medieval patterns. Industry, housing, caravan sites, transport routes and other structures now occupy what are often highly visible sites within the low-lying marshes due to post-war improvements in flood defence measures. Some settlements, such as Clacton-on-Sea, Southend-on-Sea and Frinton-on-Sea, have developed as popular seaside resorts along the coast, fed by the expansion of the railways in the mid-19th century. The higher ground between Sheerness, Minster and Leysdown is a densely urbanised area with caravans, huts and bungalows at the eastern end.

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

8.2 Main settlements

The main settlements are; Southend-on-Sea (only partially within the NCA); Clacton-on-Sea (only partially within the NCA); Sheerness; Walton-on-the-Naze; Frinton-on-Sea (only partially within the NCA); Maldon (only partially within the NCA); South Woodham Ferrers and Canvey Island. The total estimated population for this NCA (derived from ONS 2001 census data) is: 665,269.

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

8.3 Local vernacular and building materials

The Greater Thames Estuary is characterised by a lack of major settlements. A result of this is that there are no particular local vernacular styles and building materials associated with this NCA.

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



View of Canary Wharf from the south side of the River Thames in east London.

9. Key historic sites and features

9.1 Origin of historic features

Human activity, using the rich resources of the coastal zone, has taken place for millennia. Temporary encampments by Mesolithic hunter-gatherers are known to be preserved by the muds of the intertidal zone.

The more settled communities of the Neolithic period left more extensive remains including the extremely rare causewayed enclosures at Orsett on the north side of the Thames and Kingsborough Farm on the Isle of Sheppey.

Late bronze-age settlement evidence is widespread, extending inland from the coastal marshland and associated with a wide range of field systems and funerary monuments. Land surfaces with artefacts from this period have been revealed in the intertidal flats of the Blackwater Estuary.

Further inland there is evidence of iron-age and earlier occupation in the form of defended enclosures (Prittlewell Camp near Southend-on-Sea and Danes Camp, Shoebury) surviving as earthworks or as cropmark signatures.

There are abundant remains relating to local salt industries, with notable iron-age sites on the Essex marshes and later medieval salt mounds on the edge of the Kent marshes.

Roman settlement in the NCA was extensive but short lived although evidence of their fields is still visible.

Early medieval settlement was extensive and wealthy with a mixture of

nucleated villages and isolated manorial complexes set back from the marshes on the rising clayland, sometimes moated and accompanied by a church.

The network of minster churches founded by Christian Saxons are still evident in the landscape and form the basis of several settlements including Minster on the Isle of Sheppey, Barking, Tilbury, Great Wakering and Hoo St Werburg. Their positions in the landscape means that they occupy some of the most dramatic locations around the estuary, reflected in their marking on admiralty charts as navigation aids.

Prominent military associations include the historic naval dockyards surviving at Sheerness and Chatham while Deptford and Woolwich also contain a fine collection of historic naval buildings.

Military defences to protect the dockyards and London have made long-standing impacts on the coast, including Tilbury Fort (1670), the string of Martello Towers built during the Napoleonic Wars along Clacton Beach from St Osyth to Walton on the Naze, together with the Medway forts – Amherst, Clarence and Pitt. The later forts of the 1860s are among the most distinctive heritage features of the lower Thames marsh landscape at Cliffe, Coalhouse, East Tilbury, Allhallows and Sheerness, plus the island forts at Darnet and Hoo. Also many anti-invasion works from the First and Second World Wars can be found along the entire coastline. All this comprises one of the finest collections of historic military architecture in the world.

The long history of use and trade along the coastal fringe is evidenced by the patterns of oyster beds, duck decoys, sea defences and drainage works, and small settlements with minor wharfs and harbours.

There is a rich, if often hidden, repository of prehistoric archaeology within the mudflats and marshland.

Farming settlements are located principally in the inland zone and reflect an ancient pattern of farming tenure.

The pattern of inland agriculture is ancient in origin; for example the co-axial grid-like field system of the Dengie peninsula is considered to be over 2,000 years old. Medieval or earlier irregular drained fields are characteristic of the Isle of Sheppey, the Cliffe marshes, Foulness and the Dengie marshes.

There is a high survival of pre-1750 farmstead buildings, particularly farmhouses, but also including medieval and later aisled barns.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 4 Registered Parks and Gardens covering 55 ha
- 1 Registered Battlefield covering 35 ha
- 109 Scheduled Monuments
- 1,940 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

- Five per cent of the NCA, 4,175 ha, is classified as being publically accessible.
- There are 1,136 km of public rights of way at a density of 1.4 km per km².
- There is 1 National Trails (the Thames Coastal Path) extending along 17 km within the NCA.

Sources: Natural England (2010)

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

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	<1	<1
Common Land	103	<1
Country Parks	651	1
CROW Access Land (Section 4 and 16)	101	<1
CROW Section 15	93	<1
Village Greens	14	<1
Doorstep Greens	3	<1
Forestry Commission Walkers Welcome Grants	199	<1
Local Nature Reserves (LNR)	422	<1
Millennium Greens	1	<1
Accessible National Nature Reserves (NNR)	2,859	3
Agri-environment Scheme Access	23	<1
Woods for People	197	<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 urban areas of Southend-on-Sea, Clacton-on-Sea, Canvey Island and the western tip of the NCA around Greater London. The highest scores are found along the coast between Southend-on-Sea and Clacton-on-Sea, as well as the Kent coast opposite Corringham and to the south of the Isle of Sheppey.

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

Category of tranquillity	Score
Highest	116
Lowest	-128
Mean	3

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 the 'disturbed' areas of land are predominantly associated with the main areas of development, with significant areas of 'undisturbed' land occurring in Essex between Southend-on-Sea and West Mersea, as well as in Kent on the coast opposite Corringham and the southern half of the Isle of Sheppey. A

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

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	23	33	46	23
Undisturbed	56	44	37	-18
Urban	11	11	17	6

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are the loss of undisturbed land (18 per cent) and an increase in the area of disturbed land (22 per cent).

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



The branching estuary and coastal habitats surrounded by reclaimed arable land at Hamford Water in Essex.

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

Trees and woodlands

- Loss of elm from higher ground was significant in the 1960s and 1970s resulting in a more open landscape character. More recent data suggests that woodland cover increased slightly in the 1990s and 2000s.
- Tree cover is limited to farmsteads and villages on higher ground, and although character was thought to have remained stable between 1999 and 2003, there was notable decline in woodland management agreements during this period.
- New community woodland, linked to housing development, has recently been planted on the south side of the Isle of Sheppey uplands.

Boundary features

- While 10 per cent of field boundaries were covered under an agri-environment agreement as of 2003, Countryside Quality Counts (CQC) data suggested some loss of ditches had occurred, especially in the drained marshes of the coast.
- In 2011, 26 per cent of field boundaries were covered under Environmental Stewardship boundary options, suggesting the resource has probably been strengthened.

Agriculture

- The character of agricultural land was found to have been stable or possibly strengthened in 2003, with the area of grass sustained, and some shift from mixed and general cropping to lowland cattle and sheep.
- Between 2000 and 2009 there was a 19 per cent reduction in the number of arable and horticulture farms in the NCA and a reduction in the area of cereal crops from 40 per cent of the total farm area to 34 per cent.
- Numbers of grazing animals (sheep and pigs) were substantially lower in 2009 than 2000, although the number of cattle remained relatively constant. The area of livestock farms increased from 36 per cent to 39 per cent of the total farmed area.

Settlement and development

- Significant expansion of the urban fringe close to London, with development pressure continuing to transform the intrinsic character of the area.
- Increasing demand since 1945 for waste disposal sites and spoil heaps has further changed the character of the landscape, with the impacts of dredging also a major issue within the context of the estuary.
- New green infrastructure networks in association with Thames Gateway development are currently being created, and waste and mineral sites are being restored, including the Thurrock Thameside Nature Park at Mucking which lies on top of a former major landfill site. The Parklands Project has developed sites including Milton Creek Landscapes, Great Lines Heritage Park and Canvey Wick Nature Reserve.
- New roads and industrial complexes and their ancillary structures, the Thames Gateway and associated developments continue to place pressures on the capacity of the landscape to accommodate growth which is particularly visible within the flat estuary landscape.
- Some post-Second World War holiday settlements/plotlands, such as Clacton-on-Sea, became run down in the 1970s and 80s but are now being regenerated. Jaywick currently has the third most deprived area in England.

Semi-natural habitat

- Significant loss of unimproved marshland, in the order of 65 per cent, has taken place since the 1950s, with conversion largely to arable and improved pasture, but also to industrial development and recreational use.
- Today SSSI designated land covers just over 20 per cent of the NCA (around 17,000 ha), over 65 per cent of which is in favourable condition, although 25 per cent is still classified as unfavourable and declining.
- The extent of salt marsh habitat in front of sea defences is rapidly declining due to coastal squeeze.
- Essex Wildlife Trust carried out the largest managed coastal realignment project in Europe in 2002 at Abbots Hall Farm on the Blackwater Estuary to create 80 ha of new coastal habitat including salt marsh, grazing marsh and mudflats⁸.

Historic features

- A number of scheduled ancient monuments including the distinctive Martello towers and fort defences along the Essex and Kent coastlines have been placed on the Heritage at Risk Register due to their current poor condition and risk of future decay.^{9,10}

⁸ http://www.essexwt.org.uk/visitor_centres__nature_reserves/abbotts_hall_farm/
http://www.natura.org/sites_uk_abbotts.html

⁹ Heritage at Risk Register 2011 - East of England, English Heritage (2011)

¹⁰ Heritage at Risk Register 2011 - South East, English Heritage (2011)

Coast and rivers

- A modest uptake of agri-environment schemes for intertidal habitats in 2003 suggests that some enhancement of coastal character may have occurred.
- Coastal habitats and defences are under increasing pressure from climate change, especially salt marsh habitat which is being lost due to coastal squeeze.
- River water quality has recently shown a decline. CQC data from 1995 shows a mostly good biological and very good chemical river water quality. Current data classes river quality in areas of Kent and towards London as failing, while the ecological quality is moderate throughout, and poor towards London.
- Tourism and formal recreation-related uses of the estuary, such as boating, water and jet skiing, new marinas and increasing visitor pressure, may have acted to reduce the feeling of remoteness and wilderness in some areas.

Minerals

- The extraction of gravel remains an important industry within the NCA with new sites proposed in Kent¹¹ and Essex¹².
- There are currently ten active mineral extraction sites within the NCA covering approximately 168 ha, which have the potential to be restored for varying uses including nature conservation, green space, amenity, water storage and agriculture¹³.
- During 2011, 0.66 million tonnes of marine aggregates were dredged in the Thames Estuary region and nearly 88 per cent of that was landed at wharfs in the Thames Estuary.¹⁴ Dredging will continue to be an important and highly visible activity in the NCA.

¹¹ Kent Minerals and Waste development Scheme 2010-2015 (December 2012)

¹² Essex Replacement Minerals Local Plan Pre-Submission Draft (January 2013)

¹³ Nature After Minerals (2013). Accessed March 2013 at <http://afterminerals.com/index.aspx>
Crown Estates Marine Aggregate Dredging 14th Annual Report (2012)

¹⁴ Crown Estates Marine Aggregate Dredging 14th Annual Report (2012)

Drivers of change

Climate change

- Sea level rise is likely to result in significant losses of salt marsh and other habitats (including sand dunes, coastal vegetated shingle and mudflats) through coastal squeeze, with increased pressure on coastal defence structures due to reduced wave attenuation by the salt marsh and pressure on active dynamic coastal processes.
- A substantial alteration of estuary morphology may occur due to changes in sedimentary processes, with extensive mudflats likely to become sandier, affecting composition of bird species, changes in community composition of estuarine habitats due to increased submergence levels and a continuing and potentially accelerating reduction in sediment supply to recharge shingle beach systems.
- Increased sedimentation and barrier breaches would result in the loss of saline lagoons. Increased saline intrusion would potentially result in a significant alteration to, and the loss of, other species and habitats, including a reduction in quality of coastal arable farmland.
- Likely impacts of climate change on grazing marsh habitat include the loss of species due to saline intrusion, drying out in summer, and unpredictable inundation due to wetter winters and more frequent storm events with increased silt loading and loss of breeding habitat for wetland birds.
- A change in the arable landscape may also occur, with the appearance of species and crops adapted to new climatic conditions and a longer growing season potentially leading to double cropping.

- The urban nature of a significant area of the NCA puts increasing demands on flood management and water supply. Green infrastructure plays an important part in planning for this and other factors such as cooling the urban heat island effect.

Other key drivers

- New industrial complexes and their ancillary structures including roads, the Thames Gateway and associated developments all form growing pressures on the landscape. Such developments are particularly visible within the flat landscape of the Estuary.
- There is intense pressure to increase housing provision and for linear expansion of settlement along major communication routes and towards London. This is likely to increase further within the Thames Gateway Growth Area.
- Major port developments and other nationally important infrastructure projects may further impact upon character, especially in the London area.
- The restoration of mineral and waste sites, including areas of disused industrial land, offers opportunities to enhance the character of the landscape.
- New planting to re-establish tree and shrub cover around farmsteads and other sites on areas of higher ground may help to conserve the open character of the Estuary.
- Tourism and formal recreation-related uses of the Estuary, such as boating, water and jet skiing, new marinas and increasing visitor pressure, may reduce the feeling of remoteness and wilderness in some areas.

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.



Brent Geese feeding on reclaimed arable farmland in North Kent.

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: Maintain and enhance the expansive, remote coastal landscape – with its drowned estuaries, low islands, mudflats, and broad tracts of tidal salt marsh and reclaimed grazing marsh – maintaining internationally important habitats and their wildlife, and underlying geodiversity, while addressing the impacts of coastal squeeze and climate change and considering dynamic coastal processes.	↘*	↔***	↔**	N/A	↔***	↑***	↗**	↔**	↔**	↗***	↗**	↗**	↑***	↑***	↗**	↑***	↗**	↑***	↑***	↑***
SEO 2: Work with landowners and managers to incorporate measures to improve biodiversity, geodiversity, pollination, water quality, soil quality and climate adaptation and to prevent soil erosion in this important food-providing landscape, while maintaining its historic character.	↗**	↔***	↑**	N/A	↔***	↑***	↑**	↗**	↗**	↑**	↗**	↗**	↔**	↑**	↗**	↗**	↔**	↑***	↗**	
SEO 3: Ensure that the tranquil and remote character of the estuary is maintained by conserving and enhancing important coastal habitats and distinctive historic and geological features, while providing increased opportunities for recreation and enjoyment of the landscape.	↔**	↔**	↔**	N/A	↔**	↑***	↗**	↔**	↔**	↗**	↗**	↔**	↗**	↑***	↑**	↗**	↑***	↗**	↑***	
SEO 4: Encourage a strategic approach to development that is informed by and makes a positive contribution to local character, incorporates green infrastructure which provides ecosystem services where they are needed most, and promotes recreation and addresses climate change, while maintaining important open mosaic and coastal habitats, and historic and geological features.	↔**	↗**	↑**	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
Extensive open spaces within a predominantly flat, low-lying landscape give heightened importance to the skyline and dominating skylines.	<ul style="list-style-type: none"> ■ Open skylines are a particular characteristic of the low-lying estuary landscape. ■ A large and varied bird population adds movement to the expansive skyline. ■ Modern development, including expanding settlements, power stations, mineral extraction works, caravan parks and transport networks, is often highly visible within the open landscape and has had a significant impact upon the area.
Geological exposures of Tertiary and Quaternary deposits in soft eroding cliffs and foreshores and in quarries and pits, plus geomorphological interest of the estuary itself.	<ul style="list-style-type: none"> ■ A dynamic 'soft' coastline continually influenced by the action of waves and tides on the mobile sediments results in the ongoing erosion, accretion and creation of coastal landscapes. ■ The area contains two of the 11 Geological Conservation Review Saltmarsh Morphology Sites in Great Britain. ■ The coastline of the Isle of Sheppey provides some of the best examples of recent mass movement in Britain. ■ Important exposures of Tertiary sedimentary rocks such as at Walton-on-the-Naze, an exposure of London Clay with a rich source of fossils. ■ Exposures of Thames gravels with associated archaeological artefacts and paleoenvironmental remains. ■ Recreational and educational opportunities provided by important fossil collecting sites. ■ Geological SSSI provide important access to geodiversity and opportunities for research and education.
Geological contrast and variety within the Estuary is reflected in low islands such as Sheppey, Foulness, Northey and Mersea.	<ul style="list-style-type: none"> ■ Sheppey rises from a stretch of very flat marsh along the Swale estuary in Kent, with low, steep, clay cliffs facing north towards Essex. ■ Mersea is a low island in the Blackwater Estuary in Essex with sand/gravel cliffs.
Reclaimed grazing marsh and its associated habitats, including sea walls, reedbeds, ditches and saline lagoons, notably in Kent where extensive tracts remain.	<ul style="list-style-type: none"> ■ Coastal grazing marsh is a freshwater-brackish habitat created from reclaimed areas of salt marsh and supports a wide range of species. ■ Sustained by sea defences, much of it now lies as much as a metre below mean sea level. ■ Around 64 per cent of grazing marsh has been lost since 1945, most of it to arable conversion. ■ The habitat is identified as being at high risk to the direct impacts of climate change¹⁵.
Other semi-natural estuarine habitats, including intertidal sand and mudflats, salt marsh, sand dunes, shingle, shell and sand banks, and subtidal sand and mud.	<ul style="list-style-type: none"> ■ These habitats occur in front of sea defences, supporting a wide variety of wildlife. ■ Extensive areas covered by international designation, including Essex Estuaries SAC (over 3,700 ha) and ten SPAs covering nearly 15,000 ha (and extending inshore). ■ Intertidal sand and mudflats support a wide range of invertebrates and significant populations of breeding waders and wintering wildfowl. ■ The NCA has a larger area of salt marsh than any other area in England, supporting a very specialised flora of species as well as key examples of classic salt marsh morphology. ■ Significant threat of habitat loss due to coastal squeeze, with salt marsh identified as being at high risk to the direct impacts of climate change.¹⁶

^{15, 16} Mitchell, R.J et al. (2007) England Biodiversity Strategy - towards adaptation to climate change. Defra, UK.

<p>Arable farmland helping to support important populations of breeding birds, notably Brent geese.</p>	<ul style="list-style-type: none"> ■ The NCA supports over 50,000, or more than a fifth of the world population, of the dark-bellied variety of Brent geese. ■ The management of arable field margins and the availability of winter stubbles are crucial to the survival of breeding birds. ■ Conflict with Brent geese damaging crops.
<p>Nationally important open mosaic habitat on previously developed brownfield sites supporting assemblages of rare and scarce invertebrates.</p>	<ul style="list-style-type: none"> ■ Brownfield sites provide an important refuge for rare invertebrate species, including the brown-banded carder bee and shrill carder bee. ■ Flower-rich and open sward brownfield habitats have developed on post-industrial sites, particularly in south Essex, the Colchester area and the north Kent coast, including Canvey Wick SSSI. ■ These habitats and the species they support are now very scarce in 'natural' areas due to the loss of flower-rich grasslands.
<p>Limited woodland cover predominantly associated with farmsteads and villages on higher ground.</p>	<ul style="list-style-type: none"> ■ Woodland (just 1 per cent of NCA) associated with settlement on higher ground forms distinctive vertical elements in the landscape.
<p>A network of ancient reed-fringed drainage ditches and dykes reflecting historic patterns, including regular medieval field systems associated with villages, irregular medieval or earlier patterns at Sheppey, Cliffe and Foulness, and the extremely ancient grid system of the Dengie peninsula.</p>	<ul style="list-style-type: none"> ■ Field patterns are frequently extremely ancient in origin, with strong linear systems running tangentially to rivers (for example the grid-like field system of the Dengie peninsula, thought to be over 2,000 years old). ■ Regular medieval field systems associated with villages and small settlements are similarly aligned towards the coast and estuaries, with frequent 20th century enlargement (notably around Tilbury, Rochford and Tillingham). ■ Medieval or earlier irregular drained fields are characteristic of Sheppey, the Cliffe marshes, Foulness and the Dengie marshes, interspersed with later more regular drained enclosure of the 18th or 19th century.
<p>Rich historic associations include Neolithic and Iron Age features, and most notably a distinctive military heritage along the coastline such as Napoleonic military defences and 20th-century pillboxes.</p>	<ul style="list-style-type: none"> ■ Prominent military associations include the historic naval dockyards surviving at Sheerness and Chatham, the string of Martello towers built in the Napoleonic Wars along Clacton Beach, a number of distinctive forts, and the pillboxes from the Second World War. ■ Abundant remains relating to local salt-industries, with iron-age/Roman sites on the Essex Marshes and later medieval salt mounds on the edge of the Kent Marshes. ■ Extensive areas of Neolithic land surface in the Blackwater Estuary and rare Neolithic causewayed enclosures at Orsett on the north Thames side and Kingsborough Farm on the Isle of Sheppey. ■ Widespread evidence for late bronze-age settlement, extending inland from the coastal marshland and associated with a range of field systems and funerary monuments. ■ Iron-age defended enclosures survive as earthworks or as cropmark signatures, such as at Prittlewell Camp, near Southend and Danes Camp, Shoebury.

Settlement pattern of numerous small villages and hamlets located on higher ground reflecting the medieval layout of parishes.

- Medieval settlement patterns of numerous small villages and hamlets located on higher ground and on the edge of the marshes.
- Historic settlement patterns related to the coastal economy of fishing and boatbuilding.
- Local vernacular predominantly of red brick and weatherboarded houses, nucleated villages around churches, and isolated farmsteads, including a large number of pre-1750s buildings.
- Some of the least settled parts of the English coast.

Strong feelings of remoteness and wilderness persist on the open beaches and salt marshes, the reclaimed farmed marshland and on the mudflats, with 37 per cent of land still classified as 'undisturbed' according to CPRE data.

- Tranquillity and perceptions of remoteness are important characteristics of the NCA.
- Such large remaining areas of tranquillity are unusual so close to London and thus represent an important resource.

Landscape opportunities

- Protect the open spaces and expansive skylines from intrusive development, conserving the large areas of tranquillity and remoteness that remain especially remote coastal habitats and low lying islands.
- Protect the historic settlement pattern of numerous small villages and hamlets located on higher ground reflecting the medieval layout of parishes, and ensure new development is sympathetic to the built character of these settlements.
- Protect the network of ancient reed-fringed drainage ditches and dykes that include very ancient inland patterns (for example, those of the Dengie peninsula) and regular medieval patterns by the coast,
- Protect exposures of Tertiary and Quaternary deposits in soft eroding cliffs and foreshores, including important sites for London Clay fossils and Thames gravel exposures and enhance the recreational, research and interpretation opportunities provided by internationally important fossil collecting sites.
- Protect the geomorphological processes that shape the estuary, allow natural processes to continue unimpeded, and enhance the opportunities for research, education and interpretation they provide.
- Protect the area's rich historic and archaeological associations that include Neolithic and iron-age features, and most notably a distinctive military heritage along the coastline such as Napoleonic military defences and 20th-century pillboxes, and improve interpretation and promotion of these assets to reinforce the sense of history of the estuary and connect communities with their local heritage.
- Protect key open mosaic habitats and species on brownfield sites through site protection, mitigation and habitat creation.
- Manage and significantly restore areas of coastal grazing marsh and its associated habitats, including sea walls, reedbeds, ditches and saline lagoons, re-linking fragmented habitats to create a robust wildlife network with enhanced adaptation to climate change.
- Manage estuarine habitats including intertidal sand and mudflats, salt marsh, sand dunes, shingle, shell and sand banks, and subtidal sand and mud, supporting their adaptability to sea-level rise and maintaining opportunities for natural regeneration and allowing natural processes to continue unimpeded where appropriate, and identifying possibilities for creation of compensation habitats in other locations where they will be lost to coastal squeeze.
- Manage and enhance existing arable farmland helping to support important populations of breeding birds, notably dark-bellied Brent geese, including through the creation of arable field margins and conservation headlands.
- Plan to create new landscapes that include sustainably managed broadleaved woodlands that provide a setting to urban areas, as well as existing disused industrial land and mineral/waste sites, to significantly enhance landscape character and help to protect the tranquil and open character of the estuary.
- Plan strategic and local networks of green infrastructure as part of ongoing development to make a positive contribution to climate change, biodiversity, geodiversity and recreation within urban areas of the NCA.

Ecosystem service analysis

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	<p>High quality reclaimed arable land and grazing marsh</p> <p>Productive fertile soils</p> <p>Shellfish grounds</p> <p>Intertidal fish breeding and nursery habitats</p> <p>Fishing waters of the Estuary</p>	<p>Extensive areas of drained and ploughed arable land producing wheat and barley. Traditional wet pasture grazed with sheep and cattle. Some mixed agriculture on higher ground.</p> <p>Just over 49 per cent of the area is under some form of agricultural management, of which 55 per cent is described as cultivated. Wheat and barley are the main crops, although there are some areas of more mixed agriculture on higher ground including orchards in North Kent.</p> <p>Sheep are the most common livestock although together with pigs, numbers have declined since 2000. Numbers of beef cattle and the area of grazing land have remained steady since 2000.</p> <p>The Estuary supports an important commercial fishing industry.</p>	Regional	<p>Extensive areas of reclaimed arable land and grazing marsh make this a regionally important area for food production.</p> <p>Farmland in the NCA is increasingly under threat from loss due to sea level rise caused by climate change. There are also pressures due to development, especially in the west towards London, and surrounding existing settlements. Protecting high quality farmland through sustainable development plans, and maintaining flood defences in appropriate areas will help to address these issues.</p> <p>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.</p> <p>Agricultural crops provide a food source for internationally important breeding birds, especially Brent geese. This is potentially a source of conflict with local farmers as foraging may result in reduced crop yield.</p> <p>Salt marsh and intertidal and subtidal mud are an important breeding and nursery area for fish such as Dover sole, flounder, sea bass and mullet and are rich shellfish grounds.¹⁷ The estuary is especially important for its cockle beds. The large populations of cockles are maintained at a sustainable level by the Kent and Essex Sea Fisheries Committee under a Regulating Order and other fisheries are controlled under EU and national legislation.</p>	<p>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.</p> <p>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.</p> <p>Sustainably manage arable land to preserve its importance for food production and enhance associated habitat opportunities for Brent geese and other wildlife to benefit both agricultural production and wildlife.</p> <p>Ensure high-quality agricultural land is safeguarded in development plans.</p> <p>Protect existing intertidal fish nursery sites, fish breeding grounds and shellfish grounds and identify new sites for their creation through managed realignment.</p> <p>Work with fishermen to sustainably manage the shellfish and fishing industries.</p>	<p>Food provision</p> <p>Biodiversity</p> <p>Geodiversity</p> <p>Sense of place / inspiration</p> <p>Regulating coastal erosion</p> <p>Regulating soil erosion</p> <p>Regulating water quality</p>

¹⁷ The Tidal Thames Habitat Action Plan, Thames Estuary Partnership Biodiversity Action Group (2002)

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Timber provision	Small amounts of existing woodland cover	<p>Very small woodland cover of 1,797 ha (2.1 per cent of NCA), the area is not a provider of timber.</p> <p>Trees are restricted to pockets of higher ground surrounding farmsteads, churches and larger settlements. Limited areas of ancient woodland occur on the edge of the marshes (such as in Thundersley Glen and Shipwrights woods in Castle Point or Copperas Woods on the Stour Estuary in Essex). Elm hedges and tree lines were once a characteristic feature of certain areas (such as the Dengie Peninsula and Isle of Sheppey) until the arrival of Dutch elm disease in the 1960s.</p> <p>Clumps and rows of trees are a key characteristic of the higher knolls of land on the Sheppey Marshes, for example, Kings Hill Farm on Elmley Island and on the Isle of Harty.</p>	Local	<p>Trees are largely incompatible with the open character of the estuary landscape, however, sustainably managed broadleaved woodland could potentially be planted to screen urban and industrial developments, including mineral and waste sites, which may help to preserve a sense of tranquillity and remoteness.</p> <p>The absence of hedgerows and hedgerow trees is now a distinctive feature of the NCA and contributes to its open character, although a hedgerows and trees were a more common feature in the past, especially large elm trees in hedgerows on the upper areas of the Isle of Sheppey, and there is some scope to increase and manage them again. The presence of individual trees in urban/industrial areas and in hedgerows on the raised areas off the marsh, is an important feature and should be maintained and enhanced where appropriate.</p>	<p>Increase sustainably managed broadleaved woodland to provide a limited, local timber supply, screen urban and industrial developments.</p> <p>Investigate the potential to reinstate hedgerows in areas of historical occurrence, where this does not impact on the open character of the estuary.</p> <p>Maintain and enhance the presence of trees in urban/industrial areas and as characteristic features of areas of higher ground away from the open marshes.</p>	<p>Timber provision</p> <p>Tranquillity</p> <p>Sense of place / inspiration</p> <p>Biodiversity</p> <p>Climate regulation</p>

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Water availability	Groundwater Rivers Chalk aquifer Thanet Sands formation	<p>The rivers Colne, Blackwater, Crouch, Thames, Medway, Swale and Lea all drain into the estuary, plus several lakes and reservoirs. The western reach of the NCA overlies the principal London chalk aquifer, although recharge of the aquifer does not occur from within the NCA. The Thanet Sands Formation which overlies the aquifer has high permeability and forms a hydrological continuity with the chalk. Some abstraction, mainly for public water supply, occurs from the aquifer within the NCA.¹⁸</p> <p>Groundwater flow from East London and Essex is drawn west into central London.¹⁸</p> <p>The North Kent and Swale area²⁰ has no distinctive watercourses flowing through it, instead there are spring-fed and surface-fed streams that flow over the low-lying marshes into the Swale which are largely dependant on groundwater levels, and the Sheppey and Iwade systems which are dependant on rainfall and therefore vulnerable to drought conditions. Water is available for abstraction, including the Isle of Sheppey and the coastline from Faversham eastwards, although the area of coastline west of Faversham to the Medway has no available water.</p> <p>The northern reaches of the Medway²¹ including the Isle of Grain, Cliffe Marshes and Shorne Marshes all have water available for abstraction. Some water is abstracted from the principal chalk aquifer in this area.</p> <p>Surface water availability is more mixed in South Essex,²² with no water available for abstraction along the whole of the coastline at very low flows but water available in the Colne and Tendring, Blackwater, and Dengie systems at median and high flows. New abstraction licences may be granted in these areas under 'hands off flow' conditions (abstraction is stopped when the flow falls below a certain level). Groundwater may be available for abstraction in some coastal areas, and this is subject to individual assessment to ensure no impact on surface water flows.</p> <p>Water is extracted to supply domestic water needs and for industrial and farming uses.</p>	Local	<p>Development pressures in the area, including an increase in the urban population and in industry, will put increasing demands on the water resource.</p> <p>Water availability issues within the NCA are largely dependent on abstraction levels from aquifers, surface waters and groundwater upstream. Integrated water management, including adopting land management practices to aid groundwater recharge and protect water quality, are vital to sustaining the resource in the long term. Water management in the Thanet Sands area towards London is especially important to protect the principal aquifer.</p> <p>Coastal grazing marsh in the NCA is a complex ecosystem, with continuous fluctuation from the mixing of brackish and fresh water, which is managed through the manipulation of water levels and livestock grazing. This makes the marshes highly vulnerable to groundwater abstraction. Under the Habitats Directive an assessment is required of existing and new abstraction licences to ensure they are not impacting on the SPA and SAC in the Thames Estuary and to ensure appropriate measures are taken to continue protection of water flows in these areas.</p>	<p>Ensure water conservation and efficient water use is embedded within spatial strategic planning policies, including requiring all new developments to be designed to achieve minimum water efficiency levels, and requiring the use of sustainable urban drainage systems to reduce flood risk, improve water quality and increase groundwater recharge.</p> <p>Promote integrated water management to slow run off and increase infiltration to aquifers (for example reduce soil compaction and increase soil organic matter on agricultural land) and targeted drainage management where possible to increase water availability in periods of low rainfall.</p> <p>Ensure that the freshwater resource for internationally important coastal habitats is protected through the management of water abstraction levels, and through sustainable land and water management.</p>	<p>Water availability</p> <p>Geodiversity</p> <p>Regulating water quality</p> <p>Regulating soil quality</p> <p>Biodiversity</p> <p>Regulating soil erosion</p>

¹⁸ London Abstraction Licensing Strategy, Environment Agency (2013) (accessed August 2013; URL: www.environment-agency.gov.uk/business/topics/water/132669.aspx)

¹⁹ Management of the London Basin Chalk Aquifer – Status Report 2012, Environment Agency (2012) (accessed August 2013; URL: <https://publications.environment-agency.gov.uk/skeleton/publications/ViewPublication.aspx?id=e068d7b0-7eb2-4461-b5d7-07dc3be75c28>)

²⁰ North Kent and Swale Catchment Abstraction Licensing Strategy, Environment Agency (2013) (accessed March 2013; URL: www.environment-agency.gov.uk/business/topics/water/132669.aspx)

²¹ Medway Abstraction Licencing Strategy, Environment Agency (2013) (accessed March 2013; URL: www.environment-agency.gov.uk/business/topics/water/132669.aspx)

²² Essex Abstraction Licencing Strategy, Environment Agency (2013) (accessed March 2013; URL: www.environment-agency.gov.uk/business/topics/water/119931.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	N/A					
Biomass energy	Small areas of existing woodland	Existing woodland cover (1 per cent of NCA) provides limited scope for the provision of biomass.	Local	Planting biomass crops in the NCA may be possible although care must be taken to maintain the open character of the landscape, and grazing marsh and historic features should be avoided. The potential miscanthus yield is generally high, falling to medium closer to London, while that for short rotation coppice is medium with low yields where crops would be exposed to salt laden winds and towards London. ²³ There is scope to plant around existing and proposed settlements and large-scale developments (such as major ports, waste disposal facilities, refineries, power stations) to add variety and screening.	Investigate and secure opportunities for planting biomass crops in association with new developments, but care needs to be taken to ensure there are no adverse impacts on the open character of the landscape.	Biomass energy Climate regulation Tranquillity
Climate regulation	Soils of coastal flats Semi-natural habitats including salt marsh, grazing marsh, reedbeds, mudflats and saline lagoons Woodlands	The NCA contains predominantly mineral soils which generally have a low proportion of carbon stored in the top soil horizon (0–5 per cent). Some variants of the loamy/clayey soils of coastal flats (covering around half the NCA), especially the large areas of grazing marsh, may have more organic rich topsoils, while marine sediments of the salt marsh soils can have elevated organic matter levels. Areas of reedbed (9,957 ha), mudflats (818 ha) and saline lagoons (220 ha) are likely to be associated with areas of higher carbon content. In addition there will be a limited amount of carbon locked up in hedgerow trees and the small woodlands on higher ground.	Regional	There may be the opportunity for enhanced carbon sequestration of soils within the NCA, especially those under cultivation, by increasing organic matter inputs and by reducing the frequency and area of cultivation. Coastal habitats within the NCA are at high risk of being lost from coastal squeeze as sea levels rise due to climate change. Maintaining the areas of salt marsh, grazing marsh and intertidal mudflats and creating new areas of coastal habitat through managed realignment to mitigate for predicted losses will ensure continued carbon storage in the future. Predicted increased flooding of coastal areas from rising sea levels may increase salinity levels inland, which presents a risk to freshwater wetland habitats. The increasing demand on water resources may also impact on freshwater habitats. Sustainable management of the freshwater resource is needed to ensure no future losses of habitat, including the identification of new sites for habitat creation. There is the potential for increasing carbon sequestration by planting broadleaved woodland to screen developments and by promoting the planting of trees, green walls and roofs, and back gardens within urban areas, and increasing the amount of green space in the NCA through initiatives such as Greening the Gateway.	Maintain and enhance existing intertidal coastal habitats and identify new sites for the creation of salt marsh, grazing marsh and intertidal mudflats through managed realignment. Maintain, enhance and create new areas of freshwater wetland habitat, and sustainably manage the freshwater resource to ensure its future sustainability. Seek opportunities to link fragmented habitats with other semi-natural habitats such as well managed ditches and grasslands to enable species to move in response to changing sea levels and habitats. Increase organic matter in soils through management interventions. Promote the greening of urban and industrial areas by the planting of trees, green walls and roofs, and back gardens within urban areas, and increasing the amount of green space. Plant sustainably managed broadleaved woodland to screen urban and industrial developments and bring existing woodland into positive management. Investigate the potential to reinstate hedgerows in areas of historical occurrence, where this does not impact on the open character of the estuary.	Climate regulation Biodiversity Regulating soil quality Regulating soil erosion Regulating coastal erosion Regulating water quality Timber provision Sense of place / inspiration Geodiversity

²³ Opportunities and optimum sitings for energy crops in the South East region, Natural England (accessed March 2013; URL: www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/south_east_region.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	<p>Aquifers, ditches, streams, rivers, estuaries and coastal waters</p> <p>Semi-natural coastal habitats including grazing marsh, salt marsh and intertidal mudflats</p>	<p>The chemical status of surface water is good to the north of the NCA²⁴ but failing to reach good status in the Greater London and Kent areas.²⁵ The groundwater chemical status is equally mixed throughout the NCA with the Kent area achieving a good status while the rest of the NCA is poor, although some of the Essex coast areas have not been assessed. The ecological quality of the area's rivers is generally moderate, although some towards the Greater London area are of poor status.</p> <p>The ecological potential of the area's coastal and estuarine waters is moderate, apart from the mouth of the Colne Estuary and Hamford Water which is classed as good. Chemical status is good in the waters to the south of Essex but failing on the Kent coastline and from Southend and the Isle of Sheppey towards London.</p> <p>The Colne and Stour in the north form part of a Defra priority catchment.</p> <p>There is some hydrological continuity between the Thanet Sand formation in the far west of the NCA and the principal London Basin Chalk aquifer underneath.²⁶ The principal chalk aquifer is vulnerable to saline intrusion from the tidal section of the River Thames and water quality is closely monitored and water levels managed to reduce this risk.²⁷</p>	Local	<p>Much of the ecological and chemical status of the estuary depends on waters that flow into it from upstream, which makes it vulnerable to inputs from urban and industrial areas and from agriculture, and limits the possibilities of addressing these issues.</p> <p>Development within the NCA is likely to increase pressures on the water environment, and increase potential sources of pollution, especially in more urban and industrial areas towards London but there is potential to mitigate for this by including measures to ensure the sustainable management of water resources, such as sustainable urban drainage schemes, sewage treatment options and reducing nutrients from diffuse pollution, are included in local development plans.</p> <p>Within agricultural areas in the NCA, measures can be taken to reduce nutrient and sediment run-off by establishing permanent grassland as a buffer along watercourses.</p> <p>The quality of water in the Thanet Sand Formation should be protected and enhanced to help protect the principal chalk aquifer. Adopting land management practices and integrated water management policies to protect groundwater throughout the NCA, and especially in the Thanet Sands, and to minimise risks through pollution, contamination, saline intrusion and run-off are vital to sustaining the resource in the long-term.</p>	<p>Implement catchment wide water management plans to reduce the impacts of upstream point source and diffuse pollution on the estuary.</p> <p>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.</p> <p>Enhance land management and increase buffer strips along watercourses to help prevent deterioration in water quality caused by high nutrient levels.</p> <p>Protect groundwater quality by adopting land management practices and integrated water management policies to minimise risks through pollution, contamination, saline intrusion and run-off.</p>	<p>Regulating water quality</p> <p>Regulating water flow</p> <p>Biodiversity</p> <p>Regulating soil erosion</p>

²⁴ Anglian River Basin District Management Plan, Environment Agency (2009) (accessed March 2013; URL: www.environment-agency.gov.uk/research/planning/124725.aspx)

²⁵ Thames River Basin District Management Plan, Environment Agency (2009) (accessed March 2013; URL: www.environment-agency.gov.uk/research/planning/125035.aspx)

²⁶ Groundwater Quality Review: The confined Chalk of the London Basin, Thames Region, Environment Agency (2006) (accessed August 2013; URL: www.environment-agency.gov.uk/static/documents/Business/GW_Aquifer_Quality_Reports.pdf)

²⁷ Management of the London Basin Chalk Aquifer – Status Report 2012, Environment Agency (2012) (accessed August 2013; URL: <https://publications.environment-agency.gov.uk/skeleton/publications/ViewPublication.aspx?id=e068d7b0-7eb2-4461-b5d7-07dc3be75c28>)

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Regulating water flow	Ditches, streams, rivers Grazing marsh Thames flood barrier	The risk of flooding from rivers in the NCA is limited, with tidal flooding posing the greatest risk. The Thames Barrier protects areas upstream from flooding during exceptionally high tides and storm surges from the North Sea.	Regional	Flood events may increase with more storm events occurring due to climate change, and flooding on lower reaches of rivers occurring due to tidal surges. A lack of major settlements in the area means that few properties are at risk from river flooding, and future urban development is not predicted to increase the risk of fluvial flooding. ²⁸ Flood events pose no risk to SPA and SAC habitats and these may benefit from increased water levels during flood events (for example Mucking Flats and Marshes SPA). ²⁹ To prevent increased flooding of the River Thames the TE2100 plan ³⁰ proposes the option of storing tidal waters (at Erith Marshes, Aveley and Wennington Marshes, Dartford and Crayford Marshes, and Shorne and Higham Marshes) during very large surge tides to help to reduce extreme water levels at the Thames Barrier. Options of an additional outer barrier are also being explored.	Maintain the network of drainage ditches and drains in floodplain areas to provide effective floodwater management during storm events. Manage flood risk upstream of the NCA to reduce impacts towards the estuary and maintain river flood defence structures where necessary. Identify and safeguard areas of functional floodplain needed for strategic flood storage in the Thames Estuary in local development plans.	Regulating water flow Biodiversity Sense of place / inspiration
Regulating soil quality	Loamy/clayey soils of coastal flats Seasonally wet base-rich loamy/clayey soils	There are six main soilscape types in this NCA: loamy and clayey soils of coastal flats with naturally high groundwater (48 per cent of NCA); slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (17 per cent); slightly acid loamy and clayey soils with impeded drainage (12 per cent); freely draining slightly acid loamy soils (11 per cent); salt marsh soils (5 per cent); and loamy soils with naturally high groundwater (4 per cent). These loamy and clayey soils, when adequately drained, provide fertile arable land.	Regional	The agricultural potential of coastal soils is dependent on the continued ability to pump drain and protect them from sea flooding and saline intrusion. Coastal soils are increasingly under threat of loss from sea level rise although they will help protect other inland soils from these issues. Compaction, poaching and/or capping may be a problem in the seasonally wet soils leading to increasingly poor water infiltration and diffuse pollution as a result of surface water run-off. The freely draining slightly acid loamy soils may be valuable for aquifer recharge, requiring the maintenance of good structural conditions to aid water infiltration.	Protect salt marsh and other intertidal habitats as a buffer between the sea and agricultural land and to protect against saline intrusion. Reduce soil compaction by careful timing of activities including avoiding compaction by unnecessary machinery use in wet conditions Increase organic matter in soils through management interventions including fallow within rotations, overwintering stubbles and pollen and nectar strips.	Regulating soil quality Regulating soil erosion Regulating coastal erosion Food provision Biodiversity Geodiversity Regulating water quality

²⁸ North Kent Rivers Catchment Flood Management Plan, Environment Agency (2009) (accessed March 2013; URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

²⁹ South Essex Catchment Flood Management Plan, Environment Agency (2009); North Essex Catchment Flood Management Plan, Environment Agency (2009) (accessed March 2013; URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

³⁰ Thames Estuary 2100 Plan, Managing Flood Risk through London and the Thames Estuary, Environment Agency (2012) (accessed March 2013; URL: www.environment-agency.gov.uk/homeandleisure/floods/125045.aspx)

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Regulating soil erosion	<p>Loamy/clayey soils with impeded drainage</p> <p>Freely draining loamy soils</p> <p>Semi-natural habitats, woodland, hedgerows</p> <p>Salt marsh soils</p>	<p>Dominant waterlogged soils of the coastal flats have a low risk of soil erosion (65 per cent of NCA).</p> <p>Freely draining soils (11 per cent), and soils with impeded drainage (12 per cent), especially on sloping land, have an enhanced risk of erosion.</p> <p>Salt marsh soils (5 per cent) will protect inland soils from loss by coastal erosion.</p>	Regional	<p>The two dominant NCA soil types have a low risk of soil erosion, as do the loamy soils with naturally high groundwater except where coarser textured variants occur on sloping or uneven ground.</p> <p>The slightly acid loamy and clayey soils found in the area with impeded drainage are prone to capping/slaking, leading to increased risk of erosion. These soils are easily compacted by machinery or livestock if accessed when wet, which increases the risks of soil erosion by surface water run-off, especially on the steeper slopes next to rivers.</p> <p>The freely draining loamy soils have enhanced risk of soil erosion on moderately or steeply sloping land where cultivated or bare soil is exposed, exacerbated where organic matter levels are low after continuous arable cultivation or where soils are compacted. There is also the potential for wind erosion on some coarse textured cultivated variants but it is not known if this is an issue in the NCA.</p> <p>Salt marsh soils provide an important natural defence against the erosion of soils further inland by reducing the impact of wave action on the coastline and its flood defence structures, and by providing a barrier between the sea and inland habitats.</p>	<p>Create grass buffers along ditches and watercourses to capture sediment run-off.</p> <p>Reduce soil compaction by careful timing of activities.</p> <p>Increase organic matter in soils through management interventions.</p> <p>Protect salt marsh soils and other intertidal habitats to create a buffer between the sea and agricultural land and protect soils from loss by coastal erosion.</p>	<p>Regulating soil erosion</p> <p>Regulating water quality</p> <p>Regulating coastal erosion</p> <p>Food provision</p> <p>Biodiversity</p> <p>Geodiversity</p> <p>Regulating water quality</p>

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Pollination	Semi-natural habitats including grazing marsh Brownfield sites	<p>The NCA is important for some of the UK's rarest bumble bees and three priority species are strongly associated with the North Kent and South Essex coastlines: the shrill carder bee, brown-banded carder bee and moss carder bee.</p> <p>Two other UKBAP bumblebee species are also present in the NCA but have a less strong coastal association: red-shanked carder bee and large garden bumble bee.</p> <p>Dry, flower-rich habitats within the NCA, including open mosaic habitat on previously developed brownfield sites, provide important nectar sources for pollinators.</p>	Regional	<p>The NCA contains large areas of agricultural land with some food crops which are dependent on insect pollination, and its coastal habitats provide an important refuge for rare pollinator species.</p> <p>The three bumble bee species found on coastal habitat tend to be associated with tall open flower-rich grasslands and in the NCA, they are mainly found on remnant grazing marsh and in particular the sea walls. Flower-rich ex-industrial brownfield sites also provide important habitat for bees.</p> <p>Pollen and nectar margins on arable farms (through agri-environment schemes) can provide important foraging habitat for pollinators.</p> <p>The open mosaic habitat on brownfield sites supports important populations of pollinator species. This is at risk of being lost through development and conversion of sites to more formal greenspace.</p>	<p>Maintain and enhance the floristic diversity of grazing marsh and other semi-natural habitats to increase the area of habitat suitable for pollinators, and to act as a wildlife corridor between other coastal habitats.</p> <p>Increase the area of, and sustainably manage existing semi-natural habitat, including grazing marsh, to benefit pollinating insects.</p> <p>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.</p> <p>Protect flower-rich open mosaic habitat on brownfield sites supporting important populations of pollinator species.</p>	<p>Pollination</p> <p>Biodiversity</p> <p>Food provision</p>
Pest regulation	Semi-natural habitats Field margins	The extensive semi-natural habitats adjacent to arable farmland support populations of pest regulating invertebrate, bird and mammal species.	Local	<p>Increasing diversity in species and structure of field margins will increase the ability for these areas to support populations of pest regulating species.</p> <p>There are opportunities to improve the network of semi-natural habitats across the NCA through appropriate management of existing habitats including sea walls and creation of new habitat.</p>	<p>Manage semi-natural habitats to increase diversity of structure and composition and increase populations of pest regulating species.</p> <p>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.</p>	<p>Pest regulation</p> <p>Pollination</p> <p>Biodiversity</p> <p>Food provision</p>

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Regulating coastal erosion and flooding	<p>Semi-natural coastal habitats including salt marsh, and grazing marsh</p> <p>Geomorphology</p> <p>Active natural processes</p>	<p>The major risk of flooding in the area comes from the sea, with large areas of reclaimed arable land and grazing marsh below sea level and maintained by sea defences.</p> <p>Within the Thames Estuary, as far as Sheerness and Shoeburyness, flood protection is provided by walls, embankments, barriers, gates and other defence structures designed to protect against a 1-in-1,000 year flood up to 2030. Some less developed areas (such as Grain, North Kent Marshes and parts of the Southend frontage) have lower standards.</p> <p>Much of the area is at risk from flooding, mostly from surge tides, including the Isle of Sheppey and all areas to the north of Chatham and along the Essex coast. Areas at Southend and along the courses of the River Crouch, River Colne and River Blackwater are all at high risk.</p> <p>The extensive coastal habitats in the NCA, especially salt marsh, provide an important natural defence against flooding and coastal erosion by reducing the impact of wave action on the coastline and its flood defence structures, and by providing a barrier between the sea and inland habitats.</p> <p>Coastal features and habitats are being lost at a rapid rate due to 'coastal squeeze', where an inflexible sea defence prevents natural regeneration in the face of rising sea levels.</p>	Regional	<p>The vulnerability of the area to flooding is increasing due to a predicted increase in extreme weather events as well as rising sea levels. The increased threat of sea defences breaching would have significant consequences for the area's settlements, farmland and semi-natural habitats.</p> <p>Sustainable shoreline management is needed to ensure the protection of vulnerable areas from flooding in the face of climate change. The relevant shoreline management plans^{31 32 33} identify where sea defences will be maintained and where there is opportunity or need for managed realignment. Within the estuary, combined policies of predominantly 'hold the line' and 'managed realignment' will be implemented. Managed realignment would create new areas of internationally important coastal habitats and potentially help to mitigate for predicted losses caused by coastal squeeze.</p>	<p>Ensure no net loss of internationally important coastal habitats by promoting natural regeneration and identifying opportunities to create compensation habitats where natural regeneration is not possible or practical.</p> <p>Implement sustainable shoreline management plans including managed realignment schemes where appropriate.</p>	<p>Regulating coastal erosion and flooding</p> <p>Sense of place / inspiration</p> <p>Sense of history</p> <p>Biodiversity</p> <p>Geodiversity</p>

³¹ Essex and South Suffolk Shoreline Management Plan 2, Environment Agency (2010) (accessed March 2013; URL: www.environment-agency.gov.uk/research/planning/105014.aspx)

³² Isle of Grain to South Foreland Shoreline Management Plan, Environment Agency (2010) (accessed March 2013; URL: www.environment-agency.gov.uk/research/planning/105014.aspx)

³³ Medway Estuary and Swale Shoreline Management Plan, Environment Agency (2010) (accessed March 2013; URL: www.environment-agency.gov.uk/research/planning/105014.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sence of place / inspiration	<p>Expansive remote estuarine landscape with views dominated by the skyscape</p> <p>Distinctive estuarine habitats and geodiversity</p> <p>River Thames and the North Sea</p> <p>Large bird populations</p> <p>Historic settlement patterns</p> <p>Contrasting urban and industrial landscapes</p>	<p>Sense of place is provided by the flat, open and expansive estuarine landscape where distinctive shallow creeks, drowned estuaries, low islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh provide a strong sense of remoteness and skylscapes dominate the views.</p> <p>Ancient patterns of reed-filled ditches crossing reclaimed farmland, the historic settlement patterns of isolated farms and villages on higher land, coastal military landmarks, and the ever present presence of the sea all contribute to the source of inspiration and escapism provided by this wild place.</p> <p>Several of Dickens' novels make use of the landscape of the north Kent marshes, notably the evocative opening to Great Expectations which perfectly captures the nature of the estuary.</p>	Regional	<p>The overriding character of the area is defined by the wild and remote coastal marshes and mudflats and the ever present presence of the sea, a character which is being largely maintained despite the close proximity to London and ever growing pressures from development.</p> <p>The close proximity of the highly industrial and urban areas of east London, and industrial landmarks along the coast, provide an interesting contrast to the sense of isolation that can be felt in the estuary marshes. A sustainable approach to development in the area which protects more isolated areas will help protect the tranquillity of the marshes and the opportunity for escapism that they provide.</p> <p>Increasing recreational use of estuary waters for water sports and increasing visitor numbers may reduce feelings of tranquillity in isolated areas.</p>	<p>Protect, enhance and create semi-natural coastal habitats including grazing marsh, salt marsh and mudflats to preserve the remote and tranquil character of the estuary and ensure the large flock of birds remain to bring inspiration and movement to the marshes.</p> <p>Conserve the historic character of the area, including the ancient patterns of reed-filled drainage ditches that criss-cross reclaimed farmland, the medieval settlement patterns of isolated farms and villages on higher land and the historic military associations along the coast.</p> <p>Ensure development has minimal impact on the expansive views and existing character of the area.</p> <p>Maintain and improve sustainable access to and provide interpretation of important features of the estuary to encourage tourism and visitor enjoyment.</p>	<p>Sense of place / inspiration</p> <p>Tranquillity</p> <p>Sense of history</p> <p>Biodiversity</p> <p>Recreation</p> <p>Geodiversity</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	<p>Distinctive coastal military heritage</p> <p>Historic settlement patterns and land use</p> <p>Iron-age, bronze-age and Saxon heritage</p>	<p>A sense of history is most evidently provided by the prominent military associations that survive along the coastline, including the naval dockyards at Sheerness and Chatham, the Martello towers from the Napoleonic Wars along Clacton Beach, a number of distinctive forts, and the pillboxes from the Second World War.</p> <p>Other important historical features include iron-age/ Roman salt mounds and bronze-age funerary monuments, as well as the Saxon minster churches and the historic settlement patterns of isolated farms and villages on higher land.</p> <p>Sea banks and sea walls and the radically different land use on each side of these, including the ancient drainage systems, vividly illustrate the efforts that generations of local communities have made to create and maintain viable livestock and arable farms and protect them from the sea.</p>	National	<p>The distinctive military landmarks along the coastline are a defining feature of the estuary and reflect the historical importance of the area in protecting London from invasion by the sea. It is important to protect and provide interpretation of these features, and other historical assets to preserve the sense of history of the area.</p> <p>The area's cultural isolation particularly that of the northern estuaries and marshes of the Crouch, Blackwater the Colne and the Stour has resulted in these areas being less subject to change than many other parts of rural Britain and so they maintain a sense of history enriched by the saltings and marshes which line the river mouths, and the ancient land use and settlement patterns.</p> <p>The historical assets in the NCA provide opportunities to link communities with their local heritage and provide an important resource to encourage visitors to the area.</p>	<p>Protect and provide interpretation of the distinctive military landmarks along the coastline to reflect the historical importance of the area in protecting London from invasion by the sea.</p> <p>Protect, interpret and promote the coastal military heritage and iron-age, bronze-age and Saxon historic assets of the area, and where appropriate increase access to reinforce the sense of history of the estuary, connect communities with their local heritage and encourage tourists.</p> <p>Ensure development in the estuary preserves historic medieval settlement and land use patterns.</p>	<p>Sense of history</p> <p>Sense of place/ inspiration</p> <p>Geodiversity</p> <p>Recreation</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	<p>Remote estuarine habitats and seascape including vast open skies</p> <p>Remote rural areas, with ancient field and settlement patterns</p> <p>Greenspace</p>	<p>Tranquillity is an important feature of the NCA, with relatively high levels remaining given its proximity to London.</p> <p>Some 37 per cent of the NCA is still identified as undisturbed (a decline from 55 per cent since the 1960s). These areas are generally associated with the expansive and remote mudflats and marshes, notably on the Dengie Peninsula and Foulness Island in Essex, as well as part of the Isle of Sheppey in Kent.</p>	Regional	<p>Pressure for urban growth in parts of the estuary (for example Dartford, Medway Towns and Thurrock) and new developments such as the Thames Gateway container port at Shellhaven are likely to reduce tranquillity due to increases in population, and in the infrastructure associated with proposed developments, such as new or wider roads and associated light pollution and traffic. Efforts could be made to conserve tranquillity in the estuary, through creation of new green infrastructure associated with development.</p> <p>Noise pollution from increased air travel would reduce tranquillity in this area, valued for its high tranquillity levels and sense of escapism.</p> <p>Wind turbines, as proposed on the Dengie peninsula, can impact negatively on people's sense of tranquillity.</p> <p>There is a positive association between visiting natural green spaces and good mental health. Both physical activity and exposure to nature have separately been demonstrated to provide benefits for mental well-being.³⁴</p> <p>Feelings of calm and wellbeing increase with increased biodiversity richness of a green space.³⁵</p>	<p>Maintain the extent and quality of current 'tranquil' semi-natural habitats within the NCA and create new habitats where feasible.</p> <p>Maintain and enhance tranquillity by planting broadleaved woodland screening, and potentially miscanthus, as part of new developments and to reduce the impact of existing urban and industrial areas where appropriate.</p> <p>Increase the areas of greenspace with high biodiversity value in more developed parts of the NCA.</p> <p>Limit development, including increases in light and noise pollution, in more remote parts of the NCA including semi-natural habitats and farmland that currently score highly for tranquillity.</p>	<p>Tranquillity</p> <p>Biodiversity</p> <p>Sense of place/ inspiration</p>

³⁴ 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)

³⁵ Psychological benefits of greenspace increase with biodiversity. Biology Letters 3: 390–394, RA Fuller, KN Irvine, P Devine-Wright et al. (2007)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Coastal paths Greenspace Semi-natural coastal habitats including beaches Estuary waters Birdwatching	<p>Recreational access is provided by the Thames Estuary Coastal Path which is currently under development on the Essex coastline (its eventual extent yet to be decided and dependant on the treatment of estuaries), as well as the Thames Path National Trail (17.2 km) and 1,136 km of public footpaths (equivalent to 1.36 km per km²). Routes include the London Loop, Swale Heritage Trail and Two Forts Trail and the green spaces associated with the East London, Kent and South Essex Green Grids. The Saxon Shore Way provides a continuous path from Gravesend along the Kent coastline as far as Hastings in Sussex.</p> <p>Recreational access to sea walls is interrupted in places by industrial installations (for example Bradwell or Grain Power Stations, Shellhaven), by unbridged tributaries (for example the River Darent), and it often has limited links inland.</p> <p>Recreation is also provided by numerous beach resorts including the popular tourist destinations of Clacton and Southend-on-Sea, and the fossil hunting cliffs at Walton-on-the-Naze.</p> <p>The internationally important semi-natural coastal habitats along the estuary attract many visitors for their birdwatching spectacle and for the sense of escapism and inspiration they provide.</p> <p>Yacht and sailing clubs are popular within the estuary, and pleasure boats provide trips into London from the outer Thames Estuary in summer. The waters of the estuary are used for a range of other activities including recreational fishing. Recreation water use is high in some areas but there are large areas that do not have good recreational access such as the Hoo Peninsular and the Swale.</p>	Regional	<p>Recreational activities in the Thames Estuary provide an important opportunity for local people, and those from more urban areas including Inner London, to enjoy the natural environment.</p> <p>The provision of greenspace within urban areas is important to encourage recreational use of nature by local people as most visits to the natural environment take place within 2 miles of home and are by foot.³⁶ Individuals with easy access to nature are three times more likely to participate in physical activity than those with poorer access and, therefore, 40 per cent less likely to become overweight or obese.³⁷</p> <p>Increasing recreational use of remote areas may act to reduce feelings of tranquillity in the estuary. Increasing visitor pressure may also impact on fragile habitats including internationally important coastal sites.</p> <p>Local development plans, including Greening the Gateway, promote the creation of new areas of green space, which would increase recreational opportunities in urban areas.</p> <p>Encouraging volunteering opportunities and working with local schools and community groups to promote activities such as birdwatching and visiting important coastal habitats would help connect people to the natural landscape and its wildlife.</p>	<p>Implement sustainable access routes currently under development and identify opportunities to enhance access to areas of biodiversity, geological and historic interest, incorporating interpretation of local heritage and important landscape features.</p> <p>Develop new areas of greenspace to provide enhanced recreational opportunities in urban areas.</p> <p>Preserve sustainable recreational opportunities by protecting characteristic features of the landscape, including internationally important coastal habitats and species, estuary waters and historic assets.</p> <p>Manage increased visitor pressure by promoting the sustainable recreational use of appropriate areas while protecting fragile habitats, geological and historic features.</p> <p>Encourage opportunities for people to connect to the natural landscape through volunteering, working with local schools and community groups and activities such as birdwatching and visiting coastal habitats.</p>	<p>Recreation</p> <p>Sense of place / inspiration</p> <p>Biodiversity</p> <p>Sense of history</p> <p>Tranquillity</p>

³⁶ Natural England Commissioned Report NECR094. Monitor of Engagement with the Natural Environment: Annual Report 2012, Natural England (2012)

³⁷ A systematic review of evidence for the added benefits to health of exposure to natural environments. BMC Public Health 10: 456–466, DE Bowler, LM Buyung-Ali, TM Knight and AS Pullin (2010); Environment, design and obesity. Environment and Behavior 39(1): 6–33, NM Wells, SP Ashdown, EHS Davies et al. (2007)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
<p>Biodiversity</p> <p>(continued on next page)</p>	<p>Coastal habitats including grazing marsh, salt marsh and intertidal mudflats</p> <p>Associated terrestrial habitats including arable farmland</p> <p>Open mosaic habitat on brownfield sites</p> <p>Rare plant, invertebrate and bird species</p> <p>Wintering waterfowl and breeding wetland birds</p> <p>Estuarine waters</p> <p>Greenspace in urban areas</p>	<p>The NCA is of international importance for its extensive semi-natural coastal habitats, and the species these habitats support. International and national designations cover significant areas of the NCA (15,329 ha and 32,267 ha respectively) and include one SAC, ten SPAs and ten Ramsar sites.</p> <p>Coastal and flood plain grazing marsh, a freshwater-brackish habitat created from reclaimed areas of salt marsh, and its associated habitats, including reedbeds, ditches and saline lagoons, form the dominant semi-natural habitats within the NCA (13,135 ha), notably in Kent where extensive tracts remain.</p> <p>The salt marsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates, and the surrounding rich mosaic of terrestrial habitats supports nationally rare plants and invertebrates including three of the UK's rarest bumble bee species. There are a number of notable marshland plants, for example the pedunculate sea-purslane, re-established at Foulness in 1989.</p> <p>Arable land provides important foraging habitat for breeding wetland birds, farmland bird species and invertebrates.</p>	International	<p>Coastal habitats within the NCA are at high risk of being lost from coastal squeeze due to climate change as inflexible sea defences prevent natural regeneration in the face of rising sea levels. Salt marsh in the NCA is disappearing rapidly. The pressure on marshland habitats is reflected by the history of the pedunculate sea-purslane; thought extinct by the 1930s, it was rediscovered in 1987, and programme of re-establishment and recovery has subsequently begun.</p> <p>Coastal habitats should be protected and, where this is not feasible, managed realignment schemes could create new areas of internationally important coastal habitats, and potentially help to mitigate for predicted losses caused by coastal squeeze. A successful managed realignment project created 80 ha of new coastal habitat including salt marsh, grazing marsh and mudflats at Abbots Hall Farm on the Blackwater Estuary in 2002.</p> <p>The management of arable farmland to benefit wildlife, including planting wild flower margins, management options for farmland birds and foraging ground for breeding birds is crucial for bird and invertebrate species within the NCA.</p> <p>Open mosaic habitat on previously developed land provides an important refuge for rare invertebrate species following the loss of more 'natural' flower-rich grassland habitats in the Thames Estuary.</p>	<p>Protect existing intertidal coastal habitats and identify new sites for the creation of salt marsh, grazing marsh and intertidal mudflats through managed realignment to ensure no net loss occurs, as appropriate and in accordance with the shoreline management plan.</p> <p>Support and promote initiatives and programmes that serve to secure the re-establishment and recovery of rare species associated with the marshland, coastal and estuarine habitats of the area, for example the species recovery programme for the pedunculate sea-purslane.</p> <p>Ensure effective management of protected sites across the Estuary and re-link fragmented habitats to create a robust wildlife network with enhanced adaptation to climate change.</p> <p>Maintain and enhance the floristic diversity of sea walls to increase the area of habitat suitable for pollinators, and to act as a wildlife corridor between other coastal habitats.</p> <p>Work with the farming community to ensure sympathetic management of land to benefit wildlife (including field margins, conservation headlands and buffer strips on watercourses), and that land used by bird populations for foraging and roosting, outside the designated areas, is adequately protected and managed.</p>	<p>Biodiversity</p> <p>Regulating coastal flooding/ erosion</p> <p>Pollination</p> <p>Climate regulation</p> <p>Sense of place/ inspiration</p> <p>Recreation</p> <p>Tranquillity</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
<p>Biodiversity</p> <p>(continued from previous page)</p>		<p>The estuary supports hundreds of thousands of wintering waterfowl and provides some of the best breeding sites for rare wetland birds in southern England, most notably one-fifth of the world's population of dark-bellied Brent geese.</p> <p>The NCA is of national importance for its open mosaic habitats on post-industrial sites, particularly in south Essex, the Colchester area and the north Kent coast, including Canvey Wick SSSI, which support nationally important invertebrate assemblages and key populations of rare species, including the brown-banded carder bee and shrill carder bee.</p> <p>Salt marsh and intertidal and subtidal mud support a diverse assemblage of marine life and are an important breeding and nursery area for fish such as Dover sole, flounder, sea bass and mullet.</p> <p>Green spaces within urban areas provide important habitats and resources for wildlife.</p>	International	<p>Development of brownfield sites is occurring in the Thames Gateway as part of regeneration projects, including turning those sites into greenspace. The biodiversity interest of brownfield sites should be retained or incorporated into future developments.</p> <p>Freshwater wetland habitats along the coastal areas, including reedbed, are under threat due to climate change from potential saline intrusion and a reduction in available water. Existing areas should be protected and new sites identified for creation of habitat. Water availability should be managed to ensure an adequate supply for protected areas in the future.</p> <p>The intertidal and subtidal areas of the estuary are important for a variety of marine life and should be protected, and new areas created where possible.</p> <p>Green spaces within urban areas should be managed to improve their biodiversity value. Leaving areas of unmown grass would increase vegetation richness and structure providing better habitat for wildlife, and may reduce maintenance costs.</p>	<p>Ensure that new developments adequately incorporate features to make a positive contribution to biodiversity.</p> <p>Raise awareness of the importance of brownfield sites in the Thames Gateway for biodiversity, and conserve key open mosaic habitats and species through site protection, mitigation and habitat creation.</p> <p>Protect intertidal and subtidal habitats and the estuarine processes.</p> <p>Manage areas of greenspace to benefit wildlife, for example increasing areas of unmown grass.</p>	

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	<p>Coastal geomorphological processes</p> <p>Exposures of London Clay and Thames gravels</p> <p>Palaeolithic archaeology</p>	<p>The NCA contains five SSSI notified solely for their geological interest and four mixed interest SSSI. This NCA is also intersected by three further geological SSSI as well as one Local Geological Site.</p> <p>The NCA typically represents the eastern edge of the London Basin, a geological formation of Tertiary sediments predominantly comprised of sands and clays deposited between 65 and 23 million years ago. Within this NCA, these Tertiary sediments contain fossils of both national and international importance including very well preserved flora and fauna that are the basis for defining the stratigraphy of the London Clay (Sheppey Cliffs and Foreshore SSSI), as well as diverse avifauna assemblages (Burnham on Crouch SSSI and The Naze SSSI), that form the type localities for some taxa and also contain evidence of fossil families only recorded in Britain.</p> <p>Important stratigraphic evidence of the major glacial event, which was responsible for the shift in the course of the Thames to its present day route, is preserved at Holland-on-Sea SSSI. Within this NCA, we also have sites that preserve evidence of past climates, landscapes and biodiversity as well as evidence for early humans and the landscapes they lived in around 400,000 years ago (Clacton SSSI).</p> <p>The estuary coastline is of major geomorphological interest for its range of landforms and active processes. The estuary coastline comprises of a system of estuaries, characterised by a maze of winding, shallow tidal creeks that dissect islands, mudflats, sandflats, 'soft coasts' and salt marsh where natural active processes can be observed.</p> <p>A sense of the geological history of the estuary is provided by exposures of London Clay and Thames gravels along the coastlines of Essex and Kent.</p> <p>Walton-on-the-Naze on the Essex coast is an internationally important site for its London Clay fossils, and the cliffs and foreshore between Warden and Minster on the north coast of Sheppey represents one of the best-known fossil collecting sites in Britain.</p>	National	<p>The area is of major geomorphological interest for the study of estuarine and coastal processes. Of particular interest are Colne Point, a 4-km shingle spit used to study the movement of shingle and the development of shingle structures, the 4,000-year-old salt marsh at St Osyth Marsh which is an important site for studying mature salt marsh features and documenting changes in salt marsh growth, and the continuous 8-mile salt marsh and mudflat structure of Dengie Flat.</p> <p>The geological SSSI along the coastline provide important access to geodiversity, enabling interpretation, understanding and continued research and make a positive contribution towards sense of place and sense of history. The remote and wild coastal habitats formed by geomorphological processes are inspiring features of the landscape.</p>	<p>Continue to research, monitor and record coastal geomorphological processes that shape the Thames estuary to improve our understanding and inform future management of the area.</p> <p>Conserve and enhance the natural dynamic processes that shape the estuary.</p> <p>Continue to maintain, enhance, study, and provide access to, sites of geological interest including Colne Point, St Osyth Marsh and Dengie Flats and important exposures of fossils as a source of recreation.</p>	<p>Geodiversity</p> <p>Regulating coastal erosion</p> <p>Recreation</p> <p>Sense of place/ inspiration</p> <p>Sense of history</p> <p>Biodiversity</p> <p>Tranquillity</p>

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