



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.

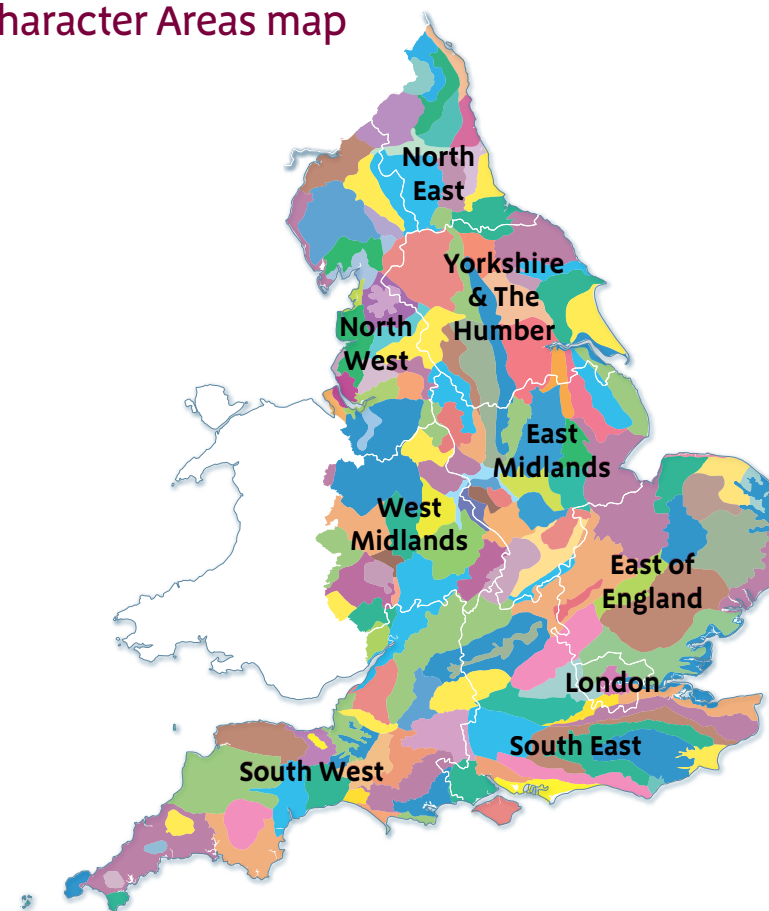
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

[Click map to enlarge; click again to reduce](#)

[Click map to enlarge; click again to reduce](#)

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.

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.

- **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.

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.