National Character Area profile:

31. Morecambe Coast and Lune Estuary

NATURAL ENGLAND

www.naturalengland.org.uk

Introduction

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

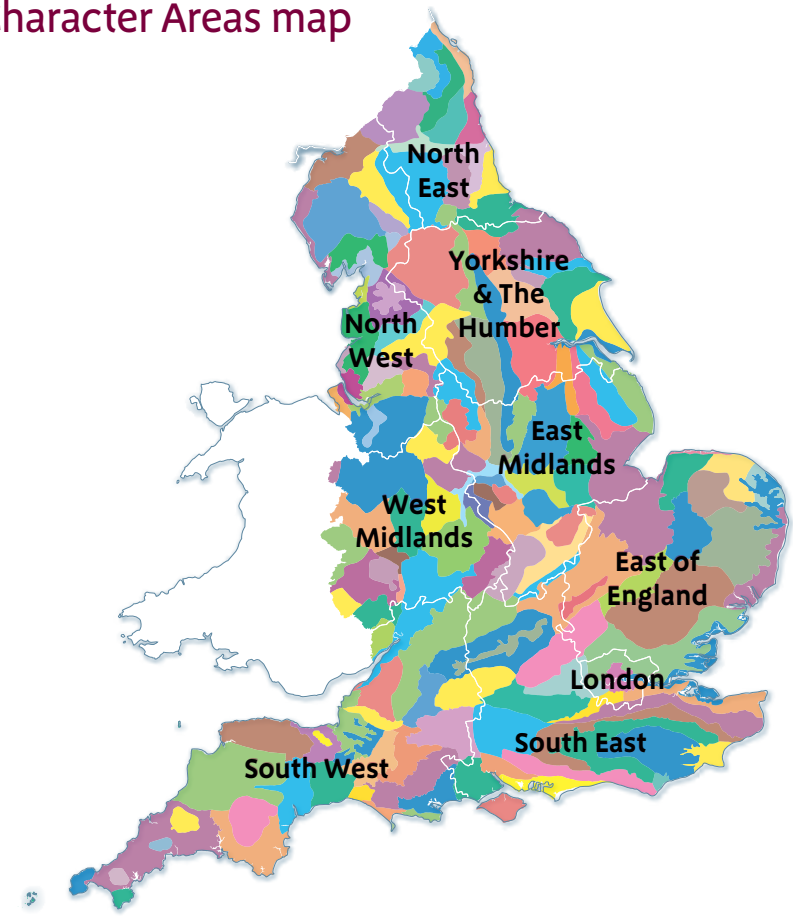
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

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

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

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

National Character Areas map



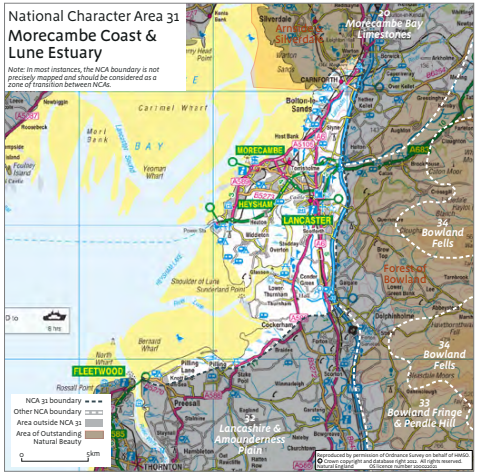
[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: **www.official-documents.gov.uk/document/cm80/8082/8082.pdf**)
[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: **www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf**)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

Summary

The Morecambe Coast and Lune Estuary is a relatively small and low-lying National Character Area (NCA) bordering Morecambe Bay. It includes areas of high population in the towns of Heysham and Morecambe and the City of Lancaster, but also encompasses areas of high tranquillity, particularly around the Lune Estuary and westwards along the Pilling Coast. Its distinctive identity is strongly linked to the coastal environment along its margin with Morecambe Bay, and inland through the estuaries of the Lune and the Keer. These are nationally and internationally designated as Sites of Special Scientific Interest, Special Area of Conservation, Special Protection Area and Ramsar site for their coastal habitats and the wildlife that they support, including salt marshes, intertidal reefs, and wader and waterfowl populations. There is a longstanding cultural link to the coastal environment through fisheries, trade and tourism.

Away from the coast and urban areas, the landscape is mainly one of pastoral agriculture, including dairy, which varies in character from reclaimed grasslands bounded by wet ditches in the lowest-lying areas to a hedged landscape including frequent boundary trees as the land begins to rise. Towards the boundary with the adjacent upland NCAs, and where drumlins are present providing abundant field stone, stone walls start to predominate. To the north and west the NCA is framed by areas of higher ground, including the Lake District Fells and Bowland Fells.

The key opportunities reflect the importance of the coastal zone, both intrinsically and because of the diverse services that it supports through its coastal processes such as regulation of coastal flooding and erosion, climate regulation, biodiversity, sense of place and recreation. There are opportunities presented by the juxtaposition of areas of urban development with a coastal zone of exceptional quality, including recreation and tourism and environmental education for the urban populations, as well as for visitors. Future challenges include energy security and the impacts of climate change, particularly in the low-lying coastal zone.



Click map to enlarge; click again to reduce

Statements of Environmental Opportunities:

- **SEO 1:** Maintain and enhance the historic and landscape character and the internationally significant habitats of the coastal environment, including the mudflats, salt marsh, sand dunes, vegetated shingle and the Lune Estuary, to support its key features, reflect the dynamic nature of the coastal systems, and ensure that the area remains able to regulate coastal flooding and sequester and store carbon, while providing access and recreation that is sensitive to the character of the coastal zone.

- **SEO 2:** Enhance the mainly pastoral, rural landscape by supporting land managers to adopt long-term sustainable land management practices on both the organic soils of the coastal plain and reclaimed land from the Lune Estuary to Knott End-on-Sea, and the mineral soils of higher ground, seeking outcomes which deliver both economic and environmental benefits.

- **SEO 3:** Working with land managers, seek opportunities to enhance the historic character of the rural landscape, including heritage assets, boundary features and habitats, to protect the character of the rural landscape and restore the ecological condition and connectivity of these features.

- **SEO 4:** Promote the social, economic and cultural value of a healthy natural environment and embed wide understanding of sustainable management, building on the close proximity of areas of exceptional environmental value, particularly the coastal zone, to areas of high population density.

The Lune Estuary with its estuarine habitats is of international importance for waders and wildfowl.

Description

Physical and functional links to other National Character Areas

The NCA is bounded to the north by the Morecambe Bay Limestones NCA, where the soft sediment and superficial deposits of this NCA are replaced by harder limestone geology. To the east the area grades into the Bowland Fringe and Pendle Hill NCA, as its character moves from that of lowland to upland, roughly along the line of the M6 motorway. To the south, the coastal fringe gives way to the reclaimed coastal wetland landscape of the Lancashire and Amounderness Plain NCA. This coastal stretch from Cockerham to Knott End-on-Sea also protects the low-lying farmland of the Lancashire and Amounderness Plain from the influence of Morecambe Bay. The western boundary of the NCA merges into the intertidal sands of Morecambe Bay, which provides a common physical identity to the margin of all the NCAs that border the bay. The Morecambe Coast and Lune Estuary NCA and its coastal neighbours are inherently linked by coastal processes, being part of the shared single Morecambe Bay sediment system.

The rivers that empty into the bay also provide a strong physical connection between the area and the upland NCAs that frame it, particularly through the Lune Catchment, which drains a number of NCAs including Cumbria High Fells, Howgill Fells, Yorkshire Dales and Bowland Fells.

Upland NCAs form the backdrop from viewpoints in the area to the Bowland Fells to the east and the Lake District across the sands of Morecambe Bay to the north. From these surrounding NCAs the Morecambe Coast and Lune Estuary NCA forms a low-lying fringe punctuated by such features as Heysham nuclear power station and the Ashton Memorial.

Cockle fishermen, Morecambe Bay. The riches of the bay have for centuries shaped both cultural and economic development.

Key characteristics

- Broad and relatively flat lowlands enclosed by escarpments which open out dramatically into the undulating landscape of the coastal strip with substantial drumlin features.
- The sheltered expanse of the Lune Estuary with its salt marshes and tidal channels overlooked by low ridges on the Heysham peninsula and around Lancaster.
- Panoramic vistas across Morecambe Bay from Lancaster and higher ground, to backdrops of the Cumbrian Fells and across the Lune Estuary from Sunderland Point and the Heysham peninsula towards the Bowland Fells.
- Range of coastal landscape features including extensive salt marshes backing extensive sand and mud flats, particularly around the Lune Estuary; reclaimed mosses and marshland; a small area of intact remnant mossland at Heysham; sand and shingle beaches north of the Lune Estuary; and Millstone Grit sandstone cliffs at Heysham.
- Intensively managed pastoral landscape bounded by ditches in the lowest-lying reclaimed areas, hedges with mature trees in low-lying areas and grading into stone walls on drumlin fields and upland foot slopes with limited extent of semi-natural habitats away from the coastal strip.
- Low woodland cover throughout with woodland largely restricted to the sides of the Lune Valley on the boundary of the NCA and small copses on farmland.
- Presence of Heysham power station, which is a dominant feature on the visual profile of the coastal strip and is widely visible from adjacent NCAs, as well as the associated infrastructure such as power lines which are also widely visible.
- The cathedral city of Lancaster, market town and former administrative capital of Lancashire. Mainly built from Millstone Grit sandstone, the city overlooks a former fording point at the head of the Lune Estuary with a castle, cathedral, neo-Georgian town hall, canal and Victorian parks.
- Rural architecture, including farmsteads, that mostly results from rebuilding in brick and stone in the late 18th and 19th centuries, with fragments of earlier timber frame, sandstone, Millstone Grit and earth constructions, with fields subject to high levels of boundary change since the mid-19th century.
- Coastal developments that reflect a long history of a visitor economy and associated recreation, including the sea front facade at Morecambe with hotels, amusements and a promenade, and a range of caravan sites and golf courses along the more rural parts of the coastal strip from Heysham north to Carnforth.
- Traversed north–south by the west coast transport network including the M6, the West Coast Main Line railway and the Lancaster Canal, which pass between the Bowland Fells and Morecambe Bay.

Morecambe Coast and Lune Estuary today

Underlain by sandstones and mudstones of Carboniferous, Permian and Triassic age, but with a surface mainly shaped by superficial deposits of glacial, fluvial and coastal origin, this is a low-lying NCA which grades into the flat expanses of Morecambe Bay. The area is crossed by the rivers Lune and Cocker, both of which enter the NCA from the Bowland Fringe and discharge into the expanse of Morecambe Bay.

On the coastal margin and around the low-lying marshes of the Lune Estuary the landform is the product of coastal processes, with a flat topography incised by creeks, channels and, where land has been reclaimed, ditches. Elsewhere it is gently undulating with shallow slopes and enclosed views. This plain is a drumlin field formed by glaciers moving southwards between the Westmorland Fells and Yorkshire Dales Fells, over Silverdale and around the Bowland massif during the Quaternary period. There are limited outcrops of the solid geology with Carboniferous Millstone Grit sandstones on the beach and the low cliffs of Heysham Head and with Permian and Triassic rocks outcropping near Sunderland Point. Across much of the NCA the soils are free draining and acidic, supporting Grade 3 agricultural land, but on the reclaimed margins some pockets of Grade 2 land are present associated with former peatlands. Throughout the NCA the management of the rural landscapes is dominated by pastoral agriculture.

The most distinctive characteristics of the NCA's rural landscape are tied to the coast of Morecambe Bay. From the Lune Estuary south there is a broad open coastal margin composed of salt marshes that grade smoothly into the vast expanses of intertidal mud and sand flats of the bay. From Sunderland Point north the same features are present but as part of a narrower coastal strip associated with a more open coastline. This part of the NCA's coast is more diverse with occasional rock outcrops and glacially derived cobble skears. The natural attributes of the coast include extensive salt marshes and intertidal mud and sand flats which, along the entire coastal margin of the NCA, are nationally and internationally important and designated as Sites of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site for the habitats they include and the species they support, most notably hundreds of thousands of wintering wildfowl and waders including oystercatcher, knot and pink-footed geese, rare insects such as the belted beauty moth and also extensive reefs of the honeycomb worm on cobble skears.

Sunderland Point and the Lune Estuary. The dynamic coastal environment has always exerted a strong influence on coastal settlements.

Throughout much of the coastal plain the low-lying and flat landscape, combined with the open views punctuated by the natural features of Morecambe Bay and an upland backdrop, gives a strong sense of isolation to the area. However, this changes along the coast between Heysham and Hest Bank, including Morecambe itself, to one where an urban coastal landscape, which has developed in conjunction with the visitor economy and coastal industry, looks out on a vista of the natural expanse of Morecambe Bay with its ever-changing sand flats and seascape.

These natural assets, manifest in distant views, often across shining wet mudflats and glistening sand banks animated by large numbers of shore birds, serve to accentuate the characteristic sense of wide open space that has been the base from which the cultural landscape has developed. This can be seen economically, with Morecambe Bay's traditional economy based on the collection of cockles, mussels and shrimps as well as the visitor economy that developed during the 1800s, and socially, as is reflected in the high density of pre-Conquest churches and religious artefacts on the coast.

Backing many of the coastal salt marshes are areas of reclaimed ground including both former salt marshes and peat bogs. These areas are defended by a sea wall and drained through an artificial network of ditches, with little or no tree cover and large, open fields bounded by ditches. From the coastal fringe, the area grades eastwards into gently rolling farmland whose origin lies in glacial deposits and the glacially smoothed sandstone bedrock. This is a more intimate pastoral landscape of gently graded low hills where smaller, older field patterns are enclosed by hedges, often with standard trees. Away from the urban extents of Heysham, Morecambe and Lancaster, this pastoral landscape reaches the coast from Heysham northwards, providing the green space between the urban settlements. The easternmost parts of the NCA are the highest, reaching to 110 m, with stone walls gradually replacing hedges as soils thin towards the upland margin of the Bowland Fringe and Pendle Hill NCA. The transition to stone walls is also evident where drumlin fields provide an abundant source of field stones. Throughout the area tree cover is generally limited to hedgerow trees, occasional farmland copses and urban areas with very little cover of woodland away from the steeper slopes flanking the River Lune.

Although coastal trade was part of the early influence on settlement, more recently land-based trade routes have been more important and the NCA sits at one end of a bottleneck in north–south trade routes up the west side of England. This route is still much evidenced today with the Lancaster Canal, the West Coast Main Line railway and the M6 motorway all squeezed into a narrow corridor between the uplands of Bowland and the lowlands of Morecambe Bay.

Heysham power station dominates the view across the sands of Morecambe Bay.

The coast has also shaped the modern industrial character of parts of the NCA, dictating the evolution of the Port of Heysham and the nuclear power plant on Heysham Point. Away from the principal coastal settlements the modern recreational sites, such as caravan sites and golf courses, now form a distinctive element of the rural coastal landscape, particularly from Heysham north to Carnforth.

The urban settlements in the NCA differ in nature. The town of Morecambe has a Victorian seaside resort character, particularly along its seaside town facade, reflecting its development as a coastal town with recreation and visitors at its heart, which was made possible by the arrival of the railway in the 1840s. The coastal strip is dominated by guest houses and shops serving the needs of seaside visitors. Behind this the town has a more suburban character. This character, which is shared by some of the other coastal towns, differs from that of Lancaster, the important historic city and modern university town, which was formerly the administrative centre for Lancashire. Associated with its history as a trade and administrative centre, the city has a number of historic buildings including Lancaster Castle, overlooking the Lune crossing points, and Lancaster Cathedral. It rises up from the banks of the River Lune to high points such as the Ashton Memorial in Williamson Park, with panoramic views across the NCA, Morecambe Bay and on towards the mountains of Cumbria. The majority of the buildings in Lancaster are constructed from local natural sandstone from the Millstone Grit Series and typically take the form of two- and three-storey stone terraces. Millstone Grit is also the traditional building material in the villages south of Lancaster along the course of the Lancaster Canal.

The sea front of Morecambe has evolved over time but has always reflected the identity of Morecambe Bay.

The landscape through time

Occasionally outcropping, but more often buried, the NCA is underlain by mudstones and sandstones that owe their origins to the Carboniferous, Permian and Triassic periods. This solid geology is generally capped by glacially deposited material, often in the form of drumlin fields, which were formed by glaciers moving southwards between the Westmorland Fells and Yorkshire Dales Fells, over Silverdale and around the Bowland massif in the Quaternary period. Due to marine transgression, which caused the partial drowning of the drumlin field, the lower margin of the NCA merges gradually into the flatter coastal strip. Along the coast material has been reworked by coastal processes and often more recent Quaternary deposits of estuarine origin dominate. Some of these areas developed into peat-forming systems, as seen at Heysham Moss.

This natural landform has been extensively modified by human activity. The long history of the human landscape is evident in its links with Christianity, with a high density of churches and religious artefacts including Norse hog-back tombs, Anglian preaching or sepulchral crosses and chapels such as the chapel of St Patrick at Heysham. Since the 1100s the peatlands have been modified by human activity, for fuel and agriculture, to such an extent that now only a small remnant survives, at Heysham Moss, in a semi-natural state.

Between the 12th and 14th centuries, population pressure resulted in land claim along the coast, reflected in earth embankments, sea walls, and drained marshlands crossed by a network of deep ditches and surface drains, with further reclamation from the late 17th century. As a consequence, extensive areas of the coastal plain have been reclaimed for agriculture, and are now defended from the sea by large embankments following drainage through a network of artificial watercourses. By the mid-1800s the land around the bay was mostly drained and let in large farms producing crops of wheat, oats or barley, turnips and seeds. Today, however, the agricultural system is essentially pastoral with grazing and grass managed for winter feed which forms the dominant agricultural land use.

New tidal creek forming in response to coastal sea defences protecting Morecambe.

The reclamation and enclosure of low-lying areas was carried out in two phases. Post-medieval enclosure resulted in regular medium-to-large fields being created bounded by thorn hedgerows, as concentrated in the area inland and south of Glasson (where some is taken from former parkland). This is also evident in the area south of Morecambe and east of Cockerham where enclosure of former mossland was the dominant process. Modern enclosure is more limited in extent and relates mainly to reclaimed coastal areas near Pilling. Earlier enclosures are more apparent away from the coastal strip, where pre-1600 enclosure patterns can be seen around Hest Bank, west of the River Lune around Middleton, and also to the north of Cockerham. The rural buildings that survive, including farmsteads, mostly date from the late 18th century, there being only rare fragments of earlier buildings of timber frame and earth construction.

As well as agricultural modification, the landscape has been modified by commerce. Local shellfish fisheries and coastal trade routes led to the development of parts of the coastal strip while, to a lesser extent, inland trade routes affected areas along the Lancaster Canal. From the 16th century the landscape became densely settled through demands for raw materials for industry and the expansion of settlements.

Until the late 18th century the main trade routes through the NCA were coastal. However, as a response to the silting up of the Port of Lancaster, and the rise in importance of the Port of Liverpool, the Lancaster Canal was built in the 1790s to reinvigorate the declining Lancaster trade. The first part of the canal network linked Preston with Tewitfield, via Lancaster. Connections north to Kendal and a branch to Glasson Dock were added in 1819. The canal was superseded by the railway in the 1840s but the route established for the canal is now followed by both the rail and road networks, most recently in the form of the M6 motorway which opened in 1968.

North of Heysham development of the coastal strip has been reinforced over time, starting with the arrival of the railway in the 1840s, which led to the development of the seaside resort of Morecambe. In the 20th century caravan sites and golf courses were also developed either side of Morecambe in the rural zone, followed by the development of the port and the power station at Heysham, the latter with a connecting infrastructure of power lines. These economic forces, combined with the development of Lancaster as the (former) administrative capital of Lancashire, have resulted in large parts of the NCA developing into urban and suburban landscapes.

View of the Lune Estuary looking towards the marina at Glasson.

Ecosystem services

The Morecambe Coast and Lune 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 Morecambe Coast and Lune Estuary NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision**: Much of the rural landscape is given over to pastoral farming, including dairy as well as beef and sheep businesses. Pastoral management as a whole accounts for over 95 per cent of agricultural land use. The health of the coastal fisheries in underpinned by the health of marine and coastal habitats. There is some marketing of products based on local identity which has the potential to support the area's tourism, and encourage a locally sustainable green economy.

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

- **Climate regulation:** The NCA contains extensive areas of salt marsh and significant areas of grazing marsh and peat bog, all of which have the capacity to sequester and store considerable amounts of carbon when appropriately managed.

- **Regulating coastal flooding and erosion:** The coastal margin of large parts of the NCA is dominated by salt marshes which act as a natural regulator of coastal flooding and erosion. Although there are areas of erosion and deposition, the dynamic balance between the two processes is important in maintaining the structure of the coastal landscape. Overall there is net accretion of material within the coastal zone of Morecambe Bay.

The pastoral landscape of the Lune Estuary with extensive salt marshes backed by low-lying glacially shaped hills.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration**: Both the rural and built environments of the NCA give a strong sense of place. These include panoramic views across Morecambe Bay to the Lake District Fells from higher viewpoints, such as Williamson Park in Lancaster, and more intimate coastal views where the coastal expanse is punctuated by wildlife. In the built environment this is complemented by historic features connected with the NCA's long religious and trading associations and also the frequent use of sandstone as a building material.

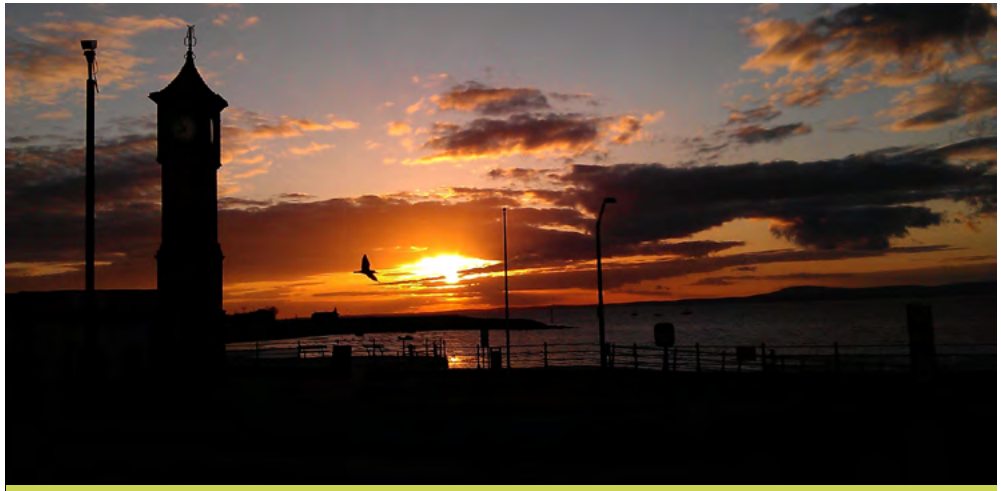
- **Sense of history**: Many historic features lend a sense of history to the NCA, particularly the early churches of the coastal margin, the Lancaster Canal and also the historic buildings of Lancaster.

- **Tranquillity:** The open, expansive landscape of the southernmost part of the NCA, especially around the outer margins of the Lune Estuary, is highly tranquil, in sharp contrast to the more urbanised northern half of the NCA and the M6 corridor. Contact with these tranquil and sensory environments has a calming and restorative effect, leading to improvements in health and wellbeing.

- **Recreation:** The NCA has a long history of coastal recreation linked to the town of Morecambe, which developed as a 19th-century seaside resort and became the basis of the tourist economy. This has developed into a wider recreational economy, but is still focused on the coastal zone including both seaside town and tranquil coastal experiences in different parts of the NCA. In addition, a series of national and regional cycle routes cross the NCA, providing alternative recreational opportunities for visitors. These link the coastal attractions of the area with the wider local environment.

- **Biodiversity:** The coastal margin of the NCA is particularly diverse and the entire margin is covered by national (SSSI) and international (SAC, SPA and Ramsar site) designations. These reflect not just the exceptional quality of the coastal habitats, including salt marshes, intertidal mud and sand flats, and biogenic reefs, but also the species that they support. These include internationally important numbers of wildfowl and wading birds such as oystercatcher, knot and pink-footed geese, in addition to significant populations of animals such as honeycomb worm and belted beauty moth.

- **Geodiversity:** The geodiversity of the NCA strongly contributes to the overall sense of place through its influence over the historical development of the NCA and, particularly through the adoption of Millstone Grit as a building material, its strong influence on the built environment.



Sunset across Morecambe Bay from the clock tower.

Statements of Environmental Opportunity

SEO 1: Maintain and enhance the historic and landscape character and the internationally significant habitats of the coastal environment, including the mudflats, salt marsh, sand dunes, vegetated shingle and the Lune Estuary, to support its key features, reflect the dynamic nature of the coastal systems, and ensure that the area remains able to regulate coastal flooding and sequester and store carbon, while providing access and recreation that is sensitive to the character of the coastal zone.

For example, by:

- Maintaining and enhancing the biodiversity of the coastal zone, including the estuary systems, both within and buffering the Sites of Special Scientific Interest, Special Area of Conservation, Special Protection Area and Ramsar site through careful management of salt marshes, sand dunes and rocky skears by well-managed grazing, sensitive access provision and managed fisheries, in line with the favourable condition objectives of the designated sites.
- Protecting the open and tranquil character of the area provided by long, unmodified estuary views and distant views to the surrounding uplands by ensuring that new development is in keeping with the character of the landscape.
- Conserving the habitats, open views and sustainable access along the coastal zones, which allows residents and tourists to enjoy the sight of wintering waders and wildfowl moving between feeding and roosting areas, so characteristic of this area.
- Improving existing interpretation facilities to inform and educate visitors, and to increase their understanding of the value of the natural environment and their enjoyment of contact with it.
- Ensuring that the habitats of the coastal zone such as grazed and ungrazed salt marshes, mudflats and cobble skears are managed in favourable condition so that they are capable of supporting species such as wintering waders and wildfowl, breeding waders, belted beauty moth and honeycomb worm reefs.
- Restoring transitional grassland with ephemeral pools habitat along the coastal fringe to a quality where it can support formerly distinctive species such as natterjack toad.
- Recognising the predicted impacts of climate change, with sea level rise and an increase in storm events, seeking opportunities to maintain dynamic coastal processes and, where appropriate, restore dynamic processes in order to maintain the coast and its habitats in line with the Shoreline Management Plan policies and related strategies, particularly around the Lune Estuary where the likelihood of impacts driving change is greatest.
- Supporting the role of coastal habitats in managing coastal flooding and erosion risk, in particular by allowing salt marsh and sand dune accretion and development, as well as supporting their ability to sequester and store carbon. **Contnued on next page...**

... continued from previous page

- Addressing both point and diffuse sources of pollution to improve the water quality of the coastal environment to European bathing water and shellfish water standards in order to support the seaside economy, sustainable traditional and shellfish fisheries, and recreational fisheries for economic and food production benefit.
- Conserving archaeological evidence of earlier settlement and land use and, where appropriate, securing off-site conservation of artefacts at risk from coastal change, with reference to heritage- at-risk priorities and bespoke surveys such as English Heritage's Rapid Coastal Zone Assessment (RCZA): Morecambe Bay and its environs.
- Re-creating transitional habitats where opportunities allow, either as part of shoreline adaptation programmes or as bespoke projects, such as brackish water systems and semi-natural transitional grasslands, particularly around the estuary systems of the Lune, Cocker and Keer, in order to increase connectivity in the coastal zone, facilitate species movement and restore nursery areas for fish.
- Taking steps to ensure that planned changes in the coastal zone are considered holistically so that they provide sustainable use of the coastal environment to the benefit of wildlife, tourism, access and recreation.

SEO 2: Enhance the mainly pastoral, rural landscape by supporting land managers to adopt long-term sustainable land management practices on both the organic soils of the coastal plain and reclaimed land from the Lune Estuary to Knott End-on-Sea, and the mineral soils of higher ground, seeking outcomes which deliver both economic and environmental benefits.

For example, by:

- Seeking to establish lower fertilizer systems where appropriate, for example by promoting nitrogen fixation by legumes or improving targeting of fertilizer applications, to improve water quality and aquatic biodiversity by reducing nutrient loading.
- Supporting sustainable land management systems on peat-based soils and allowing water storage on flood plains to provide local flood regulation, reduce soil erosion risk, improve soil quality and enhance climate regulation by increasing the carbon sequestration and storage capacity of organic soils.

Continued on next page...

... continued from previous page

- Establishing agricultural systems with more diverse swards to benefit both biodiversity and productivity, for example planting grasses which bind soils to reduce soil erosion, encouraging species such as clover which fix nitrogen, and establishing appropriate cutting and grazing regimes to allow flowering and seed set to support pollinators.
- Working with land managers to improve infield habitat structure to maintain the resource for wintering wildfowl, including whooper swans, pink-footed geese and wigeon which feed on the grasslands around the coastal margins, leading to a more ecologically permeable landscape.
- Maintaining pastoral systems in areas of high erosion risk, such as on steep slopes on the mineral soils, and areas of waterlogged soils throughout, with particular reference to priorities identified by the Catchment Sensitive Farming Programme, which aims to improve water quality and reduce nutrient loading through simple adaptive farm business measures.
- Restoring the hydrological integrity and ecological function of remnant lowland peatlands such as Heysham Moss, including their hydraulic buffers, employing measures such as the removal of invasive scrub, blocking artificial drains and raising the water table to restore the biodiversity of peat ecosystems, secure the historical environmental record in the layers of peat, and restore the carbon sequestration and storage capacity of peat-forming systems. This will also act as an ecological stepping stone between the more extensive peatlands of the Lancashire and Amounderness Plain National Character Area (NCA) to the south and the Morecambe Bay Limestones NCA to the north.
- Supporting re-establishment of cropping and horticulture systems, with an emphasis on spring-sown crops, in areas with improved mineral soils and gentle gradients where cropping systems will not lead to erosion problems. This may help to increase efficiency of food production, and provide the disturbed ground conditions suitable for locally distinctive plant species such as purple ramping-fumitory and wider year-round habitat and food requirements of declining farmland birds.
- Protecting and expanding surviving areas of high-quality semi-natural habitat in the pastoral landscape, such as the species-rich grasslands and lowland wetland around Crag Bank and Thwaite House Moss, to prevent the loss of these systems, maintain biodiversity value and establish stepping stones of wetland habitat to allow species movement across the NCA.
- Protecting, expanding and connecting surviving areas of ancient woodland to support its biodiversity and act as stepping stones for woodland species moving across the landscape.
- Managing and establishing woodlands away from the coastal plain, for example by promoting wood fuel as a local energy source through re-establishing coppice management. Aiming to support climate regulation by promoting low-carbon energy sources, enhancing the biodiversity of woodland ecosystems by re-establishing managed woodland systems as well as low intervention systems, locally reducing soil erosion and addressing water quality issues by stabilising watercourse boundaries and steep slopes, and buffering watercourses to trap sediment and run-off.

SEO 3: Working with land managers, seek opportunities to enhance the historic character of the rural landscape, including heritage assets, boundary features and habitats, to protect the character of the rural landscape and restore the ecological condition and connectivity of these features.

For example, by:

- Protecting and restoring boundary features such as hedges, mature trees, ditches, rivers and walls, including restoring areas of semi-natural habitat. Carrying out works such as wall restoration, gapping up and protecting hedges, including management in locally traditional styles.
- Maintaining the landscape structure of fields bounded by ditches on the coastal plain, hedges on the lowlands and walls on the upland margins of the NCA and on drumlins that provide abundant field stone.
- Ensuring that hedges provide habitat, food such as nectar and berries, and enhanced connectivity for wildlife by securing good management such as cutting regimes that allow flowering and fruiting.
- Ensuring that ditches and other watercourses have buffers of vegetation, including trees where appropriate, and riparian habitats along their margins to support riparian species and enable species movement, trap sediment and run-off in areas of high erosion risk, and ensure that stock access does not result in sediment entering watercourses.
- Conserving and enhancing traditional buildings throughout the NCA and promoting the use of traditional building materials, such as Millstone Grit, and vernacular styles to strengthen the character of the NCA and the skills base in traditional techniques.

Hedges are a common boundary feature in the low-lying areas of the NCA but are often in poor condition, as here near Glasson.

SEO 4: Promote the social, economic and cultural value of a healthy natural environment and embed wide understanding of sustainable management, building on the close proximity of areas of exceptional environmental value, particularly the coastal zone, to areas of high population density.

For example by:

- Increasing awareness of the rural and especially the coastal environment and appreciation of how it functions through heritage programmes and celebratory cultural programmes (such as the Tern Project in Morecambe). Providing local interpretation around key sites, for example historic buildings and principal wader roosts, and viewpoints to ensure that key assets are protected, valued, celebrated and understood, helping residents and visitors to better appreciate and enjoy the features of interest.
- Developing programmes which use local features as a platform for understanding wider management of the landscape and understanding of wider environmental processes and challenges, for example the presence of wader roosts on the sea front at Morecambe as a connector to the health of the bay.
- Promoting the value of a well-managed, healthy and locally distinct coastal and rural environment as an economic opportunity underpinning the renaissance of the visitor economy of Morecambe and other coastal towns.
- Developing programmes that enhance awareness among landowners, land managers and the business sector of environmental assets and measures to protect and enhance them, and which are also accessible to urban residents.
- Promoting opportunities to link education and health programmes with experience of the natural environment. Embedding environmental awareness through educational access programmes and health interventions such as Walking for Health to increase opportunities for users to access, and to benefit from, the health and social rewards that their local environment affords them.
- Promoting responsible recreational experience of the coastal zone and other sensitive areas. Achieving this by increasing awareness of the risks posed by disturbance, uninformed access and inappropriate recreation types to other users and vulnerable wildlife assets. Recognising that appropriate measures may vary between the more disturbed coast and the less disturbed parts of the NCA such as around the Lune and Keer estuaries, and along the Pilling coast, positively promoting measures that can be taken to protect sense of place assets, such as wader roosts, alongside other uses.

Additional opportunity

1. Plan for the creation of new green infrastructure to provide a framework for new development that integrates the needs of urban areas of Lancaster, Heysham and Morecambe with those of the surrounding rural and coastal landscapes. Ensure that potential new development and infrastructure is appropriately sited and designed to make a positive contribution to biodiversity, to help to improve health and social benefits for the community, and enhance the character and local distinctiveness of the area.

For example by:

- Protecting and enhancing key features which identify the distinctiveness of the area and act as a selling point for growth and inward investment, in tandem with developments that have a positive impact overall on both the environment and economy, and further increase the profile of the area as a good place to live as well as work through the provision of a healthy environment.
- Ensuring that potential new developments, particularly large infrastructure projects including energy developments, are appropriately sited and designed and make a positive contribution to the biodiversity and character of the area, particularly in the coastal zone and with respect to the needs of key species that require a high-quality environment.
- Promoting enhanced habitat management as mitigation for areas that are negatively impacted by development and ensuring that the landscape is able to adapt to change while retaining its distinctive character, including the management of green infrastructure and green estates to complement local character and local species' needs.
- Increasing the ecological permeability of the landscape by promoting the use of native species in landscaping schemes, including street trees and small woodlands, linked to all sizes of development.
- Promoting the use of traditional building materials, such as Millstone Grit, and vernacular styles where possible to strengthen landscape character and the skills base in traditional techniques.
- Recognising and promoting the wider value and importance of green infrastructure in the health and wellbeing of people, improved connectivity and habitat opportunities for wildlife, and embedding an appreciation of the role played by green infrastructure in maintaining the character and local distinctiveness of the NCA.

Supporting document 1: Key facts and data

Morecambe Coast and Lune Estuary National Character Area (NCA): 13,211 ha

1. Landscape and nature conservation designations

This NCA includes part of one Area of Outstanding Natural Beauty (AONB); the Arnside and Silverdale AONB. 127 ha of the AONB are in the NCA (1 per cent of the NCA area).

Management Plans for the protected landscape can be found by following the link below:

- www.arnsidesilverdaleaonb.org.uk

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Site(s)	Area (ha)	% of NCA
International	Ramsar	Morecambe Bay	1,866	14
European	Special Protection Area (SPA)	Morecambe Bay SPA	1,866	14
	Special Area of Conservation (SAC)	Morecambe Bay	1,866	14
National	National Nature Reserve (NNR)	n/a	0	0
National	Site of Special Scientific Interest (SSSI)	A total of 7 sites wholly or partly within the NCA	1,899	14

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.

Morecambe Bay SAC, SPA and Ramsar sites are overlapping and are composed of Morecambe Bay (in part) and Lune Estuary SSSIs in this NCA

There are 42 local sites in the Morecambe Coast and Lune Estuary NCA covering 254 ha, which is 2 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	4	<1
Favourable	1,784	94
Unfavourable no change	0	0
Unfavourable recovering	104	6

Source: Natural England (March 2011)

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

2. Landform, geology and soils

2.1 Elevation

Elevation in the NCA varies from sea level around the Morecambe Bay fringe to a high point of 110m on the hills forming the NCAs eastern boundary, and the transition to the Bowland Fringe and Morecambe Bay Limestones NCAs.

Source: Natural England (2010)

2.2 Landform and process

The landform is generally low-lying with the higher points associated with sandstone bedrock. The lowlands are more recently derived with the landform generated by a combination of glacial deposition and coastal and fluvial processes. Over all the landform is very smooth with extensive low-lying flats and gentle-sloped hills. Heysham Head is an outcrop of Millstone Grit, forming cliffs and a rocky foreshore. Drumlins characterise much of the area - drowned in places where they meet the coast.

Source: Natural England (2010)

2.3 Bedrock geology

The bedrock geology of the NCA is entirely sedimentary in nature with 93 per cent being composed of sandstones, mudstones and siltstones from the Carboniferous, Permian and Triassic periods. The remaining 7 per cent is predominantly limestone. There are few outcrops, though the bedrock is exposed in some coastal areas such as the Millstone Grit sandstones Heysham Head.

Source: Natural England (2010)

2.4 Superficial deposits

The drift geology in this NCA is derived of glacial, fluvial and coastal sediments and is dominated by clays, silts and gravels with drumlin fields in some areas.

Source: Natural England (2010)

2.5 Designated geological sites

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

There are 7 Local Geological Sites within the NCA.

Source: Natural England 2011

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

2.6 Soils and Agricultural Land Classification

On elevated ground the soils are dominated by free draining acid soils reflecting the NCAs extensive drift and sandstone based geologies. In lower lying areas the soils are more diverse as a consequence of fluvial and coastal influences, and in some areas higher water tables. The best areas of agricultural land (Grade 2) are found on the drained peatlands around Pilling and Glasson. Otherwise the NCA is dominated by grade 3 land with lower grades found on the upland, and coastal fringes of the NCA.

Source: Natural England (2010)

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	% of NCA
Grade 1	0	0
Grade 2	362	3
Grade 3	7,565	57
Grade 4	1,597	12
Grade 5	628	5
Non-agricultural	0	0
Urban	2,549	19

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 (km)
Lancaster Canal	28
River Conder	5
River Keer	3
River Lune	2

Source: Natural England (2010)

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

The three main rivers in the NCA all rise in uplands to the north and east and cross this NCA to discharge into Morecambe Bay. The Conder and Keer are both relatively short, rising in the adjacent Bowland Fringe and Morecambe Bay Limestones NCAs respectively. The Lune has a much wider catchment which extends to the Lake District High Fells, the Orton Fells, the Howgills, Yorkshire Dales and Bowland Fells NCAs. The NCA is also crossed by the Lancaster Canal which linked South Cumbria with Lancaster and industrial centres to the south and connects to the sea at Glasson Dock on the Lune Estuary.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 203 ha, 2 per cent of the NCA.

Source: Natural England (2010)

3.3 Water Framework Directive

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

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 399 ha of woodland, covering 3 per cent of the total area, of which 30 ha is ancient woodland.

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

4.2 Distribution and size of woodland and trees in the landscape

Woodlands are largely absent from the low lying parts of the NCA with the greatest extents on the elevated areas between Galgate and Lancaster where they are associated with farmsteads or with the designed landscapes around country estates.

Source: Natural England (2010)

4.3 Woodland types

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

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

Type	Area (ha)	% of NCA
Broadleaved	374	3
Coniferous	6	<1
Mixed	15	<1
Other	4	<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	30	<1
Ancient re-planted woodland (PAWS)	0	0

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Fields in this NCA are generally bordered by hedgerows in the elevated areas and by ditches, sometimes with associated hedgerows, in the low-lying areas. The total length of boundary features in the NCA is about 663km. Of this about 5 per cent was under agri-environment agreement management in 2003. This had increased to about 23 per cent in 2011

Source: Morecambe Coast and Lune Estuary Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

On flood plains and reclaimed salt marshes fields tend to be rectilinear reflecting their origin in campaigns of organised reclamation. In higher areas the fields tend to be less regular in shape reflecting a longer period of development in association with other features of the landscape.

Source: Morecambe Coast and Lune 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

The NCA is dominated by pastoral agriculture though other farming systems become more prevalent in certain areas, particularly on the Grade 2 agricultural land.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

There is a spread of commercial farm sizes across the NCA with a relatively high proportion of smallholdings although the majority of the land area is accounted for by holdings over 100ha in size.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

By area most farms in the NCA are owned rather than tenanted, though the owned area dropped between 2000 and 2009.

Source: Agricultural Census, Defra (2010)

6.4 Land use

In common with the pastoral predominance in the NCA most farmland is used to grow stock feed, in particular grass, with other uses being mainly arable and root crops.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

Stock numbers are dominated by sheep (17,000) and cattle (13,700) with the latter deriving from both dairy and beef enterprises.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

Of the 314 farm employees in the NCA the majority are principal farmers, with fewer employed posts. Very few enterprises support salaried managers.

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.

Cattle grazed salt marsh, Lune Estuary. The salt marshes of the coastal margin are internationally important for wildlife and support a range of ecosystem services.

7. Key habitats and species

7.1 Habitat distribution/coverage

The greatest extents of priority habitat are found in the low-lying areas particularly around the Lune Estuary and westwards along the Morecambe Bay estuary fringe to Pilling and include large extents of coastal and flood plain grazing marsh and salt marsh. These areas are particularly important for wintering wildfowl and wader populations, and also support significant breeding wader populations and the rare belted beauty moth and natterjack toad. Away from the coastal fringe, priority habitats are more scattered in the intensively managed agricultural or urban landscape, but remnants include a range of habitat types and this part of the NCA is important for some priority species such as purple ramping-fumitory, which occurs on arable land and disturbed urban margins.

Source: Lancashire Plain and Valleys Natural Area Profile

7.2 Biodiversity Action Plan (BAP) priority habitats

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

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

UK BAP priority habitat	Area (ha)	% of NCA
Coastal and flood plain grazing marsh	2,749	21
Broadleaved mixed and yew wood-land (broad habitat)	104	1
Lowland meadows	48	<1
Maritime cliff and slope	16	<1
Mudflats	14	<1
Purple moor grass and rush pasture	12	<1
Lowland raised bog	10	<1
Lowland calcareous grassland	5	<1
Upland hay meadows	1	<1

Source: Natural England (2011)

Note: In addition Natural England SSSI data indicates that, subject to natural change, there are approximately 1,762ha of saltmarsh in this NCA.

7.3 Key species and assemblages of species

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

8. Settlement and development patterns

8.1 Settlement pattern

South of the Lune the settlement pattern is essentially a rural one with settlements having developed around farmsteads and local industry centres such as those associated with the Lancaster canal. This is very different from the City of Lancaster and settlement to the north and west, where there is a much more significant urban element to the settlement pattern with significant developments and associated settlement at Heysham and along the coast north from Morecambe to Carnforth.

Source: Morecambe Coast and Lune Estuary Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main settlements are: Lancaster, Morecambe, Heysham and Carnforth. The total estimated population for this NCA (derived from ONS 2001 census data) is: 125,930.

Source: Morecambe Coast and Lune Estuary Countryside Character Area description; Countryside Quality Counts (2003)

8.3 Local vernacular and building materials

Most traditional buildings are constructed of red brick though in Lancaster there is a significant use of local, natural Millstone Grit sandstone.

Source: Morecambe Coast and Lune Estuary Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

Early historic features mainly relate to the early-Christian, pre-Norman Conquest period including a high density of pre-Conquest churches and religious artefacts such as Norse hog-back tombs, Anglian preaching or sepulchral crosses and numerous chapels. The chapel of St. Patrick on the cliffs at Heysham is reputed to have been built by the Angles before AD 800 following the legend that St. Patrick was shipwrecked off the coast of Morecambe. More recent features are generally associated with the development of Lancaster as the former administrative centre for Lancashire and its associated civic amenities such as Williamson Park and Lancaster Cemetery, both registered parklands.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 2 Registered Parks and Gardens covering 22 ha
- 0 Registered Battlefields
- 10 Scheduled Monuments
- 622 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

- Three per cent of the NCA, 371 ha, is classified as being publically accessible.
- There are 168 km of Public Rights of Way at a density of 1.3 per km^2.
- There are no National Trails within the NCA.

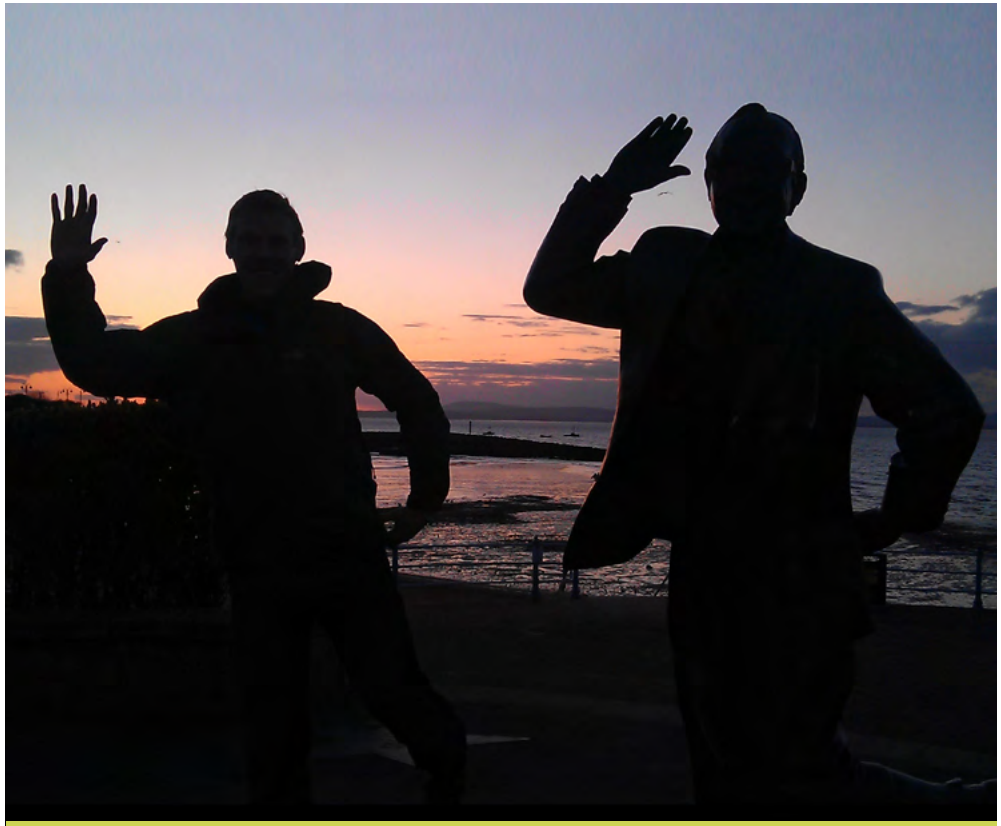
Sources: Natural England (2010)

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)	0	0
Common Land	328	2
Country Parks	0	0
CROW Access Land (Section 4 and 16)	340	3
CROW Section 15	69	1
Village Greens	0	0
Doorstep Greens	0	0
Forestry Commission Walkers Welcome Grants	<1	<1
Local Nature Reserves (LNR)	0	0
Millennium Greens	1	<1
Accessible National Nature Reserves (NNR)	0	0
Agri-environment Scheme Access	0	0
Woods for People	2	<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.



Statue on right in honour of the late Eric Morecambe, a famous local comedian and keen bird watcher.

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of Tranquillity (2006) the areas of highest tranquillity occur around the Lower Lune estuary, while the most disturbed areas are associated with the essentially urban northern parts of the NCA.

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

Category of tranquillity	Score
Highest	35
Lowest	-80
Mean	-15

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

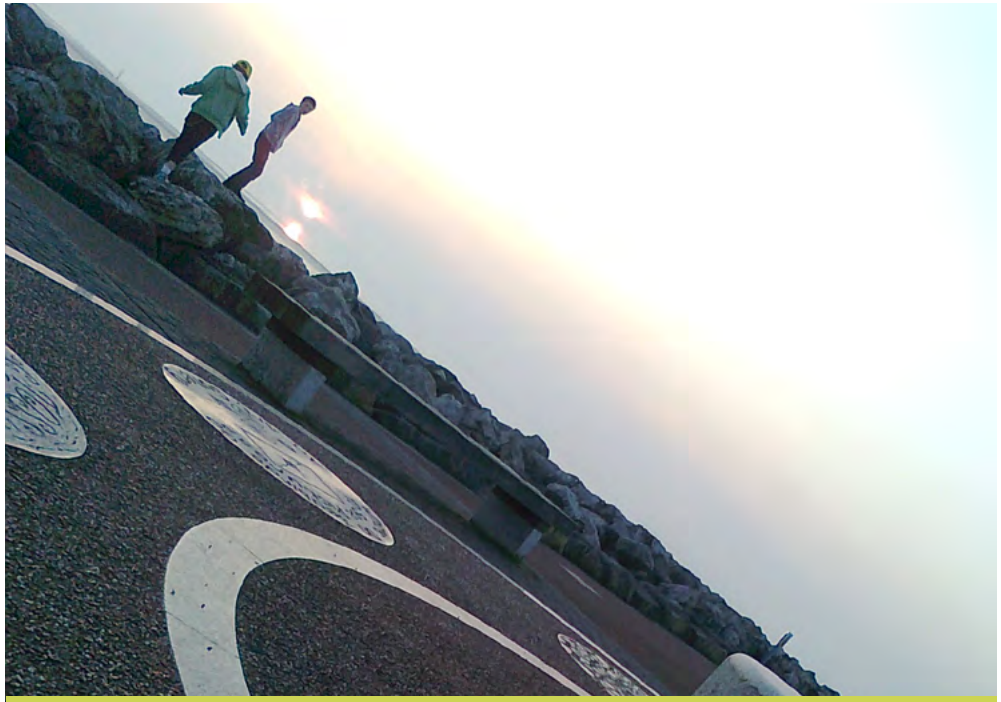
The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows that the Urban and industrial areas, and their associated infrastructure, in the north of the NCA intrude into the rural landscape; this is less significant in the more southerly parts of the NCA. A breakdown of intrusion values for this NCA is detailed in the table below.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	41	48	60	19
Undisturbed	31	22	21	-10
Urban	18	18	20	2

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are an apparent 19 per cent increase in disturbed areas since the 1960s linked to 10 per cent falls in both undisturbed and 'no data' areas.

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



Experiencing and celebrating the coast through the arts - the Tern project on Morecambe sea front.

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)
- BAP Priority Habitats GIS data, Natural England (March 2011)
- Special Areas of Conservation data, Natural England (data accessed in March 2011)
- Special Protection Areas data, Natural England (data accessed in March 2011)
- Ramsar sites data, Natural England (data accessed in March 2011)
- Sites of Special Scientific Interest, Natural England (data accessed in March 2011)
- Detailed River Network, Environment Agency (2008)
- Source protection zones, Environment Agency (2005)
- Registered Common Land GIS data, Natural England (2004)
- Open Country GIS data, Natural England (2004)
- Public Rights of Way Density, Defra (2011)
- National Trails, Natural England (2006)
- National Tranquillity Mapping data, CPRE (2007)
- Intrusion map data, CPRE (2007)
- Registered Battlefields, English Heritage (2005)
- Record of Scheduled Monuments, English Heritage (2006)
- Registered Parks and Gardens, English Heritage (2006)
- World Heritage Sites, English Heritage (2006)
- Incorporates Historic Landscape Characterisation and work for preliminary Historic Farmstead Character Statements (English Heritage/Countryside Agency 2006)

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

Supporting document 2: Landscape change

Recent changes

Trees and woodlands

- Woodland is not a major feature of the NCA with only about 3 per cent coverage. Of this less than 1 per cent is ancient woodland. Woodland is a feature of some designed landscapes such as Williamson Park in Lancaster and Ashton Hall, at Conder Green near Glasson. There is limited evidence of recent change.

Boundary features

- Data suggests that the length of boundaries under agri-environment scheme management has increased from about 5 per cent in the period 1999 – to 2003 to 23 per cent in 2011 with an uptake of options for hedges, walls and ditches. This suggests a recent move to maintain the resource compared to past historic losses.

- Most boundary features, other than walls, are now under mechanical management differing from historic management techniques, such as laying by hand, which affects their character.

Agriculture

- Data from 2003 indicates that since 1999 the grassland area of the NCA had declined (especially rough grassland), coinciding with a marked loss of dairy holdings. There was also evidence of farm amalgamation. Prior to this the inland plain comprised improved pasture grazed by dairy cattle, while the poorer draining clays and coastal marsh areas were grazed by cattle and sheep. Well-drained areas of moss and coastal plain were under arable cultivation or intensive market gardening (Countryside Quality Counts data).

- Comparison of farm data between 2000 and 2009 shows some further changes in the agricultural landscape. Although the area farmed and use of land by area is similar, there have been shifts in holding type with moves away from some land uses such as horticulture and livestock farming (102 commercial enterprises to 90) and an increase in 'other farm types' (from 29 to 47 holdings). This has been coincident with a slight decline in both cattle and sheep numbers. There has also been a shift away from medium-sized enterprises (20 to 100 ha) in favour of both small holdings and larger enterprises. The employment base of the agricultural landscape has also changed with a 34 per cent decline in labour overall, with the greatest decline in full time (55 per cent decline) and part-time (69 per cent decline) categories.

- Recent decades have seen a decline in species particularly adapted to the NCA's agricultural landscape including species like corn bunting, grey partridge and lapwing.

Settlement and development

- Between the 1960s and 2007 there was little change in the distribution of urban areas in the NCA, though there has been an increase in the areas affected by the transport network that service the urban areas. This has affected the character of the rural parts of the NCA particularly in the east along the M6 corridor and in the Lancaster – Morecambe – Heysham area, particularly in terms of tranquillity and intrusion (CPRE 2006, 2007).

- There has also been an increase in the presence of caravan parks and holiday related developments in the rural zone, particularly along the coast, decreasing the gap between settlements.

Semi-natural habitat

- Of the area designated as SSSI, 94 per cent is in favourable condition with a further 5 per cent recovering (Natural England 2011 data) indicating that these areas have seen little change in recent years, and that the limited changes have been positive. In the NCA most of the SSSI resource consists of coastal habitats, in particular salt marshes, including some of the best quality ungrazed marshes in the north-west, which grade into un-vegetated intertidal communities.

- Away from the coastal margin, data on habitat condition and change is limited but 2003 data (Countryside Quality Counts) indicates a loss of ponds and hollows has taken place in the coastal lowlands, either through natural colonisation or by infill using river dredgings or rubbish. There had also been a general loss of species-rich grasslands, scrubland and hedgerows as a direct result of agricultural improvements.

- Some of the most distinctive species in the NCA appear to have shown recent declines, which are likely to be linked to a decline in habitat extent and/or quality including natterjack toad and purple-ramping fumitory.

Historic features

- There is limited evidence to detail landscape change for historic features. However, only about 50 per cent of historic farm buildings remain unconverted, indicating an ongoing usage but in a changed context. Most are intact structurally.

- Some historic features are undergoing restoration, for example work is currently ongoing to restore the Grade 1 listed Lune Aqueduct on the Lancaster Canal and to make improvements to its environment. This includes relining a section of the canal, and making improvements to local access provision, enhanced interpretation and educational facilities, and training and volunteering activities.

Coast and rivers

- In 1995 the biological river water quality and chemical water quality was very good and in 2003 it had been maintained. However, this appears to have declined in recent years with current Environment Agency data for both freshwater and estuarine systems indicating the NCA water bodies to be in good or moderate condition, while those freshwater watercourses subject to chemical assessment are generally failing (http://www.environment-agency.gov.uk/homeandleisure/37793.aspx).

- SSSI data indicates that coastal habitats are generally being maintained in good condition, however, there are local issues with recreational pressures in the coastal zone affecting character, and in particular populations of wintering birds.

- The desire to control natural coastal processes has resulted in the building and upgrading of coastal defences along parts of the NCA, which has modified the character of the coastline for example at Morecambe.

- The Lancaster Canal, which links Preston to Kendal, was connected to the National Waterway Network in 2002 via the Ribble Link. This is one of the country's few contour canals, built along the natural lie of the land and with a level profile. This connection has supported the adoption of the canal corridor for a range of recreational activities including walking, cycling, and canoeing.

Drivers of change

Climate change

- Recent analysis of vulnerability to climate change (Natural England 2011, NWLCF – Climate Change Vulnerability in Lancashire) identifies that this NCA is at high (coastal plain) or medium (non-coastal plain) vulnerability to the impacts of predicted climate change.

- Climate Change is likely to have a significant impact on the coastal zone because of rising sea levels and a projected increase in storm events. Around the estuaries this may be compounded by increased fluvial flows associated with high rainfall events in the upper catchments. The shoreline management plan for the area advises defending the principal coastal towns and port of Heysham and the adaptation of other areas around the coast. Currently processes, including relative isostatic stability and the sedimentation of Morecambe Bay, are offsetting sea level rise but this may not continue. Much of the sediment within the inner bay is thought to come from inland sources which in itself is an issue for inland areas because of the loss of soil.

- Changing patterns of rainfall and increases in temperature are likely to have impacts on farming practices, particularly dairy which is a water-intensive industry. However, temperature rise may bring some benefits through an extended growing season resulting in a shift back towards mixed farm systems with an increase in cropped land.

- Carbon sequestration and storage by habitats such as salt marshes, peat bogs and organic soils, which are important features of this NCA, can help reduce atmospheric carbon dioxide levels.

- Climate Change is likely to result in drying of peat soils. This process reduces both their carbon storage capacity and also their ability to re-hydrate. The net effect of this process is both to increase carbon emissions from the soils and to decrease its resistance to further drying. Locally this may also impact on buried archaeological features.

- Climate change, compounded by other environmental changes, may lead to increased risks from new diseases affecting both the character of the NCA and its management.

Other key drivers

- Adapting farming practices to a changing climate may result in a return to a mixed farming economy in rural areas of the NCA, including an increase in cropped land and less intensive stock management, within the existing structure of the landscape. If farm business adaptation can be done strategically this may offer opportunities for enhancing a range of ecosystem services and to enhance ecological connectivity through, for example, diversifying the range of ecological niches available; decreasing energy usage through shortening the food production chain; decreasing pressure on water supplies; and allowing for better soil functioning.

- The impacts of climate change, such as sea level rise, increased storminess and both coastal and fluvial flood events, will require the coastal zone to be able to adapt to these changes. This will offer opportunities to create a sustainable coastal environment where natural coastal processes are allowed to take place unimpeded. Coastal habitats provide a natural defence to coastal and fluvial flooding by diminishing tidal energy, acting as a flood defence, and stabilising systems, increasing the robustness of the landscape to climate change. In the NCA the pressure to adapt systems is most likely to be felt around the Lune Estuary.

- Energy security is likely to have significant impacts on the NCA. Currently Heysham power station and its associated infrastructure, including power lines, are a significant feature of the NCA's landscape and its economy. Increases in demand for renewable energy sources including wind power and nuclear, are likely to affect this NCA both from energy generating facilities in, and visible from, the NCA, and because of potential links to offshore installations and the grid network.

- There are opportunities for improving the appropriate management of recreational sites so visitor pressures are minimised, and benefits and visitor experiences enhanced.

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.

The tides, weather and light combine to constantly adapt the appearance of Morecambe Bay.

Statement of Environmental Opportunity	Ecosystem Service: Food Provision	Timber Provision	Water Availability	Genetic Diversity	Biomass Energy	Climate Regulation	Regulating Water Quality	Regulating Soil Quality	Regulating Water Flow	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 historic and landscape character and the internationally significant habitats of the coastal environment, including the mudflats, salt marsh, sand dunes, vegetated shingle and the Lune Estuary, to support its key features, reflect the dynamic nature of the coastal systems, and ensure that the area remains able to regulate coastal flooding and sequester and store carbon, while providing access and recreation that is sensitive to the character of the coastal zone.	↗ ***	↔ ***	↔ ***	↗ ***	↔ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ **	↑ ***	↑ ***	↔ ***	↑ ***	↔ ***	↑ ***	↗ ***
SEO 2: Enhance the mainly pastoral, rural landscape by supporting land managers to adopt long-term sustainable land management practices on both the organic soils of the coastal plain and reclaimed land from the Lune Estuary to Knott End-on-Sea, and the mineral soils of higher ground, seeking outcomes which deliver both economic and environmental benefits.	↗ ***	↔ ***	↔ ***	↗ ***	↗ **	↑ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↔ ***	↔ ***	↑ ***	↔ ***
SEO 3: Working with land managers, seek opportunities to enhance the historic character of the rural landscape, including heritage assets, boundary features and habitats, to protect the character of the rural landscape and restore the ecological condition and connectivity of these features.	↗ ***	↔ ***	↔ ***	↔ ***	↗ ***	↔ ***	↗ ***	↗ ***	↗ ***	↗ ***	↑ ***	↗ **	↔ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↔ ***
SEO 4: Promote the social, economic and cultural value of a healthy natural environment and embed wide understanding of sustainable management, building on the close proximity of areas of exceptional environmental value, particularly the coastal zone, to areas of high population density.	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↔ ***	↑ ***	↑ ***	↑ ***	↑ ***	↗ ***	↔ ***

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
Coastal and lowland wetland habitats with their associated species and their role in the cultural landscape.	■ The entire coastal zone of the NCA is internationally designated for its habitats and species, including extensive grazed and ungrazed salt marshes, intertidal reefs and the tens of thousands of migratory birds it supports. ■ The resources provided by Morecambe Bay were core to the development of the local cultural landscape and this link continues to the present day through both direct and indirect economic pathways, including fisheries, trade and the visitor economy. ■ The habitats of the coastal strip are also continuous with those of the other NCAs fringing Morecambe Bay ensuring a high connectivity of the coastal environment. ■ Throughout the NCA the coastal environment gives a strong sense of place through the character of the coastal towns, the expansive views, the large numbers of wintering waterfowl and waders and the ever-changing balance of sands and the tide which, in areas such as the Lune Estuary and the Pilling coast, is enhanced by a feeling of isolation.
Agriculture with particular emphasis on pastoral systems.	■ Pastoral agriculture is the dominant land use in the rural parts of the NCA with both meat and dairy enterprises significant. ■ Development of this sector has shaped the development of the rural landscape and strongly influences the rural economy today. ■ In the reclaimed lowlands the pastoral landscape is an important resource for the wintering waterfowl, such as whooper swans and pink-footed geese, which are an important component of the NCA's designated sites and a feature of the NCA's character. ■ The field pattern and composition of boundary features in different parts of the NCA can be linked to both to periods of land reclaim and the varying nature of the NCA's geology.
Presence of Lancaster and other trading towns in the corridor between the uplands and the bay.	■ The identity and character of the historic settlement of Lancaster with its castle, cathedral, other historic buildings and designed landscapes. ■ The location of the NCA at a bottleneck between the uplands of the Forest of Bowland and Morecambe Bay, particularly around Lancaster and the Lune crossing, has given the NCA a strategic role in north-south trade. Both the Lancaster Canal and the railway have had a large influence on settlement patterns and growth. ■ In more recent times this has been consolidated by the development of the trading link through the port at Heysham. ■ Development of particular parts of the NCA in association with particular different trading periods has given distinctive period associations with particular settlements in the NCA, rather than an evolving structure. For example Morecambe's seafront reflects early-Victorian period design associated with the arrival of the railway, and the administrative parts of Lancaster mid-Victorian values associated with trading wealth, while Heysham is more modern associated with the growth of the port and power station. ■ Millstone Grit sandstone is the traditional building material of Lancaster and many other historic features, such as the Lancaster Canal.

Landscape attribute	Justification for selection
Outward views from the NCA, both from the coastal fringe and from inland highpoints to distant uplands.	■ Views across the changing intertidal landscape of Morecambe Bay play a strong role in the identity of the NCA. ■ The coastal zone, as epitomised by the sea-side town of Morecambe, which grew economically from the 1840s onwards with the arrival of the railway, making coastal recreation a key part of the local economy. ■ The designed landscapes of the Victorian period, including Willamson Park in Lancaster, built on the profits of local trade, strongly capture these views making them a feature of inland areas as well as the immediate coastal zone. ■ The views from elevated areas embrace both the intertidal areas of the bay, but also the backdrop of the Cumbrian Fells. Some features of this landscape, such as the Aston Memorial at Williamson Park in Lancaster, are also designed to be seen from afar as well as offering outward views.
Marrying of urban and rural landscapes with their historical context.	■ Different parts of the NCA have strongly urban and rural identities which have developed from the area's trading and visitor economies superimposed on what would otherwise be a strongly rural lowland landscape. This gives a distinctive contrast to the structure of the cultural landscape in different parts of the NCA.

Landscape opportunities

- Maintain and enhance the coastal habitats of the NCA, in particular salt marshes, intertidal reefs and mudflats.
- Maintain and enhance key sites for vulnerable coastal species, such as wintering waders and wildfowl, breeding waders, and honeycomb worm reefs.
- Promote sustainable management of coastal fisheries, supported by a healthy natural environment.
- Promote the cultural and economic value of a healthy coastal environment such as the sea-side vistas and coastal fisheries.
- Promote awareness of the sensitivity of the coastal environment to the challenges of human influenced pressures.
- Plan for and proactively seek opportunities to enhance coastal habitats alongside coastal adaptation programmes.
- Protect and restore areas of lowland peatland, such as Heysham Moss.
- Protect and restore areas of species-rich grassland, such as around Crag End and Thwaites Moss.
- Maintain and restore boundary features, such as ditches (in the coastal plain), hedges (in lowland areas), and walls (on drumlins and the upland margins).
- Promote sustainable land use practices and address sources of pollution.
- Protect and conserve the important sites and features linked to cultural heritage.
- Enhance awareness of rural management and the sensitivities of the rural environment to urban communities whilst understanding their needs and reasons for its use.
- Develop links between rural and urban communities.
- Provide improved interpretation and educational facilities to increase visitors' understanding and enjoyment of the NCAs natural and historic features, and engage the local community in its future management.
- Embed local vernacular building styles in planning policy.
- Promote links between a healthy environment and economic growth.
- Plan for climate change adaptation including provision for species movement, changes to the coastline, and documentation of heritage at risk.
- Plan for transition to a low-carbon economy.
- Support adaptation of farm businesses to a changing climate.
- Maintain the relationship between boundary features and the variations in local geology.

Ecosystem service analysis

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Soils through agricultural management Intertidal habitats supporting shellfish populations	78 per cent of the NCA area is agricultural land, with 57 per cent being classified as grade 3. Food production in the NCA is strongly centred on pastoral farming for meat and dairy production, with less than 5 per cent of the agricultural land managed under cropping systems. Former mixed farming systems have declined as land management has become more intensive and efficient, with most landholdings now exclusively pastoral, and any cropping being focused on additional food provision for livestock. Generally farms are managed to an intensive pastoral regime with artificial fertilizers used to maximise productivity, supporting silage production, with generally three cuts taken between April and September, and aftermath stock grazing. Cattle are housed indoors for the winter with pastures being sheep grazed. Slurry collected from animals housed indoors is spread throughout the year when ground conditions allow. Diffuse pollution arising from the disposal of farm waste on fields has been identified as a particular contributor to water quality failures in the NCA's bathing waters. In the coastal zone traditional fisheries are still an important part of the rural economy, particularly shellfisheries for cockles and mussels based upon the harvesting of wild stocks with variable supply from year to year. In recent years the mussel fishery has been relatively consistent, however, the cockle fishery has been closed for a number of years as a consequence of low stock numbers.	Regional	Pastoral farming is important in maintaining the current rural economy and environment There are however, some management practices that have wider impacts on ecosystem services, where they are not targeted, for example reliance on artificial fertilizers and slurry has impacts on soil fauna and consequently soil structure; spreading of slurry at periods of high rainfall and on waterlogged ground can result in nutrients entering water courses causing diffuse pollution; and relatively high stock numbers, particularly on dairy holdings, can result in issues of soil compaction affecting soil and water quality. Increasing roofed slurry storage capacity and covering farm yards to ensure rain water remains separate from grey water can significantly reduce the levels of diffuse pollution associated with the farm infrastructure. Increased storage capacity can allow slurry to be applied when field conditions are more optimal, thus reducing the risk of pollution and improving the water quality of bathing waters. The recent return to a more diverse mix of farming systems on mineral soils has potential to increase the efficiency of food production where commercial crops are being produced. If a wider range of farming types is adopted, there may be opportunities to benefit a greater range than the landscape currently supports. Where conversion from pasture is being considered the principles of precision farming should be followed, allowing efficient management targeted at a fine scale. Measures such as water course buffers and improved management of point-sources of pollution, may improve water and soil quality, and bring biodiversity and climate regulation benefits alongside continued food provision.	Seek opportunities to support change to more sustainable agricultural systems. Seek opportunities to support agricultural businesses that undertake to provide long-term sustainable food provision. Ensure sustainable management of coastal fisheries and shell fisheries.	**Food provision** **Biodiversity** **Climate regulation** **Water availability** **Regulating water quality** **Sense of place**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Woodland cover	The existing woodland cover is limited (3 per cent of the NCA area). Currently there is little woodland managed for timber.	Local	There is the potential to increase woodland cover, particularly along river corridors and in more elevated parts of the NCA. Where timber is provided by native species, biodiversity in general may benefit. As a by-product, developing a timber resource of broad-leaved species will also provide important dead wood habitat and the non- or limited intervention management associated with hard-wood timber supports a range of species. As timber takes a considerable time to develop as a crop, consideration should also be given to the impacts of climate change on suitable species for planting. Timber production would best fit areas of river corridor, where woodland presence can help to slow runoff rates regulating flooding and soil erosion and, through shading, lower water temperatures which allows increased oxygenation benefiting fish and other aquatic animals. It would also prove particular benefit where it buffers and links exiting areas of ancient woodland, and in urban areas.	Due to the limited resource and long development time opportunities to develop this service are extremely limited. Seek opportunities to protect, buffer and connect surviving areas of ancient woodland.	**Timber provision** **Biodiversity** **Sense of place** **Regulating soil erosion** **Regulating water quality** **Climate regulation**
Water availability	Surface water catchment	The northernmost tip of the Fylde aquifer extends into the southern part of this NCA and has 'water available' status. Principal surface water resources within the NCA are the catchments of the Rivers Keer, Lune, and Conder. The River Lune within the NCA is 'over licensed'. Actual abstractions (as opposed to licensed abstractions) in the Lune CAMS area as a whole are mainly for public water supply (particularly the Lancaster area), industry, aquaculture and energy generation. The Lancaster area is supplied from Langthwaite Reservoir, which is filled from the River Lune intake at Caton. The reservoir and intake both lie within the Bowland Fringe and Pendle Hill NCA. The River Lune can support flows in the River Wyre via pipeline transfers.[1] The rivers Keer and Conder within the NCA have a 'water available' status. Water is taken from the River Conder to supply the Glasson branch of the Lancaster Canal (much of which lies within this NCA), and also from White Beck, a tributary of the River Keer.	Local	The principal abstractions occur upstream of the NCA, as do many smaller abstractions in the Lune, Keer and Conder catchments, which discharge through the NCA. Measures to improve water availability to benefit the NCA, at least in terms of surface water supply, would mainly need to be implemented in these wider catchment NCAs. Locally there may be opportunities for the more efficient use of natural water sources, such as through rain water harvesting to support business and residential use and decreasing pressure on surface and ground water abstractions.	Being a receiving NCA there is limited opportunity to influence water availability within the NCA other than through local management of water sources. Support sustainable water management in the upper catchment NCAs. Identify opportunities for more efficient water management such as rain water harvesting.	**Water availability** **Regulating water quality** **Biodiversity** **Food provision** **Regulating soil quality**

[1] The Lune Catchment Abstraction Management Strategy, Environment Agency (March 2004; accessed from URL: www.environment-agency.gov.uk/business/topics/water/119927.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biomass energy	Woodland cover	The existing woodland cover is limited (3 per cent of the NCA area) and therefore offers little potential for the provision of biomass, either through bringing unmanaged woodland under management or as a by-product of commercial timber production.	Local	The NCA has generally medium potential yield for short rotation coppice although potential is high to the north of the Lune Estuary around Heysham and between Lancaster and the River Conder. Potential miscanthus yield is high throughout the NCA but may be dependent on the viability of local markets. For information on the potential landscape impacts of biomass plantings within the NCA, refer to the tables on the Natural England website[2]. The use of anaerobic digestion as an energy source may be viable, especially in conjunction with modification of farming systems to improve sustainability, at least in the short term, where a decrease in management intensity coupled with a legacy of elevated nutrient levels can result in an excess of produced biomass. Depending on location and type large- scale biomass production may impact on other services such as food provision, sense of place, and, if inappropriately sited, biodiversity. However, there can also be positive impacts, for example on climate regulation. Planting of native woodland for coppicing with species such as ash, hazel and oak will provide biodiversity benefits. Woodland stands alongside watercourse can limit soil erosion and regulate local flooding and the market reduces dependence of fossil fuels supporting climate regulation. Large scale biomass provision may be to the detriment of landscape character. At present there are no large-scale biomass markets in the NCA, but there may be potential for developing small-scale markets for some products. Easy access to the M6 from a large part of the NCA may make accessing markets further afield more viable in the future.	Seek opportunities to develop commercial biomass markets within close proximity of the NCA that are able to utilize products the NCA can provide. Locally develop domestic wood fuel markets to support active management of woodlands and planting of new woodlands in suitable areas.	**Biomass energy** **Climate regulation** **Biodiversity**

[2] URL: www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/areas/default.aspx

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Carbon-storing and sequestering grazing marsh soils Coastal habitats including mudflats and salt marshes	Soil carbon levels are generally low (0-5 per cent) but higher (10-20 per cent) under areas of coastal grazing marsh and areas of reclaimed mossland and marshland with their peaty soils. The peaty and organic soils of the NCA have an important role in carbon sequestration and storage.	International	The coastal zone has a range of habitats with relatively high carbon content. This includes saltmarsh soils (10 per cent) and sand dune soils (4 per cent). In addition the extensive mudflats and other estuarine habitats are important carbon stores. These areas are generally managed to support food provision and biodiversity, while supporting a range of other services, compatible with maintaining the climate regulation function. Soil carbon levels are highest (10-20 per cent) under areas of coastal grazing marsh and areas of reclaimed mossland and marshland. These are likely to be associated with the NCA's loamy and sandy soils with a peaty surface (25 per cent of NCA), loamy and clayey soils of coastal flats with naturally high groundwater (4 per cent), and naturally wet very acid sandy and loamy soils (1 per cent) all of which are likely to have organic top soils. Adaptation to sequest more carbon in soils could be achieved by increasing traditional livestock breeds and establishing more sustainable agricultural practices. Enhanced management of active peat bogs as at Heysham Moss and accreting saltmarsh around the Lune Estuary will also contribute to increased sequestration.	Seek opportunities to maintain carbon storage and increase carbon sequestration by maintaining and expanding salt marshes and protecting and restoring peat bogs and other peaty soils. Conserve organic and peaty soils. Work with the farming community on the agricultural land of the coastal plain to seek opportunities to establish sustainable grazing regimes to allow for enhanced carbon storage.	**Climate regulation** **Regulating water quality** **Biodiversity** **Sense of place** **Regulating coastal erosion and flooding** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Agricultural land Semi-natural wetland habitats	Ecological surface water quality is 'good' in the rivers Keer and Conder and in the Lancaster Canal whilst that of the River Lune is 'moderate'. The ecological status of the Lune Estuary and Morecambe Bay (into which this NCA's rivers drain) is moderate. The only river within the NCA for which chemical status is assessed is the River Lune which fails to achieve good status; Morecambe Bay has good chemical quality[3]. The chemical status of the Fylde aquifer (see Water availability) is good. Only a small number of larger watercourses are routinely monitored in the NCA, so data is lacking for the many smaller watercourses, which may hide local issues. Three beaches in the NCA are registered bathing waters – Morecambe North, Morecambe South and Half Moon Bay, Heysham. Environment Agency monitoring data for these beaches (see http://environment.data.gov.uk/lab/bwq-web.html) indicates that most have passed water quality measures in recent years. However, there have been some failures at both Half Moon Bay and Morecambe south. Measures to address both point sources of pollution, for example from sewage works, and diffuse pollution from the agricultural catchment have been identified, and are being implemented.	Regional	Much of the main river water quality in the NCA is determined by other upper catchment NCAs, limiting the scope of measures that can be taken within the NCA to influence main river issues. The catchments of the Keer, Lune and Cocker, as well as the Wyre which will influence the transitional waters on the western edge of the NCA, are being targeted by the Catchment Sensitive Farming programme to address water quality issues affecting both main rivers and smaller water courses. Measures being promoted to improve water quality include improvements to both farm infrastructure and land management measures. These include covering slurry areas to reduce high nutrient runoff entering water courses, increasing slurry storage capacity, and better management of point source points of pollution such as around gateways. Regular soil sampling to promote a better understanding of soil nutrient status and potential is also recommended.	Work with the farming community to ensure applications of artificial fertiliser are well targeted and account for infield nutrient analysis. Seek opportunities to reduce impacts on bathing waters by establishing better nutrient management regimes in sensitive locations. Support measures to reduce nutrient loading from identified point-source discharges. Where possible establish soil trapping buffers of vegetation in areas of high hydraulic connectivity. Seek opportunities to stabilise erosion-prone slopes by establishing tree cover.	**Regulating water quality** **Food production** **Regulating soil quality** **Regulating soil erosion** **Biodiversity** **Sense of place** **Recreation**

[3] River Basin Management Plan, North West River Basin District, Environment Agency (December 2009; accessed from URL: www.environment-agency.gov.uk/research/planning/33106.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Agricultural land	There are 8 main soilscape types in this NCA: freely draining slightly acid loamy soils, covering 41 per cent of the NCA; loamy and sandy soils with naturally high groundwater and a peaty surface (25 per cent); saltmarsh soils (10 per cent); slowly permeable seasonally wet acid loamy and clayey soils (8 per cent); sand dune soils (4 per cent); loamy and clayey soils of coastal flats with naturally high groundwater (4 per cent); freely draining floodplain soils (3 per cent); and naturally wet very acid sandy and loamy soils (1 per cent).	National	The freely draining slightly acid loamy soils allow water infiltration and have potential for increased organic matter levels through management interventions. They may be valuable for aquifer recharge requiring the maintenance of good structural conditions to aid water infiltration and the matching of nutrients to needs to prevent pollution of the underlying aquifer. The loamy and sandy soils with naturally high groundwater and a peaty surface are at risk of continuing organic matter loss where drained and cultivated and topsoil loss/ redeposition as a result of wind erosion. Some soils may be locally prone to extreme acidity. The saltmarsh soils of the coastal fringe will help protect inland soils from saline intrusion and change as a result of increased wetness / flooding associated with sea level rise. Particular issues affecting soil quality include soil compaction, loss of soil fauna, decreasing carbon content of soils and loss of fertility. These are associated with the movement of stock and machinery particularly on wet soils causing compaction and the application of artificial and slurry inputs which can have the effect of shifting soil ecosystems from fungus based systems to bacterial based systems and can lead to a loss of key soil fauna species. Issues associated with a loss of soil quality may be seen most strongly in the reclaimed soils of grazing marshes where soils are prone to water logging and have naturally high carbon contents. Addressing these issues requires an integrated move to sustainable management of pastoral systems and is likely to require the integration of a number of different measures, including a reduction in soil nutrient loading, use of legumes to fix nitrogen, decreasing the need to spread waste on damaged soils, decreasing stock numbers and adapting stock management to avoid areas of sensitive soils. Developing systems that support soil quality will also benefit other services such as regulating water quality, by reducing nutrient and sediment runoff and enhancing infiltration of surface water; regulating water flow, by reducing runoff and consequent peak flow; and climate regulation through carbon sequestration, storage and reducing the carbon footprint of agricultural management and biodiversity.	Seek opportunities to establish sustainable land management regimes which protect and enhance the soil resource. Protect and enhance salt marshes. Work with the farming community to safeguard and enhance good soil structure. Promote land management practices that ensure soils can support food provision into the future. Encourage measures to reduce diffuse pollution from land management.	**Regulating soil quality** **Food production** **Regulating water quality** **Regulating water flow** **Climate regulation** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Agricultural land Intertidal and inter-coastal habitats	Most (81 per cent) of the soils covering this NCA are susceptible to erosion, however, the predominance of pastoral agriculture will limit soil loss.	Regional	The freely draining slightly acid loamy soils can erode easily on steep slopes, especially where vegetation is removed or where organic matter levels are low after continuous cultivation. These soil types are light and also at risk of wind erosion, especially where coarse textured variants are cultivated or left bare. The loamy and sandy soils with naturally high groundwater and a peaty surface and the naturally wet very acid sandy and loamy soils have a low risk of water erosion but are susceptible to wind erosion. Sand dune soils are characteristically very droughty and unstable. The risk of wind erosion is increased by disturbance along paths and tracks but decreased where vegetation has stabilised the dune system or when the land surface approaches ground water level. Importantly in this coastal location, saltmarsh soils may be lost to coastal erosion, including from sea level rise. The predominance of pastoral agriculture will limit soil erosion, by limiting the amount of bare ground with high erosion risk. Areas of soil loss are likely to be associated with compacted soils and along watercourses.	Along water courses manage areas of erosion to reduce soil loss through in- field management and soft engineering. Enhance riparian corridors to reduce sediment transport rates. Work with the farming community to adapt to sustainable land management regimes such as stock management within areas with high soil erosion risk and where soils are prone to compaction. Seek opportunities to stabilise erosion-prone slopes by establishing tree cover.	**Regulating soil erosion** **Regulating water quality** **Food provision** **Recreation** **Sense of place** **Biodiversity**
Regulating water flow	Semi-natural wetland habitats	The rivers Keer, Lune and Conder flow into Morecambe Bay on the coast of this NCA. The River Lune has its headwaters in the Cumbria High Fells and Howgill Fells NCAs. Its tributaries also drain parts of the Bowland Fells and Yorkshire Dales NCAs. The steep topography, high rainfall and saturated soils of these upland areas give rise to downstream flood risk including in Lancaster (fluvial flood risk with tidal interaction on the River Lune) and on low-lying agricultural land within this NCA.	Regional	The restoration of moorland habitat by grip blocking in adjacent upper catchment NCAs and changes in land and soil management practices to reduce erosion rates and increase local water retention will both help to manage flood risk.[4] The River Conder drains the western slopes of the Bowland Fells NCA and downstream flood risk exists within this NCA at Galgate.[5] Opportunities within the NCA for managing flood risk around the principal settlements are limited by location, with Lancaster, Heysham and Morecambe all being situated either in areas were the topography of the land would limit the effectiveness of flood management or away from principal water courses. There may be some potential for managing flood risk in the southern part of the NCA, through allowing surface flooding at periods of peak rainfall to slow water entering fluvial systems, which could be managed to benefit other services. Potential mechanisms for regulating water flow include restoration of peat soils, increasing percolation through agricultural soils and storage of water on upper and mid-catchment floodplains to moderate peak flows. Measures such as these will generally benefit other services such as regulating water quality, biodiversity and climate regulation. See also 'Managing coastal erosion and flooding'.	Seek measures to reduce peak flows from upper catchment NCAs such as the Cumbria High Fells, the Howgills, the Yorkshire Dales and the Bowland Fells, by restoring the ability of upland habitats to intercept and store increased volumes of precipitation, including by increasing tree cover.	**Regulating water flow** **Regulating water quality** **Regulating coastal erosion and flooding** **Regulating soil erosion** **Biodiversity** **Climate regulation**

[4] Lune Catchment Flood Management Plan Summary Report, Environment Agency (December 2009; accessed from URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

[5] River Wyre Catchment Flood Management Plan Summary Report, Environment Agency (December 2009; accessed from URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Semi-natural habitats including salt marshes, pastoral farmland and edge habitats such as hedges and field margins	Away from the salt marsh zone on the coastal fringe of the NCA, where management is tailored to habitat quality, this service is likely to be in poor condition due to the limited extent of semi-natural habitat.	Local	There is low dependence on pollinator services from the agricultural sector in this NCA, as the agriculture is currently predominantly pastoral. Supporting pollinator services would allow for future changes in food provision both directly by providing pollination and indirectly by supporting species which provide natural pest control as well as making the rural landscape more permeable for a range of species. Coastal and floodplain grazing marsh and other grassland types can provide valuable nectar sources for pollinating insects. Management of grazing marsh and other grassland habitats under regimes that provide flowering plants, either for nutrient management or biodiversity gain, is likely to result in increased sward diversity. Leguminous species such as clover can provide nectar for insects while improving soil quality by nitrogen fixing leading to a reduced reliance on artificial fertilizers and benefiting both food provision and biodiversity as well as pollinator function. Hedgerows and other field margins can provide a significant nectar source. However, this is often inhibited by modern machinery-based management practices which limit the presence of second year growth which is essential for flowering in many species. There are significant areas of ungrazed saltmarsh along the coastal margin the NCA, which are particularly floristically diverse and could be expanded.	Protect and expand areas of species-rich semi-natural habitat including salt marshes, grassland and wetlands such as around Crag Bank and Thwaite Moss to increase the availability of nectar sources in the pastoral landscape, to enable more diverse food provision. Manage grazing marsh and pastures to restore/maintain a floral component in the sward. Improve management of hedges to allow flowering.	**Pollination** **Biodiversity** **Food provision** **Sense of place/ inspiration** **Tranquillity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Managing coastal erosion and flooding	Coastal transition habitats	This section of coast includes the Lune Estuary and the mouths of the rivers Keer and Conder, all forming part of the larger Morecambe Bay system which is characterised by extensive sandflats, which become exposed at low tide. Various channels cut across these sandflats and the dynamic meandering of these is an important influence upon patterns of shoreline erosion and accretion. The shorelines of the Bay are characterised by large areas of saltmarsh in more sheltered areas fronting rocky outcrops, low cliffs and low-lying land. This NCA forms part of 'sub-cell 11c' of the Shoreline Management Plan 2 (SMP2). See: http://mycoastline.org/index.php/shoreline-management/smp2 for more information.	Regional	The Lune and other key estuaries in neighbouring NCAs exert a significant control on the behaviour of adjacent shorelines. The inter-tidal zone of Morecambe Bay and the estuaries are internationally important environmentally designated areas. The habitats along the Morecambe Bay coastline do not stop at the NCA boundary but continue into neighbouring NCAs. The open coast section between Knott End-on-Sea at the southern end of the NCA and the headland at Heysham is characterised by the SMP2 as consisting of low lying agricultural land fronted by large areas of saltmarsh in sheltered areas and a wide sandy intertidal zone. There is some recreation and tourist use, and a number of scattered settlements, including Knott End-on-Sea, Preesall and Pilling. A range of significant realignment opportunities were identified at Cockerham and Thurnham. Due, however, to the potential extent of realignment and implications on property, heritage, agricultural output, ground water bodies and flows into/out of the Lune estuary, the SMP2 recommends that further studies need to take place to inform management intent in the medium and long term. The mouth of the Lune Estuary is constrained by eroding cliffs at Sunderland Point and Plover Hill. The outer areas of the estuary are characterised by large intertidal areas, saltmarsh and a meandering low water channel. At present, the access route to Sunderland village (at the mouth of the Lune Estuary) across a marsh is cut off at very high tides. Within the middle reaches of the Lune, training walls which once constrained the channel are becoming increasingly ineffective. Consequently, where the channel is now able to meander freely, saltmarsh erosion is occurring. The city of Lancaster is located in the inner part of the estuary where there has been significant development on the flood plain. There is inherent uncertainty over the impact of erosion at Sunderland Point and on the wider Lune Estuary, and a policy of managed realignment will allow the Point to behave as naturally as possible with only limited intervention to reduce the rate of erosion whilst further monitoring is undertaken. The section of coastline between Heysham and Arnside (in Morecambe Bay Limestones NCA) includes the large port and nuclear power stations at Heysham and the tourist town of Morecambe. The SMP2 confirms that this infrastructure will all justify continued protection into the long term. Maintenance of this headland will also continue to provide protection to adjacent frontages to the south. Elsewhere, the long-term plan is generally to continue to provide **Continued on next page...**	Identify opportunities for managed realignment, particularly in areas around the Lune Estuary, where impacts are likely to be highest because of the soft sediment which forms much of the coast and the combination of coastal and fluvial process at work here. Proactively pursue realignment opportunities to allow managed adaptation to future climate change and ensure wider benefits where these can be secured. Ensure dynamic coastal processes can continue where possible. Maintain and enhance areas of coastal habitats, in particular salt marsh, to act as a coastal defence. Encourage further research to understand processes to enable well informed management decisions in the future.	**Managing coastal erosion and flooding** **Climate regulation** **Biodiversity** **Sense of place** **Recreation** **Geodiversity**

...continued from previous page

appropriate protection to property and infrastructure where it is threatened by erosion or flooding while allowing other coastal sections to evolve naturally. Long-term management along significant parts of this section will, however, depend on whether the coastal railway continues to operate into the long term.[6]

Tidal flooding is caused by storm surge and wave action in times of high astronomical tides. This is likely to be most significant around the Lune Estuary where both tidal flooding and fluvial flooding are risks and may be felt in combination. The Lune has the largest catchment of any of the watercourses in the NCA and both tidal flooding and fluvial flooding events are predicted to increase in frequency and severity with climate change.

The main urban areas influenced by tidal flooding are Lancaster, from the tidal reaches of the lower Lune, and Morecambe, Heysham and Knott End-on-Sea directly from the sea. The lower reaches of the River Keer, River Conder (including Thurnham Moss) and Pilling Water are also influenced by tides. There is widespread tidal flood risk at the downstream end of the Conder near Glasson. The tidal floodplain is continuous through Thurnham Moss to the Pilling area to the south. On the Keer, and particularly in the Pilling Water / Cocker area, there is significant fluvial flood risk and drainage issues that combine with tidal interaction.[7]

Accretion along the coastal margin around Pilling while increasing protection from coastal flooding also impacts on the drainage of a significant part of the Lancashire and Amounderness Plain NCA which has been reclaimed from former coastal marshland peatlands and is very low lying. This happens when accretion leads to drainage channels becoming blocked by sediment affecting areas upstream.

Around the Lune Estuary, and to a lesser extent the Keer, are extensive areas of salt marsh. Appropriate management of these areas provides a natural buffer against coastal erosion, though process such as energy dissipation and sediment stabilisation, as well as helping to manage coastal flood risk, by allowing land to accrete through sediment trapping. Enhancing this role would also provide biodiversity and carbon storage benefits.

Where a strategic approach can be implemented it can be planned to bring diverse ecosystem service benefits and be cost effective. If a non-strategic approach is adopted, measures in one location may negatively impact on others, environmental assets including biodiversity and historic assets may be put at risk and sustainable solutions may be missed exacerbating issues in the longer term. There is also an increased risk of catastrophic failure of defences around poorly managed weak points.

[6] North West England and North Wales Shoreline Management Plan, Main SMP2 Document, North West England and North Wales Coastal Group

[7] Lune Catchment Flood Management Plan Summary Report, Environment Agency (December 2009; accessed from URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Expansive and dynamic coastal and intertidal environment often with a backdrop of the Lake District fells.	A sense of place is provided by distinctive, broad, flat lowlands enclosed by higher land and steeply sloping, often wooded escarpments to the north and east opening out to a coastal, undulating landscape dominated by the presence of drumlins, the dynamic coastal environment with constantly changing views governed by the tide and the tidally governed movement of waders and wildfowl between roosts and feeding grounds. In winter daily movement of up to hundreds of thousands of waders, linked to the tide, between feeding and roosting areas, is a key sense of place feature of the NCA.	Local	Along the coast there are a range of key landscape features including extensive intertidal mudflats and sand banks, backed by saltmarsh with creeks and low cliffs, as well as reclaimed mosses and marshland and shingle beaches north of the Lune estuary with headlands and rocky promontories at Heysham and Sunderland Point. The landscape supports a mix of settlements, industry and farmed lowland with large rectilinear fields enclosed by either well maintained hedgerows or ditches on low ground, or stone walls at higher levels. Inland pasture is grazed by cattle whereas poorer coastal marsh areas are grazed by cattle and sheep. Large parts of the coastal plain and moss have been drained, although some areas of moss comprising of raised mire remain, such as remnant mossland at Heysham, and are valued semi-natural habitats. Tree cover is sparse and generally restricted to low often windswept trees and bushes along field boundaries with small blocks of woodland and fragments of ancient woodland elsewhere. There are atmospheric and panoramic views from a number of well used access routes across the Lune Estuary, Morecambe Bay and intertidal sand flats animated by large numbers of wildfowl and broken by church spires of former fishing villages as well as other small buildings and structures: the nuclear power station at Heysham features prominently on coastline, and is widely visible from both this and adjacent NCAs. Measures to maintain and enhance the coastal environment will generally be beneficial and this may include work to benefit species indirectly by raising their profile as well as the habitat management, for example, wintering birds have been adopted as part of the character of rejuvenation of Morecambe through the Tern project. This has used art, to reflect the sense of place offered by the sight of birds moving to and from winter roost sites by installing bird-orientated art works in the form of sculpture, and literature quotes along the sea front at Morecambe. Sympathetic management of the coastal fringe and articulation of the value of the assets may benefit a range of local and regional economic and social interests. The high quality of the coastal environment offers eco-tourism potential.	Seek opportunities to raise awareness of sense of place particularly along the coastal margin. Seek opportunities to maintain the character of the different landscape types (coastal, lowland pastoral, foothills) in the NCA.	**Sense of place/ inspiration** **Sense of history** **Recreation** **Biodiversity** **Tranquillity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Historic environment features including both built heritage and the structure of the rural landscape	Three sites (1 building and 2 Scheduled Ancient Monuments) are listed on English Heritage's 'at risk register'[8]. Some sites are undergoing restoration, for example at the current time (2013) the Lune Aqueduct on the Lancaster Canal.	Local	Corridors such as the River Lune have formed an important route since the Roman period with evidence of Roman and medieval roads and small motte and bailey castles alongside the river. The rural economy was founded on sheep and cattle grazing with ancient and post-medieval enclosures, peat extraction from the mosslands, and fishing based on cockles, mussels and shrimp collection; the large mussel beds off Plover Scar, used by monks from the 13th century Cockersands Abbey is a prominent feature along the coastline. Key settlements include Lancaster with its sandstone buildings and Morecambe which developed as the interest in sea bathing grew. In between are fishing villages with stone built cottages such as Heysham and many small, stone built farmsteads. Most buildings from the Victorian period onwards are of brick. Ashton Memorial Gardens and Williamson Park, and Lancaster Cemetery, together with the Lune Aqueduct on the Lancaster Canal are important historic features. Measures to secure the condition of historic features will help maintain a sense of history. However, measures that secure the condition of the historical assets in a context that links them to the surrounding historical landscape will have wider benefits linked to the sense of place and may support other services. Some historical assets may be at risk from sea-level rise and associated coastal change, for example through changing erosion and deposition patterns. Identified sites that may be at risk include the area around Cockersand Abbey at Cockersand, Sambo's Grave at Sunderland Point and early medieval graves and chapel and Mesolithic features at Heysham Head.	Document heritage features at risk from coastal change, and seek ex-situ preservation where appropriate. Seek opportunities to raise awareness of historic features through improved interpretation and educational information, particularly associated with the development of the landscape, in order to increase public engagement, enjoyment and understanding.	**Sense of history** **Sense of place/ inspiration** **Recreation**
Sense of tranquillity	Rural areas away from main towns and the presence of Morecambe Bay	Tranquillity and intrusion levels have declined with areas of undisturbed land having decreased from 31 per cent in the 1960s to 21 per cent in 2007.	Local	The lowest areas of tranquillity lie along the M6, around Morecambe and Lancaster to the north of the NCA and Preesall to the south. Areas remaining unaffected by development include areas around the mouth of the River Lune, lower Thrunham and Cockerham as well as Sunderland Point. A sense of tranquillity is likely to be particularly associated with the wide expanses of intertidal mudflats and sand banks, backed by saltmarsh. Promotion of informed and responsible experience of tranquil areas will help to secure their value as an asset for the benefit of both people and the natural environment and may offset erosion of tranquillity by increasing recreation pressure on the wider environment.	Seek opportunities to protect areas providing tranquil experiences, especially in the coastal zone. Seek solutions to issues arising from disturbing recreational activities in tranquil areas. Providing suitable visitor access to a landscape where people can be inspired and experience the feeling of escapism.	**Sense of tranquillity** **Sense of place/ inspiration** **Sense of history** **Biodiversity**

[8] URL: http://risk.english-heritage.org.uk/register.aspx

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Rights of way network	Recreation is supported by the area's 168 km rights of way network (with a density of 1.27 km per km^2) as well as 340 ha of open access land (2.6 per cent of the NCA).	Local	Access routes along the margins of Morecambe Bay, the estuary, river and canal are especially important for the access to the natural environment and sense of escapism that they provide both within and next to the towns of Lancaster and Morecambe. A number of national cycle routes cross the NCA including the Canalside Path, Railway Path and the Seaside Promenade. These routes are supported by the Lancashire Cycleway, a regional route that meanders in and out of the NCA along its length. The (car-free) cycleways and footpaths along the River Lune, Lune Estuary, Lancaster Canal and coast (including Morecambe promenade) are heavily used by local residents. The Lune estuary and river route is part of the Way of the Roses "Coast to Coast" cycle route and footpath from Morecambe to Bridlington via Lancaster and York. Improved access, including signage and surfaces is important for all levels of ability and interest, especially at key locations. In addition to providing greater public access, appropriate access can enhance visitors experience, increase their understanding of the local environment and lead to improvements in health and wellbeing. Sensitive access to coastal areas and view points and the presence of assets such as the abundant bird life of the bay acts as an important social and economic resource. Integration of opportunities to understand the context of the landscape and its origins with the rights of way network offers the chance to inform experience of the landscape. Future provision of coastal access may supplement the existing resource, but will need to be implemented sympathetically to avoid potential conflicts with the internationally designated nature conservation interest of the coastal margin. Improved management of more disturbing recreational activities, such as jet skiing and low-level gyrocopter flying, could benefit both biodiversity and the recreational experience of users seeking sense-of-place experiences.	Where environmental assets are sensitive to disturbance seek opportunities to manage recreational practice to minimise impacts. Seek opportunities to provide interpretation of the landscape and its many features, enabling visitors to understand, value and enjoy its character. Seek opportunities to enhance the network of national and regional and local cycle routes crossing the NCA, providing alternative recreational opportunities for visitors, linking coastal attractions with the wider local environment, and supporting the development of a green visitor economy. Seek opportunities to enhance access to the local environment providing recreation, health and social benefits and outdoor education close to where people live and work. Develop opportunities to work with commerce in support of initiatives that promote sustainable tourism and that help to grow a local green economy, recognising the value to the local economy that recreational visitors bring to the NCA.	**Recreation** **Sense of place/ inspiration** **Sense of history** **Tranquillity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Coastal habitats, Coastal and floodplain grazing land and other semi-natural habitats.	BAP priority habitats cover over 4,700 ha which is over 35 per cent of the NCA area. In the coastal zone much of this is protected by national and international designations. The majority of the SSSI area in the NCA is in favourable (94 per cent) or unfavourable recovering (5 per cent) condition. This indicates the coastal zone (which accounts for the majority of the SSSI area) is in good condition and/or appropriate management. The non-coastal SSSI are in variable condition and include sites in unfavourable declining condition. The biological resource in this NCA includes 2,700 ha of coastal and floodplain grazing marsh and 1,700 ha of saltmarsh. There is 1 SAC, 1 SPA, 1 Ramsar site and 1,900 ha are nationally designated as SSSI, covering 14 per cent of the NCA. Most of this designated site area refers to the coastal fringe of Morecambe Bay and the estuaries that feed into it.	International	In the coastal zone key habitats include both grazed and ungrazed salt marshes, the latter including some of the most extensive stands in the north-west; honeycomb worm and mussel reefs and extensive areas of mud and sand flats. The habitats along the Morecambe Bay coastline do not stop at the NCA boundary but continue into neighbouring NCAs. The mussel reefs, on cobble skears (the eroded remains of glacially derived drumlins), and cockle beds on intertidal sand flats support both internationally important numbers of wintering waders, but also economically important traditional shellfisheries. Poor management of the resource could be detrimental to both the waders and the fishing industry. On areas of former moss land the dominant land use is pastoral grazing. These areas are generally classified as coastal and floodplain grazing marsh and form an important feeding ground for species such as pink-footed goose and whooper swan which roost on the estuary and commute into the farmland to feed. These flights form a particular sense of place feature of the NCA. Heysham Moss is the most intact remnant of the formerly more widespread peat bogs in the NCA. Although it has been greatly damaged and reduced over time it retains a relatively intact core area which is receiving sympathetic management such that the site is classified as being in unfavourable recovering condition. As well as its biodiversity importance this will be of benefit to its geodiversity value, climate regulation and its role as a record of environmental change through the palaeo-environmental record preserved in the peat layers. **Continued on next page...**	Protect and enhance the extent and quality of semi natural habitats, in particular coastal and lowland wetland habitats. Enhance connectivity of habitats within the NCA and as a link to adjacent NCAs, particularly in coastal the coastal zone and along rivers and other watercourses. In suitable locations establish cropped agricultural systems to allowing better support for key species such as purple ramping fumitory and provide year-round requirements for declining farmland birds. Seek opportunities to restore natterjack toad populations along the coastal margin. Protect and enhance the coastal environment including restoration of transitional habitats.	**Biodiversity** **Food provision** **Regulating water quality** **Regulating water flow** **Regulating coastal erosion and flooding** **Pollination** **Tranquillity** **Sense of place / inspiration** **Climate regulation** **Geodiversity**

		Part of the coastal fringe between the Lune Estuary and Knott-end-on-sea has been proposed as a Marine Conservation Zone due to its importance for migratory fish species, namely smelt and eel. Away from the coastal margin, and including the extensive areas of coastal and floodplain grazing marsh, little of the biodiversity resource is considered to be in optimal management.		**... continued from previous page** Crag Bank and Thwaite Moss survive as fragments of formerly more extensive freshwater wetlands in hollows between drumlins on the coastal plain but are considered to be in poor condition due to abandonment. Nonetheless as an example of species-rich fen it represents an increasingly rare habitat in the NCA and one that acts as a reminder of the former character of the grassland landscape. Pockets of other key habitats survive including areas of ancient woodland. The biodiversity value of these areas is often disproportionate to their size as they hold reserves of specialist species. The NCA is significant for a number of species of principal importance including purple-ramping fumitory, tubular water-dropwort and the brindled beauty moth. Formerly it also supported natterjack toads in some of the coastal transition wetlands, particularly around Cockerham. These have however declined to the point where the species may currently be extinct in the NCA. With over a third of the NCA being composed of semi-natural BAP habitat sympathetic management of the rural environment could realise significant benefits. Some features such as saltmarsh and grazing marsh may be at risk due to effect of climate change with associated changes such as sea-level rise leading to coastal squeeze and increased saline intrusion to freshwater systems. If unmanaged this could put at risk both saline and freshwater habitats, but if managed sensitively measures could be adopted to ensure the maintenance and enhancement of the biodiversity.	Promote sustainable management of coastal fisheries. Seek opportunities to protect enhance, buffer and connect surviving relicts of ancient woodland. Opportunities to enhance biodiversity lie both in targeted work to improve the state of the resource, for example through the targeting of agri-environment schemes, and also through ensuring that other measures to address issues consider the ecosystem services provided by a healthy natural ecosystem and incorporate biodiversity into programme design.	

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Local Geological Sites Peat bogs Inter-tidal environments	There are no geological SSSI in this NCA and only a small number of local sites (Geological Heritage Sites). Peat-forming bogs and dynamic intertidal environments are both examples of dynamic geomorphological processes, with the former also maintaining an important palaeo-environmental record. Generally peat bogs are in declining condition due to past exploitation and consequent degradation, though some sites are now being restored. The functioning of the intertidal environment shows some localised degradation through agricultural management and system constraint by land reclamation.	Local	The NCA contains a range of geological features and processes including dynamic sedimentary landforms in the coastal zone, drumlin fields and exposures of geology at sites such as Heysham Head. In the intertidal zone the cobble skears that are the remains of glacial drumlins are an important feature as they form the substrate on which biogenic reefs of honeycomb worm and mussels establish. The latter are of particular significance supporting a traditional mussel fishery and are a key food resource for the wintering birds, particularly oystercatcher and knot, which are a feature both of the SSSI, SPA and Ramsar designations but also an important sense of place asset. Supporting opportunities to restore peatlands to re-establish their geomorphological function as a recorder of environmental change will also restore their biodiversity and carbon sequestering role. Restoration of salt marshes by reinstating natural creeks and flashes would restore the geomorphological context of a number of marshes and could be linked to habitat and sense o place workstreams.	Increase awareness of geodiversity in the NCA and its role in developing its character including both dynamic and static geologies. Ensure protection of intertidal skears from disturbance and promote awareness of their importance. Seek opportunities to restore peatlands to re-establish their geomorphological function and as records of palaeo-environmental evidence.	**Geodiversity** **Biodiversity** **Food provision** **Tranquillity** **Sense of place / inspiration**

Photo credits

Front cover: The Lune Estuary looking inland along the power lines from Heysham power station. © Alison Chapman

Page 5, 8, 9, 12 & 24 © Natural England/Bart Donato

Page 1, 4, 7, 11, 13, 17 & 27 © Natural England/Alison Chapman

Page 10, 28, & 34 © Natural England/Mike Wheatley

NATURAL ENGLAND

Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

Catalogue Code: NE407

Should an alternative format of this publication be required, please contact our enquiries line for more information: 0845 600 3078 or email enquiries@naturalengland.org.uk

www.naturalengland.org.uk