3 The Evolution of the Arnside and Silverdale Landscape and Seascape

Introduction

- 3.1 The special qualities that are experienced in the landscape of the AONB today are a consequence of the long complex interaction of both natural and cultural forces shaping the landscape.
- 3.2 This chapter summarises the main phases of natural and cultural evolution which have given rise to the special qualities of the AONB landscape and continue to shape it. It incorporates updated information from The Arnside and Silverdale Landscape (1997)¹⁶.

Geology and geomorphology

3.3 The variety of landforms within and near the AONB reflects the structure of the underlying solid Carboniferous limestone rock and the overlying superficial geology. The effects of glacial and post-glacial erosion and deposition (for example in the form of drumlins), and the ongoing dynamic processes of coastal deposition and erosion have had considerable influences on the shaping of the landscape. The landscape has, in turn, influenced the pattern of settlement, constraining the activities of the settlers and the ways in which they utilised the natural resources of the area. **Figure 3.1** and **Figure 3.2** provide an overview of the solid and superficial geology of the area.

Geological Background

- 3.4 The Arnside & Silverdale AONB is almost entirely underlain by a great thickness of Lower Carboniferous Limestone which was deposited between 360 and 325 million years ago. Deposition of the rocks of the AONB occurred over some 15 million years up to approximately 330 million years ago when the region was located near the equator and tropical shallow waters of an ancient sea covered the area.
- 3.5 There are three principal limestone formations underlying the AONB which unify its character and shape its landscape. The three formations are in decreasing age: the Dalton Beds, the Park Limestone and the Urswick Limestone (Lower and Upper). The three blocks exhibit different lithologies and appearances: the Dalton Beds are interbedded limestones, sandstones and mudrocks; the Park Limestones are thinly bedded; and the Urswick is relatively massively bedded. Additionally the overlying and younger Gleaston Formation is exposed in a few places. Fossil assemblages can be found at exposures of the Dalton Beds along the shoreline between Arnside Promenade and New Barns Bay and in the Park Limestone towards Jack Scout. Another important site in the AONB for fossil preservation is Trowbarrow LNR which is a geological SSSI.
- 3.6 Additionally there are recurrent beds of mudstones and shales. The most extensive is the Woodbine Shale that outcrops in a number of locations around the AONB and is close to the boundary between the Upper and Lower Urswick limestones.
- 3.7 Strong faulting of the limestone bedrock has created the block and basin topography which is characteristic of the area. Major north-south faults, together with secondary east-west cross faults have split the area into a complex series of steep-sided upland blocks, such as Arnside Knott, which rise abruptly along the fault lines above low, down-thrown basins. The north-south 'valley' which extends from Arnside Moss through to Leighton Moss is the most prominent 'basin' feature of the area. In the northern part of the AONB a series of secondary faults has resulted in the open valley to the north of Middlebarrow Wood and down-thrown the western part of Arnside Knott to form the lower-lying landscape of Arnside Park.
- 3.8 The tectonic structural movements and the differing limestone lithologies have ensured the development of a wide variety of landforms and contributed to the formation of many different karst landscape features.
- 3.9 Glacial scouring during the last phase of the Devensian period left bare limestone scars and resulted in the deposition of glacial material in the form of till/boulder clay (such as forms the drumlins to the east) and subsequent adjustments of the relative levels of land and sea. Post-glacial erosion led to the development of extensive limestone pavements.

- 3.10 Post-glacial changes in sea level inundated lower lying areas and resulted in the establishment of a range of wetlands, both coastal and freshwater. During the early Holocene sea-level was some 3m below present levels, and over this period sea-level continued to rise, drowning previously 'dry land' such as the areas of limestone pavement which can be seen dipping into the sea or beneath saltmarsh, as at Jenny Brown's Point. By about 8,000 years ago the sea had deposited clays over peats in the area of Silverdale Moss before it became re-colonised by sedges and finally raised mire.
- 3.11 Other indications of general changes in the post-glacial environment include the blocks of cemented scree on Arnside Knott, while the main tufa deposits in Woodwell, Silverdale are considered to be visible evidence of the post-glacial climatic maximum. Occasionally, following channel changes in Morecambe Bay, it is also possible to see the stumps of trees, often referred to as the submerged forest that date to around 6,000 years ago¹⁷. Such remains are a reminder that one effect of historic rising sea-level may have been to drown the land surface on which humans primarily lived and hunted during the Mesolithic and early Neolithic.
- 3.12 Fossilised pollen, preserved in the peat of the mosses, confirms that at the end of the last ice age areas of dry land within the AONB were colonised by a succession of different types of tree. Birch, pine, oak, elm and lime, with a hazel understorey formed a mosaic of woodland on the limestone outcrops, while wet valley floors were characterised by sedges and mosses with patches of birch, willow and alder.
- 3.13 The distinctive and unique geological and landform features which distinguish the AONB, and in which glacial and post-glacial processes are evident, are described in further detail below.

Limestone Features and Glaciation

- 3.14 During the Devensian glacial period (c.118,000-10,000 years ago), ice sheets from the Irish Sea and the Lake District repeatedly covered and then retreated from the Arnside and Silverdale area in response to fluctuations in the climate. The upstanding Carboniferous limestone blocks were scoured by ice which swept away overlying soils, and preferentially eroded weaker beds of limestone. Exposed on the surface, the limestone has been weathered during warmer climatic periods – including the current interglacial - by moderately acidic water. This solutional erosion of the limestone has produced a range of characteristic features collectively known as karst landforms.
- 3.15 The karst features that characterise many parts of Arnside and Silverdale include some of the finest examples of limestone pavement in the country. Large-scale solutional landforms shape much of the AONB landscape. Many are thought to pre-date the most recent incursion of ice, which took place during the late Devensian, between 26,000 and 10,000 years ago. The solutional landforms include dolines, which are roughly circular depressions that have eroded downwards into the limestone bedrock and larger scale poljes. The poljes are probably collapsed cavern features which formed within basin areas between the limestone uplands, and are characterised by steep cliff-like sides and broad, flat floors. These extensive depressions were flooded in the post-glacial period by meltwater and by rising sea-levels, possibly leaving the higher limestone hills as islands. Wave-cut notches found on the coastal cliffs suggest a sea-level some 8m higher than today.
- 3.16 Low drumlins and ridges form distinctively undulating scenery along the eastern margins of the AONB. These characteristically ovoid glacial hills were deposited as ice retreated within the broad Milnthorpe – Carnforth valley. They were formed from drift deposits beneath the ice, and now comprise part of one of the largest drumlin fields in the country, which extends from Kendal southwards to Preston.

Limestone Pavements

- 3.17 Distinctive areas of limestone pavement have developed throughout Arnside and Silverdale, particularly on sites where the Urswick Limestones are exposed in the surface. The pavements appear as flat, bare surfaces of limestone, broken into blocks, or clints, by solution-widened fissures, or grikes, which are deeply etched into the rock surface along joints. Many pavements, including the examples at the Gait Barrows National Nature Reserve, Underlaid Wood, Thrang End and Yealand Hall Allotments, and at Middlebarrow, are at least partially hidden within areas of woodland or scrub.
- 3.18 The intricate form of the pavements allows a variety of special micro-climates to develop, and the grikes commonly contain a wide range of plant species, including the nationally rare Rigid Buckler fern and Angular Solomon's Seal. The very rare whorl snail *Vertigo angustior* is found in hollows on the pavement in Gait Barrows. There are 16 areas of pavement protected by Limestone Pavement Orders which cover 15.5% of the AONB. The Arnside & Silverdale AONB is regarded as one of the best areas for limestone pavements within the UK, and its wider European importance is recognised through designation of the Morecambe Bay Pavements SAC.

3.19 **Figure 3.3** provides a map illustration of the location of the limestone pavements within the area which are protected by Limestone Pavement Orders.

Glacial Erratics

3.20 Other features that contribute to the character of the AONB include many prominent erratic boulders. Many are glacial erratics, found notably at Gait Barrows and Underlaid Wood, which were transported by glaciers from as far away as the central Lake District and deposited within a thin layer of glacial till/boulder clay. They remain as small boulders on the pavement surface following the weathering away of the surrounding matrix. Larger erratics are also found throughout the area, notably the Three Brothers stones on Warton Crag, and the large boulder of Shap granite found within the grounds of Beetham Hall.

Screes

- 3.21 Stratified and cemented screes characterise the steep southern face of Arnside Knott and all faces of Middlebarrow Hill. These have developed where the underlying rock is intensively jointed Park Limestone. Much affected by frost, the limestone has broken down into a highly shattered rock mass of small fragments, leading to scree formation on the steep slopes.
- 3.22 The loose rock and scree supports important native species, including the rarest British woodlouse *Armadillidium pictum*, a southern species of snail *Pomatias elegans* which is at its northern limits in the Arnside and Silverdale area, and the very rare Teesdale violet *Viola rupestris*, found on only a very few British sites.

Limestone Cliffs

- 3.23 Low, limestone cliffs occur within the AONB, generally associated with faulting. These cliffs fringe the coast between the mouth of the Kent Estuary and Silverdale, occurring where the Park Limestone is more massively bedded, especially at Jack Scout.
- 3.24 In addition to natural cliffs, often associated with faulting, there are a number of upstanding cliff-like faces at a number of locations in the AONB. These are the excavated rock faces in both disused and active quarries, such as those at Trowbarrow, Warton Crag, Jenny Brown's Point, Middlebarrow and Sandside.

The Trough

- 3.25 A linear zone of near vertical bedding within the Urswick Limestone, including the Woodbine shale and associated with folding and faulting along the 'Silverdale Disturbance', is responsible for a feature known as 'The Trough'. This remarkable shale and limestone sequence, faulted to either side and tilted, has formed a trench-like feature between two small cliffs running north-south from Storrs Lane, Trowbarrow through to Throughs Lane, Storth.
- 3.26 The deep cut of the Trough is due to the presence of a mudrock or shale, known as the Woodbine Shale, which is interbedded within the Lower Urswick Limestone. The softer mudrock has been eroded more rapidly than its enclosing walls of hard Urswick Limestone, resulting in this gorge-like feature, some eight metres wide, which can be traced along its alignment for a considerable distance, from Leighton Moss in the south as far as Yans Lane in Storth in the northern part of the AONB. The Woodbine Shale forms an extensive impervious layer within the Limestone that has a profound effect on the local hydrogeology.

Dolines

3.27 Within the AONB the formation of dolines and uvalas have resulted in the development of the wetlands at Deepdale Pond in Cringlebarrow Wood and possibly Hawes Water. Hawes Water is one of only two water bodies of natural origin remaining in Lancashire, and forms part of an area supporting a wide range of important wildlife habitats. It is particularly remarkable for the shell material found lining the shore, which represents post-glacial deposits of dried-out calcareous marl deposited under fresh-water conditions when the lake was larger and the water level higher. The marl also underlies all of Hawes Water Moss and Little Hawes Water Moss.

Cave Systems

- 3.28 Weathering of the limestone within the AONB has resulted in the development of cave systems by groundwater solution, such as Harry Hest Hole on Warton Crag. Old caves also occur along the limestone cliffs at the former sea-level. Now mostly dry and fossilised, they were eroded as roughly circular passages by groundwater under pressure.
- 3.29 The Hale Moss caves are Britain's only examples of water-table karst caves. These systems of small caves developed in the steep cliff-like limestone bluffs which once formed the margin of the Hale Moss polje lake.

Coastal Processes

- 3.30 Morecambe Bay is a large embayment, fed by the estuaries of the rivers Wyre, Lune, Kent, Keer and Leven. Numerous smaller watercourses such as the River Bela, on the north-western boundary of the AONB also drain into the vast expanse of the Bay. It is the largest area of intertidal flats in Britain and includes a range of nationally significant geomorphological features and processes, particularly the sediment transport systems that operate to develop and maintain Walney Island, a very large, distinctive and nationally rare barrier island to the west of Barrow-in-Furness.
- The Bay, and the estuaries of the Kent and the Keer, are critical elements in the character of the 3.31 AONB's landscape, and the dynamism of these seascapes is a key aspect of the area's special qualities. The varied tidal regime of the northern Irish Sea, and the orientation of the coastline relative to the prevailing winds, set against the direction of the key estuarine sediment pathways, results in a complex system of sediment circulation and deposition. Over the centuries, the channel dynamics of the Kent in particular has had - and continues to have - a major influence on the appearance of the foreshore as erosion / accretion patterns cyclically scour away coastal salt marshes and deposit the material elsewhere. Channel migration is facilitated by the very strong tidal currents in the Bay, and can occur within a very short space of time. Saltmarsh erosion and accretion is strongly dependent on channel and bank positions. When the main channel of the Kent is in an inshore position (relative to the AONB), it allows larger – higher energy – waves to erode the marsh: conversely, the presence of substantial sand banks in front of the shore attenuates wave action in all but the most severe of weather. Flows from the River Bela into the Kent estuary are also an important contributory factor in lateral movement of the main Kent channel. The patterns of shifting sands within the Bay, and the highly varied composition of the substrate, contributes to the estuary's reputation for danger, and the tradition - begun in 1548 - of the appointment of the Queen's Guide to the Sands.
- Historical coastal erosion has contributed to many of the AONB's distinctive features, most notably 3.32 the expanses of intertidal flats and coastal saltmarsh, but also a series of low cliffs carved from the limestone around the northern and western shorelines. While these processes are ongoing, development and land use practices from the 18th century onwards have had a major impact on the operation of the system in the vicinity of the AONB, and consequently, the character of the landscape. Several unsuccessful attempts at drainage and land reclamation were made around the coastline during the late 18th and early 19th centuries; eventually succeeding at Leighton Moss in around 1840, with a further 300 acres reclaimed around 1857 with the construction of the Carnforth to Ulverston Railway. The creation of the railway embankment adjacent to Leighton Moss, and the Kent viaduct, served to fix sections of a previously dynamic coastline. From the mid-19th century through to the 1960s, saltmarsh accumulated along the artificial coastline formed by the railway embankment between Jenny Brown's Point and the Keer Estuary. However, due to movements in the Kent channel during the 1970s, the marsh began to erode – a pattern that continues at the time of writing. It is therefore likely that, unless there is a major shift westward in the Kent channel, saltmarsh erosion will continue and overall coastline exposure will increase.

Figure 3.1 Bedrock Geology



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Figure 3.2 Superficial Geology



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Figure 3.3 Limestone Pavement Orders



Soils

3.33 The glacial till/boulder clay which once thinly covered much of the area, has weathered to form brown earths and brown calcareous soils over the Carboniferous limestone. The same soils, together with rendzinas and outcrops of bare rock, characterise the limestone hills. Low-lying mosses have gleyed peaty or brown earth soils, with organic soils on drier sites. Fine wind-blown loess¹⁸ was laid down over the limestone outcrops throughout the AONB. This has created patches of acidic soil within the predominantly calcareous area which support heath vegetation communities such as those found on Arnside Knott and Warton Crag. The unusual juxtaposition of basic limestone and acidic heathland habitats contributes to the diversity and value of the AONB's habitats and landscape (see **Figure 3.4**).

Drainage

- 3.34 Permanent surface streams are absent from the limestone hills, due to the highly permeable nature of the bedrock and the low level of the water table. Rainfall percolates into the ground surface along joints, bedding planes and faults, emerging at lower levels as major springs which feed a number of historic wells and wet flushes which provide important habitat (e.g. Woodwell, Bank Well, and Dogslack Well). Some springs, including those at Arnside Tower and those at Hawes Water, are perennial, while others, such as at Cove Well, are intermittent. Lower lying valley areas are drained by streams and watercourses such as Leighton Beck, and Myers Dyke. Some parts of the lower-lying areas remain as wetland areas, such as Leighton Moss. Originally an extensive peat moss, it was drained in the 19th century, and cultivated, almost within living memory, for arable crops. However, the drainage relied on an artificial pumping system, and when this was shut down, due to a fuel shortage during the First World War, the basin was flooded and rapidly developed into a reed swamp.
- 3.35 The groundwater-fed River Keer, on the southern boundary of the AONB, flows through a shallow floodplain of drift deposits into Morecambe Bay. Tidal in its lower reaches, the Keer runs in a channel through Warton Sands to join the shifting channel of the River Kent, which forms the northern boundary of the area. A short section of the River Bela winds through a narrow valley to the north of Beetham at the north-eastern boundary and discharges into Milnthorpe Sands (see **Figure 3.5**).

Current Climate

3.36 The moderating influence of coastal waters and the North Atlantic Drift have an important influence on the climate of the Arnside and Silverdale area, particularly in the southern and western parts. The combination of shelter provided by the landform and woodland cover with an equable climate affect plant and animal life within the AONB. As a result the area is able to support a number of species, such as the small-leaved lime (*Tilia cordata*), which are at or near to their northern limit of distribution.

Figure 3.4 Soil Classification



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Figure 3.5 Hydrology



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Natural Heritage and Biodiversity

3.37 The AONB is a nationally and regionally important core biodiversity resource that contains an unusually wide range of habitat types, e.g. deciduous woodland, traditional orchards, limestone grasslands, limestone heathland, etc. The AONB has 19 SSSIs including Gait Barrows NNR and the Morecambe Bay Pavements SAC. While the majority of SSSIs are designated for their ecological importance, four of them are included wholly or partly because of their geological interest. In addition Morecambe Bay and Leighton Moss have international designation under the Ramsar Convention on Wetlands of International Importance (RAMSAR). At European level Morecambe Bay and Leighton Moss are designated as SPAs for the conservation of wild birds with the Bay also designated as an SAC for the conservation of valued habitats. There are also many non-statutory Local Sites registered within the AONB, and these represent a comprehensive set of biodiversity and geodiversity assets in the area.

Habitats and Biodiversity

- 3.38 The area supports a rich and diverse range of habitats which make a significant contribution to the character of the AONB landscape. Much of the special interest of the area lies in the intricate mosaic of semi-natural limestone habitats and coastal habitats. Calcareous grassland, scrub and woodland, together with small but important areas of limestone heath, cover much of the limestone hills and cliff tops which remain agriculturally unimproved. At the coastal edge, intertidal flats and saltmarshes are covered by national (SSSI) and international (SAC, SPA and RAMSAR) designations, reflecting the exceptional quality of the coastal habitats and the species that they support. The flora and fauna is outstandingly rich, with many rare or uncommon species including those known only within the local area.
- 3.39 **Figure 1.3** provides an overview of the nature conservation designations.

Woodlands

- 3.40 The AONB is a well-wooded landscape, with some 35-40 percent of the land area clothed in principally semi-natural broadleaved woodland. These woods occur extensively throughout the area on the thin calcareous soils of the limestone hills, and on areas of exposed limestone pavement. They are valued features of the landscape which are enhanced by their cultural and conservation interest.
- 3.41 Ash and birch dominate the woodland canopy in many places, with sessile oak and an understory typically of hazel, hawthorn and holly, with juniper in places. Much is secondary, semi-natural woodland which has expanded within the AONB since 1900, and in particular over the last 50 years, as the grazing of livestock diminished. Scattered clumps of large, widely spreading 'veteran' trees, particularly oak, elms and yew are important features of the secondary woodlands, and are potential indicators of ancient wood pasture. Many have been designated as SSSIs including Thrang End and Yealand Hall Allotment, and are included in the Inventory of Ancient Semi-natural Woodland.
- 3.42 The richest and most varied areas of woodland are likely to represent truly ancient semi-natural woodland, under continuous cover since at least 1600. They generally contain a higher proportion of sessile oak trees, together with significant numbers of small-leaved lime and an understorey including the rare Lancastrian Whitebeam *Sorbus lancastriensis* and the Wild Service tree. Parts of Eaves Wood, Gait Barrows, Cringlebarrow, Barrow Scout and Arnside Park are considered to be ancient semi-natural woodland.
- 3.43 Areas of upland mixed Ash woods, which are fern- and moss-rich and have a rich and diverse ground flora, are found over limestone outcrops and pavement, such as at Warton Crag, Underlaid Wood, Cringlebarrow Wood, Gait Barrows, Yealand Hall Allotments and Eaves Wood. The dominant ash tree is one of the last species to come into leaf in spring. As a result, high levels of light and sunshine continue to reach the woodland floor until the end of May. This encourages the diverse ground flora, with wood anemone, primrose, wild daffodil and bluebells, and an assemblage of rare and uncommon plants, including the Yellow Star-of-Bethlehem, Stinking Hellebore and Fingered Sedge. Over 1,000 species of fungus have been recorded at Gait Barrows, and scarce invertebrates are also present, including the bug *Issus muscaeformis* which is found on only two sites in Britain, both within the AONB. Many native mammals also live within the woods, including roe and red deer, and badgers.
- 3.44 Historically, the woodlands were a fully integrated part of the rural economy, and their character reflects management practices which have origins in the medieval period. Almost all of the AONB woodlands were once managed to provide forage and pasture for livestock, as a source of building timber, and by coppicing or pollarding, as a steady supply of young wood, or 'poles'. The crop of young wood was of value, meeting local demand for charcoal to fuel various iron furnaces in the area, for the needs of the local bobbin industry, and for a range of woodland products such as swill baskets and hurdles.

- 3.45 Today, modern woodland management concentrates on the production of mature standard trees, particularly oak, ash and beech. However, the practice of coppicing, especially of hazel, is beginning to be re-introduced on a small scale in many of the traditionally coppiced woods. This has had nature conservation benefits, and has stimulated the local craft production of charcoal, baskets, hurdles, cleft oak gates and chairs. The practice of coppicing is increasing and is being promoted and carried out by a range of landowners and organisations.
- 3.46 **Figure 3.6** illustrates the woodland cover within the AONB.

Limestone Grasslands

- 3.47 Open cliff tops and unimproved pasture across the limestone hills, such as Arnside Knott, support species rich, semi-natural calcareous grassland, often in an intimate mosaic with bare rock outcrops, heath and scrub vegetation. Together these form part of a rich range of habitats which are an important nature conservation resource, attracting a wide variety of insects, including rare butterflies such as the high brown fritillary, Scotch Argus, and Duke of Burgundy.
- 3.48 The calcareous grasslands are dominated by blue moor grass and limestone bedstraw. When appropriately grazed, these form a fine turf which is rich in unusual plants adapted to thrive on the shallow and free-draining limestone soils. In spring and summer the limestone grasslands are carpeted with wild flowers, including the common rock rose and a number of orchid species, together with sweet-smelling herbs such as marjoram and wild thyme. Nationally rare arctic-alpine plants, including Dark Red Helleborine, Spring Sandwort and Spring Cinquefoil also survive within the grassy sward as well as between the bare rocky scars.
- 3.49 Patches of scrub vegetation frequently occur within the limestone grasslands and have become more widespread in recent years. These are dominated by blackthorn, with a range of other species such as spindle, dogwood and buckthorn more commonly found in southern England.

Limestone Heathland

3.50 Lowland heathland, which is unusual within a limestone setting, is found in the AONB in mosaic with limestone grassland. This is due to the windblown deposits of loess which have filled the joints and fissures of the limestone bedrock, creating deeper pockets of more acidic soil conditions within a lime-rich environment. The small areas of limestone heath occurring on the grassy western slopes of Arnside Knott, at Yealand Hall Allotment and on Warton Crag, are important and valuable features of the AONB. The heathland areas are of special interest for the close association of contrasting acid loving species, with Common Heather, Bell Heather and Tormentil growing immediately adjacent to lime-loving plants such as Salad Burnet and Common Rock Rose.

The Mosses - Wetland Habitats of the AONB

- 3.51 The low-lying mosses of the AONB generally lie between 4.5m and 6m, i.e. below mean high-water level. Some of these mosses are also of significant nature conservation value, supporting a wide range of wetland habitats, including raised mire.
- 3.52 The mosses form part of the expanse of lowland peat deposits which fringe Morecambe Bay and the Lancashire coast. In the AONB, they developed within the low-lying basins or poljes, depressions which separate the limestone hills. It is likely the poljes were inundated by glacial meltwater at the end of the last glacial period, around 10,000 years ago. These water-filled depressions were gradually colonised by vegetation, developing progressively from freshwater swamps dominated by the common reed *Phragmites* to fen-carr and raised *Sphagnum* moss peat bog. Patches of birch, willow and alder may have become established on the drier margins of the wetland.
- 3.53 Many of these mosslands developed fully to the raised bog or mire stage. However, their value as a ready source of fuel has, over the centuries, resulted in widespread clearance and cutting of the mossland peat, which is now generally reduced to the lower reed swamp horizons. Most of the peaty mosslands were also reclaimed as flat, fertile farmland through a variety of artificial drainage schemes. Only a small part of Thrang Moss survives within the AONB as an example of a *Sphagnum* moss habitat.
- 3.54 Leighton Moss, an RSPB reserve, is protected as SSSI, SPA and a RAMSAR site. The special interest of Leighton Moss lies in the way it has been actively managed to retain, within a single site, all the stages of colonisation from open water to woodland. Extensive areas of open water, Phragmites reed beds, willow scrub and mixed fen carr are present, mirroring the original development of the mosslands. Such a wide range of habitats has attracted a rich diversity of wildlife to Leighton Moss. Bird populations are varied, with over 65 species breeding regularly. These include the marsh harrier and nationally important populations of bittern and bearded tit. Roe and red deer and otters are also resident within the moss.

- 3.55 Many of the same mossland habitats are found at Hawes Water, also an NNR and SSSI, which lies close to Leighton Moss. It contains a nationally important example of a marl lake, which is lined with shelly calcareous deposits. Rich fen flora is established along the northern fringes of the lake shore, where the marl is exposed.
- 3.56 Silverdale Moss has in recent years been re-flooded to reverse the effects of drainage and to promote it as a habitat for bird species including bittern. Re-wetting has also occurred at Barrow Scout fields.
- 3.57 **Figure 3.7** illustrates the priority habitats within the AONB.

Coastal Habitats

3.58 A significant proportion of the area of the AONB is represented by the tidal waters of Morecambe Bay and by the intertidal landscapes of saltmarsh and flats which characterise much of the coast.

Morecambe Bay

3.59 Approximately 40% of AONB is covered by the tidal waters of Morecambe Bay and the Kent Estuary. The areas of salt marsh and the broad expanses of mud and sand flats form part of a shallow inlet and bay estuarine system of international importance for the conservation of wild birds and valued habitats designated both as SPA and SAC.

Saltmarsh

- 3.60 The saltmarshes fringe areas of the coast in the vicinity of Silverdale, Warton, Arnside, Sandside and at New Barns. The flat sea-washed turf is patterned by narrow water-filled rills that are interrupted in places by winding muddy creeks, rocky patches and slabs of limestone, which fringe the shore. Only covered in the highest tides, the salt marsh is extensively grazed by sheep and has a long history of turf cutting.
- 3.61 Considerable erosion has occurred in recent years however, as the River Kent channel has swung closer to the Silverdale shore and now only relatively small areas of saltmarsh remain. The change of route of the Kent channel is believed to be cyclical, with salt marsh having developed at Grange and Kent's Bank on the west side of the estuary.
- 3.62 Red fescue grass (*Festuca rubra*) dominates the sward of the saltmarshes, which also contains occasional patches of pink sea thrift (*Armeria maritima*).
- 3.63 The maritime cliff and slopes which occur around Morecambe Bay support rare ledge and limestone grassland communities.

Sand and Mud Flats

3.64 Intertidal estuarine flats of fine sand and mud, interlaced by a dynamic system of shifting tidal channels, fringe many parts of the AONB. The scenery is one of visual contrast, varying between open water and 'land' as the flats are constantly covered and uncovered by the tide. Pools of quicksand and fast-moving tides, with tidal rips and eddies are typical of this dynamic and changing seascape. The tidal flats are important to the survival of breeding waders and waterfowl. They support a diversity of wintering wading birds, including Oystercatcher, Dunlin and Knott, and wintering wildfowl such as Shelduck, Pintail and Eider.

Figure 3.6 Woodland Cover



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Figure 3.7 Priority Habitats





Historic Landscape and Archaeology

- 3.65 The landscape of the Arnside & Silverdale AONB has been heavily modified by the actions of human communities. Although many of the most visible relics of human activity relate to more recent events and processes, even the earliest permanent settlers in the region have left a distinctive mark on the landscape. From the Neolithic to the modern industrial era, the landscape has played a significant role in the everyday lives of communities and has made an important contribution to the formation of local identity.
- 3.66 **Figure 3.8** illustrates the historic environment designations within the AONB.

Early Prehistory

- 3.67 During the earliest phases of the Mesolithic, around 7250BC, the coastline of North West England lay around 20m below current levels¹⁹. This created a coastline drawn approximately from Anglesey to a point west of Walney Island in Morecambe Bay – forming a belt of now-submerged land some 10-15km wide²⁰. This lost littoral landscape diminished up to around 5200BC, as sea-levels rapidly rose to around 2m below current levels. Consequently, evidence for Mesolithic communities in the region is scant, given that activity and occupation were likely to have been concentrated on this lost coastal zone. Palaeo-environmental evidence suggests that the drier ground would have been forested from sea-level up to around 500m²¹.
- 3.68 It is widely accepted that the dramatic loss of elm pollen from fossil records across Britain during the late 5th and early 4th millennia BC (known as the 'elm decline') may have resulted, in part, from human activity during the late Mesolithic/early Neolithic. Current research suggests that this phenomenon occurred relatively rapidly much like contemporary Dutch elm disease and would have had a major effect on the oak and elm-dominated woodland landscapes of the region. The gradual transition to farming also had a significant impact on the landscape as communities cleared woodland to create small fields. The fossil pollen record indicates that, by around 3500BC, human communities had begun to significantly alter the natural vegetation patterns of the AONB. Excavations at Storrs Moss revealed a range of cultural deposits and wooden structures dating to at least the mid-4th millennium BC²² indicating that Neolithic communities were present and active in the AONB. Similarly, ground stone axes found in the vicinity of the Moss attest to the improved tools available in this period. These would have enhanced the tree-felling abilities of the first farming societies in the region. The deep and relatively easily worked valley soils of the AONB would have been attractive to early farmers.
- 3.69 The karst caves in the limestone hills of the AONB appear to accrue additional significance during the later Neolithic. Scattered deposits of ceramics, small amounts of human skeletal material and animal bone were recovered from Dog Holes Cave on Warton Crag. Loosely dated to the later Neolithic, these deposits perhaps relate to a wider pattern of use and veneration of natural places spanning this period and the early Bronze Age. Elsewhere in the region, this pattern is echoed in the deposition of cultural material, including stone and early bronze axes, in the environs of natural mounds and hummocks²³.
- 3.70 Flint scatters found near Yealand and the discovery of some high quality, bronze implements in the vicinity of Burton suggest that the soils and slopes around Warton and Yealand, and possibly Hale, were already being 'intensively' farmed by the beginning of the 2nd millennium BC. This increased 'domestication' of the landscape is matched by the development of albeit relatively small ritual landscapes in the area. Evidence for this is provided by a number of burial mounds, including a circular mound found on Summerhouse Hill, Yealand Conyers, which is thought to date from around 2,000BC. This marks a partial move away from earlier patterns of behaviour that venerated natural places in the landscape to a more human-centred system of activity, focussed on man-made places and spaces.

²² Powell, T. G. E., Oldfield, F., & Corcoran, J. X. W. P., 1971. Excavations in Zone VII peat at Storrs Moss, Lancashire, England, 1965-67. *Proceedings of the Prehistoric Society 37*(1), 112-37.

¹⁹ Tooley, M.J., 1974. Sea-Level changes during the last 9000 years in North-West England. *Geographical Journal 140*, 18-42.

²⁰ Tooley, M.J., 1985. Climate, sea-level and coastal changes. In Tooley, M.J., & Sheail, G.M. (eds.), 2006, *The Climatic Scene*. Allen and Unwin: London. pp. 206–234.

²¹ Tallis, J. H., 1975. Tree remains in southern Pennine peats. *Nature 256,* 482-484.

²³ Edmonds, M., Evans, H., Lund, J., Maxwell, R., & Start, M., 2002. Evaluation of landscape Features on Sizergh Fell. Archaeology North 20, 13-15.

Later Prehistory

- 3.71 Increasing density of settlement, and increasing reliance on agriculture, during the Bronze Age required further woodland clearance. By around 1500BC it is likely that the forested landscapes of the AONB (see Figure 3.9) had given way to a mosaic of secondary woodland and dispersed settlement. However, little evidence survives relating to these settlements or field systems. It is likely that the relatively ephemeral traces of such sites have been lost to later agriculture, industry and building. The limestone hills are likely to have been extensively used for summer grazing of livestock, further increasing pressure on the regeneration of woodlands outside the immediate settled area. The development of increasingly stratified societies in the later Bronze Age and early Iron Age illustrated by the increased prevalence of 'prestige goods' in the archaeological record - is inscribed on the landscape through a series of hilltop ancient enclosures. The small Iron Age hill fort on Warton Crag provides the ideal illustration of the move toward the use of communal defensive sites. However, the precise nature and function of many of these 'forts' remain unclear. What is certain is that they would have required significant manpower from the local area to construct – implying a reasonable density of settlement and population - and the attendant power structures to organise and deploy a suitable labour force.
- 3.72 However, apart from large and readily visible sites such as the Warton Crag fort, the early and middle Iron Ages are largely invisible within the AONB and in the north west of England in general. Smaller sites in the settlement hierarchy are conspicuous by their absence in the landscape. Similarly, the pollen record indicates that there was less man-made disturbance of natural vegetation patterns during this period, suggesting lower population densities or different cultivation practices. In contrast, the later Iron Age well dated pollen data suggests that there was widespread clearance activity throughout the region.
- 3.73 This later Iron Age intensification is broadly comparable with the pattern throughout England, with the development of an increasingly agricultural landscape through the adoption of formal fields and farmsteads.

Romano-British and Early Historic Periods

- 3.74 While there is no direct evidence for a Roman presence in the AONB, it is likely that the political upheaval created by the arrival of the Roman military in the region during the AD70s would have had a profound effect on local populations. Only 10kms away, the Roman fort at Lancaster would have had a significant impact on both people and the landscape. As a major installation with an associated civilian settlement, or vicus, it would have required an extensive supply network and may have influenced patterns of agricultural production in the surrounding area. Given the paucity of late Iron Age and Romano-British settlement evidence within the AONB it is difficult to make inferences on the impact of the Roman military on settlement patterns. However, it is clear that some local movement of population occurred as people left the rural hinterland to provide goods and services in the vicus, beginning a drive towards (small scale) urbanisation.
- 3.75 Despite the initial impact of military occupation, the Roman system of provincial government allowed native populations to continue with their everyday lives with little intervention. Roman polytheism allowed indigenous cult practices to continue in parallel with local adoption of Classical gods by native populations. Excavation of the Dog Holes cave, Haverbrack, recovered human and animal remains associated with finds dating from the first to the ninth centuries AD. This suggests that the Iron Age 'head' cults associated with significant natural places persisted in some form well into the early Christian period.
- 3.76 Roman administration in the northwest ended in the early 5th century AD. In rural areas, such as the AONB, this may have had a relatively limited impact on communities. Similarly, it is likely that there would have been little change in agricultural and settlement practices from the late Iron Age into the early historic period.
- 3.77 Suitably for a period commonly known as the 'Dark Ages,' little is known of the early historic settlement record in and around the AONB. The area is likely to have been part of the Brythonic-speaking Kingdom of Rheged during the 6th century but was annexed by Northumbria at some time before AD 730. This drew the area into an extensive Anglo-Saxon kingdom that stretched from Edinburgh to the Humber.

3.78 As in prehistory, the Atlantic seaways continued to be a major route of communication for the inhabitants of Arnside and Silverdale, transmitting goods, people and ideas the entire length of the British Isles, from Shetland to Cornwall. The seaways were a major conduit for early Christianity, illustrated by the fine 9th century cross found at St Mary and St Michael's Church, Great Urswick, on the Furness peninsula. Similarly, relative proximity to the Norse kingdom of Dublin would inevitably have brought contacts through both raiding and settlement. Place name evidence indicates the extent to which Norse settlers influenced the landscape. The suffix –thwaite, meaning 'clearing' is particularly informative and is well represented throughout the region. Finds of metalwork in Arnside also attest to a Viking presence in the AONB during this period. In addition, in September 2011, the Silverdale Hoard, an early 10th-century Viking hoard comprising 201 silver coins, jewellery, ingots and hacksilver, was unearthed in the vicinity of Silverdale.

The Norman Conquest to the 17th century

- 3.79 The Conquest of 1066 and the subsequent entrenchment of the Norman feudal system created a distinctively medieval landscape within the fertile farmland of the eastern fringe of the AONB. Essentially, this was a landscape of linear villages, each with attendant communal 'open fields' of arable land with large areas of common grazing beyond. Open fields were farmed in individual strips (furlongs) often running perpendicular to the axis of the village. Many of these fields were effectively 'fossilised' by later enclosures as formalised stone or hedged boundaries preserved the characteristic profile of the cultivation strips. This sinuous, 'reverse-S', form is a product of medieval mould-board plough technology; the need to form and preserve ridges (or 'rigs') to improve soil depth and drainage; and the practicalities of turning a team of eight oxen at the end of each furrow. This characteristic form is also visible in the preserved 'moss rooms' of Hale and Arnside mosses. Medieval 'commoners' (i.e. those with access to common land) often enjoyed the 'right of turbary' the ability to freely cut peat for their own use from common mossland. Digging drains to dry out the peat to enable cutting eventually allowed this newly-reclaimed land to be cultivated and incorporated into the surrounding field systems, significantly altering the character of the landscape.
- 3.80 This pattern of settlement and land use was still a dominant and distinctive feature of the eastern fringe landscape at the time of the Tithe Map and the first edition of the Ordnance Survey map in the first half of the 19th century. It is best seen today in the villages of Warton, Yealand and Hale within the AONB, and also extended eastward to include the villages of Burton-in-Kendal and Farleton on the far side of the valley. The 18th century designed landscape and deer park at Dallam Tower which may have been in existence in some form for a considerable period before its current formal design preserves an interlocking pattern of medieval open fields. As this land has largely escaped the effects of modern intensive agriculture, the characteristic ridges, furrows and field-banks survive and are clearly visible on current aerial photography.
- 3.81 In contrast to the eastern fringe of the AONB, the remaining 'interior' of the area had much less favourable conditions for agriculture. The relatively thin soils of this area supported dispersed farms, like those associated with the medieval towers of Arnside and Hazelslack, which were almost 'islands' within the wastes of outcropping rock, mosses and woodlands. Nevertheless, the common grazing and 'wastes' which lay beyond the villages played an important part in the medieval agricultural economy. The limestone hills would have been exploited for communal grazing, and areas of surviving woodland managed for fuel and building materials. The low-lying mosses were a particularly valued community resource which provided grazing, arable land on the drier margins, and provided peat for use as fuel. These commons and 'wastes' became partially enclosed, often in a piecemeal fashion, throughout medieval and post-medieval times.
- 3.82 Early industries, often connected with the activities of monastic houses elsewhere in the region, began to have an influence on the landscape during the medieval period. The extraction of iron ore in Silverdale by the Priors of Cartmel began perhaps as early as the 12th century, as mentioned in the Priory's founding charter. Although the mines were small-scale and confined to surface workings, they paved the way for more intensive exploration and processing during the early industrial period.
- 3.83 Increased stability in the north of England during the 16th and 17th centuries facilitated the development of less utilitarian estate centres and the growth of recognisable 'country houses'. The defensive structures of the preceding centuries such as the 14th century fortified manor at Beetham Hall were augmented by ancillary buildings and deer parks. Consequently, areas of the landscape took on a significantly different character, with former common land being subsumed into the private estates of landlords largely for leisure activities (i.e. hunting) and paving the way for the development of formal designed landscapes.

18th and 19th Centuries

- 3.84 The early phases of the Industrial Revolution had a significant impact on the landscapes of the AONB. The Furness peninsula had long been a centre of iron production and in 1713 the Backbarrow Company expanded its operations into the AONB by constructing a furnace complex at Leighton. Using locally produced charcoal to fuel the blast furnace and water power from Leighton Beck, the furnace operated until the late 18th century. Place name evidence on historic maps (particularly 'coppice' names) indicates the extent to which woodland was managed for charcoal production. However, the resource was insufficient and the surrounding peat bogs were tapped as a fuel source, further driving their depletion. The landscape impact of this industry should not be underestimated, drastically thinning and changing the character of the remaining broadleaved woodlands and paring down the surfaces of the area's raised mires. Even this was not sufficient, and by the late 18th century the Cumbrian ironmasters were forced to seek alternative fuel sources – transporting ore by sea as far as the west coast of Scotland in order to utilise the vast timber resources of the Atlantic Oak woods.
- 3.85 Although land in the AONB had been enclosed in a piecemeal fashion since at least the 17th century, the agricultural improvements of the 18th and 19th centuries made further significant changes to the face of the AONB landscape. The 19th century Acts of Enclosure led to changes in the landscape of the AONB (see **Figure 3.10**). Remaining 'wastes' were taken into private ownership, transforming open areas into a landscape of large regular enclosures, a pattern in marked contrast with the old strip fields. This is most clearly visible between Warton and Silverdale, and at Brackenthwaite and Thrang End farms. Warton Crag was enclosed at this time, as was the common between the village and Yealand Conyers.
- 3.86 Application of artificial soil conditioners was a key aspect of agricultural improvement. As a result, the limestones of the AONB were in great demand and quarrying activity intensified significantly, the relics of which are readily visible throughout the area. Processing facilities, in the form of large lime kilns, were constructed close to extraction sites and continue to be an important aspect of landscape character and industrial heritage. The products of this, and the iron industry, were exported via the Lancaster Canal, constructed just outside the AONB and completed in 1819.
- 3.87 The landscape was further modified through the drainage of Leighton, Storrs and Arnside Mosses (1840) to enable their use for agriculture. Substantial embankments were constructed to protect landowners' investment from marine inundation, further altering the natural processes of the AONB. The first edition of the Ordnance Survey six-inch map (1848) shows these areas as entirely drained and improved. This reclaimed agricultural land was maintained through continual pumping until the First World War. The ruins of the pump engine house are still visible at the foot of Warton Crag.
- 3.88 Increasing revenues to landowners from booming agricultural and industrial production in the late 18th and 19th centuries were also channelled into the further improvement of estate centres. In addition to constructing grand new houses and ancillary buildings, prime agricultural land was also converted to parkland and gardens.
- 3.89 Such was the improving zeal that enclosures were not restricted to dry land. A highly ambitious scheme offered for sale by auction "upwards of 50,000 acres" of Warton Sands, "power being given by the Enclosure Act to embank the same" (advertisement, Lancaster Gazette, 13 November 1813). Precisely what became of this scheme is not clear, but in 1881 Mannex and Co. reported that 6,000 acres (2,430 hectares) were then "in the course of reclamation". This almost certainly involved the use of slag from the Carnforth Iron Works to construct a sea wall or embankment, the remains of which can still be seen on Warton Sands.
- 3.90 Other measures improved communications between the area and the wider region, making it more accessible and providing opportunities for new development. At Warton the enclosure of land was accompanied by the construction of a new road to Silverdale around the bottom of the Crag. This was an improvement on the original route which passed over the Crag. The building of the Furness Railway followed, including the Arnside Viaduct across the Kent Estuary in 1857 and the construction of the Sandside Hincaster Kendal branch line in 1867.
- 3.91 The arrival of the railway opened a new chapter in the area's history, affording easier access to and from the district – and radically changing its character. Wealthy businessmen working and living in the region's urban and industrial centres increasingly sought refuge in the countryside at the weekends and for holidays. Storth, Arnside and particularly Silverdale expanded as agglomerations of large villas were developed to meet this need.
- 3.92 The construction of the railway embankment around the foot of Warton Crag cut off a significant section of saltmarsh, enabling its reclamation for agriculture and creating a barrier against which the seaward marshes could accrete. Similarly, the later construction of the branch line from Arnside to Hincaster junction created a similar sediment trap in the Kent Estuary.

- 3.93 The railway also afforded a ready means by which to export limestone and processed lime to markets desperate for soil conditioners, building materials and refractory limestone for ironworking. This drove significant expansion of the existing lime industry, including Trowbarrow Quarry. Although lime had been extracted and processed for local use attested by the lime kilns dotted throughout the AONB the new demand drove rapid industrialisation and technical innovation.
- 3.94 James Ward, the pioneering director of the Northern Quarries Company Ltd, developed a range of tar-bound road surfacing and flooring products using limestone from the Trowbarrow Quarry. Ward introduced systematic analysis and grading of quarried limestone and developed a tar distilling plant at Silverdale to guarantee the quality of his products which were used nationwide.

20th Century

- 3.95 Northern Quarries opened Sandside Quarry, southwest of Milnthorpe, at the Hincaster railway junction to provide additional material in the late 19th century. Middlebarrow Quarry, opened in the early 20th century and operated continuously to 2000, was similarly strategically located on the rail network.
- 3.96 However, the demand for road stone and the availability of rail transport was severely hit by the onset of the First World War. Once a major driving factor in the success of the quarries, rail transport became a major issue after 1922 when rail companies refused to carry tar products in their wagons. Northern Quarries was therefore required to expend significant sums acquiring rolling stock.
- 3.97 The increasing prevalence of road haulage from the 1930s onwards required significant upgrading of the narrow lanes between the quarries and the main (A6) road. The closure of the Hincaster branch line as a result of the 'Beeching Axe' in the 1960s (the track was lifted in 1966, with a spur to Sandside Quarry surviving until 1972) further increased reliance on road haulage and enabled vegetation to recolonise the previously cleared railway corridor.
- 3.98 The closure of Trowbarrow Quarry in 1959 allowed recolonisation by characteristic limestone vegetation, in addition to affording access to valuable geological exposures. Sandside and Middlebarrow continued to expand, creating significant voids which, particularly in the case of Middlebarrow, are visible in longer views across the AONB and provide a reminder of the area's industrial heritage and changing priorities.
- 3.99 Leisure pursuits began to make their mark on the AONB during the early years of the 20th century. The Silverdale Golf Club was founded in 1906 in former fields adjacent to Leighton Moss. It subsequently expanded from 9 to 12 holes in 1992 and to a full 18 in 2002. The increasing popularity of the area for tourism led to the development of a number of camping and caravan sites throughout the AONB, introducing new temporary and semi-permanent elements to the landscape.
- 3.100 The designation of the AONB in 1972 (having been under consideration since the 1947 Hobhouse Report²⁴), increased the protection of the natural and cultural heritage value of the area in relation to new development. Further information on the changing landscape is provided in **Chapter 4 Forces for Change.**

Cultural and Industrial Heritage and the Landscape

Agriculture and Fishing

- 3.101 Farming has historically provided much of the employment within Arnside and Silverdale. Over half of the AONB is farmland, much of it being part of larger estates and being farmed by tenants. The patterns of land use within the area have a fundamental influence on the character of the AONB landscapes. Arable crops were once cultivated throughout the area, particularly on the more fertile soils of the reclaimed mosses. However, much of the farmland is now improved permanent pasture which supports both dairy cattle and sheep, and recent years have seen further de-intensification as increasing areas of land have come under management for conservation, with conservation grazing by small herds being used to control scrub, such as at Gait Barrows NNR. Farmland is typically divided by a regular pattern of limestone walls and hedgerows which enclose fields of grassland. In an increasing number of places, the grasslands are less intensively managed species-rich pastures. Drystone walls and rich hedgerows are both features of the local landscape. They form a distinctive pattern of field and roadside boundaries, most of which date from the 19th century Acts of Enclosure.
- 3.102 Orchards have been a feature of the landscape of the AONB for hundreds of years. Although there are no commercial orchards within the AONB there are approximately 90 orchards and gardens within the AONB growing a wide range of apple, plum, damson and pear varieties. The condition of many older orchards has deteriorated over the years and many are in need of concentrated restoration work, although some new planting of fruit trees by individuals has been carried out.

3.103 The fine grasses which thrive on the coastal saltmarshes have traditionally provided a valuable source of sheep grazing within the AONB. They were once cut for amenity turf. In addition to farming, a small fishing industry existed in Arnside and Silverdale until the late 1950's. Fishing for flukes, a small flat fish, was carried out using nets in the channels of the estuary, and cockles were collected at low tide with the aid of horses and carts, using 'jumbos' to coax the cockles to the surface and 'drags' to comb them out of the sand.

Quarrying

- 3.104 The Carboniferous limestone underlying the Arnside and Silverdale area provides a valuable mineral resource which has long been exploited. Numerous small quarries, now mostly abandoned, are scattered throughout the area. Some were the workings of individual farmers, others were communally owned by parishes, and each provided for local needs in building stone, required for the construction of cottages and farmsteads, and for walling. A frequent feature of small quarries was the exploitation of a particular strata of rock for a specific purpose. On Warton Crag, for example, quarrymen exploited a band of limestone suitable for the production of gate stoops, one of which lies abandoned where it was detached from the rock face.
- 3.105 Limestone from the quarries was also processed by roasting in nearby lime kilns, the remains of which are familiar features of rural landscapes. Many of these have been restored in recent years. At first the burnt lime was used in the manufacture of mortar, limewash and plaster for the construction of many local buildings. Later, in the 18th and 19th centuries, its main use was as a soil conditioner intended to improve or 'sweeten' heavy, acidic land.
- 3.106 In addition to the scattered quarries which catered for local needs, a number of large commercial sites extract, or once extracted, limestone for large commercial kilns (see **Figure 3.11**). These include those at Sandside (operational since 1885), and at Trowbarrow (now a Local Nature Reserve and popular rock climbing venue).
- 3.107 The former quarries at Middlebarrow and Trowbarrow are both associated with nearby terraced cottages and the railway. A small railway from Carnforth also served the quarry at Scout Crag, the remains of which can be seen alongside the road from Cote Stones towards Silverdale. In contrast, at Jenny Brown's Point and at Blackstone Point the quarries relied on shipping to transport their products. Today only the Sandside Quarry remains in operation, extracting limestone which is crushed as aggregate for use in construction. The long stone embankment and jetty constructed at Jenny Brown's Point is a feature of the coastline at low tide.

The Arnside and Silverdale Iron Industry

- 3.108 The remains of various types of metalliferous ore mines can be seen today, mainly within the southern half of the AONB. The principal ore extracted within the AONB was iron, and records show that 'iron mines' in Silverdale were granted to Cartmel Priory on its foundation in the 12th century. These were probably shallow workings, dug wherever the ore outcropped on the surface, as at the Cove, and on the top of Cringlebarrow in Yealand Redmayne.
- 3.109 The iron ores found in the AONB are generally soft and of poor quality, properties which led to them being used in the 19th century for the manufacture of paint rather than metallic iron the scant remains of a paint factory are located to the south-east of Crag Foot. Limestone is a vital part of the smelting process and is used as a flux to remove impurities in the melt, being tapped off as 'slag.' It also has refractory²⁵ properties and is therefore desirable for the construction of furnace linings.
- 3.110 Building on a legacy of early iron working within the AONB, a large iron furnace was constructed at Leighton Beck in 1713 by the Backbarrow Company – one of the 'big three' Cumbrian ironmasters. It had a huge effect on the contemporary landscape, as the furnace was fuelled by large quantities of charcoal and by peat. Its operation accelerated the depletion of local mosses, and required the management of extensive areas of local woodland for coppice.
- 3.111 The furnace was closed in the late 18th century as coke-fired ironworks (such as those constructed in the 1840's at Carnforth) rendered the old fashioned charcoal and peat-fired alternatives uneconomic. Little remains to be seen of the ironworks today, however the main charcoal sheds are still in situ and have been converted for domestic use.
- 3.112 Copper and lead reserves were also sought within the AONB, and the chimney at Jenny Brown's Point is believed to have belonged to a failed copper smelting enterprise, active from around 1780 to 1820.

Salt Production

3.113 From the medieval period onwards, salt was produced locally through the evaporation of brine. The name 'Saltcotes' hints at the location of sites in Warton, Storth, and Arnside, while the Cartmel Priory established another site in Silverdale in medieval times. Salt pans at Arnside are recorded in the Historic Environment Record. Coastal salt making in general declined in the 18th century with large-scale production in Cheshire, but precisely when the pans in the AONB ceased to be used is not clear.

Designed Landscapes

- 3.114 The AONB contains a number of noteworthy buildings and designed landscapes, which have a strong influence on the character of the area (see **Figure 3.12**). Although Dallam Tower is the only historic designed landscape within the AONB listed on English Heritage's National Register of Parks and Gardens, there are numerous others which are of significance (see **Figure 3.13**)^{26 27}.
- 3.115 In the 18th and 19th century, industrial wealth was channelled into the building of substantial new houses within the AONB, such as Challan Hall. It also funded the creation of 'country' estates, in which farmland was converted and sometimes remodelled to provide a parkland setting to houses such as Leighton Hall, Dallam Tower and Hyning Park.
- 3.116 Ornamental tree planting, particularly of beech, horse chestnut and larch was an integral part of the new designed landscapes; and individual specimen trees, distinctive clumps, roundels and avenues are frequent and characteristic features, albeit that their decline is evident, as a consequence both of their age, storm damage and insufficient maintenance.
- 3.117 The new planting was very different to the woodlands which had previously served industry. Single-species beech woods were created to the south of Hawes Water, while other woodlands were deliberately created to enhance 'the picturesque' qualities of the area - in line with fashionable Romantic visions of landscape. They represent a more recent phase in the history of the landscape and, like the 'knotted trees' of Arnside Knott and the Jubilee Monument or 'Pepperpot' in Eaves Wood, reflect a changing emphasis towards recreation, retirement and commuting in the Arnside and Silverdale area.
- 3.118 Hand-in-hand with the creation of designed landscapes within the AONB came the development of Silverdale and Arnside. Large villa properties, set within landscaped grounds, reinforced the amenity character of the area. Examples of these include Ash Meadow (Ashmeadow House), Hazelwood Hall and Ridgeway Park (Greywalls). The gardens of Ridgeway Park and Hazelwood Hall were designed in the Arts and Crafts style by the renowned Edwardian landscape architect Thomas H. Mawson in the early 20th century.

Country Lanes, Tracks and Paths

- 3.119 Enclosure added many new lanes and tracks which are now a particular feature of the Arnside and Silverdale countryside. The lanes are narrow and rise over the limestone hills and skirt the fringes of the valley wetlands. Grassy verges and walls of limestone rubble line the lanes in many places, with walls sometimes hidden within broad hedgerows of hazel, hawthorn and ash. The lanes have an intimate character, particularly where they pass through woodland and are enclosed by the tall tree canopies which arch across the roads.
- 3.120 The lanes are linked by a network of footpaths and bridleways which extend into the surrounding countryside. Some are ancient rights-of-way which now form 'green lanes', largely free of vehicular traffic. These include Dollywaggon Lane near Hazelslack, and Occupation Road, which rises over Warton Crag.
- 3.121 The minor road which winds along the foot of the western limestone ridge, through Warton and the Yealand villages, was once the main highway for travellers en route between Scotland and 'the south'. Its use greatly declined after the early 19th century construction of the new turnpike road (now the A6) and today the area is bypassed by through traffic, which uses instead the A6 and M6 roads further to the east.

²⁶ Barker, S., Bennis, E., Brereton, S., Neil, N., Riley, J., Taylor, E., & Thurnhill, R., 2013. *A local list of Lancashire's Unregistered Historic Designed Landscapes* [pdf]. APPENDIX 2 Available at: http://www.lancsgt.org.uk/llr4.613.pdf [Accessed 06 July 2014].

²⁷ Barker et al. (2013) builds on the study undertaken by Bennis and Dyke in 1998 titled Historic Designed Landscapes of Lancashire Research Report. The historic designed landscapes identified by Bennis and Dyke are illustrated in Figure 3.8.