Natural Area: 41. North Downs	**Geological Significance:** Considerable **(provisional)**

General geological character: The North Downs Natural Area is dominated by Cretaceous Chalk. This very pure limestone was deposited on a tropical sea floor between 97 and 65 Ma and is composed of the skeletons of very small marine shells. Although the chalk was originally deposited as a horizontal layer or sheet of relatively uniform thickness, it has been folded by subsequent tectonic movements during the Alpine orogeny (beginning around 50 million years ago). This has buckled the horizontal sheets into the now distinctive North Downs hills. Other Cretaceous sediments include the marine clays of the Lower Greensand and Gault Clay (112 to 97 Ma) which fringe the southern edge of the Downs. The Downs are dissected in many places by networks of dry valleys, cut when the periglacial climates of the Quaternary (the last 2 million years) allowed the Downs to carry surface streams. Some of these dry valleys contain ephemeral streams which are the product of seasonal fluctuations in the levels of the chalk aquifer. The summits of the South Downs often display pure chalk in places where the weathering mantle of clay-with-flints is absent although natural exposures are rare. The footslope of the Downs is masked by periglacial solifluction deposits, known as Coombe Rock. These deposits were washed down the hill slopes of the Downs during periods of surface weathering as a result of the intense periglacial climates during this time. Exposures of the Cretaceous rocks are rare except where they form the coastal cliffs in the east of the area.

Key geological features:

- Cretaceous stratigraphy
- Downs landscape of chalk escarpment and dry valleys
- Periglacial deposits and coombe rock along the footslope of the Downs
- Coastal exposures showing the Cretaceous rocks and nature of the Alpine folding

Number of GCR sites:

Quaternary of Southern England: 4 Tufa: 2 Pliocene: 2 Mass Movement: 2 Quaternary of the Thames: 2 Aptian-Albian: 2 Cenomanian-Maastrichtian: 2 Jurassic-Cretaceous Reptilia: 2 Mesozoic-Tertiary Fish/Amphibia: 1 Coastal Geomorphology of England: 1

Geological/geomorphological SSSI coverage: There are 13 (P)SSSIs in the Natural Area containing 20 GCR SILs representing 10 different GCR networks. Folkestone Warren SSSI is a good example of a coastal exposure of the Cretaceous rocks of the area. It is the type site for the Folkestone Beds of the Lower Greensand, as well as showing the composition of the Gault Clay. The soft cliffs demonstrate important aspects of coastal mass movement and their relationship to coastal geomorphology. Hart Hill SSSI and Lenham Quarry SSSI are important as exposures of the Pliocene Lenham Beds, while Houlder and Monarch Hill Pits, Upper Halling SSSI and Wye and Crundale Downs SSSI show the development of the chalk dry valleys of the Downs and the nature of environmental change through the Quaternary.

Key geological management issues:

- Threat to coastal exposures and coastal geomorphological processes from coastal defences and associated engineering works
- Threats to inland exposure sites from landfill
- Lack of exposure of Cretaceous sediments other than in coastal sections

Key geological objectives:

1. Maintain existing geological exposures through (1) protecting coastal sections from coastal defences and maintaining natural coastal processes (2) agreeing conservation sections in working pits and quarries and (3) targeted site clearance in disused pits and quarries.

2. Encourage the creation of temporary and permanent exposures in the inland parts of the Natural Area where geological exposures are uncommon.

3. Encourage initiatives aimed at promoting the geological resource in this scenic area.

Useful guides/references:

GALLOIS, R.W. 1965: British Regional Geology, The Wealden District. Institute of Geological Sciences. HMSO, London

MILLWOOD, R. & ROBINSON, A. 197: South East England: Thameside and the Weald. Landscapes of Britain Series, Macmillan, London.

WHITTOW, J.B. 1992: Geology and Scenery in Britain. Chapman and Hall, London.

Earth science (P)SSSIs in the Natural Area:

- Lenham Quarry
- Dover to Kingsdown Cliffs
- Folkestone to Etchinghill Escarpment
- Folkestone Warren
- Hart Hill
- Wye and Crundale Downs
- Dalham Farm
- Houlder and Monarch Hill Pits, Upper Halling
- Wouldham to Detling Escarpment
- Greatness Brickworks
- Mole Gap to Reigate Escarpment
- Sheeplcas
- Upper Common Pits

Natural Area: 42. Romney Marsh	Geological Significance: Considerable (provisional)

General geological character: The Romney Marsh Natural Area is characterised by wide expanses of reclaimed coastal marshland with shingle ridges and sand dunes rising a few metres above them. The area is bounded by Lower Cretaceous Wealden and Lower Greensand rocks (110 to 145 Ma). The oldest rocks, exposed along the western edge of the Natural Area, belong to the Wealden Hastings Group; these sands, silts and clays were deposited by a complex river system which occupied much of the Hampshire and Wealden Basins. Rise in sea level led to the deposition of the Lower Greensand which is today exposed on the northern margin of the area. The geology of the Natural Area is, however, dominated by Flandrian coastal deposits which have accumulated over the last 9,500 years and, most importantly, the cuspate shingle foreland of Dungeness. This started to form about 5,000 years BP following the development of a sandy bar across Rye Bay. Eastward longshore drift caused by southwest prevailing winds has transported flint shingle from Beachy Head to Dungeness (some 50 km). Today the shingle foreland is characterised by storm gravel beach deposits forming semi-permanent ridges or 'falls'. Associated sediments include marine alluvium (deposited over the last 3,000 years) and blown sand forming sand dunes such as Camber Sands. The evolution of the Dungeness foreland over the last 5000 years has been researched in detail providing much information about coastal changes in southern England and includes historical records of the abandonment of towns such as Old Winchelsea and Broomhill due to storm damage in 1287 AD.

Key geological features:

- Lower Cretaceous environments
- Flandrian coastal evolution

Number of GCR sites:

Coastal geomorphology of England: 2 Wealden: 2

Geological/geomorphological SSSI coverage: There are 5 (P)SSSIs in the Natural Area containing 4 GCR SILs representing 2 different GCR networks. Houghton Green Cliff and Winchelsea [road] Cutting expose sands and clays of the Wealden Hastings Bed Group. Dungeness (viewed as internationally important), North Lade and Rye Harbour form a network of sites all associated with coastal geomorphology and the Flandrian coastal deposits of the area.

Key geological management issues:

- Maintain and enhance existing exposures
- Maintain natural coastal processes
- Maintain the integrity of sensitive geomorphological features such as Dungeness
- Assess new sites (temporary or permanent)
- Promote the scientific/educational value of the geological and geomorphological resource

Key geological objectives:

1. **Maintenance and enhancement of the geological resource** through a) continued maintenance of natural coastal processes (Shoreline Management Plans), b) development of local conservation strategies that include geology and geomorphology, c) continued assessment of educational/research value of new sites (in particular, inland quarries, pits and cuttings, temporary or permanent), d) promotion of joint geomorphological/wildlife conservation initiatives, (e) protection of sensitive geomorphological features such as Dungeness from mineral extraction and vehicle disturbance.

2. **Promotion of geological resource** through a) assessment and promotion of site educational value (e.g. historical documentation of coastal evolution), b) on-site interpretation (e.g. sign boarding , trail guides, leaflets) c) promotion of the influence of geomorphology on local habitats and scenery.

Useful guides/references:

GALLOIS, R.W. 1965: British Regional Geology, The Wealden District. Institute of Geological Sciences, HMSO. London.

LAKE, R.D. & SHEPHARD-THORN, E.R. 1987: Geology of the country around Hastings and Dungeness. Memoir of the British Geological Survey, Sheets 320 & 321, England and Wales.

Earth science (P)SSSIs in the Natural Area:

- Dungeness
- Houghton Green Cliff
- North Lade
- Rye Harbour
- Winchelsea Cutting

Natural Area: 43. The Low Weald	**Geological Significance:** Considerable **(provisional)**

General geological character: This Natural Area is dominated by the Lower Cretaceous Weald Clay Formation (135-125 Ma) of the Wealden anticline. The relief is largely determined by outcrops of sandstone and limestone beds which form prominent escarpments in an area otherwise dominated by low relief clays. The area is bounded by older rocks of the Wealden Hastings Beds Group and younger rocks of the Cretaceous Lower Greensand Escarpment. Sediments of the Wealden Series were deposited by complex river system which occupied much of the present Wealden area and extended into the Hampshire and Paris Basins. Sediments were derived from areas of high ground to the north, west and south, increased influx in sediment being in response to uplift and erosion of these massifs. The Weald Clay is made up of clays, silts and localised sandstones and limestones. It marks an increased marine dominance within the Wealden Series with possible links to the North Sea Basin. The Weald Clay is locally fossiliferous, a number of sites yielding well-preserved fossil insects, plants and reptiles. Younger Cretaceous sediments (70 to 125 Ma) are also exposed in the Natural Area; these include marine Gault and Folkestone Beds of the Lower Greensand Escarpment and chalk sections on the edge of the South Downs around Lewes, the latter containing important Upper Cretaceous fish faunas. During the Tertiary Period (approximately 15 Ma) the Wealden basin was affected by the Alpine Orogeny and the sequence of Cretaceous rocks was folded into the present anticlinal structure. The area was not glaciated during the Pleistocene but was, however, affected by periglacial erosion in the tundra-like environment of the late Devensian (approximately 12,000 years BP).

Key geological features:

- Weald Clay Formation, Wealden Series
- Palaeontology of the Weald Clay Formation
- Upper Cretaceous Chalk stratigraphy and palaeontology

Number of GCR sites:

Wealden: 10 Palaeoentomology: 3 Aptian-Albian: 2 Mesozoic-Tertiary Fish/Amphibia: 2
Cenomanian-Maastrichtian: 2 Jurassic-Cretaceous Reptiles: 1 Pleistocene/Quaternary of SE England: 1

Geological/geomorphological SSSI coverage: There are 16 (P)SSSIs in the Natural Area containing 21 GCR SILs representing 7 different GCR networks. Most of the sites selected are active or disused quarries. Twelve of these sites lie within the Weald Clay Group and provide detailed coverage of the varied lithologies (in particular the sandstones and limestones) of this unit. Auclaye, Clock House Brick Works and Smokejack Clay Pit have all yielded well preserved insects, Smokejack has also yielded the remains of the Lower Cretaceous dinosaurs *Iguanodon* and *Baryonyx*. At Chantry Mill the junction between the Lower Cretaceous marine Gault Clay and Folkstone Beds is exposed. The chalk pits at Southerham, near Lewes, provide the most complete inland section of the Upper Cretaceous Chalk Marl and Grey Chalk which has also yielded an exceptionally diverse fish fauna (27 type specimens are recorded from this area). Asham Quarry provides evidence for late Devensian periglacial erosion as well as development of early Flandrian soils.

Key geological management issues:

- Maintain and enhance existing exposures
- Agree conservation sections in working quarries and pits
- Notification of remaining Wealden PSSSIs
- Ensuring responsible fossil collecting from sensitive or vulnerable sites
- Assess new sites (temporary or permanent)
- Promote the scientific/educational value of the geological and geomorphological resource

Key geological objectives:

1. Maintenance and enhancement of the geological resource through a) enhancement of existing exposures and agreed conservation sections in active and disused quarries , b) development of local conservation strategies that include geology, c) notification of outstanding PSSSIs d) assessment of educational/research value of new sites (e.g. quarries and cuttings, temporary or permanent).

2. Promotion of geological resource through a) assessment and promotion of site educational and scientific value (e.g. Clock House Brick Pit rock store), b) on-site interpretation (e.g. sign boarding, trail guides, leaflets), c) promotion of the link between geology and local habitats, scenery.

Useful guides/references:

DINES, H.G. *et al.* 1969: Geology of the country around Sevenoaks and Tonbridge. Memoir of the British Geological Survey, Sheet 287, England and Wales.

GALLOIS, R.W. 1965: British Regional Geology, The Wealden District. Institute of Geological Sciences, HMSO, London.

GALLOIS, R,W., & WORSSAM, B.C., 1993. Geology of the country around Horsham. Memoir of the British Geological Survey, Sheet 302, England and Wales.

LAKE, R.D. & SHEPHARD-THORN, E.R. 1987: Geology of the country around Hastings and Dungeness. Memoir of the British Geological Survey, Sheets 320 and 321, England and Wales.

LAKE, R.D *et al.* 1987: Geology of the country around Lewes. Memoir of the British Geological Survey, Sheet 319, England and Wales.

WORSSAM, B.C. 1963: Geology of the country around Maidstone. Memoir of the British Geological Survey, Sheet 288, England and Wales.

Earth science (P)SSSIs in the Natural Area:

- Southerham Grey Pit
- Southerham Pit
- Asham Quarry
- Chailey
- Lower Dicker
- Auclaye
- Chantry Mill
- Clock House Brick Works
- Coneyhurst Cutting
- Coppedhall Hanger
- Marehill Quarry
- Newdigate (North)
- Newdigate (South)
- Slinfold Stream and Quarry
- Smokejack Clay Pit
- Warnham

Natural Area: 44. High Weald	**Geological Significance:** Considerable **(provisional)**

General geological character: The boundaries of the High Weald Natural Area follow the base of the Weald Clay and contain the core of the Wealden anticline. Exposed is a succession of clays and sandstones belonging to the Lower Cretaceous Hastings Beds Group of the Wealden Series (approximately 140 Ma). There is also a small area belonging to the underlying Jurassic Purbeck Group in the Crowhurst-Robertsbridge area. The Purbeck Group was deposited in an enclosed basin dominated by sabkha environments and periodically inundated by the sea. Today, limestones and evaporites remain, the latter providing economically viable gypsum deposits. Sediments of the following Wealden Series were deposited by a complex river system which occupied much of the present Wealden area and extended into the Hampshire and Paris Basins. These sediments were derived from areas of high ground to the north, west and south, increased sediment influx being in response to uplift and erosion of these massifs. The earlier part of the Wealden was dominated by the Hastings Beds Group, a sequence of alternating sandy/silty to clay rich units, this Group marking the onset of the Lower Cretaceous fluvial environment. The Hastings Beds Group is locally fossiliferous and has yielded a substantial vertebrate fauna comprising freshwater fish, crocodiles, turtles, dinosaurs and, very rarely, the remains of mammals. These often occur in thin 'bone beds' and ironstone horizons. An important flora is also known from a limited number of sites.

The area was eventually inundated by rising Cretaceous seas, associated sediments being stripped off during folding and erosion of the Tertiary Alpine Orogeny. Compression at this time further tightened the Wealden anticline and caused dense faulting within the Hastings Group producing the complex outcrop pattern now seen and, contributing to the rapidly changing scenery and vegetation of the area. The area was not glaciated during the Pleistocene but shows much evidence of periglacial activity in the tundra-like environment that dominated the area: wind erosion; valley cambering, widening joints and producing features locally known as 'gulls'; and micro-weathering producing surface honeycomb patterns unique to the sandstones of the Weald.

Key geological features:

- Uppermost Jurassic environments - Purbeck Group
- Lower Cretaceous stratigraphy and environments - Hastings Beds Group of the Wealden Series
- Lower Cretaceous palaeontology

Number of GCR sites:

Wealden: 17 Jurassic Cretaceous Reptilia: 3 Pleistocene/Quaternary of SE England: 3
Mesozoic Palaeobotany: 2 Mesozoic Mammalia: 1 Portlandian-Berriasian: 1
Alpine Structures of Southern England: 1

Geological/geomorphological SSSI coverage: There are 18 (P)SSSIs within the Natural Area containing 28 GCR SILs representing 7 different GCR networks. The best exposures are found in the Hastings Cliff to Pett Beach coastal section which is viewed as a classic European reference section for the Hastings Beds Group of the Wealden Series. Inland sections include active and disused quarries and pits, road cuttings and natural exposures. The SSSI network here provides a detailed coverage of the constituent units of the Hastings Beds Group including the Ashdown Beds, Wadhurst Clay, Lower Tunbridge Wells Sand, Grinstead Clay and Upper Tunbridge Wells Sand. Particularly important are a number of 'bone beds' (found at Blackhorse Quarry, Brede Pit and Cutting and Hastings Cliff to Pett Beach SSSIs) which have yielded a diverse freshwater and terrestrial vertebrate fauna. Hastings Cliff to Pett Beach SSSI also exposes faults and folds associated with the Alpine Orogeny. The River Line provides the best exposure of the Jurassic Purbeck Beds. High Rocks, Chiddingly Wood and Rusthall Common provide evidence of Pleistocene periglacial weathering features, the last containing the well known 'Toad Rock'; an isolated block of rock resting on a narrow pedestal.

Key geological management issues:

- Maintenance and enhancement of existing exposures (in particular disused quarries and cuttings)
- Agreement conservation sections in working quarries and pits
- Notification of remaining Wealden PSSSIs
- Maintenance of natural coastal processes
- Assess new sites (temporary or permanent)
- Promote the scientific/educational value of the geological and geomorphological resource

Key geological objectives:

1. Maintenance and enhancement of the geological resource through a) enhancement of existing exposures (eg. disused inland sites) and agreed conservation sections in active quarries and pits, b) development of local conservation strategies that include geology, c) maintenance of natural coastal processes - development of Shoreline Management Plans, d) notification of outstanding PSSSIs, e) assessment of educational/research value of new sites (eg. quarries and cuttings, temporary or permanent).

2. Promotion of geological resource through a) promotion of site educational and scientific value (eg. Hastings Cliffs to Pett Beach), b) on-site interpretation (eg. sign boarding, trail guides, leaflets), c) promotion of the link between geology and local habitats, and geomorphology and the development of the landscape.

Useful guides/references:

BRISTOW, C.R. & BAZLEY, R.A. 1972: Geology of the country around Royal Tunbridge Wells. Memoir of the British Geological Survey, Sheet 303, England and Wales.

GALLOIS, R.W. 1965: British Regional Geology, The Wealden District. British Geological Survey, HMSO. London.

LAKE, R.D. & SHEPHARD-THORN, E.R. 1987: Geology of the country around Hastings and Dungeness. Memoir of the British Geological Survey, Sheets 320 and 321, England and Wales.

Earth science (P)SSSIs in the Natural Area:

- Hastings Cliff to Pett Beach
- Blackhorse Quarry
- Brede Pit and Cutting
- Hastingford Cutting
- High Rocks
- Horsted Keynes
- Northiam
- Pembury Cutting and Pit
- Philpots and Hook Quarries
- River Line
- Rusthall Common
- Scaynes Hill
- Southborough Pit
- Stone Hill Rocks
- Waldron Cutting
- West Hoathley, Sharpthorne
- Turner's Hill
- Wakehurst and Chiddingly Woods

Natural Area: 45. South Downs	**Geological Significance:** Considerable **(provisional)**

General geological character: The South Downs Natural Area is dominated by Upper Cretaceous Chalk. This very pure limestone was deposited on a tropical sea floor between 97 and 65 Ma and is composed of the skeletons of microscopic marine shells. Although the chalk was originally deposited as a horizontal layer or sheet of relatively uniform thickness, it has been folded by subsequent tectonic movements during the Alpine orogeny (beginning around 50 million years ago). This has buckled the horizontal sheets into the now distinctive South Downs hills. The South Downs are dissected by networks of dry valleys, cut when the periglacial climates of the Quaternary (the last 2 million years) allowed the Downs to carry surface streams. Some of these dry valleys contain ephemeral streams known as winterbournes which are the product of seasonal fluctuations in the levels of the chalk aquifer. The summits of the South Downs often display pure chalk in places where the weathering mantle of clay-with-flints is absent. The footslope of the Downs is masked by periglacial solifluction deposits, known as coombe rock. These deposits were washed down the hill slopes of the Downs during periods of surface weathering as a result of the intense periglacial climates during this time.

Key geological features:

- Cretaceous stratigraphy
- South Downs landscape of chalk dry valleys and winterbournes
- Periglacial deposits and coombe rock at the foot of the Downs
- Coastal exposures of the chalk showing the nature of the Alpine folding

Number of GCR sites:

Quaternary of South East England: 3 Quaternary of South Central England: 2
Cenomanian-Maastrichtian: 2 Aptian-Albian: 1 Coastal Geomorphology of England: 1
Karst: 1 Caves: 1 Alpine Structures of Southern England: 1

Geological/geomorphological SSSI coverage: There are 6 (P)SSSIs in the Natural Area containing 12 GCR SILs representing 8 different GCR networks. The majority of these are contained within the large coastal sections of Brighton to Newhaven Cliffs SSSI and Seaford to Beachy Head SSSI. Both these sections show the composition of the Cretaceous Chalk, and the nature of the Alpine folding which affected the South Downs. The large dry valley cut into the South Downs at Beeding to Newtimber Hill SSSI is a splendid example of these downland landforms. Beachy Head is famous for its coastal cliff section and its coastal geomorphology, and for the large cave cut into the sea cliff at this point. Eartham Pit SSSI at Boxgrove has recently become internationally famous for the discovery of a human tibia in Quaternary sediments, dated as the oldest known human remains in Europe (around 500,000 years old). This is now recognised as the type site for "Boxgrove Man".

Key geological management issues:

- Threat to coastal exposures and coastal geomorphological processes from coastal defences and associated engineering works
- Threats to inland exposure sites from landfill
- Lack of exposure of Cretaceous sediments other than in coastal sections

Key geological objectives:

1. Maintain existing geological exposures through (1) protecting coastal sections from coastal defences and maintaining natural coastal processes (2) agreeing conservation sections in working pits and quarries and (3) targeted site clearance in disused pits and quarries.

2. Encourage the creation of temporary and permanent exposures in the inland parts of the Natural Area where geological exposures are uncommon.

3. Encourage initiatives aimed at promoting the geological resource in this scenic area.

Useful guides/references:

GALLOIS, R.W. 1965: The Wealden District, British Regional Geology. HMSO, London

MILLWOOD, R. & ROBINSON, A. 1971: South East England: Thameside and the Weald. Landscapes of Britain Series, Macmillan, London.

WHITTOW, J.B. 1992: Geology and Scenery in Britain. Chapman and Hall, London.

Earth science (P)SSSIs in the Natural Area:

- Brighton to Newhaven Cliffs
- Seaford to Beachy Head
- Beeding to Newtimber Hill
- Butser Hill
- Eartham Pit
- Horton Clay Pit

Natural Area: 46. Greensand	**Geological Significance:** Considerable **(provisional)**

General geological character: The Greensand Natural Area follows the outcrop of the Lower Greensand escarpment of the Wealden Anticline. The oldest rocks in the area (on the southern edge) belong to the Lower Cretaceous Weald Clay Group. These are unconformably overlain by the Lower Greensand (dominantly sands) which in turn is overlain by the Gault Clay. The complete sequence varies in age from approximately 125 to 100 Ma, a span of some 25 million years.

Deposition in the Wessex Basin in Early Cretaceous times was initially dominated by the fluvial Wealden Series. Increasing marine dominance is seen in the Weald Clay Group, but not until Lower Greensand times was the Wessex Basin inundated by wholly marine conditions. The Atherfield Clay (offshore muds and silts) and Hythe, Sandgate and Folkestone Formations (shallow marine sands) dominate the Lower Greensand facies. The Greensand is so-called due to the green mineral glauconite, however, this is usually oxidised to yellow or brown, the more usual colour of the Greensand Formations. Another characteristic rock type of the Lower Greensand is the 'rag and hassock' of the Hythe Formation; 'rag' being a hard, sandy, blue limestone and 'hassock' a loamy sand speckled with glauconite. Rise in sea level towards the end of the Cretaceous lead to the deposition of the Gault Clay, dominantly an outer shelf mud.

Though the area was not glaciated during the Pleistocene it was affected by interglacial and glacial climate changes. Periglacial erosion associated with the latter has produced a sequence of landslips, in particular cambering and gullying, the oldest being dated as Wolstonian (approxiamtely 130,000 years BP) and the youngest as Devensian (approximately 12,500 years BP). A number of the 'gulls' have been filled by Pleistocene wind blown sand or loess.

Key geological features:

- Lower Greensand and Gault sequence in classical area
- Pleistocene deposits including loess
- Pleistocene landslip features; cambering and gullying

Number of GCR sites:

Aptian-Albian: 6 Pleistocene-Quaternary of South East England: 4 Wealden: 3 Tufa: 1
Mass movement: 1

Geological/geomorphological SSSI coverage: There are 14 (P)SSSIs in the Natural Area covering 15 GCR SILs which represent 5 different GCR networks. Netherside Stream Outcrops is the type locality for the Weald Clay Group Netherside Sand Member. The site coverage is dominated by Lower Greensand sites; Brook Brick Pit providing the last remaining exposure of the Atherfield Clay in the western Weald, Dryhill providing an excellent example of Hythe Formation 'rag and hassock' facies, Park Farm Cutting exposing the Sandgate Beds and Squerries Pit exposing the junction between the Folkestone Beds and the Gault Clay. Otterpool Quarry provides the finest East Kent section through the Lower Greensand Hythe Beds and their junction with the overlying Sandgate Beds. The Pleistocene erosion features are particularly well exposed at Allington Quarry (loess filled gulls), Hubbard's Hill and Oaken Hill, the last providing the best example in Britain of ridge/trough topography. A calcareous tufa deposit is found at Wateringbury, this was deposited by precipitation from calcium enriched streams and contains fossilised land snails that reflect climate changes over the last 10,000 years.

Key geological management issues:

- Poor quality of many Cretaceous exposures
- Deterioration of Quaternary sites
- Threats due to infilling
- Landscape management - Pleistocene ridge/trough topography

Key geological objectives:

1. **Ensure adequate management of resource**, eg. site clearance.

2. **Integrate with RIGS to facilitate protection** of key non-SSSI sites in Lower Greensand .

3. **Adoption of geological policies in local plans**.

4. **Encourage recording/conservation of new sites** (temporary or permanent).

5. **Promotion of the scientific/educational value of the sequence drawing links between geology, landscape and habitat development.**

Useful guides/references:

GALLOIS, R.W. 1965: British Regional Geology, The Wealden District. British Geological Survey, HMSO. London.

THURREL, R.G., WORSSAM, B.C. & EDMUNDS, E.A., 1968: Geology of the country around Haslemere. Memoir of the British Geological Survey, Sheet 301, HMSO, London.

WORSSAM, B.C. 1963: Geology of the country around Maidstone. Memoir of the British Geological Survey, Sheet 288, HMSO. London.

Earth science (P)SSSIs in the Natural Area:

- Allington Quarry
- Dryhill
- Hubbard's Hill
- Oaken Wood
- Spot Lane Quarry
- Squerries Pits
- Wateringbury
- Bognor Common Quarry
- Brook Brick Pit
- Netherside Stream Outcrops
- Otterpool Quarry
- Park Farm Cutting
- Perry Copse Outcrops
- Stockstone Quarry

Natural Area: 47. Hampshire Chalk	Geological Significance: Some (provisional)

General geological character: The Hampshire Chalk Natural Area typically comprises open rolling countryside varying from 90 to 150m AOD and contains key habitats including chalk grasslands, ancient woodlands, river valleys and arable headlands. A conspicuous topographical feature (the 'Litchfield-Wootton chalk ridge') occurs in the north of the area and rises to over 210m. The solid geology consists almost entirely of Cretaceous-aged (approximately 75-90 Ma) Upper Chalk deposits which are represented by near horizontally-bedded, or slightly folded, soft white chalks containing many flint nodules. Occasional inliers of Middle Chalk crop out; these typically lack flint nodules. A small outlier near East Stratton exposes the youngest solid strata in the Natural Area; these are Palaeocene-aged (approximately 60 Ma) red mottled clays asigned to the Reading Beds. In places the Chalk deposits exhibit evidence of structural deformation (folding/tilting) related to the Alpine Earth movements. Quaternary surficial deposits on higher ground are represented by Clay-with-flints which are mostly of local origin and formed by the weathering/eroding of the Cretaceous Chalk deposits. There are relatively few geological exposures in this Natural Area.

Key geological features:

- Inland exposures of Middle/Upper Chalk
- Exposures of structural features, folds, tilted strata

Number of GCR sites:

Alpine Structures of Southern England: 1

Geological/geomorphological SSSI coverage: There is only 1 geological (P)SSSI within this Natural Area containing 1 GCR SIL representing 1 GCR network. Duncroft Farm Pit provides an exposure of Upper Chalk clearly dipping northwards within a regional fold structure termed the Kingsclere Monocline. A conspicuous topographical feature (the 'Litchfield-Wootton chalk ridge') occurs in the north of the Natural Area, this contains a number of biological SSSIs and Countryside Heritage Sites.

Key geological management issues:

- Maintain and enhance existing exposures
- Increase the number of permanent geological exposures
- Encourage recording/data collecting of temporary sections
- Promote the link between underlying geology and the natural wildlife resource

Key geological objectives:

1. **Maintain and enhance current geological exposures**

2. **Increase the number of permanent geological exposures and/or recording of temporary sections** by encouraging joint initiatives with RIGS, local geological groups

3. **Promote the strengthening of links** between geology, habitats, flora and fauna

Useful guides/references:

MELVILLE, R.V. & FRESHNEY, E.C. 1982: British Regional Geology: The Hampshire Basin and adjoining areas. Institute of Geological Sciences, NERC

Earth science (P)SSSIs in the Natural Area:

- Duncroft Farm Pit

Natural Area: 48. South Coast Plain	**Geological Significance:** Considerable **(provisional)**

General geological character: The South Coast Plain Natural Area is bounded to the north by the South Downs. Within the area the Littlehampton anticline forms an E-W chalk ridge while elsewhere, the area is dominated by low relief Tertiary sands, silts and clays. During the Upper Cretaceous southern England was covered by a shallow sea leading to the widespread deposition of the chalk, Campanian (approximately 83-74 Ma) Upper Chalk being exposed within the Littlehampton anticline. The Tertiary saw an initial fall in sea level, Upper Palaeocene Reading Beds (approximately 54-51 Ma), which flank the chalk ridge and the edge of the South Downs, being deposited in an area of freshwater marsh with dunes and temporary pools. The Reading Beds contain a diverse fossil flora unique to the Hampshire Basin. Rise in sea level lead to the deposition Eocene London Clay (approximately 51-47 Ma); a sequence of dark marine clays rich in fossil plants typical of a sub-tropical rain forest. The overlying Middle Eocene Bracklesham Group (approximately 47-41 Ma) was deposited in an alternating intertidal and off shore environment. Bracklesham sediments contain a diverse fossil fauna and flora, notably numerous shark teeth and rare birds.

Uplift, associated with the late Tertiary Alpine (approximately 15 Ma) Orogeny, folded the sequence of Cretaceous and Tertiary rocks producing the Littlehampton chalk ridge and a parallel chalk ridge to the south (remnants seen on the Isle of Wight). The ancient River Solent flowed between these two ridges from west to east until rising sea levels eventually breached the chalk ridge and isolated the Isle of Wight from the mainland. Terrace gravels from the Solent contain vertebrate remains associated with the Pleistocene Hoxnian, Cromerian and Ipswichian interglacials 350,000-125,000 years BP). Though the area was not covered by ice during the Pleistocene there is evidence for sea ice which has deposited a number of erratics in the area. Today, coastal processes are important in particular the development of shingle beach, spit, dune and intertidal marsh complexes.

Key geological features:

- Upper Cretaceous stratigraphy and environments
- Lower Tertiary stratigraphy
- Lower Tertiary palaeontology
- Evolution of the River Solent and Pleistocene environments
- Modern coastal geomorphology

Number of GCR sites:

Tertiary Palaeobotany: 4 Pleistocene/Quaternary of Southern England: 4
Mesozoic-Tertiary Fish/Amphibia: 3 Aves: 2 Coastal Geomorphology of England: 2 Palaeogene: 1
Palaeoentomology: 1 Cenomanian-Maastrichtian: 1 Pleistocene Vertebrata: 1

Geological/geomorphological SSSI coverage: There are 8 (P)SSSIs in the Natural Area containing 19 GCR SILs representing 9 different GCR networks. The majority of sites are largely concentrated on the coast. Downend Chalk Pit is the only inland site and exposes Campanian chalk in the Littlehampton anticline. Felpham foreshore exposes Reading Beds yielding the most diverse flora of its age in the UK. Bognor Reef provides the best exposure of London Clay in the Natural Area and has yielded many type specimens of fossil birds, insects, fish and plants. Bracklesham Bay is the type (reference) locality for the Bracklesham Beds Group and, together with Lee on the Solent to Itchen Estuary , has yielded type fossil fish, bird and plant material. Terrace gravels from the River Solent are exposed at Lee on the Solent, Bracklesham Bay and Selsey; these gravels contain important Pleistocene vertebrate remains and Palaeolithic artifacts. Pagham harbour and Chichester Harbour provide classic examples of the modern development of shingle beach, spit, dune and intertidal marsh complexes.

Key geological management issues:

- Maintenance of natural coastal processes
- Maintenance and enhancement of existing exposures
- Assessment new sites (temporary or permanent)
- Promotion of the scientific/educational value of the geological and geomorphological resource

Key geological objectives:

1. Maintenance and enhancement of the geological resource through a) clearance of existing exposures (eg. Downend Quarry), b) development of local conservation strategies that include geology, c) maintenance of natural coastal processes - development of Shoreline Management Plans, d) assessment of educational/research value of new sites (especially inland quarries and cuttings, temporary or permanent).

2. Promotion of geological resource through a) promotion of site educational and scientific value, b) on-site interpretation (eg. sign boarding, trail guides, leaflets), c) promotion of the link between geology/geomorphology, local habitats and landscape evolution.

Useful guides/references:

CURRY, D. 1992: Tertiary *in*: McL. D. Duff, P. & Smith, A.J. (eds). Geology of England and Wales, Geological Society, London.

MELVILLE, R.V. & FRESHNEY, E.C. 1982: British Regional Geology: The Hampshire Basin and adjoining areas. British Geological Survey, HMSO.

Earth science (P)SSSIs in the Natural Area:

- Pagham Harbour
- Chichester Harbour
- Bognor Reef
- Bracklesham Bay
- Downend Chalk Pit
- Felpham
- Selsey, East Beach
- Lee on the Solent and the Itchen Estuary

Natural Area: 49. Isle of Wight	Geological Significance: Outstanding (provisional)

General geological character: The Isle of Wight Natural Area has magnificent coastal exposures with a virtually unbroken succession from the early Cretaceous Wealden Series to the Oligocene Hamstead Beds (approximately 144-24 Ma). The whole sequence strikes E-W across the island having been folded during the Miocene Alpine Orogeny (approximately 15 Ma) to produce a monoclinal fold, vertically dipping chalk forming a central 'backbone' across the island. To the north and south of this central area beds dip at a low angle. The south coast is dominated by Cretaceous rocks. The earliest (Wealden Series) were deposited in a complex fluvial environment that covered the Hampshire and adjacent Wealden Basins between 144 and 132 Ma. The Wealden Series is noted for its diverse fossil fauna and flora, notably this is the richest Lower Cretaceous reptile locality in the UK and among the best in the world. Sea level rise towards the Upper Cretaceous led to the deposition of the Lower Greensand, the most complete section in the UK. The succeeding Gault and Upper Greensand are also present and overlain by key sections in the Cretaceous chalk deposited by a shallow sea covering much of England during the Upper Cretaceous.

Tertiary beds including the Upper Palaeocene Reading Formation, the Eocene London Clay Formation, Bracklesham Group, Barton Group and Headon Hill Formation, and the Oligocene Bouldner Formation are well exposed in near vertical sections on the eastern and western points of the island. The Bouldner Formation forms much of the northern part of the island. Initially estuarine (Reading Formation) the bulk of this Tertiary sequence is marine in origin and contains a diverse reptile, mammal, insect and plant fauna. Fluvial gravels and raised beaches were deposited during the Pleistocene and provide a valuable record of Pleistocene sea level changes, including the highest Pleistocene deposit in the UK. This diversity of geology has also produced some of the UK's most important coastal geomorphology producing differential erosion rates, varied headland development and classic coastal landforms such as the Needles.

Key geological features:

- Lower Cretaceous Wealden palaeontology, stratigraphy and palaeoenvironments
- Upper Cretaceous stratigraphy
- Tertiary palaeontology, stratigraphy and palaeoenvironments
- Coastal geomorphology

Number of GCR sites:
Tertiary Palaeobotany: 7 Palaeogene: 6 Tertiary Mammalia: 4 Aptian-Albian: 3
Jurassic-Cretaceous Reptilia: 2 Mesozoic Palaeobotany: 2 Tertiary Reptilia: 2 Aves: 1
Mesozoic-Tertiary Fish/Amphibia: 1 Cenomanian-Maastrichtian: 1 Alpine Structures of S. England: 1
Coastal Geomorphology of England: 1 Wealden: 1
Pleistocene/Quaternary of South Central England: 1

Geological/geomorphological SSSI coverage: There are 14 (P)SSSIs within this Natural Area containing 33 GCR SILs most of which lie on the coast. These represent 14 different GCR neyworks which is a reflection of the geological diversity and importance of this Natural Area. Hanover Point to St Catherine's Point and Whitecliff Bay are currently considered to be of international status. The south coast exposes a near complete Cretaceous sequence from the Lower Cretaceous Wealden Beds (Hanover Point to St Catherine's Point) to the Upper Cretaceous Lower Greensand (Bonchurch Landslips) and the Upper Cretaceous Chalk (Headon Warren & West High Down and Bembridge Down). The north coast exposes Tertiary rocks, most notably the vertical sequences in Alum Bay and Whitecliff Bay in the extreme west and east. The youngest Tertiary rocks, and the type section for the Bouldner Formation, are exposed at Bouldner & Hamstead Cliffs while rare inland Tertiary sections are exposed at Lacey's Farm and Prospect Quarry. The Cretaceous Wealden sequence of Hanover Point to St Catherine's Point is particularly noted for its reptile fauna and plant flora while Tertiary Beds have yielded important mammal, reptile (Alum Bay and Bouldner & Hamstead Cliffs), insect (Gurnard Ledge and St Helen's Ledges) and plant remains (King's Quay Shore). The sequence in Whitecliffe Bay and Bembridge Ledges displays folding and faulting associated with the Alpine Orogeny while at Bembridge Ledges an important Pleistocene sequence documents recent sea level changes affecting the Isle of Wight.

Key geological management issues:

- Maintenance of natural coastal processes
- Maintenance and enhancement of existing exposures
- Assess new sites (temporary or permanent)
- Promote the scientific/educational value of the geological and geomorphological resource
- Fossil collecting, especially from Cretaceous-aged rocks

Key geological objectives:

1. Maintenance and enhancement of the geological resource through a) development of local conservation strategies and initiatives that include geology (I.o.W. Geology Museum Fossil collecting leaflets), b) maintenance of natural coastal processes - development of Shoreline Management Plans, c) development of responsible fossil collecting policies on the island, d) assessment of educational/research value of new sites (especially inland quarries and cuttings, temporary or permanent).

2. Promotion of geological resource through a) promotion of site educational and scientific value, b) on-site interpretation (eg. sign boarding, trail guides, leaflets), c) promotion of the link between geology/geomorphology, local habitats and landscape evolution.

Useful guides/references:

WHITE, H.J.O. 1922 (reprinted 1990): Geology of the Isle of Wight. Memoir of the Geological Survey of Great Britain.

MELVILLE, R.V. & FRESHNEY, E.C. 1982: British Regional Geology, The Hampshire Basin and adjoining areas. British Geological Survey, HMSO.

Earth science (P)SSSIs in the Natural Area:

- White Cliff bay and Bembridge Ledges
- St Helen's Ledges
- Gurnard Ledge to Saltmead Ledge
- Bouldner and Hamstead Cliffs
- Bembridge Down
- Bonchurch Landslips
- Colwell Bay
- Compton Down
- Hanover Point to St Catherine's Point
- Headon Warren and West High Down
- King's Quay Shore
- Lacey's Farm Quarry
- Prospect Quarry
- Watcombe Bay