Natural Area: 33. East Anglian Plain	Geological Significance: Outstanding (provisional)

General geological character: The solid geology of the East Anglian Natural Area is mainly underlain by Upper Cretaceous chalk. This very pure limestone was laid down on the floor of a tropical sea between 97 and 74 Ma. Locally the chalk is rich in fossils including sea-urchins and bivalves. Overlying much of the chalk is a complex sequence of Quaternary deposits (deposited over the last 2 Ma) showing changes in climate and environment from both cold (glacial) and temperate (interglacial) periods. These sediments almost completely obscure the underlying chalk and it is their composition which gives the Natural Area its character. The base of the Quaternary sequence is the early Pleistocene Crag deposits which are marine sediments of shelly muds and sands, often containing temperate marine molluscan faunas. However, the most extensive and thickest Quaternary sediments consist of glacial sands, gravels and clays deposited by the Anglian ice sheet as it advanced across the area around 300,000 to 250,000 years BP. These deposits are collectively known as 'boulder clay' and their calcareous nature reflects glacial erosion and transportation of the chalk bedrock beneath. The Anglian glaciation interrupted a well-developed fluvial network of eastward flowing rivers, and patches of these preglacial river gravels are still found within the area. Many localitites show river gravels related to the early development of the River Thames, which crossed this area prior to diversion by the Anglian ice sheet. These sites are important for Quaternary stratigraphy (including records of climate change) because they can be correlated with sediments in other parts of Britain and abroad. Some of these Quaternary sites are probably of international importance, such as Hoxne Brick Pit which is named as the type site for the Hoxnian Interglacial. Post glacial river terraces are also found in the area, many of which have yielded cold climate mammal remains including traces of early humans.

Key geological features:

- Late Cretaceous fossiliferous chalk, including vertebrates remains of marine reptiles such as Mosasaurs.
- Quaternary stratigraphy, including glacial and interglacial deposits
- Quaternary river gravel deposits, including cold-climate mammal remains.

Number of GCR sites:

Quaternary of East Anglia: 19 Pleistocene Vertebrata: 2 Cenomanian-Maastrichtian: 2
Fluvial Geomorphology of England: 1

Geological/geomorphoogical SSSI coverage: There are 23 (P)SSSI in the Natural Area covering 24 GCR SILs which represent 4 different GCR networks. The coverage reflects the importance of this area for Quaternary geology with 22 sites. These include both the Ipswichian Interglacial type site at Bobbitshole, Belstead SSSI and the Hoxnian Interglacial type site at Hoxne Brick Pit SSSI (which also shows a Clactonian flint tool industry of great archaeological importance). Important sites showing the evolution and diversion of the Thames are also represented, including Little Oakley Channel Deposit SSSI, Wivenhoe Gravel Pit SSSI and Newney Green Pit SSSI. The terrace gravels at Lofts Farm Pit, Great Totham SSSI are famous for the quantity and preservation of their fossil fauna, including reindeer, woolly mammoth and hyaena. These show the environment which existed in this area during the Devensian. More modern river gravels, showing the relationship between fluvial and glacial environments are found exposed at sites such as Leet Hill SSSI and at Broome Heath Pit SSSI. The basal sequence at Great Blakenham SSSI shows the sediments and fossils of the early Pleistocene Crag seas, and therefore the contrast between this temperate period and the subsequent cold stages which involved ice sheet glaciations. At other sites, such as St James Pit SSSI, earlier rocks including the chalk are exposed. These have yielded important fossil marine reptiles.

Key geological management issues:

- Lack of natural exposures: Quaternary exposures created by gravel workings.
- Potential conflict between mineral extraction industry and geological conservation.
- Loss of exposure in gravel workings due to landfill or degradation.
- Need to protect palaeontological/archaeological sites from disturbance.
- Need to record important temporary sections.

Key geological objectives:

1. **Ensure adequate recording of temporary sections and working Quaternary sites** to avoid loss of resource.

2. **Integrate geological and archaeological conservation** wherever possible.

Useful guides/references:

BRIDGLAND, D.R. 1994: Quaternary of the Thames. Geological Conservation Review Series 7, Chapman and Hall, London.

GIBBARD, P.L. & ZALASIEWICZ, J.A. 1988: Pliocene-Middle PleistocenE of East Anglia. Field Guide. Quaternary Research Association Guide, London.

CHATWIN, C.P. 1961: British Regional; Geology, East Anglia and adjoining areas. Institute of Geological Sciences, HMSO, London.

Earth science (P)SSSIs in the Natural Area:

- Creeting St Mary Pits
- Ardleigh Gravel Pit
- Bobbitshole, Belstead
- Flixton Quarry
- Great Blakenham Pit
- Hascot Hill Pit
- Holton Pit
- Hoxne Brick Pit
- Little Oakley Channel Deposit
- Sandy Lane Pit, Barham
- Stoke Tunnel Cutting, Ipswich
- Wivenhoe Gravel Pit
- Broome Heath Pit
- Caistor St Edmunds Pit
- Caton Grove Chalk Pit
- Leet Hill
- Lofts Farm Pit (Great Totham)
- Newney Green Pit
- River Ter
- Halls Quarry
- Hill Collins Pit
- Marks Tey Brickpit
- Downfield Pit, West Mill

Natural Area: 34. Chilterns	**Geological Significance:** Considerable **(provisional)**

General geological character: The Chilterns Natural Area forms a major ridge of Cretaceous chalk (80 to 95 Ma) delimiting the northern edge of the London Basin. In many places the chalk is obscured by a sporadic capping of Tertiary clays and sands, whilst the foot of the escarpment is covered by sands and gravels deposited by the ancient Thames river as it changed courses through Quaternary times (the last 2 million years). The Chilterns chalklands are deeply dissected by a network of dry valleys excavated under recent periglacial conditions. These streamless valleys are generally floored by thick layers of chalky mud derived from the valley sides. Beechwoods clothe most of the high chalk hills and the Chilterns support a dense woodland cover on their clay capping. As the chalk ridge is traced north-eastwards through Hertfordshire its crestline becomes progressively lower where it has been over-ridden by former ice sheets. Here the chalk disappears under a thick layer of glacial boulder clay deposited during the Anglian glaciation (around 400,000 years BP).

Key geological features:

- Ancient Thames river gravels exposures in pits and quarries
- Chalk dry valleys and periglacial landforms
- Chalk escarpment and landscape, clay capping and associated exposures

Number of GCR sites:

Pleistocene/Quaternary of the Thames: 8 Cenomanian-Maastrichtian: 4 Palaeogene: 1
Mesozoic-Tertiary Fish/Amphibia: 1

Geological/geomorphological SSSI coverage: There are 14 (P)SSSIs in the Natural Area, containing 14 GCR SILs representing 4 different GCR networks. The site coverage is dominated by the Quaternary of the Thames and Cenomanian-Maastrichtian GCR blocks. The majority of these sites are either in quarries or cuttings. Many of the Quaternary (P)SSSIs in the Natural Area are famous as type localities for river terraces of the former Thames, and are correlated with those of other northern European countries. Sites such as Cannoncourt Farm Pit and Fern House Gravel Pit are also internationally important for the archaeological artefacts contained within them. In addition, Pitstone Quarry is famous for the organic deposit (around 180,000 years BP) which is recognised as evidence of a formerly unknown British interglacial. Although there are few present day exposures, Cretaceous strata in the Chilterns represent a key sequence extending upwards from basal glauconitic 'sands' (Cambridge Greensand) into condensed hard chalky limestones capped by thick Middle-Upper Chalk rocks. Some levels yield important and well preserved fossils (such as sea urchins and ammonites) which are important in correlating these rocks with similar chalk deposits elsewhere in Britain.

Key geological management issues:

- Loss of exposures in Quaternary Thames river gravels due to site degradation
- Loss of chalk exposures (especially shallow pits) by infill, tipping and degradation.

Key geological objectives:

1. Maintain and wherever possible enhance existing Quaternary river gravel exposures.

2. Increase number of exposures of Chalk within the Natural Area.

3. Encourage initiatives aimed at integrated management of the geological and biological resources in the Natural Area.

Useful guides/references:

BRIDGLAND, D.R. 1994: Quaternary of the Thames. Geological Conservation Review Series 7. Chapman and Hall.

RAWSON, P.F. *et al.* 1978: A correlation of Cretaceous rocks in the British Isles. Geological Society of London, Special Report No. 9

Earth science (P)SSSIs in the Natural Area:

- Kensworth Chalk Pits
- Pitstone Quarry
- Totternhoe Lime Pit
- Highlands Farm Pit
- Aston Rowant Cutting
- Bolter End Sand Pit
- Cannoncourt Farm Pit
- Chinnor Chalk Pit
- Fern House Gravel Pit
- Froghall Brickworks
- Little Heath Pit
- South Lodge Pit
- Westwood Quarry
- Priest's Hill

Natural Area: 35. Oxford Clay Vales	**Geological Significance:** Outstanding **(provisional)**

General geological character: The Oxford Clay Vale Natural Area is dominated by its clay vales formed in Middle and Upper Jurassic clays (around 160 to 150 Ma), including both the Oxford Clay and Kimmeridge Clay. These are the deposits of tropical sea floors and yield abundant fossil remains including bivalves, ammonites, belemnites and large marine reptiles such as ichthyosaurs and plesiosaurs. In the south west of the Natural Area there are also equivalent-aged limestones ('Corallian') which form the higher ground towards the Oxford Heights. In places, younger Jurassic limestones ('Portlandian', 150 to 145 Ma) overlie the clays and there are also outcrops of Cretaceous shallow water sands (of Aptian-Albian age, 124 to 97 Ma). The bedrock geology of the Natural Area is completed by the presence of Wealden-aged (140 to 130 Ma) non-marine sandstones. More recent Quaternary events (over the last 2 million years) are represented by the presence of mature river systems and river terrace gravels associated with the evolution of the River Thames. These include 'Ice Age' cold-stage deposits, many of which have yielded important vertebrate remains.

Key geological features:

- Outcrops of Oxford and Kimmeridge Clays in brickpits
- Most northerly deposits of Wealden rocks in Britain
- Upper Jurassic 'Corallian' limestones and fossil remains in classic area
- Most northerly exposures of Portlandian rocks

Number of GCR sites:

Portlandian-Berriasian: 7 Oxfordian: 5 Bathonian: 3 Pleistocene/Quaternary of the Thames: 3 Wealden: 2 Jurassic-Cretaceous Reptilia: 1 Kimmeridgian: 1 Aptian-Albian: 1 Pleistocene/Quaternary of South Central England: 1

Geological/geomorphological SSSI coverage: There are 22 geological/geomorphological (P)SSSI in the Natural Area containing 24 GCR SILs representing 9 different GCR networks. The majority of these sites are of Jurassic age, including the 'Corallian' limestones. Some of these sites are also of historical importance, yielding important fossil remains (eg. Bugle Quarry). Although the solid geology is dominated by Jurassic clays there are few SSSIs of this rock type due to the lack of exposures in working quarries. The Oxfordian sites primarily show the 'Corallian' facies, including classic sites such as Westbury Ironstone Quarry and Steeple Ashton. The Quaternary evolution of the River Thames is shown by sites such as Stanton Harcourt which contains rich and important vertebrate fossils.

Key geological management issues:

- Maintain and enhance existing exposures
- Promote the educational value of the geological resource
- Ensure adequate recording of temporary exposures in otherwise poorly-exposed beds

Key geological objectives:

1. Maintenance and enhancement of existing geological resource through targetted site clearance at overgrown sites and assessment of new exposures.

2. Promotion of geological resource through on-site interpretation and promoting the educational value of existing exposures.

Useful guides/references:

BRIDGLAND, D.R. 1994: Quaternary of the Thames. Geological Conservation Review Series 7, Chapman and Hall, London.

HORTON, A. *et al.* 1987: Geology of the country around Chipping Norton. Memoir of the British Geological Survey. Sheet 218, England and Wales.

KELLAWAY, G.A. and WELCH, F.B.A. 1980: British Regional Geology: Bristol and Gloucester District London. HMSO.

Earth science (P)SSSIs in the Natural Area:

- Bierton Clay Pit
- Bugle Quarry
- Stone
- Warren Farm, Stewkley
- Bratton Down
- Great Quarry, Swindon
- Gripwood Quarry
- Magdalen Grove
- Magdalen Quarry
- Rock Edge
- Muswell Hill
- Stratton Audley Quarries
- Long Hanborough Gravel Pit
- Okus Quarry
- Old Town Railway Cutting, Swindon
- Stanton Harcourt
- Stert Brook Exposure
- Seend Cleeve Quarry
- Seend Ironstone Quarry and Road Cutting
- Stanton St Quintin Quarry and Motorway Cutting
- Steeple Ashton
- Westbury Ironstone Quarry

Natural Area: 36. Oxford Heights	**Geological Significance:** Considerable **(provisional)**

General geological character: The Oxford Heights Natural Area is dominated by rocks of Upper Jurassic Oxfordian age (approximately 157-146 Ma) which are assigned to the 'Corallian Group'. These include sands and limestones deposited in shallow tropical seas, the latter locally richly fossiliferous and including coral reefs. Ammonite faunas within these rocks are particularly important allowing correlation with rocks of this age on a global scale. Kimmeridge Clay and Portland Group limestones, also of Upper Jurassic age, overlie the Corallian Group and also include key ammonite faunas. Kimmeridge Clays have yielded marine reptile and occasional dinosaur remains. Scattered Pleistocene deposits are also present, most notably interglacial (Cromerian, approximately 300,000 years BP) river deposits associated with the early evolution of the Thames.

Key geological features:

- Classical 'Corallian Group' localities, some internationally well known with important ammonite fossils
- Important Kimmeridgian reptile faunas

Number of GCR sites:

Oxfordian: 6 Bathonian: 1 Kimmeridgian:1 Jurassic-Cretaceous Reptilia:1
Pleistocene/Quaternary of the Thames:1 Pollen Stratigraphy of England:1 Aptian-Albian: 1

Geological/geomorphological SSSI coverage: There are 12 (P)SSSIs in the Natural Area covering 12 GCR SILs and representing 7 different GCR networks. The majority of sites selected emphasise the Oxfordian (Corallian Group) geology which underlies most of the area. A number of the sites have yielded ammonite faunas of significance for correlation with sites elsewhere in Europe (eg. Dry Sandford Pit and Cumnor). The overlying Kimmeridgian is exposed at Littleworth Brick Pit (again, a type locality for ammonite zonation and specimens) and Hurst Hill which has yielded marine reptiles (ichthyosaurs, plesiosaurs, pliosaurs) and a unique ornithopod dinosaur more typical of North America. Sugworth exposes a Cromerian fluvial channel which is the only channel of this age associated with the Thames.

Key geological management issues:

- Poor condition of many famous Jurassic localities (especially Oxfordian and Kimmeridgian localities)
- Threats from infill to surviving sites
- Management of sensitive palaeontological sites

Key geological objectives:

1. **Maintain and enhance the site coverage** by clearance, interpretation, etc.

2. **Investigate possibilities of educational trails** in the region.

3. **Adopt a responsible collecting policy on all sensitive/vulnerable sites with important fossil faunas**

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

Useful guides/references:

ARKELL, W. J. 1947: The Geology of Oxford. Clarendon Press.

PRINGLE, J. 1926: The geology of the country around Oxford. Memoir of the British Geological Survey of Great Britain.

SHERLOCK, R.L. 1960: British Regional Geology, London and the Thames Valley. British Geological Survey, HMSO. London.

Earth science (P)SSSIs in the Natural Area:

- Dry Sandford Pit
- Cothill Fen
- Cumnor
- Wicklesham and Coxwell Pits
- Hurst Hill
- Lamb and Flag Quarry
- Littlemore Railway Cutting
- Littleworth Brick Pit
- Lyehill Quarry
- Sugworth
- Woodeaton Quarry
- Shellingford Crossroads Quarry

Natural Area: 37. Wessex Downs	**Geological Significance:** Notable **(provisional)**

General geological character: The solid geology of the Wessex Downs Natural Area is dominated by Upper Cretaceous chalk, a very pure and soft limestone deposited on a tropical sea floor around 97-84 Ma. This chalk was subjected to tropical weathering during the Tertiary Period (approximately 65-5 Ma) in a relatively warm and humid climate, resulting in the formation of clay-with-flints on the surface of the chalk. Also during this time, silcretes (sandstones with a hard, silica cement) formed as a result of weathering in sandy soils. As the silcretes were broken up, they became isolated blocks (now known as sarsen stones). They are often found at a distance from their original source area, having been transported over the chalk surface during the Quaternary 'Ice Ages' (the last 2 million years) by periglacial processes such as widespread solifluction (the flow of an active surface layer over seasonally thawed permafrost). During the times when permafrost covered the chalk, surface streams were able to flow over the normally porous surface cutting deep karst valleys. These remain today as the dry valleys or coombes of the area. Often the floors of these coombes are partially filled by a chalk and clay rubble mixture known as coombe rock. The area is reknowned for its chalk karst landscape.

Key geological features:

- Chalk downland landscape
- Tertiary weathering features and associated Sarsen stones
- Modification of the chalk landscape under periglacial conditions in the Quaternary producing dry valleys and coombe rock

Number of GCR sites:
Pleistocene/Quaternary of South Central England: 4 Cenomanian-Maastrichtian: 2 Karst: 1
Mesozoic-Tertiary Fish/Amphibia: 1

Geological/geomorphological SSSI coverage: There are 6 (P)SSSI in the Natural Area covering 6 GCR SILs and 4 different GCR networks. The site coverage reflects both the stratigraphical interest of the chalk bedrock and the Tertiary/Quaternary surface-weathering processes. Sites such as Boxford Chalk Pit SSSI and Fognam Chalk Pit SSSI show the composition of the Cretaceous chalk. They demonstrate the presence of hardgrounds (layers of exceptionally hard chalk) produced on highs within the tropical sea floor where rates of sedimentation were low. The slow rates of sedimentation allowed the concentration of phosphatic material of which fish teeth (eg. sharks) and small coprolites form a significant component. The effects of the Tertiary tropical weathering and Quaternary periglacial activity are shown by the Sarsen stones of Fyfield Down and Piggledene. These sites are particularly noted for their dry valleys and Sarsen 'trains'. They have the highest concentration of Sarsen stones in England. White Horse Hill SSSI is a famous example of a karst dry valley.

Key geological management issues:

- Potential loss of chalk exposures due to neglect or infill and restoration of disused sites
- Need to protect sensitive Quaternary landforms and features (eg Sarsen stones) from disturbance and removal
- Damage to karst landscape from development such as change in land use or road building

Key geological objectives:

1. **Protection and enhancement of the Cretaceous sites**

2. **Protection of the periglacial and other Quaternary landforms** (eg Sarsen stones) and other features and need to **integrate with archaeological, biological and landscape conservation**

3. **Develop interpretation** of classic Sarsen stones and karst dry valleys

Useful guides/references:

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

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

Earth science (P)SSSIs in the Natural; Area:

- Boxford Chalk Pit
- Fognam Chalk Pit
- Fyfield Down
- Winterbourne Chalk Pit
- Piggledene
- White Horse Hill

Natural Area: 38. London Basin	**Geological Significance:** Considerable **(provisional)**

General geological character: The London Basin is a large syncline which dominates the South East corner of England. The basin itself was created during the Alpine Orogeny (a period of mountain-building) which began around 50 million years ago. The sediments of the London Basin are predominantly sands and clays deposited during the Paleogene (between 65 million and 23 million years ago), fringed by more resistant Cretaceous chalk to the north, west and south. The most extensive of the London Basin sediments is the London Clay, a thick marine clay which was deposited from a warm sea at a time when global sea level was much higher than present. In contrast, the older Tertiary sediments such as the Reading Beds are the deposits of ancient river systems which formerly drained into the basin. During the Quaternary Ice Ages (the last 2 million years) the climate has been relatively cold in this area. Approximately 400,000 years ago, the Anglian ice sheet advanced from the north into the most northerly parts of the basin, leaving behind varying thicknesses of glacial sands, gravels and clays. Also during this time, the River Thames has migrated southwards across the basin in response to climatic and topographic controls, depositing fluvial sands and gravels along its former courses.

Key geological features:

- Exposures of Tertiary sedimentary rocks and their fossil plant remains
- Exposures of Thames gravels and associated fossiliferous river terrace deposits
- Archaeological artefacts located in Quaternary deposits

Number of GCR sites:

Pleistocene/Quaternary of the Thames: 6 Paleogene: 3 Tertiary Palaeobotany: 3 Karst: 2
Alpine Structures of England: 2 Fluvial Geomorphology of England: 1 Palaeoentomology: 1

Geological/geomorphological SSSI coverage: There are 14 geological/geomorphological (P)SSSI in the Natural Area containing 18 GCR SILs representing 7 different GCR networks. The coverage is dominated by the exposures in former gravel workings of Thames terrace deposits. Many of these sites (eg Brimpton Pit and Hamstead Marshall Pit) have yielded cold-stage mammal remains such as wooly mammoth and are also famed for their archaeological (Palaeolithic) hand axes. Although dominated by London Clay, there are few exposures of this formation in the London Basin. There are, however, excellent exposures of the fluvial Reading Beds at Pincents Kiln SSSI and Cold Ash Quarry SSSI which have yielded a fossil flora of excellent preservation unique to this Natural Area. Water End Swallow Holes SSSI is a good example of the development of karst drainage, where surface streams leaving London Clay flow onto chalk bedrock and sink through swallow holes into the chalk aquifer. Duncroft Farm Pit and Seale Chalk Pit provide detailed evidence of the earth movements associated with the Alpine Orogeny.

Key geological management issues:

- Maintaining and enhancing existing geological exposures
- Ensuring responsible fossil collecting from sensitive or vulnerable sites
- Promote the educational value of the geological resource
- Encourage links with archaeological community
- Management of geological SSSIs in an urban environment

Key geological objectives:

1. Maintenance and enhancement of geological resource through a) site clearance at overgrown or degrading sites , b) maintaining access to sites and c) encouraging responsible collecting on sensitive or vulnerable fossil localities.

2. Promotion of geological resource in this urban area by encouraging on-site interpretation and links between geology and archaeology.

Useful guides/references:

BRIDGLAND, D.R. 1994: Quaternary of the Thames. Geological Conservation Review Series 7, Chapman and Hall, London.

Earth science (P)SSSIs in the Natural Area:

- Elmstead Pit
- Hornchurch Cutting
- Wansunt Pit
- Cold Ash Quarry
- Brimpton Pit
- Castle Lime Works Quarry
- Duncroft Farm Pit
- Hamstead Marshall Pit
- Harefield Pit
- Harrow Weald
- Heath Brow
- Seale Chalk Pit
- Water End Swallow Holes
- Pincents Kiln

Natural Area: 39. Thames Marshes	**Geological Significance:** Outstanding **(provisional)**

General geological character: The Thames Marshes Natural Area is the eastern continuation of the London Basin syncline which dominates the South East of England. The basin itself was created during the Alpine Orogeny (a period of mountain-building) which began around 50 million years ago. The sediments of the London Basin are predominantly sands and clays deposited during the Paleogene (between 65 and 23 Ma). The most extensive of the London Basin sediments in the Thames Marshes is the London Clay, a thick marine clay which was deposited in a warm sea at a time when global sea level was much higher than present. During the Quaternary 'Ice Ages' (the last 2 million years) the climate was relatively cold in this area. Approximately 400,000 years ago, the Anglian ice sheet advanced from the north to cover the northern parts of the Natural Area, leaving behind varying thicknesses of glacial sands, gravels and clays. During this time, the River Thames migrated southwards across the London Basin in response to climatic and topographic controls, depositing fluvial sands and gravels along its former courses. These sands and gravels now obscure the London Clay in most places, and changes in sea level have now left the sands and gravels partly submerged as low lying coastal marsh at the mouth of the Thames estuary.

Key geological features:

- Exposures of Tertiary sedimentary rocks and their fossil remains
- Exposures of Thames gravels and associated fossiliferous river terrace deposits
- Archaeological artefacts located in Quaternary deposits

Number of GCR sites:

Quaternary of the Thames: 11 Mesozoic-Tertiary Fish/Amphibia: 4 Aves: 4 Palaeogene: 2 Tertiary Palaeobotany: 2 Tertiary Reptilia: 1 Tertiary Mammalia: 1 Pleistocene Vertebrata: 1 Mass movement: 1 Quaternary of East Anglia: 1

Geological/geomorphological SSSI coverage: There are 17 geological/geomorphological (P)SSSI in the Natural Area containing 28 GCR SILs representing 10 GCR networks. The coverage is dominated by the 11 sites which show the Quaternary evolution of the River Thames and its tributaries over the last 2 million years. The majority of these sites are inland pits (eg. Purfleet Chalk Pits SSSI, Globe Pit SSSI) although some are located in coastal sections (eg. Holland-on-Sea Cliff SSSI). Many of these sites are famous not only for their Quaternary geology but also for their Palaeolithic archaeology - Swanscombe Skull Site NNR is a world famous site where fragments of a human skull 250,000 years old were discovered. The Tertiary rocks of this area are well exposed at sites such as Gilberts Pit, Charlton SSSI. Abbey Woods SSSI and Tower Hill to Cockham Wood SSSI are sites notably rich in Tertiary fossils, yielding the remains of subtropical species of fish, sharks teeth and rare Paleogene birds and mammals. Warden Point SSSI has an equally rich fossil fauna (especially plants) and is particularly noted for its Paleogene stratigraphy.

Key geological management issues:

- Maintaining and enhancing existing geological exposures
- Ensuring responsible fossil collecting from sensitive or vulnerable sites
- Promote the educational value of the geological resource
- Encourage links with archaeological community
- Management of geological SSSIs in an urban environment

Key geological objectives:

1. Maintenance and enhancement of geological resource through a) site clearance at overgrown or degrading sites , b) maintaining access to sites and c) encouraging responsible collecting from sensitive or vulnerable fossil localities.

2. Promotion of geological resource in this urban area by encouraging on-site interpretation and links between geology and archaeology.

Useful guides/references:

BRIDGLAND, D.R. 1994: Quaternary of the Thames. Geological Conservation Review Series 7, Chapman and Hall, London.

COLLINSON, M.E. 1983: Fossil Plants of the London Clay. Palaeontological Association Field Guide, 1.

Earth science (P)SSSIs in the Thames Marshes Natural Area:

- Abbey Wood
- Aylesford Pit
- Bakers Hole
- Clacton Cliffs and Foreshore
- Gilbert's Pit, Charlton
- Globe Pit
- Goldsands Road Pit
- Holland-on-Sea Cliff
- Lion Pit
- Maldon Cutting
- Purfleet Chalk Pits
- St Osyth Pit
- Swanscombe Skull
- The Cliff, Burnham-on-Crouch
- The Naze
- Tower Hill to Cockham Wood
- Warden Point

Natural Area: 40. North Kent Plain	**Geological Significance:** Notable **(provisional)**

General geological character: The North Kent Plain Natural Area is characterised by the Cretaceous chalk of the Isle of Thanet bounded to the south and west by clays, silts and sands of the Lower Tertiary. Upper Cretaceous Santonian chalk (87-83 Ma) is exposed in a gentle anticline along the coast from Pegwell Bay to the eastern side of Herne Bay. Unconformably overlying the chalk in Pegwell Bay and Herne Bay is a sequence of Lower Tertiary sediments; the Palaeocene Thanet Formation in Pegwell Bay and the Thanet, Woolwich and Oldhaven Formations in HerneBay overlain by the Eocene London Clay Formation. The Chalk was deposited by a shallow sea which covered much of Northwestern Europe towards the end of the Cretaceous. Sea level fall was followed by the unconformable deposition of Tertiary Palaeocene and Eocene sediments. Dominantly marine in origin, these sediments were deposited by a rising, but fluctuating sea, which covered much of Southeast England. Marine conditions were well established by the Eocene leading to the deposition of the London Clay Formation. The fossil fauna and flora from the Tertiary rocks indicates a gradually warming climate with sub-tropical conditions established by the Eocene. Subsequent uplift (associated with the Alpine Orogeny) and resultant erosion removed much of the remaining Tertiary sediments leaving rare isolated inland outcrops, the next deposition occurring during the Pleistocene. Though not covered by ice, the area was affected by periglacial erosion in a tundra-like environment during the last glaciation (Devensian). Pleistocene deposits include extensive deposits of chalk and flint rubble ('Head'), wind blown sands (loess) and various river gravel deposits associated with the changing course of the River Stour.

Key geological features:

- Upper Cretaceous stratigraphy
- Lower Tertiary stratigraphy
- Lower Tertiary palaeontology
- Late Pleistocene periglacial erosion
- Modern coastal geomorphology

Number of GCR sites:

Pleistocene/Quaternary of the Thames: 2 Palaeogene: 2 Mesozoic-Tertiary Fish/Amphibia: 2 Cenomanian-Maastrichtian: 1 Alpine structures of Southern England: 1 Tertiary Palaeobotany: 1 Coastal Geomorphology of England: 1

Geological/geomorphological SSSI coverage: There are 4 geological/geomorphological (P)SSSIs in the Natural Area containing 10 GCR SILs representing 7 GCR networks. The coverage includes two extensive coastal sections (Thanet Coast and Sandwich Bay and Hacklinge Marshes); the best Cretaceous and Tertiary sections fall within these SSSIs. These include the UK type (reference) section for the Santonian Chalk between Pegwell Bay and Margate. The chalk also exhibits tension joints associated with the Alpine Orogeny. The complete Palaeocene sequence (Thanet, Woolwich and Oldhaven Formations) is exposed on the eastern side of Herne Bay. The Thanet Formation in Pegwell Bay has yielded the most diverse fossil fish fauna of its age in the UK while in Herne Bay Tertiary sediments have provided the only unequivocal Palaeocene flora which includes a number species unique to this section. These coastal sections also expose evidence for the environmental changes occurring during the mid and late Devensian including frost shattered chalk and solifluction (Head) deposits and, in Pegwell Bay, the UK's most extensive loess deposit. Sturry Pit SSSI and Chequers Wood and Old Park SSSI provide important Devensian terrace gravels (containing palaeolithic implements) deposited by the River Stour. The Thanet Coast also provides a classic cliff-shore platform; the most extensive intertidal chalk shore platform in the UK.

Key geological management issues:

- Maintain and enhance existing exposures
- Maintain natural coastal processes
- Assess new sites (temporary or permanent)
- Promote the educational value of the geological 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, c) continued assessment of educational/research value of new sites (eg. inland quarries and cuttings, temporary or permanent).

2. Promotion of geological resource through a) assessment and promotion of site educational value (e.g. Cretaceous/Tertiary boundary in Pegwell bay), b) on site interpretation (eg. sign boarding, trail guides, leaflets), c) promotion of the influence of geology on local habitats and scenery.

Useful guides/references:

HOLMES, S.C.A. 1981: Geology of the Country around Faversham, Sheet 273. Geological Survey of Great Britain.

OSBOURNE WHITE, H.J. 1928: The Geology of the Country near Ramsgate and Dover Sheets 274 and 290, Memoirs of the Geological Survey of England and Wales, HMSO London.

Earth science (P)SSSIs in the Natural Area:

- Thanet Coast
- Chequers Wood and Old Park
- Sandwich Bay and Hacklinge Marshes
- Sturry Pit