1. GEOLOGY

Solid Geology

1.1 Cambridgeshire forms part of East Anglia which is most notable for being almost flat. During the Ice Age, much of the area was covered by ice sheets and this has influenced the topography and nature of the soils.

1.2 While Cambridgeshire's underlying geology is relatively simple, its superficial deposits exhibit considerable variety. The older underlying rocks control the major land formations whereas more recent deposits are of prime importance as parent soil materials.

1.3 The major influence on the physical character of Cambridgeshire comes from a great mass of Mesozoic, or secondary rocks, which underlie the County. Broadly, these run in a north-east to south-west line extending from the Yorkshire coast to Dorset and cover southern and eastern parts of England. In Cambridgeshire, these exhibit a gentle southern dip which leads to the older formations outcropping towards the north-west of the County.

1.4 The basic geology of the County is identified, in simple format, in Figure 1 and Table 1. The very oldest rocks are found in the north-west corner of the County, where Oolite Limestone and clays occur. The main band of old rocks, however, belong to the Jurassic period and consists mainly of consolidated clays or muds. These are soft and are easily eroded and give rise to flat tracts of land which generally occupy low-lying areas. These are extensively covered by river gravels, alluvium and fen deposits from more recent times.

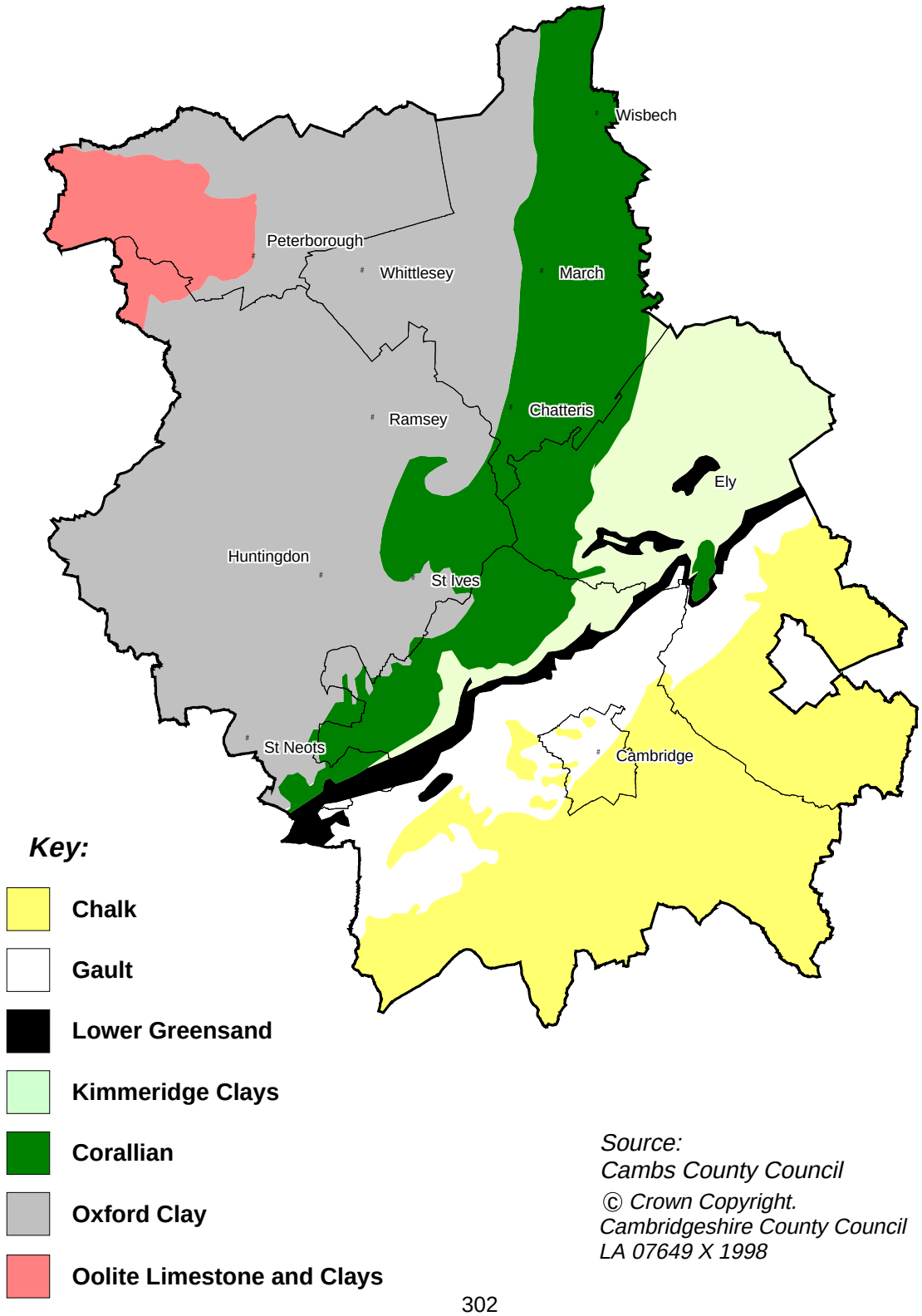
1.5 The Cretaceous rocks, found in the south of the County, contain a great variety of sediments. The lowest bed in the Cretaceous series is the Lower Greensand, the permeability of which makes it an important aquifer (layer of rock capable of holding water). The Gault outcrops as a relatively narrow belt of clay along the eastern edge of the Lower Greensand, while the Cambridge Greensand has only a few exposures. The chalk hills, to the east of Cambridge, form the highest part of the County rising to more than 400 feet. The Chalk Marl, the lowest sub-division of the Chalk, is found mainly on the sides of the valleys of the Rivers Cam and Rhee. This Marl has been of great economic importance in the manufacture of cement. The Lower Chalk was once used for building material, but possessed poor weathering qualities. The Middle Chalk is important for the production of Whiting (used in flour, toothpaste, plastics and rubber manufacture). Little of the Upper Chalk remains in the County as this was denuded, along with all subsequent solid deposits, during past glaciation periods.

Drift Geology

1.6 Recent or superficial deposits, laid down in the last 250,000 years, have led to the County's other characteristics. In the past, vast ice sheets covered the area and left behind a variety of deposits (clays, sands, brick-earths). Much was deposited as Boulder Clay when the ice melted. This covers large parts of County in the west, as well as the chalk in the south-east and forms the capping for several of the Fen islands.

Figure 1

Solid Geology



Source:
Cambs County Council

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Table 1: Geology of Cambridgeshire

Period	Formation	Thickness(m)	Comments
Recent to Neolithic	Alluvium Fen Silt Peat Boulder Clay	Variable	Prominent in river valleys and Fenland
Upper Cretaceous	Upper Chalk Middle Chalk Lower Chalk Chalk Marl	over 30 approx. 60 approx. 30 18-24	Pronounced topographic features with numerous springs at base
	Cambridge Greensand	approx. 0.3	Only a few exposures
	Gault	up to 52	Fully developed under Cambridge
Lower Cretaceous	Lower Greensand	3-21	More marked in Bedfordshire
Jurassic	Kimmeridge Clay	approx. 45	Island pockets in Fenland
	Corallian Rocks:- Ampthill Clay Elsworth Rock Corraline Oolite Coral Rag	 3-60 3-15 3-15 3-15	 Never very thick. Interesting exposures around Upware
	Oxford Clay	approx. 152	Extensive deposits in north and west of the County
	Lincolnshire Oolite Limestone		North and west of Peterborough

1.7 A huge expanse of peat, estuarine silts and clays, known as the Fens, was deposited after the Ice Age. The occurrence of peat or silt was dependent on the prevailing conditions at the time of deposit. In the past, peat coverage was much more extensive. In particular, wastage in depth has occurred due to oxidisation and improved drainage. Sands and gravels occur in large quantities around the edges of Fenland and as terraces in the County's river valleys. These, although variable, are exploited for aggregates.

2. TOPOGRAPHY

2.1 The topography of Cambridgeshire has been strongly influenced not only by the nature of the underlying solid geology but also by climatic and landscape changes which took place during the Quaternary Period. These relatively recent changes (in the past 250,000 years) have had very considerable influence on the evolution of The Fen Basin (within which Cambridgeshire largely lies) and the Wash.

2.2 Much of Cambridgeshire is low-lying and, many parts lie below present-day sea level. The flatness of the Fens contrasts with the topography in the south of the County. Here the chalklands form dry chalk down land, while to the north east of the River Cam there are gently rolling hills with rounded ridges and dry valleys; to the south west of the Cam the relief tends to be less defined.

2.3 The topographic setting is very largely the result of the dominance of an extensive river network draining the Jurassic limestone escarpment to the west, buried Cretaceous rock (mainly chalk) to the east, and Jurassic clays to the south and north west.

2.4 Much of The Fen Basin and the Wash is infilled by Quaternary sediments (boulder clay, sands and clays, peat) which mask much of the underlying bedrock, and indicate a varied and complex geomorphological history. Perrin et al (1979) suggest that much of the present shape and topography of the Fen Basin was excavated during the Anglian Glaciation. More recently, this basin has been a large embayment of the sea (Lewis et al, 1991) which inundated parts of the river systems; at other times the area has been heavily affected by ice sheets, which deposited vast thicknesses of boulder clay across the area. These latter deposits have been largely eroded during subsequent glacial and interglacial events and are largely only evident on the higher ground and along the East Anglian coast. However, the most significant imprint of the effects of glaciation are seen in the vast spreads of sand and gravel deposits laid down by melt-waters associated with the Quaternary ice sheets; these deposits overlie much of Cambridgeshire, particularly the areas around Cambridge, Huntingdon and Peterborough.

2.5 As a result of its low-lying topographic position, this landscape is very sensitive to change, and to sea level change in particular. Under natural conditions, the Wash, has been subject to considerable variation in its coastal configuration, largely in response to isostatic and eustatic changes in sea level following the end of the last Glaciation at c.15,000 years ago. This sensitivity has been tamed through the use of extensive water management systems emplaced with the Fen Basin and the Wash over the past few centuries. These water management systems and structures (e.g. canals, windmills etc.) are now very much a part of the Cambridgeshire fenland landscape River courses have been altered and barrier banks raised to produce a vast open landscape with a regimented and highly organised drainage pattern.

2.6 This land management system has, however, created new problems. The most significant of these affecting the Cambridgeshire landscape is land degradation, resulting largely from peat shrinkage due to water drainage and enhanced wind erosion due to soil destabilisation and the flatness of the topography.

3. SOILS

3.1 Soil is a product of several complex and interacting processes. Its characteristics are determined by the physical and chemical constitution of the parent rock, past and present climatic conditions, local topography, various soil forming processes, and the effects of man's activities.

3.2 A number of soil classification systems have been developed. The system used by the Soil Survey and Land Research Centre classifies soils according to their broad differences in composition or origin of soil material and whether certain diagnostic features are present or absent. This system has an hierarchical structure and defines soils at four categorical levels - major soil group, soil group, soil sub-group and soil series.

3.3 Soil can be degraded, or improved, by both natural processes and human activities. It is not an unlimited resource. It is slow to change, but it is also slow to recover from chemical, physical or biological degradation. The use land is put to influences not only the quality of the soil, but also the wider environment. For example, with agriculture, the use of inorganic fertilisers and pesticides affects not only crop yields, but can also be the cause of nitrates leaching into aquifers, and habitats altering their plant diversity.

4. CLIMATE

4.1 The British Isles enjoy a humid temperate maritime climate due to their size, latitude and location in the track of North-Atlantic depressions. The depressions or "lows", which are warmed by the warm water of the North Atlantic Drift (Gulf Stream), moderate the seasonal range of temperatures experienced and are responsible for a considerable proportion of Britain's annual rainfall. Their importance to regional climates of the British Isles is greatest in the west and diminishes eastwards. Rainfall totals therefore also tend to decrease from west to east. Eastern regions are more likely to come under the influence of anticyclonic air masses from continental Europe. These are usually dry and hot in summer but very cold in winter.

4.2 Cambridgeshire's easterly location furthest from the landfall of most Atlantic depressions mean its climate is one of the most "continental" in Britain. Day to day weather conditions and even seasonal averages in the region are governed largely by which air masses most frequently affect the County. A period of westerly maritime airstreams is likely to bring a spell of mild moist weather but as they tend to cool and dry as they cross western and central Britain they are rarely as warm or wet as further west. A period under the influence of easterly continental airstreams is likely to bring the most extreme conditions; hot dry spells in summer but very cold and sometimes snowy weather during the winter.

4.3 Cambridgeshire is one of the driest counties in the British Isles, only Essex is sometimes drier. Most places in the County receive, on average, less than 600mm of rain per annum, but in some years annual totals of less than 500mm may be recorded at some locations. Precipitation is approximately equally distributed over the year with summer rainfall being augmented by heavy convectional showers.

4.4 Compared with other parts of Britain, East Anglia is hot and sunny in the summer but cold and frosty in the winter. Cambridgeshire's inland location within East Anglia, however, does provide some protection from cool onshore breezes that affect coastal parts of the region in summer. The number of warm sunny days (over 25^{o}C), for example, varies from around 12 in Cambridge to around four along the Norfolk coast. On August 3, 1990, the temperature in Cambridge rose to 36.5^{o}C, very close to Cheltenham's 37.1^{o}C record maximum temperature for the British Isles. These temperatures occurred during a prolonged heatwave when even most coastal areas of East Anglia and Lincolnshire were above 30^{o}C.

4.5 The mean annual daily duration of bright sunshine in Britain ranges from less than 3 hours in the Shetland's to over 5 hours in the Channel Islands. Cambridgeshire's mean daily sunshine is a respectable 4.2 hours and varies from 1.3 hours (17% of possible) in December to 6.8 hours (41% of possible) in June. The absence of any high ground over the whole of eastern England is probably responsible for inland East Anglia being one of the sunniest inland parts of Britain (Lamb, 1987).

4.6 Ground frosts in inland Britain are far more common than in coastal areas and the principal control on the distribution of frost within Eastern England is proximity to the coast. Local frost pockets, however, are likely to occur at the base of even gentle slopes. Cambridge receives an average of 114 days with frost (measured as a minimum grass top temperature below 3^{o}C) while Clacton has only 25.

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