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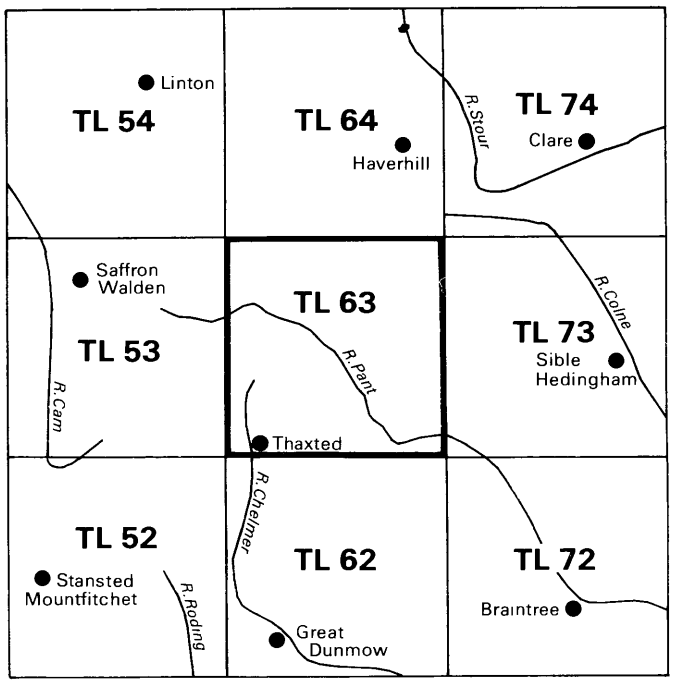

The sand and gravel resources of the country north-east of Thaxted, Essex

Description of 1:25 000 sheet TL 63

R. J. Marks

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PREFACE

National resources of many industrial minerals may seem so large that stocktaking appears unnecessary, but the demand for minerals and for land for all purposes is intensifying and it has become increasingly clear in recent years that regional assessments of the resources of these minerals should be undertaken. The publication of information about the quantity and quality of deposits over large areas is intended to provide a comprehensive factual background against which planning decisions can be made.

Sand and gravel, considered together as naturally occurring aggregate, was selected as the bulk mineral demanding the most urgent attention, initially in the south-east of England, where about half the national output is won and very few sources of alternative aggregates are available. Following a short feasibility project, initiated in 1966 by the Ministry of Land and Natural Resources, the Industrial Minerals Assessment Unit (formerly the Mineral Assessment Unit) began systematic surveys in 1968. The work is now being financed by the Department of the Environment and is being undertaken with the co-operation of the Sand and Gravel Association of Great Britain.

This report describes the sand and gravel resources of the country north-east of Thaxted, Essex, shown on the accompanying 1:25 000 resource map. The survey was conducted by R. J. Marks, under the supervision of P. I. Manning, assisted in the drilling and sampling programme by P. H. A. Nancarrow and D. W. Murray. The work is based on a geological survey at 1:10 560 carried out by J. A. Zalasiewicz and B. S. P. Moorlock between 1976 and 1980.

Mr I. Coleman and Mr W. N. Pierce (Land Agents) were responsible for negotiating access to land for drilling. The ready co-operation of landowners and tenants in this work is gratefully acknowledged.

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2 July 1982.

The first twelve reports on the assessment of British sand and gravel resources appeared in the Report Series of the Institute of Geological Sciences as a subseries. Report No. 13 and subsequent reports appear as Mineral Assessment Reports of the Institute.

Details of published reports appear at the end of this Report.

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The sand and gravel resources of the country north-east of Thaxted, Essex

Description of 1:25 000 sheet TL 63

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SUMMARY

The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 93 boreholes drilled for the Industrial Minerals Assessment Unit form the basis of the assessment of the sand and gravel resources of the country north-east of Thaxted, Essex.

All the deposits in the district that might be potentially workable for sand and gravel have been investigated and a simple statistical method has been used to estimate the volume. The reliability of the volume estimates is given at the symmetrical 95 per cent probability level.

The 1:25 000 map is divided into four resource blocks, containing between 0.9 and 9.6 km^2 of sand and gravel. For each block the geology of the deposits is described, and the mineral-bearing area, the mean thickness of overburden and mineral and the mean gradings are stated. Detailed borehole data are also given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying map.

Notes

Each borehole registered with the Institute is identified by a four-element code (e.g. TL 63 NW 33). The first two elements define the 10-km square (of the National Grid) in which the borehole is situated; the third element defines a quadrant of that square, and the fourth is the accession number of the borehole. In the text of the report the borehole is normally referred to by the last two elements alone (e.g. NW 33).

All National Grid references in this publication lie within the 100-km square TL unless otherwise stated. Grid references are given to eight figures, accurate to within 10 m, for borehole locations. (In the text, four- and six-figure grid references are used for more extensive locations, for example for farms).

Bibliographical reference

MARKS, R. J. 1982. The sand and gravel resources of the country north-east of Thaxted, Essex: description of 1:25 000 sheet TL 63. **Miner. Assess. Rep. Inst. Geol. Sci.**, No 133.

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INTRODUCTION

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, neither the economic nor the social factors used to decide whether a deposit may be workable in the future can be predicted; they are likely to change with time. Deposits not currently economically workable may be exploited as demand increases, as higher-grade or alternative materials become scarce, or as improved processing techniques are applied to them. The improved knowledge of the main physical properties of the resource and their variability, which this survey seeks to provide, will add significantly to the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971, 1981; Harris and others, 1974).

The survey provides information at the 'indicated' level "for which tonnage and grade are computed partly from specific measurements, samples or production data and partly from projection for a reasonable distance on geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout" (Bureau of Mines and Geological Survey, 1948, p. 15).

It follows that the whereabouts of reserves must still be established and their size and quality proved by the customary detailed exploration and evaluation undertaken by the industry. However, the information provided by this survey should assist in the selection of the best targets for such further work. The following arbitrary physical criteria have been adopted:

a The deposit should average at least 1 m in thickness.
b The ratio of overburden to sand and gravel should be no more than 3:1.
c The proportion of fines (particles passing the No. 240-mesh B.S. sieve, about $\frac{1}{16}$ mm) should not exceed 40 per cent.
d The deposit should lie within 25 m of the surface, this being taken as the likely maximum working depth under most circumstances. It follows from the second criterion that boreholes are drilled no deeper than 18 m if no sand and gravel has been proved.

A deposit of sand and gravel that broadly meets these criteria is regarded as 'potentially workable' and is described and assessed as 'mineral' in this report. As the assessment is at the indicated level, parts of such a deposit may not satisfy all the criteria.

Pre-Pleistocene rocks, which are usually consolidated and devoid of potentially workable sand and gravel, are referred to as 'bedrock'; 'waste' is any material other than bedrock or mineral; 'overburden' is waste that occurs between the surface and an underlying body of mineral.

For the particular needs of assessing sand and gravel resources, a grain-size classification based on the geometric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm, 64 mm has been adopted. The boundaries between fines (that is, the clay and silt fractions) and sand, and between sand and gravel material, are placed at $\frac{1}{16}$ mm and 4 mm respectively (see Appendix C).

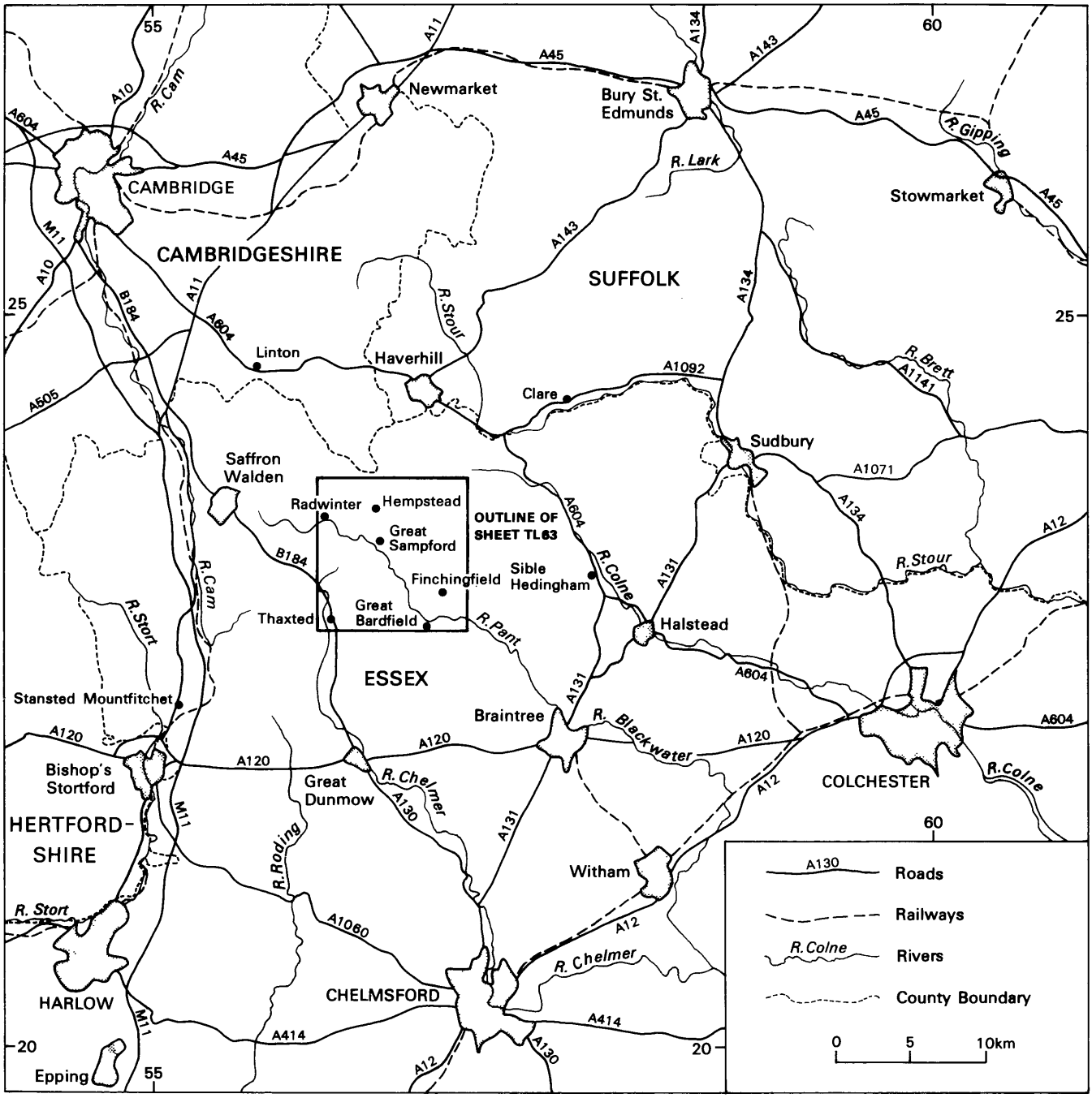


Figure 1 Map showing the location of the resource sheet area.

The volume and other characteristics are assessed within resource blocks, each of which, ideally, contains approximately 10 km^2 of sand and gravel. No account is taken of any factors, for example roads, villages or land of high agricultural or landscape value, which might stand in the way of sand and gravel being exploited, although towns are excluded. The estimated total volume therefore bears no simple relationship to the amount that could be extracted in practice.

It must be emphasised that the assessment applies to the resource block as a whole; valid conclusions cannot be drawn about mineral in parts of a block, except in the immediate vicinity of the actual sample points.

DESCRIPTION OF THE DISTRICT

The potentially workable sand and gravel resources of the country to the north-east of Thaxted, Essex, lying within the 100 km^2 Ordnance Survey sheet TL 63 (Figure 1), are assessed in this publication. Much of the area to the south and east of this region has been the subject of earlier reports in this series, the adjoining sheets in particular, describing broadly similar geological deposits.

This survey area lies in a rural part of north Essex between the small towns of Saffron Walden, Haverhill, Braintree and Great Dunmow, with Bishop's Stortford 15 km to the south-west. No major routes cross the area, though the A604 Cambridge to Colchester trunk road passes to the north and east and the M11 motorway runs 9 km to the west. Only minor roads criss-cross the district and provide communication between a number of small picturesque villages. The small town of Thaxted acts as a local centre for the predominantly arable farms of the area, which produce mainly cereals but with potatoes, sugar-beet, beans and peas used in the crop rotation.

The district forms part of the north Essex and west Suffolk Boulder Clay plateau which undulates about an average height of 100 m above OD in this area. It is

dissected by the headwaters of the River Pant which crosses the area diagonally, flowing south-eastwards, and cuts down to a level of 53 m above OD before passing off the area towards Braintree. The headwaters of the River Chelmer transect the south-west corner of the district and a tributary of the River Stour drains the area in the north.

There are no working sand and gravel pits in the district and, apart from the two disused pits [635 361 and 604 360] at Great Sampford and a reclaimed pit [617 372] at Radwinter Hall Farm, there are only a few, small disused pits. These were never operated on a commercial basis but simply opened by the local landowner to supply material to maintain his tracks and buildings.

Potentially workable sands and gravels were proved by the survey in various drift deposits: they have a combined area of 23.4 km^2 and a calculated volume of 171 million m^3. The mineral lies mainly in the south-east of the district, on both sides of the Pant valley, with a smaller area of potentially workable sand and gravel between Gt Sampford and Radwinter [606 373] and isolated patches in the Chelmer valley. Much of the high plateau, especially in the north-east, comprises a thick sheet of Boulder Clay in excess of the maximum overburden thickness (18 m, see page 1).

Geology

Old Series Geological Sheet 47 and the accompanying memoir (Whitaker and others, 1878) give an account of the geology of the area. The northern quarter of the present area is also covered by the New Series 1:63 360 Saffron Walden (205) and Sudbury (206) sheets and their corresponding memoirs (White, 1932; Boswell, 1929). More recently, between 1976 and 1980, the district has been resurveyed for the purpose of this assessment. The mapping was carried out at a scale of 1:10 560 by J. A. Zalasiewicz and B. P Moorlock of the Institute's East Anglia and South-Eastern England Unit and the geology is described in an IGS Open-File Report (Zalasiewicz, 1981).

The geological sequence is summarised in Table 1, where the deposits are listed, as far as possible, in order of increasing age. The stratigraphical relationships between the deposits are illustrated in the horizontal geological sections on the border of the resource map (which are drawn along the lines of sections inscribed on the map).

Table 1 Geological sequence.

DRIFT	
Recent and Pleistocene	Alluvium
	Head
	Glacial Sand and Gravel, upper*
	Boulder Clay
	Glacial Silt
	Barham Sands and Gravels
	Kesgrave Sands and Gravels
SOLID	
Pleistocene	Crag
Eocene	London Clay
Palaeocene	Lower London Tertiaries
Cretaceous	Upper Chalk

* abbreviated to Glacial Sand and Gravel in this report.

SOLID

The district is underlain by Upper Chalk, Lower London Tertiaries and London Clay which all have a regional dip of a few degrees to the south-south-east. The Crag overlies these formations, chiefly in the south and along the valley of the Pant around Great Sampford. An extensive cover of thick drift deposits restricts exposure of the solid rocks to the south where the London Clay crops out at a few localities. Elsewhere Industrial Minerals Assessment Unit (IMAU) boreholes and well records confirm the solid formation subcrops which are shown on the resource map.

Upper Chalk This soft white flint-bearing limestone subcrops beneath the drift in the northern half of the district and extends in the floor of the Pant valley as far south as Letches Farm [661 315]. Farther to the south, the Upper Chalk dips beneath the Lower London Tertiaries and younger rocks. Where proved in IMAU boreholes, the Upper Chalk is commonly water-saturated at its contact with the overlying drift deposits and has weathered to a putty-like consistency.

Lower London Tertiaries The Lower London Tertiaries comprise two formations, the Thanet Beds and the overlying Woolwich and Reading Beds (Hester, 1965). The Thanet Beds consist of olive-grey to greenish grey micaceous glauconitic sands and silts which rest on a basal bed of irregular to well rounded flints (the Bullhead Bed). The Woolwich and Reading Beds are yellowish brown sands and silts (Woolwich Beds) at the base passing up into chestnut-brown stiff 'waxy' clays (Reading Beds). They are strongly mottled with red and blue-coloured veins and contain secondary calcareous nodules (race).

The Lower London Tertiaries rest disconformably upon the eroded surface of the Upper Chalk. London Clay overlies them in the south. Their maximum recorded thickness is almost 21 m (see borehole SE 30) and their subcrop, beneath the drift deposits, forms a belt about 2 km wide which crosses the district from east to west. A small subcropping outlier was proved by non-IMAU borehole NE 10. Erosion in the Pant valley has cut through the Lower London Tertiaries to the underlying Upper Chalk. The subcrop of the base of the overlying London Clay is similarly deflected downstream in the Pant valley and these beds have also been removed from the tributary at Finchingfield [683 328] and in the Chelmer valley. The delineation of this subcrop pattern has been largely constructed from the borehole information.

London Clay This formation rests on the Lower London Tertiaries and subcrops in the south beneath the plateau areas. In the lowest part of the Pant valley it crops out, from beneath the drift, on the lower valley slopes. There are several other small outcrops in the tributary valley east of Little Barfield [658 307] and in the Chelmer valley south of Thaxted.

The basal 10 to 15 m of the London Clay consists of bluish black silty sands and clays. These pass up into the more characteristic London Clay lithology of stiff homogeneous olive-grey clay, which is micaceous and silty in parts. At outcrop these beds are weathered brown and orange-brown to a depth of several metres, while beneath drift this weathering penetrates only to about 0.2 m as proved by boreholes.

Crag This deposit overlies the London Clay in the south, forming an almost continuous sheet, though it is absent at the northern limits of the London Clay subcrop as seen, for example, in borehole records SW 18 and 22 and SE 25, 28 and 36, where the London Clay is directly overlain by drift deposits. Although the Crag is not separately mapped on the resource sheet, it forms the lower portion of most of the outcrops mapped as undifferentiated sands and gravels that are present in the Pant valley. Here the undifferentiated unit crops out from beneath the Boulder Clay sheet which normally covers it on the plateau. Between Radwinter and Great Sampford a series of boreholes in the Pant valley, from NW 16 in the north-west to NW 35 in the south-east,

proved an isolated deposit of Crag resting on Upper Chalk.

The sedimentary characteristics of the Crag suggest deposition in a shallow marine environment. The axis of the basin of deposition appears to have been aligned with the strike of the London Clay and the area of deposition to have extended northwards onto the Upper Chalk. Subsequent glacial erosion has removed Crag deposits in some areas as well as thicknesses of bedrock, since the residual Crag deposits often occupy a high elevation relative to the drift-covered bedrock. This can be seen in the south on the horizontal sections. However, the remnant Crag deposit between Great Sampford and Radwinter has evidently been partly protected from glacial denudation in a basin of the Upper Chalk.

The Crag, which was proved in 27 boreholes, has a mean grain-size classification of pebbly sand and a mean thickness of 4.4 m. It ranges in thickness from 1 m in borehole SE 24 to 12 m in borehole SE 44. The Crag is characterised by yellowish brown to rusty-brown medium and fine sand with a small percentage of flint, quartz and ironstone pebbles (for details see the section on the composition of Crag).

DRIFT

The middle Pleistocene stratigraphy of southern East Anglia is complex: it has been recently revised by Rose and Allen (1977), whose account is used as the basis for this report.

The bedrock surface is largely concealed by a thick sequence of superficial deposits which consists predominantly of Boulder Clay, with undifferentiated sands and gravels and Glacial Sand and Gravel prominent locally (see below and Table 1). A rockhead surface contour map has been compiled from borehole data and is reproduced on the margin of the resource map. The surface represents several phases of erosion, which relate to the overlying deposits. While the Pant valley, its tributaries and the Chelmer valley are incised into this surface, a notable feature is the buried escarpment of the Lower London Tertiaries formed by differential erosion of the various lithologies. This can also be seen on Section B on the map border. A broad asymmetical valley is developed at the foot of the scarp; it falls towards the east, as demonstrated by the bedrock contours, and can be traced north-east as far as Sudbury (Marks and Murray, 1981; Marks and Merritt, 1981; Hopson, 1982). The valley was eroded during glacial times when it would have been the main drainage channel. It influences the distribution of potentially workable sand and gravel deposits, which are only found as a continuous sheet to the south. The thicker sequences of Glacial Sand and Gravel proved in boreholes NW 29 and SW 14 (see below and Table 1) are associated with this buried valley.

Because of the difficulty in distinguishing the various sand and gravel-bearing formations during the field mapping, the Crag, Kesgrave Sands and Gravels and Barham Sands and Gravels have generally not been differentiated and are shown undivided on the geological base map. (Exceptionally, three outcrops of Barham Sands and Gravels have been positively identified in the south-east of the district, where the boulder clay cover is broken). On the other hand, it has been possible to identify on the basis of lithology all of the named formations in the assessment boreholes, and this information is quoted in the borehole logs (Appendix E) and in the borehole arrays on the resource map.

The rubified sol lessivé and associated deposits, as defined by Rose and Allen (1977), are here included with the Barham Sands and Gravels. In addition to the formations described by these authors, the succession proved by IMAU boreholes includes a further lithostratigraphic unit of sands and gravels which has been termed the Glacial Sand and Gravel, upper. This deposit is so named to distinguish it from the Barham Sands and Gravels which are also of glacial origin. For convenience the name Glacial Sand and Gravel, upper is abbreviated to Glacial Sand and Gravel in the text of this report.

Kesgrave Sands and Gravels Following the introduction of this stratgraphical term by Rose, Allen and Hey (1976), deposits referable to the Kesgrave Sands and Gravels have been recognised in IMAU boreholes across a wide area of north Essex and southern Suffolk. Several surveys have proved two distinctive lithofacies: a lower sequence of fine and medium sands overlain in places by an upper series of sands and gravels. The sand and gravel facies occurs to the south around Great Dunmow (Thomas, 1982), where it appears to cut out the underlying sand facies and the Crag, and rests on bedrock. In this district only the sand facies has been found.

These pale yellow to orange-yellow fine and medium sands commonly occupy the middle or upper portion of the sub-Boulder Clay outcrop of undifferentiated sands and gravels. They would appear to be closely related to the lithologically similar Crag, which they invariably overlie and with which they have a gradational junction. The sands have been proved in 18 IMAU boreholes in the south of the district and in the area between Great Sampford and Radwinter, but they were not present in 12 other IMAU boreholes which reached Crag. Boreholes NW 21, NE 13 and SW 27 proved the Kesgrave Sands and Gravels below more than 25 m of Boulder Clay but several boreholes, particularly in the north-east, failed to reach them because of the thick cover. The deposits have a mean grain-size classification of sand (see composition of Kesgrave Sands and Gravels for detail), and have a mean thickness of 5.0 m and range up to 15 m in thickness (borehole NW 22). The sands were the main mineral deposit extracted from the two pits at Great Sampford where the material can still be seen, though the sides of these disused pits are now largely overgrown.

Barham Sands and Gravels This deposit is considered by Rose and Allen (1977) to represent the main glacial outwash of the Anglian glaciation, preceding deposition of the till sheet. It has a limited distribution but was proved in six IMAU boreholes, where it rests on Kesgrave Sands and Gravels or Crag. It may form the uppermost portion of the undifferentiated sands and gravels at some localities but has also been separately identified in three areas in the south-east of the district where it was proved by IMAU boreholes SE 16, 34 and 38. Borehole SE 44 also proved this deposit though it has not been separately identified in the adjacent outcrop immediately to the north. These four closely grouped boreholes demonstrate geological conditions that may be typical of a wider area in which the deposit may be present. The only other records of the Barham Sands and Gravels are in boreholes NW 33 and SW 16, the latter being the sole site in this district where the rubified sol lessivé was identified. The Barham Sands and Gravels have a mean thickness of 2.1 m, with a maximum development of 6.2 m in borehole NW 33. They are poorly sorted but have a mean classification of 'clayey' pebbly sand (see composition of Barham Sands and Gravels for details).

Boulder Clay This till, of Anglian age, is the most widespread of the drift deposits. It blankets the area and forms an undulating plateau. It normally overlies the undifferentiated sands and gravels in the south and south-east of the district but is known to rest directly on bedrock at 18 borehole sites over the remaining area. Glacial Sand and Gravel and Glacial Silt often occur within the deposit, for example, in boreholes NW 16 and NE 14. The Boulder Clay is thickest along the line of the east-west buried glacial valley where non-IMAU borehole SW 7 records an unbottomed thickness of 42.7 m. Several boreholes in the north-east of the district proved thicknesses of Boulder Clay in excess of 30 m.

This deposit gives rise to the heavy soils typical of

the area. It forms a firm to stiff slightly sandy, silty clay with abundant pebbles and, more rarely, cobbles of rounded chalk with angular flint, some shale, fossil debris, rounded quartz and quartzite and other minor erratics, including sandstone, limestone, igneous and metamorphic rocks. The uppermost four metres are typically weathered brown or mottled brown and grey in colour with some decalcification near the top giving rise to sandy clay and flint pebbles. When unweathered the Boulder Clay is typically grey and olive-grey in colour but it ranges widely from light grey through to black. The base is often sandy and orange-brown in colour with a low chalk content, especially where the till overlies sands and gravels.

Glacial Silt This formation is not mapped separately at outcrop, though it was identified in 11 IMAU boreholes where it occurs at various levels in the Boulder Clay and Glacial Sand and Gravel sequences. It is commonly laminated olive-grey silt but in places may be clayey silt. Some samples include fine pebbles and pellets (coarse sand grade) largely composed of chalk but with flint and quartz in some instances. The Glacial Silt has a mean thickness of 2.3 m but a maximum thickness of 5.7 m, recorded in borehole SE 21, where it includes a little peat, rests on Upper Chalk and is overlain by Glacial Sand and Gravel.

Glacial Sand and Gravel These sands and gravels form an integral part of the glacial stratigraphy and represent localised glaciofluvial meltwater activity during the deposition of the till sheet. The deposits may occur at any level within the Boulder Clay sequence and have been recorded, often at more than one level, in many IMAU boreholes. They crop out on the lower valley slopes of the rivers Pant and Chelmer, suggesting that these rivers may have been initiated as drainage channels during glacial times. They are also found capping the plateau to the north and west of Finchingfield where they are associated with a small valley. These outcrops form 'trains' of discrete patches which may originally have been continuous. They appear to post-date the Boulder Clay. Conversely, deposits encountered within the Boulder Clay appear to have no related outcrops. This is illustrated by the occurrence of Glacial Sand and Gravel in the east-west-trending buried glacial channel proved in IMAU boreholes SW 6, 14, 25, 28, 29, NW 29, NE 18 and 20.

These deposits have a mean thickness of 3.6 m in this district; the maximum recorded thickness is 13.5 m, in borehole NW 29. The Glacial Sand and Gravel has a mean grain-size classification of 'clayey' sandy gravel though it is generally poorly sorted with characteristically variable grading (see Composition of Glacial Sand and Gravel for details). Nevertheless, it has been extracted in the past from a pit at Radwinter Hill Farm, now filled, and from the outcrop at Thaxted, now covered by buildings.

Head Solifluction deposits are present in most valleys, where they rest on the floor or lower valley slopes and overlie older drift and solid formations. These heterogeneous deposits vary widely according to the parent rock and range in this district from brown pebbly clay to orange-brown 'very clayey' sandy gravel (see borehole NW 32). Where present, sands and gravels are typically thin and impersistent, the whole being in the order of 2 m thick. In consequence, the Head is not considered to be a potentially workable deposit.

Alluvium The narrow and sinuous floodplains which border the streams in all the major and tributary valleys are underlain by Alluvium with a mean recorded thickness of 8.6 m. It typically consists of clayey silt overlying a peat and silt sequence that may contain pebbles of flint and chalk, and fresh-water shells, as well as grass and wood debris. A bed of sand and gravel is usually present at the base of this characteristic sequence.

Composition of the Sand and Gravel Deposits

One of the solid and four of the drift formations contain potentially workable sand and gravel: they are the Crag, Kesgrave Sands and Gravels, Barham Sands and Gravels, Glacial Sand and Gravel and Alluvium. There are some similarities in the mean gradings of the formations (Figure 2). The Crag and Kesgrave Sands and Gravels have a high proportion of medium and fine sand coupled with a moderate percentage of fines (8 per cent). The Barham Sands and Gravels and Glacial Sand and Gravel have a higher percentage of fines (18 per cent and 14 per cent respectively) and a moderate amount of gravel (20 per cent and 35 per cent respectively). The Alluvium contains the highest percentage of gravel (44 per cent) and the lowest percentage of fines (6 per cent).

The composition of the gravel fraction has been evaluated by pebble counts (by weight) for each deposit in each borehole. Where a large enough sample was available, the 8 to 16 mm fraction was counted, as this has been seen to be representative of the whole gravel fraction in these deposits. If the weight of this fraction was inadequate the size-range counted was lowered to include all material greater than 4 mm. This was invariably the case with the Kesgrave Sands and Gravels and less frequently the Crag.

The results of mechanical and physical tests on bulk aggregate samples from the deposits are shown in Table 3. Due to the appreciably lower percentage of chalk from the Glacial Sand and Gravel in the Pant valley, boreholes SE 21, 23 and 33 were tested separately and the two sets of results are compared.

The average composition of the gravel in the mineral deposits is displayed in Table 2. This shows that they all have a high proportion of flint, with each deposit being characterised by subordinate materials, such as ironstone and phosphatic nodules, quartz and quartzite and chalk. Other rock types occur as minor constituents. Similarities of composition in the gravel fraction suggest that there has been a recycling of earlier deposits. The quality of these deposits is related to the amount of chalk and ironstone (and to a lesser degree patinated flint), since these constituents may have deleterious properties. The flint, some of which may be water-absorbent, has been grouped into three types in the composition counts. The well rounded flint has been derived from the pebble beds of the Lower London Tertiaries and London Clay (Tertiary flint). The remaining subrounded to angular, but largely subangular, flint is subdivided into that with a significant patina (white, porcelain-textured 'skin') and that which is non-patinated.

Although the Woolwich Beds of the Lower London Tertiaries may, in part, be classified as mineral, they have not been assessed in this survey due to the very high fines content and the presence of an excessive thickness of overburden. However, they were sampled in borehole SW 20 where their grade was fines 34 per cent, fine sand 65 per cent and medium sand 1 per cent: their lithology is described in the borehole log.

Crag This well sorted deposit (Figure 3) is commonly an orange to rusty-brown sand or pebbly sand and has a mean grading of fines 8 per cent, sand 87 per cent and gravel 5 per cent. It is characterised by scattered, well rounded flint pebbles and occasional bands of ironstone, with highly polished well rounded to rounded phosphatic nodules (coprolites) at some locations. In borehole SE 44 the Crag sequence was underlain, below a depth of 18.7 m, by greenish brown partly shelly sand. This 'Green Crag', which is unoxidised and semi-consolidated, has been identified in three of the adjoining resource sheet areas (Thomas, 1982; Clarke, 1975; Marks and Murray, 1981). At the base it includes subangular to subrounded flint gravel and bored phosphatic nodules. Green Crag was also identified to the east of The Hydes [643 315] in boreholes SW 32 and 34, but although both occurrences

	Percentage by weight passing (mm)					
	1/16	1/4	1	4	16	64
Alluvium	6	14	39	56	84	100
Glacial Sand and Gravel, upper	14	25	52	65	85	100
Barham Sands and Gravels	18	32	75	80	90	99
Kesgrave Sands and Gravels	8	57	98	100	100	100
Red Crag	8	41	88	95	98	100

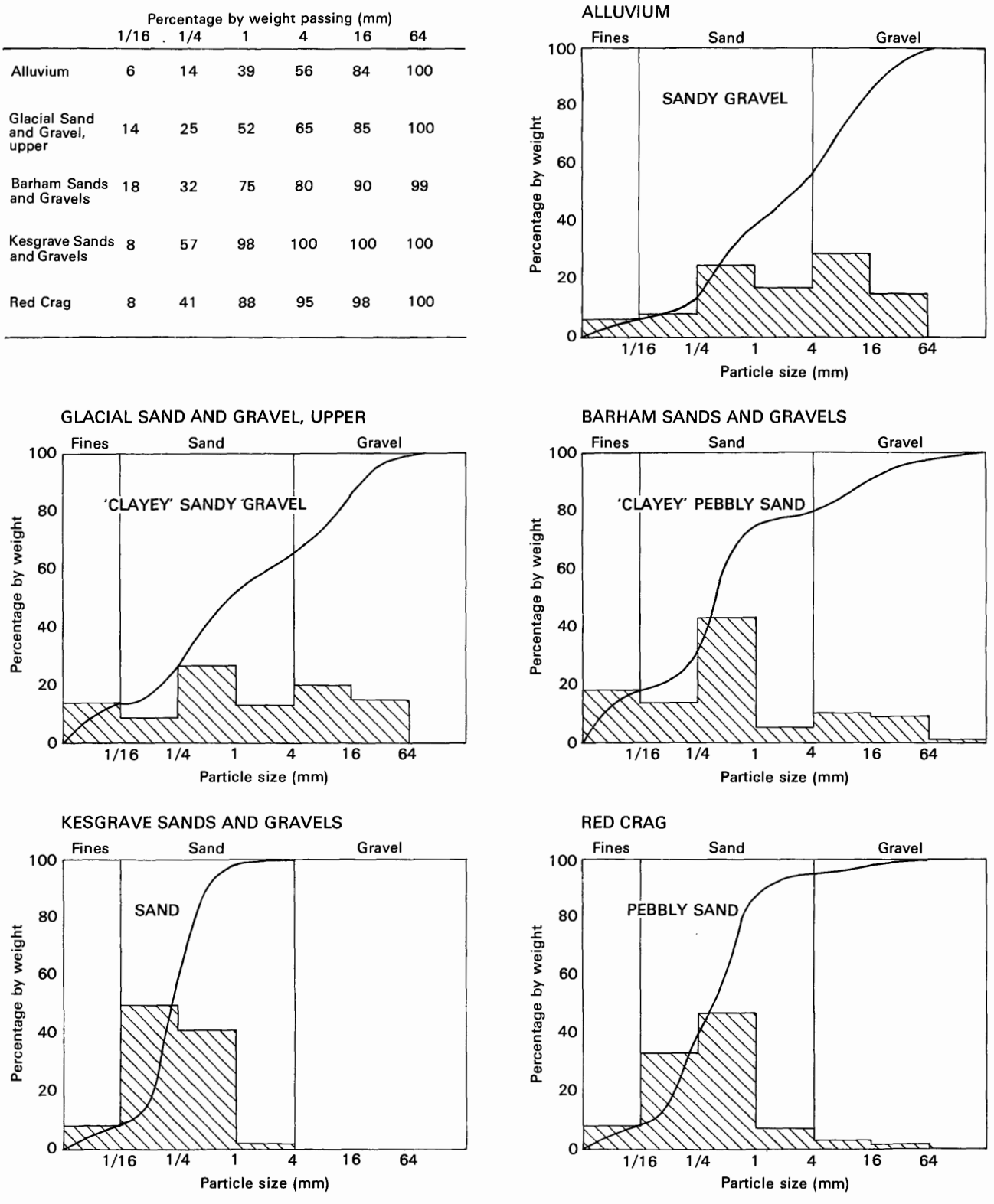


Figure 2 Mean particle-size distribution of the mineral-bearing deposits (as cumulative percentage passing in the table and line graphs and as percentage retained in the respective fractions in the histograms).

Table 2 Mean composition of the gravel (+4 mm) fraction of the mineral-bearing deposits.

Deposit	Percentages by weight											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phospatic nodules	Others
	W.R.	Ang.	Patin.									
Alluvium	3	56	18	10	1	4	2	3	1	1	trace	1
Glacial Sand and Gravel	5	34	17	28	3	4	3	3	1	1	trace	1
Barham Sands and Gravels	8	24	20	10	13	10	3	4	1	3	trace	3
Kesgrave Sands and Gravels	26	33	15	0	9	7	3	trace	0	5	1	1
Crag	25	29	20	trace	6	4	1	trace	trace	11	3	1

W.R. Well rounded Ang. Angular to subrounded Patin. Patinated angular to subrounded

Others Includes igneous, metamorphic and fine sedimentary rocks and ocassionally pyrite

Table 3 Aggregate tests.

Deposit	Aggregate Impact Value (kN)	10 % Fines Value (kN)	Relative Density		Apparent Relative Density	Water Absorption (%)
			Oven-dried	Surface-dried		
Alluvium	29	180	2.45	2.52	2.64	2.9
Glacial Sand and Gravel	36	110	2.30	2.44	2.67	6.0
Glacial Sand and* Gravel from bore-holes SE 21, 23 and 33	27	180	2.44	2.52	2.64	3.1

These tests are based on British Standard 812, parts 2 and 3, 1975.

* Selected boreholes of Glacial Sand and Gravel were tested separately, (see Composition of Sand and Gravel). These tests were not applicable to the Crag and Kesgrave Sands and Gravels with their low gravel percentage. There was insufficient material collected to test the Barham Sands and Gravels.

had the characteristic greenish brown to olive-green (unoxidised) colouration, shell debris was absent.

The gravel fraction includes both fine (+4-16 mm) and coarse (+16-64 mm) grades; cobbles (+64 mm) are present at the base of the sequence in some places. The gravel is composed of subrounded to subangular and well rounded flint with patinated flint, tabular ironstone, iron-cemented micaceous sandstone, fine rounded quartz, and some rounded quartzite and phosphatic nodules. Some chalk pebbles noted at the base of the deposit may represent contamination from the Upper Chalk bedrock during the drilling process .

The sand fraction is commonly iron-stained and is predominantly medium (1/4 to 1 mm) and fine (1/16 to 1/4 mm) grained (54 per cent and 38 per cent respectively), with only 8 per cent of coarse (1-4 mm) grade. Many of the particle-size distribution curves exibit a bimodal distibution in the sand range. A relatively low percentage of grains in the 1/4 to 1/2 mm size-range is accompanied by significantly higher percentages in the neighbouring smaller (1/8 to 1/4 mm) and larger (1/2 to 1 mm) size-ranges. The sand is predominantly composed of rounded to subrounded quartz with some mica and flint in the coarse fraction: a high proportion of coarse shell clasts occurs below 18 m in borehole SE 44. The fines are largly of disseminated silt and clay, but the deposit occasionally includes discrete seams of sandy silty clay of the order of 5 cm thick.

Kesgrave Sands and Gravels This mineral-bearing deposit is a very well sorted sand and has a mean grading of fines 8 per cent and sand 92 per cent; it ranges in mean particle-size distribution from sand to 'clayey' sand (Figure 3) but exceptionally may contain up to 4 per cent gravel, as recorded in borehole NW 35.

The sand fraction is predominantly of fine (53 per cent) and medium (45 per cent) grade with only 2 per cent coarse grade overall. It is essentially clean, of white to orange-yellow colour and is almost exclusively subangular to subrounded quartz with some flakes of mica. Examination of the grading results shows that three-quarters of the deposit falls within the size range 1/8 to 1/2 mm. In the south-east of the district the deposit is fairly evenly distributed across this size-range, but samples from between Great Sampford and Radwinter have as much as 80 per cent in the 1/8 to 1/4 mm size-range. This strikingly unimodal distribution is in contrast to the more widely spread particle-size range, and often bimodal character, of the underlying Crag. The fines consist mostly of disseminated silt and clay, though thin seams of light grey to orange-brown silt and clay, with varying percentages of sand, are occasionally present.

The Kesgrave Sands and Gravels in this district are characterised by the virtual absence of gravel. Overall, the deposit contains 0.4 per cent fine gravel and 0.1 per cent coarse gravel. This is predominantly of flint but

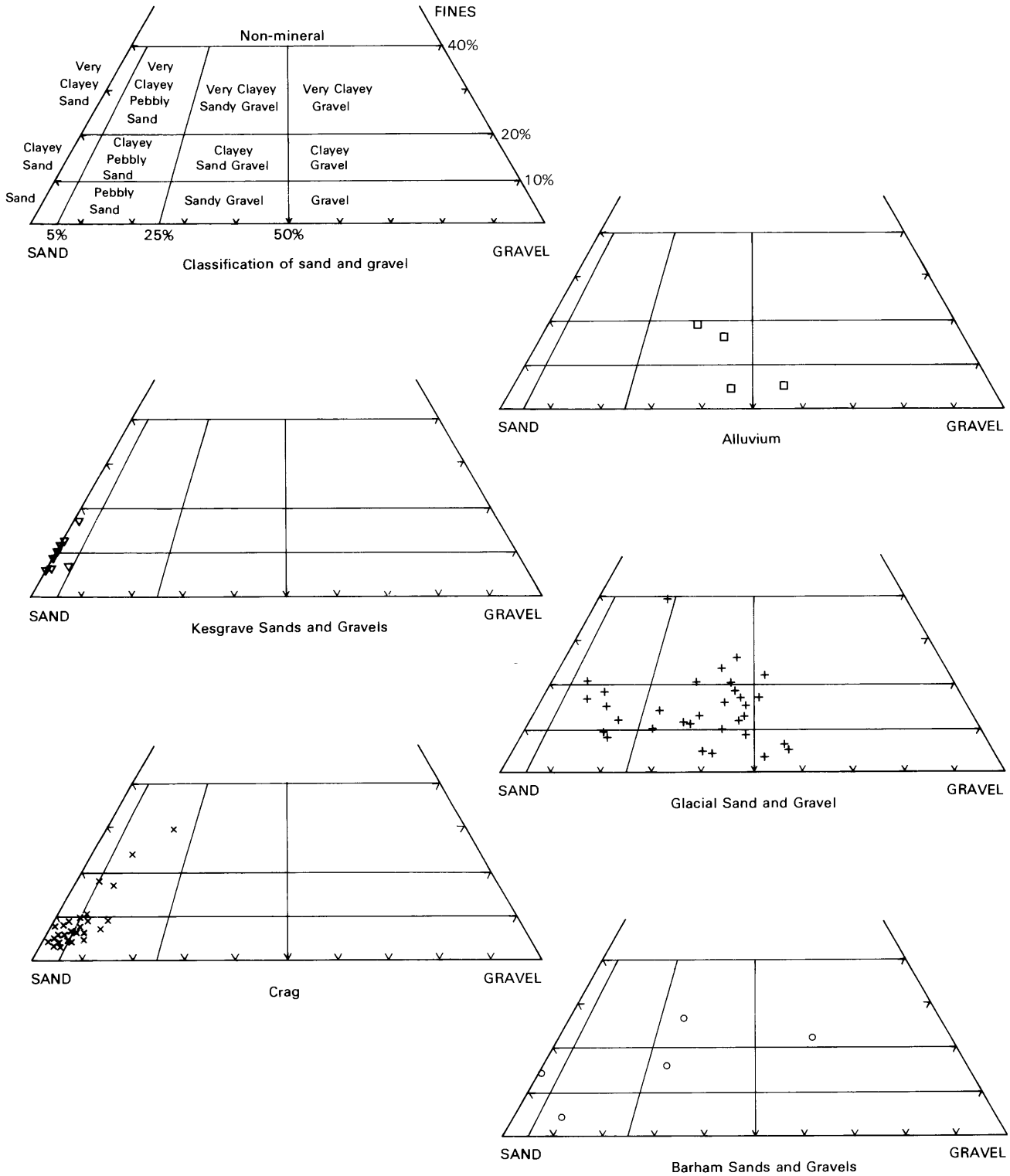


Figure 3 Range of particle-size distributions for the mineral-bearing deposits in IMAU boreholes.

rounded quartz and quartzite and some ironstone, sandstone and phosphatic nodules are rarely present.

Barham Sands and Gravels Overall the mineral in this deposit consists of 'clayey' pebbly sand and has a mean grading of fines 18 per cent, sand 62 per cent and gravel 20 per cent. However, it is a poorly sorted deposit and varies considerably in particle-size distribution. In each of the five boreholes proving mineral, the deposits classify differently: the results showed material of 'clayey' sand, pebbly sand, 'clayey' and 'very clayey' sandy gravel and 'very clayey' gravel grades (Figure 3).

The gravel fraction comprises both fine and coarse grades and includes 1 per cent cobbles. It is composed of 52 per cent flint, of which 8 per cent is well rounded. Ancillary rock types include 13 per cent rounded quartz and 10 per cent of both rounded quartzite and chalk. The minor constituents are fairly evenly represented with 4 per cent limestone, 3 per cent sandstone and ironstone and small amounts of derived fossil debris and igneous and metamorphic rocks.

The sand component of the Barham Sands and Gravels is predominantly of medium grade (69 per cent) with 23 per cent fine and 8 per cent coarse grades. It is typically orange-brown and largely composed of subrounded quartz with a significant proportion of more angular flint shards in the coarse fraction. The deposit is characterised by a high percentage of fines, which may be present as a matrix between the grains of sand and gravel or, in some cases, as disseminated silt and clay.

Glacial Sand and Gravel Characteristically, this deposit is more gravelly and has a higher percentage of chalk than the Barham Sands and Gravels to which it is otherwise generally similar. The glacial origin of this deposit has produced a highly variable lithology, the classification of the mineral from the boreholes falling into nine of the twelve possible mineral categories (Figure 3). It ranges from gravel to 'very clayey' pebbly sand, though the mean grading is fines 14 per cent, sand 51 per cent and gravel 35 per cent, giving a mean classification of 'clayey' sandy gravel. Different seams of mineral can have markedly different particle-size distributions and there may also be rapid changes of grading within the same sequence, as illustrated by borehole NW 29.

The mean grading of the gravel fraction shows an even distribution of particle sizes, though cobbles are rare. The mean composition is flint 56 per cent and rounded chalk 28 per cent with eight minor constituents forming the remaining 16 per cent. However, the composition varies considerably. This is well demonstrated by variations in the percentage of chalk which ranges from zero to levels in excess of 60 per cent of the total gravel fraction. This variation is both a function of the glacial origin and also the effect of more recent leaching of the chalk content. The physical properties of the aggregate are strongly influenced by the percentage of chalk present, as is demonstrated by the results displayed in Table 3. Of two tests on the Glacial Sand and Gravel, one was conducted on a representative sample containing 28 per cent chalk; the second was carried out on a selected sample from the Pant valley with a chalk content of 12½ per cent.

The particle-size distribution of the sand fraction is fine sand 22 per cent, medium sand 53 per cent and coarse sand 25 per cent. Its composition is variable, with rounded chalk, subrounded quartz and subangular flint forming the dominant constituents. The colour is usually light grey but it may be oxidised to orange-brown. Seams of silt and clay containing varying amounts of sand and gravel are common in this deposit (see borehole NW 29), while a high percentage of disseminated silt and clay is recorded in the mineral in some boreholes.

Alluvium The grade of the potentially workable sand and gravel within this deposit, which is moderately well sorted, lies near the boundary between sandy gravel and gravel, with the percentage of fines extending the classification into the 'clayey' category in only two boreholes (Figure 3). The mean grading of fines 6 per cent, sand 50 per cent and gravel 44 per cent, classifies the deposit as sandy gravel.

The lithological composition of the gravel fraction is given in Table 2 which shows that 77 per cent is flint, with rounded chalk constituting 10 per cent of the deposit. The flint and chalk mixture gives the deposit a speckled black, brown and white colouration. The minor constituents are rounded quartzite, limestone and sandstone, with quartz, fossil debris and ironstone only amounting to 1 per cent each. Of this fraction 64 per cent is fine grade and 36 per cent coarse.

In the sand component, the grading is fine sand 16 per cent, medium sand 50 per cent and coarse sand 34 per cent. Mostly composed of subangular flint with subrounded quartz and some rounded chalk, the sand varies from pale brown to greyish brown in colour. Seams of silt and peat invariably overlie the sand and gravel of the Alluvium and they are also common within and beneath this sequence. The proportion of disseminated fines within the sand and gravel is low.

Notes on Workings

In 1982 there were no active pits in the district. In the past, Glacial Sand and Gravel was worked, mainly on a small scale, at Radwinter [615 372], Thaxted [614 310 and 614 312] and Great Bardfield [674 310]. Barham Sands and Gravels, Kesgrave Sands and Gravels and Crag were formerly taken from two small pits at Great Sampford [636 361 and 604 360].

The Map

The sand and gravel resource map is folded into the pocket at the end of this report. The base map is the Ordnance Survey 1:25 000 Outline Edition in grey, on which the geological data are shown in black and the mineral resource information in shades of red.

Geological data The geological boundary lines, symbols, etc., shown are taken from the geological map of this area, which was surveyed recently at the scale of 1:10 560. This information was obtained by detailed application of field mapping techniques by the field staff in the Institute's East Anglia and South-Eastern England Unit.

The geological boundaries are the best interpretation of the information available at the time of survey. However, it is inevitable that local irregularities and discrepancies will be revealed as new evidence from boreholes and excavations becomes available.

Borehole data, which include the stratigraphic relations, thicknesses and mean particle size distribution of the sand and gravel samples collected during the assessment survey, are also shown on the map.

Mineral resource information The mineral-bearing ground is divided into resource blocks (see Appendix A). Within a resource block the mineral is subdivided into areas where it is exposed, that is where the overburden averages less than 1 m in thickness, and areas where it is present in continuous, or almost continuous, spreads beneath overburden. The recognition of these categories is dependent upon the importance attached to the proportion of boreholes which did not find potentially workable sand and gravel and the distribution of barren boreholes within a block. The mineral is described as 'almost continuous' if it is present in 75 per cent or more of the boreholes in a resource block. The 'discontinuous' category is used here when the number of mineral boreholes falls between 50 and 75 per cent.

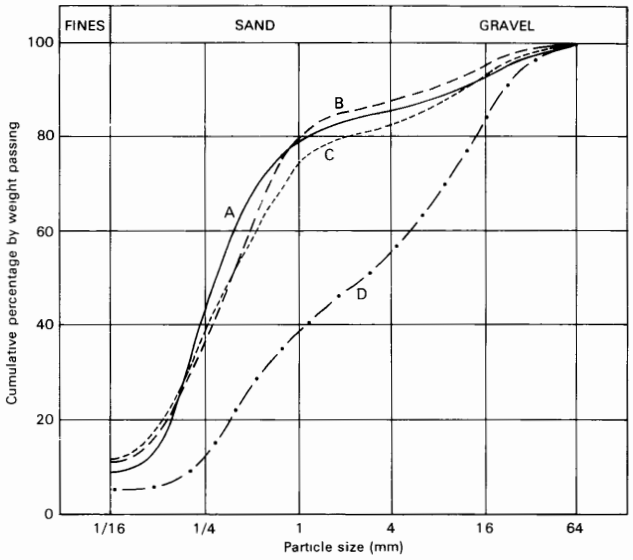
Areas where bedrock crops out, where boreholes indicate absence of sand and gravel beneath cover and where sand and gravel beneath cover is interpreted to be not potentially workable, are uncoloured on the map; where appropriate, the relevant criterion is noted. In such cases it has been assumed that mineral is absent except in infrequent and relatively minor patches that can neither be outlined nor assessed quantitatively in the context of this survey. Areas of unassessed sand and gravel, for example in built-up areas, are indicated by a red stipple.

The area of the mineral-bearing ground is measured, where possible, from the mapped geological boundary lines. The whole of this area is considered as mineral-bearing, even though it may include small areas where sand and gravel is not present or is not potentially workable. Inferred boundaries have been inserted to delimit areas where sand and gravel beneath cover is interpreted to be not potentially workable or absent. Such boundaries (for which a distinctive zigzag symbol is used) are drawn primarily for the purpose of volume estimation. The symbol is intended to indicate an approximate location within a likely zone of occurrence rather than to represent the breadth of the zone, its size being determined only by cartographic considerations. For the purpose of measuring areas the centre line of the symbol is used.

Results

The statistical results are summarised in Table 4. Fuller grading particulars are shown in Figures 2 and 4 and Tables 5 to 8.

Accuracy of results For the three resource blocks assessed at the 'indicated' level, the accuracy of the results at the 95 per cent probability level (that is, on average nineteen out of every twenty sets of limits constructed in this way contain the true value for the volume of mineral) lies between 28 per cent and 52 per cent (Appendix B). However, the true volumes are more likely to be nearer the figure estimated than either of the limits. Moreover, it is probable that roughly the same percentage limits would apply for the statistical estimate of mineral volume within a very much smaller parcel of ground (say 100 hectares) containing similar sand and gravel deposits, if the results from the same number of sample points (as provided by, say, ten boreholes) were used in the calculation. Thus, if closer limits are needed for quotation of reserves, data from more sample points would be required, even if the area were quite small. This point can be illustrated by considering the whole of the potentially workable sand and gravel in Blocks A to D. The total volume (171 million m^3) can be estimated to limits of ± 22 per cent at the 95 per cent probability level by a calculation based on the data from the 46 sample points spread across the four resource blocks. However, it must be emphasised that the quoted volume of mineral has no simple relationship with the amount that could be extracted in practice, as no allowance has been made in the calculations for any restraints (such as existing buildings and roads) on the use of the land for mineral working.



Resource block	Percentage by weight passing					
	1/16mm	1/4mm	1mm	4mm	16mm	64mm
A	8	43	78	85	93	100
B	11	37	79	87	95	100
C	12	39	74	83	93	100
D	5	12	39	55	84	100

Figure 4 Mean particle-size distribution for the mineral in the resource blocks.

Notes on the Resource Blocks

The district has been divided into four resource blocks containing a total of 23.4 km^2 of potentially workable sand and gravel (Table 4). The mineral has a mean recorded thickness of 7.3 m; the mean thickness of overburden is 4.8 m. The mineral grades as a 'clayey' pebbly sand with 10 per cent fines, 74 per cent sand and 16 per cent gravel. Outside the mineral-bearing ground, the barren plateau area is underlain by Boulder Clay more than 18 m thick, the mineral being largely confined to the valleys and interfluves. Mineral, exposed or beneath overburden, and non-mineral areas are

Table 4 Sand and gravel resources of the area.

Block	Area		Mean thickness			Volume of sand and gravel			Mean grading percentage		
	Block	Mineral	Overburden	Mineral	Waste		Limits at the 95% probability level		Fines $-\frac{1}{16}$ mm	Sand $+\frac{1}{16}$ -4 mm	Gravel +4 mm
	km^2	km^2	m	m	m	$m^3 \times 10^6$	± %	± $m^3 \times 10^6$			
A	53.9	4.2	9.1	10.9	1.0	46	52	24	8	77	15
B	24.1	9.6	3.6	7.2	0.0	69	28	19	11	76	13
C	21.1	8.7	3.4	5.5	1.3	48	37	18	12	71	17
D*	0.9	0.9	3.5	3.3	1.5	3	-	-	5	50	45
Total	100.0	23.4	4.8	7.3	0.7	17.1	22	38	10	74	16

* Confidence limits are not quoted for block D for which an inferred assessment is offered.

separated, where no geological boundary is present, by means of the standard (zig-zag) inferred boundary. Where the mineral concerned is the sub-Boulder Clay undifferentiated sands and gravels, this boundary commonly marks the limit of mineral with respect to the overburden ratio; as the thickness of these sands and gravels is relatively consistent, this boundary can be drawn with some confidence. However, where the mineral body is Glacial Sand and Gravel, for example at Mill Farm [636 345], Causeway End Farm [601 335] and Radwinter Hill Farm [618 372], the use of the inferred boundary arises from the lensing out of beds of sand and gravel (see sections accompanying the map) and the position of the boundary has been inferred on somewhat less definite evidence.

Block A This block covers a total area of 53.9 km^2 in the northern half of the district; its southern limit extends from Cornish Hall End [683 365] in the east, through Great Sampford to the northern limits of Thaxted parish 2.5 km south of Wimbush Green [605 351]. The ground in the north and east is covered by an extensive Boulder Clay sheet, which is commonly in excess of 20 m thick and has been proved to exceed 30 m in several places. Between the Chelmer and Pant valleys, the Boulder Clay is recorded as resting directly on bedrock (see borehole SW 30). To the south of Radwinter, thin non-mineral sequences of sand and gravel lie beneath and to a lesser degree within the Boulder Clay. Only at boreholes NW 29 and SW 25 do the sands and gravels thicken sufficiently to come within the 3:1 limiting overburden criterion. This potentially workable sand and gravel is delineated by an inferred boundary. A similar area, defined on the same criterion, was proved in the Chelmer valley by boreholes SW 6 and 14. These two areas along with the outcrop of Glacial Sand and Gravel to the south-west of the Pant valley at Hill Farm [641 349] have some connection with the buried glacial valley on the axis of which they lie. They form one of the more attractive resources of Glacial Sand and Gravel in the district, with relatively thick sequences of mineral containing a high proportion of gravel, although the overburden is generally thick, except in the Pant valley.

Potentially workable Glacial Sand and Gravel is also present, both exposed and beneath overburden, to the north-east of the Pant valley at Radwinter, as shown on the resource map. Borehole NW 14 proved the Glacial Sand and Gravel to be non-mineral due to an excessive distributed fines fraction, whilst borehole NW 15 proved a thin seam of Boulder Clay overlying the mineral; a small area of Boulder Clay is mapped immediately to the north-east. The large pit at Radwinter Hall Farm extracted sand and gravel from Glacial Sand and Gravel overlain by Boulder Clay.

At borehole NW 16 the mineral-bearing Glacial Sand and Gravel is underlain by Red Crag which proved to be non-mineral due to the effect of the thickness of an intercalated seam of Boulder Clay. However, it is considered that the Crag may well be regarded as mineral farther down the valley side as the full sequence of undifferentiated sands and gravels subcrops in a larger area just to the south-east of borehole NW 16. This body proved to be mineral to the north-east of the valley and it was also present, though as non-mineral, in boreholes NW 17 and 18. An inferred boundary is used to delimit the potentially workable area towards the bottom of the Pant valley where boreholes NW 24 and 34 show that the deposits have been removed by recent erosion. Boreholes NW 22, 33 and 35 proved these deposits to be about 20 m thick. The two pits at Great Sampford worked these deposits and there has been recent commercial interest in resuming operations in this general area. Away from the valley, to the north-east, the deposits tend to thin. Conversely, the overburden thickens in the same direction. The limit of mineral, as shown by the inferred boundary, was decided by the application of the 3:1 overburden ratio criterion.

Potentially workable sand and gravel covers a total area of 4.2 km^2 in this block. It is assessed on data from 11 boreholes of which 10 were drilled for this assessment. They proved a mean overburden thickness of 9.1 m and a mean mineral thickness of 10.9 m. The estimated volume of the resource is 46 million m^3 $\pm$ 52 per cent. The mineral grades as pebbly sand with a mean grading of fines 8 per cent, sand 77 per cent and gravel 15 per cent (Tables 4 and 5).

Block B Thaxted lies at the western side of this block which encompasses the southern part of the district. The block lies to the south of the River Pant and stretches from Little Sampford [653 336] in the north to Great Bardfield [676 305] and Waltham's Cross [695 305] in the east. This block has a total area of 24.1 km^2 of which 9.6 km^2 is mineral-bearing. Mineral occupies much of the eastern half of the block, and only three other small areas of mineral are present, all near Thaxted. The main resource in the block is the undifferentiated sands and gravels sequence which is exposed on the sides of the Pant valley and its tributary valleys and is overlain by Boulder Clay on the plateau areas. The inferred western boundary of the main resource was inserted on the basis of the thickness of the overburden. Borehole SW 27 proved 25 m of Boulder Clay overlying the Kesgrave Sands and Gravels. Outcrops of London Clay on the lower

Table 5 Block A: data from assessment boreholes.

Borehole	Recorded thickness (m)			Mean grading percentage						
	Over-burden	Mineral	Waste	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 -64 mm	Cobbles +64 mm
NW 15	1.3	1.3		6	5	16	20	27	26	
NW 16	6.5	2.5		19	9	20	16	26	10	
NW 22	7.5	22.0	0.3	8	56	32	1	2	1	
NW 28	4.5	9.2		7	52	41	trace	trace	trace	
NW 29	16.0	12.7	0.8	5	16	29	12	17	20	1
NW 32	16.0	6.9	1.9	10	24	41	11	7	7	
NW 33	3.6	21.1	3.1	8	39	43	4	3	3	
NW 35	14.2	11.0	5.3	12	31	40	11	3	3	trace
SW 6*	13.4	23.2		No data available						
SW 14	10.3	6.9		3	5	24	17	22	27	2
SW 25	6.3	2.7		17	11	15	14	27	15	1

* Auxiliary borehole.

Table 6 Block B: data from assessment boreholes.

Borehole	Recorded thickness (m)		Mean grading percentage						
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$ -1 mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 -64 mm	Cobbles +64 mm
SW 8d*	1.3	2.3	No data available						
SW 9*	1.2	12.2	No data available						
SW 22	2.5	5.5	15	7	22	15	26	15	trace
SW 23	7.1	9.8	6	27	62	4	1	trace	
SW 32	17.5	7.8	8	31	56	4	1		
SW 33	7.7	7.3	10	44	37	8	1	trace	
SW 35	9.8	10.1	7	30	52	9	2	trace	
SE 8*	0.0	5.0	No data available						
SE 14	1.6	1.1	20	9	17	18	23	13	
SE 15	1.3	9.2	27	9	20	10	17	17	
SE 16	1.0	8.6	16	41	26	5	5	6	1
SE 17	10.6	12.0	7	39	48	4	1	1	
SE 21	0.7	8.4	18	11	20	13	26	12	
SE 23	1.2	3.1	11	12	33	14	20	10	
SE 24	0.5	1.0	18	25	44	8	5		
SE 25	0.5	4.5	8	37	42	7	5	1	
SE 33	0.3	5.3	13	8	31	15	28	5	
SE 34	1.4	9.4	11	27	49	6	4	3	
SE 39	1.1	4.9	6	17	53	17	7	trace	
SE 44	4.3	17.0	6	28	55	6	3	2	trace

* Auxiliary boreholes

Table 7 Block C: data from assessment boreholes

Borehole	Recorded thickness (m)			Mean grading percentage					
	Over-burden	Mineral	Waste	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$ -1 mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 -64 mm
SE 26	0.3	2.9		23	13	23	8	17	16
SE 27	0.3	8.3	11.6	16	11	20	17	19	16
SE 28	0.8	4.6		17	9	21	14	26	13
SE 29	12.7	5.5		8	37	47	5	2	1
SE 30	0.8	1.6		38	22	20	6	11	3
SE 36	0.9	1.0		21	50	18	4	7	
SE 37	0.9	7.1	1.8	13	10	22	13	22	20
SE 38	1.5	8.4		9	49	38	2	1	1
SE 40	12.7	9.5		8	38	49	4	1	trace
SE 41	5.3	6.8	0.7	7	32	43	6	8	4
SE 42	1.0	4.3		5	29	55	7	3	1

valley slopes delimit the base of this resource and indicate that the thin deposits of Head and Alluvium on the valley floors are unlikely to be underlain by significant thicknesses of undifferentiated sands and gravels. An inferred boundary is used in places to delimit the mineral. The lower valley sides to the north-west of Great Bardfield are covered by a fairly continuous strip of potentially workable Glacial Sand and Gravel. This might be expected to overlie the adjacent undifferentiated sands and gravels but boreholes SE 21, 23 and 33 prove otherwise. Farther north, along the side of the Pant valley from Solomon's Farm [656 324], the undifferentiated sands and gravels are absent, although the Glacial Sand and Gravel continues, forming a narrow potentially workable tract adjacent to the Alluvium.

The area of the high plateau is barren. Borehole SW 31, at Star's Farm, Little Sampford, records Boulder Clay overlying bedrock and boreholes SW 3,10 and 24, north-east of Thaxted, show thin sequences of sands and gravels beneath excessively thick overburden. Glacial erosion in the Chelmer valley has removed any potential mineral deposits of the undifferentiated sands and gravels except in the extreme south-west where mineral bearing ground, outlined by an inferred boundary, is based on data from adjoining resource sheets (Hopson, 1982; Thomas, 1982). Near Prior Hall [615 301] borehole SW 23 proved 9.8 m of this mineral which probably relates to the outcrop further down the valley side. The outcrop of Glacial Sand and Gravel mapped to the north-east was proved by boreholes SW 9 and 22, from both of which over a metre of Boulder Clay was recorded, overlying the mineral. As a consequence, the mineral is considered to carry overburden. Two pits have worked this occurrence in the past but the whole area is now enclosed within the built up area of the small town of Thaxted.

Table 8 Block D: data from assessment boreholes.

Borehole	Recorded thickness (m)			Mean grading percentage						
	Over-burden	Mineral	Waste	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 -64 mm	Cobbles +64 mm
SW 29	1.9	4.6	4.5	5	8	24	16	29	18	trace
SE 2*	6.0	1.0		No data available						
SE 22	3.8	7.4	1.4	4	7	28	17	29	15	
SE 43	Absent									

* Auxiliary borehole

The mineral of this block averages 7.2 m in thickness and the overburden 3.6 m. The estimated volume of mineral, which occupies 9.6 km^2, is 69 million m^3 $\pm$ 8 per cent. The mean grading (Table 6) is fines 11 per cent, sand 76 per cent and gravel 13 per cent. The assessment is based on data from 17 IMAU boreholes and three auxillary borehole records.

Block C The potentially workable deposits in this block occupy 8.7 km^2 of the total area of 21.1 km^2. The block lies in the east of the district on the north and east of the River Pant and includes the village of Finchingfield in the south. It extends north as far as Cornish Hall End and west almost as far as Great Sampford. The southern part of the block is almost entirely mineral-bearing, but in the north the thickness of Boulder Clay generally exceeds 25 m. In this area, boreholes SE 3 and 18 proved Boulder Clay on bedrock and borehole SE 35 Alluvium on bedrock. Boreholes NE 18 and 20 proved respective thicknesses of 2.3 and 2.1 m of Glacial Sand and Gravel within the Boulder Clay, but both have been omitted from the assessment: borehole NE 20 because the overburden ratio exceeds 3:1 and NE 18 because it is an isolated data point and the high overburden ratio at this valley-bottom site is unlikely to become less beneath the Boulder Clay plateau of the area.

The undifferentiated sands and gravels proved to be mineral in the south-east of the block, in IMAU boreholes SE 38, 40, 41 and 42, both beneath cover and where they are exposed. Inferred boundaries are used to the north of Finchingfield and also in the south-east, where deposits of Head mask the contact with the underlying London Clay. An isolated deposit of Crag was also proved to be mineral in borehole SE 29; this may correlate, at least in part, with the mapped outcrop of undifferentiated sands and gravels in the Pant valley to the south-west. To the south-east, this outcrop abuts that of the Glacial Sand and Gravel which was proved to be mineral in borehole SE 30, though it is of limited thickness (1.6 m) and of 'very clayey' lithology. This deposit of Glacial Sand and Gravel appears to rest on the side of the valley and is likely to post-date the Boulder Clay, since the adjacent borehole, SE 31, proved bedrock at the surface. The evidence from borehole SE 32 indicates a barren area from which the undifferentiated sands and gravels have been removed and the Glacial Sand and Gravel, as mapped, has been classified as non-mineral because only 0.6 m of sand and gravel was proved.

A third area of resources within this block is also formed of Glacial Sand and Gravel. The mineral is exposed on the plateau to the west of the tributary valley at Finchingfield and it was also proved at depth in boreholes SE 27, 37 and 41 beneath waste or overburden of Boulder Clay.

On average the mineral of this block is 5.5 m thick and the overburden 3.4 m thick. The calculations are based on data from 11 IMAU boreholes. The mineral forms a 'clayey' pebbly sand overall with a mean grading of fines 12 per cent, sand 71 per cent and gravel 17 per cent (Table 7). The calculated total volume of the resouce is 48 million m^3 $\pm$ 37 per cent, at the 95 per cent probability level.

Block D This block is drawn around the narrow sinuous belt of Alluvium on the floor of the Pant valley to the south-east of Great Sampford. It has a total area of only 0.9 km^2 and the resource is considered to be discontinuous beneath overburden. The assessment is based on four borehole records (three from IMAU boreholes) of which only two proved mineral. As a consequence the assessment is at the inferred level (see Appendix B).

The mineral and non-mineral data points alternate and are fairly evenly distributed along the length of the deposit. The mean thickness of the mineral is 3.3 m and that of the overburden, 3.5 m. Borehole SW 29 proved 2.6 m of alluvial gravel beneath 1.9 m of alluvial sandy silt. This was underlain in turn by 4.5 m of Boulder Clay and 2.0 m of Glacial Sand and Gravel which was classified as mineral and included in the assessment of the resource. This borehole is the only one in the district in which the alluvial sequence does not directly overlie bedrock. To the south-east, non-IMAU borehole SE 2 at Gambers Hall [657 329] proved 6 m of alluvial silts resting on 1 m of alluvial gravel. Farther down-stream, at Beslyns [668 317], assessment borehole SE 22 proved a thick alluvial sequence of 3.8 m of overburden resting on 7.4 m of mineral split by a 1.1-m waste parting. Borehole SE 43, at Sculpins Bridge [693 310], proved 2.1 m of alluvium silt and clay overlying bedrock but with no sub-alluvial gravels.

This small block has an inferred volume of only 3 million m^3 of mineral. No confidence limits are given because there are so few data points. The mineral grades as a sandy gravel, with fines 5 per cent, sand 50 per cent and gravel 45 per cent (Table 8). Although samples were available from only two boreholes, the proportion of gravel grades is the highest for any deposit in the district. Chalk constitutes 10 per cent of the gravel, by weight.

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APPENDIX A

FIELD AND LABORATORY PROCEDURES

Trial and error during initial studies of the complex and variable glacial deposits of East Anglia and Essex showed that an absolute minimum of five sample points evenly distributed across the sand and gravel are needed to provide a worthwhile statistical assessment, but that, where possible, there should be not less than ten. Sample points are any points for which adequate information exists about the nature and thickness of the deposit and may include boreholes other than those drilled during the survey and exposures. In particular, the cooperation of sand and gravel operators ensures that boreholes are not drilled where reliable information is already available; although this may be used in the calculations, it is held confidentially by the Institute and cannot be disclosed.

The mineral shown on each 1:25 000 sheet is divided into resource blocks. The arbitrary size selected is a compromise to meet the aims of the survey by providing sufficient sample points in each block. As far as possible the block boundaries are determined by geological boundaries so that, for example, glacial and river terrace gravels are separated. Otherwise division is by arbitrary lines, which may bear no relationship to the geology. The blocks are drawn provisionally before drilling begins.

A reconnaissance of the ground is carried out to record any exposures and inquiries are made to ascertain what borehole information is available. Borehole sites are then selected to provide an even pattern of sample points at a density of approximately one per square kilometre. However, because broad trends are independently overlain by smaller-scale characteristically random variations, it is unnecessary to adhere to a square grid pattern. Thus such factors as ease of access and the need to minimise disturbance to land and the public are taken into account in siting the holes; at the same time it is necessary to guard against the possibility that ease of access (that is, the positions of roads and farms) may reflect particular geological conditions, which may bias the drilling results.

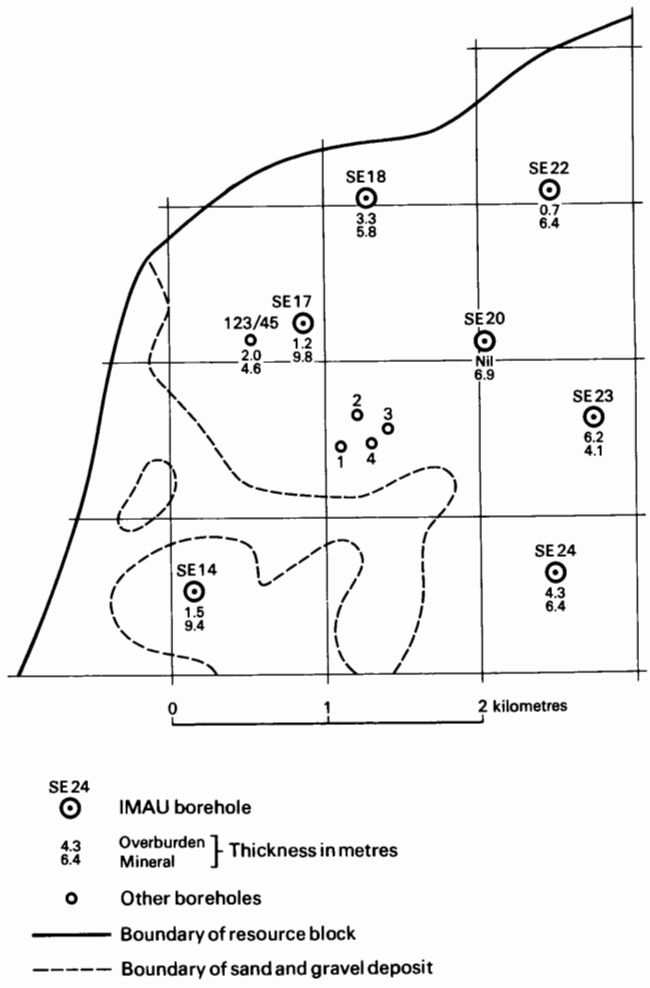
The drilling machine employed should be capable of providing a continuous sample representative of all unconsolidated deposits, so that the in-situ grading can be determined, if necessary, to a depth of 30 m (100 ft) at a diameter of about 200 mm (8 in), beneath different types of overburden. It should be reliable, quiet, mobile and relatively small (so that it can be moved to sites of difficult access). Shell and auger rigs have proved to be almost ideal.

The rigs are modified to enable deposits above the water table to be drilled 'dry', instead of with water added to facilitate the drilling, to minimise the amount of material drawn in from outside the limits of the hole. The samples thus obtained are representative of the in-situ grading, and satisfy one of the most important aims of the survey. Below the water table the rigs are used conventionally, although this may result in the loss of some of the fines fraction and the pumping action of the bailer tends to draw unwanted material into the hole from the sides or the bottom.

A continuous series of bulk samples is taken throughout the sand and gravel. Ideally samples are composed exclusively of the whole of the material encountered in the borehole between stated depths. However, care is taken to discard, as far as possible, material which has caved or has been pumped from the bottom of the hole. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel, or at every 1 m (3.3 ft) depth. The samples, each weighing between 25 and 45 kg (55 and 100 lb), are despatched in heavy-duty polythene bags to a laboratory for grading. The grading procedure is based on B.S. 1337 (British Standards Institution, 1967). Random checks of the accuracy of the grading are made in the Institute's laboratories.

All data, including mean grading analysis figures calculated for the total thickness of the mineral, are entered on standard record sheets, abbreviated copies of which are reproduced in Appendix E.

Detailed records may be consulted at the appropriate offices of the Institute, upon application to the Head, Industrial Minerals Assessment Unit.



Example of resource block assessment: map of a fictitious block

APPENDIX B

STATISTICAL PROCEDURE

Statistical assessment

1 A statistical assessment is made of an area of mineral greater than 2 km², if there are at least five evenly spaced boreholes in the resource block (for smaller areas, see Paragraph 12 below).

2 The simple methods used in the calculations are consistent with the amount of data provided by the survey (Hull, 1981). Conventional symmetrical confidence limits are calculated for the 95 per cent probability level, that is, on average nineteen out of every twenty sets of limits constructed in this way contain the true value for the volume of mineral.

3 The volume estimate (V) for the mineral in a given block is the product of two variables, the sampled areas (A) and the mean thickness ($\bar{l}_m$) calculated from the individual thicknesses at the sample points. The standard deviations for these variables are related such that

$$S_V = \sqrt{(S_A^2 + S_{\bar{l}_m}^2)} \qquad [1]$$

4 The above relationship may be transposed such that

$$S_V = S_{\bar{l}_m} \sqrt{(1 + S_A^2 / S_{\bar{l}_m}^2)} \qquad [2]$$

From this it can be seen that as $S_A^2 / S_{\bar{l}_m}^2$ tends to 0, S_V tends to $S_{\bar{l}_m}$.

If, therefore, the standard deviation for area is small with respect to that for thickness, the standard deviation for volume approximates to that for mean thickness.

5 Given that the number of approximately evenly spaced sample points in the sampled area is n with mineral thickness measurements $l_{m_1}, l_{m_2}, \ldots l_{m_n}$, then the best estimate of mean thickness, $\bar{l}_m$, is given by

$$\Sigma (l_{m_1} + l_{m_2} \ldots l_{m_n}) / n .$$

For groups of closely spaced boreholes a discretionary weighting factor may be applied to avoid bias (see note on weighting below). The standard deviation for mean thickness $S_{\bar{l}_m}$, expressed as a proportion of the mean thickness, is given by

$$S_{\bar{l}_m} = (1/\bar{l}_m) \sqrt{[\Sigma (l_m - \bar{l}_m)^2/(n-1)]}$$

where l_m is any value in the series l_{m_1} to l_{m_n}.

6 The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of a deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness. The relationship $S_A / S_{\bar{l}_m} \leqq 0.\dot{3}$ is assumed in all cases. It follows from Equation [2] that

$$S_{\bar{l}_m} \leqq S_V \leqq 1.05\, S_{\bar{l}_m} \qquad [3]$$

7 The limits on the estimate of mean thickness of mineral, $L_{\bar{l}_m}$, may be expressed in absolute units $\pm (t/\sqrt{n}) \times S_{\bar{l}_m}$ or as a percentage $\pm (t/\sqrt{n}) \times S_{\bar{l}_m} \times (100/\bar{l}_m)$ per cent, where t is Student's t at the 95 per cent probability level for $(n-1)$ degrees of freedom, evaluated by reference to statistical tables. (In applying Student's t it is assumed that the measurements are distributed normally).

8 Values of t at the 95 per cent probability level for values of n up to 20 are as follows:

n	t	n	t
1	infinity	11	2.228
2	12.706	12	2.201
3	4.303	13	2.179
4	3.182	14	2.160
5	2.776	15	2.145
6	2.571	16	2.131
7	2.447	17	2.120
8	2.365	18	2.110
9	2.306	19	2.101
10	2.262	20	2.093

(from Table 12 in *Biometrika Tables for Statisticians*, Volume 1, Second Edition, Cambridge University Press, 1962). When n is greater than 20, 1.96 is used (the value of t when n is infinity).

9 In calculating confidence limits for volume, L_V, the following inequality, corresponding to Equation [3], is applied:

$$L_{\bar{l}_m} \leqq L_V \leqq 1.05\, L_{\bar{l}_m}.$$

10 In summary, for values of n between 5 and 20, L_V is calculated as

$$[(1.05 \times t)/\bar{l}_m] \times [\sqrt{\Sigma (l_m - \bar{l}_m)^2/n\ (n-1)}] \times 100$$

per cent,

and when n is greater than 20, as

$$[(1.05 \times 1.96)/\bar{l}_m] \times [\sqrt{\Sigma (l_m - \bar{l}_m)^2/n\ (n-1)}] \times 100$$

per cent.

11 The application of this procedure to a fictitious area is illustrated in the accompanying Figure and example of a block calculation.

Inferred assessment

12 If the sampled area of mineral in a resource block is between 0.25 km² and 2 km², an assessment is inferred on the basis of geological and topographical information, usually supported by the data from one or two boreholes. The volume of mineral is calculated as the product of the area, measured from field data, and the estimated thickness. Confidence limits are not calculated.

13 In some cases a resource block may include an area left uncoloured on the map, within which mineral (as defined) is interpreted to be generally absent. If there is reason to believe that some mineral may be present, an inferred assessment may be made.

14 No assessment is attempted for an isolated area of mineral less than 0.25 km².

15 Note on weighting The thickness of a deposit at any point may be governed solely by the position of the point in relation to a broad trend. However, most sand and gravel deposits also exhibit a random pattern of local, and sometimes considerable, variation in thickness. Thus the distribution of sample points needs to be only approximately regular and in estimating the mean thickness only simple weighting is necessary. In practice, equal weighting can often be applied to thicknesses at all sample points. If, however, there is a distinctly unequal distribution of points, bias is avoided by dividing the sampled area into broad zones, to each of which a value roughly proportional to its area is assigned. This value is then shared between the data points with the zone as the weighting factor.

Block calculation

Scale: 1:25 000
Block: Fictitious

Area
Block: 11.08 km²
Mineral: 8.32 km²

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m³
Mineral: 54 million m³

Confidence limits of the estimate of mineral volume at the 95 per cent probability level: ± 20 per cent
That is, the volume of mineral (with 95 per cent probability): 54 ± 11 million m³

Thickness estimate (measurements in metres)
l_o= overburden thickness l_m = mineral thickness

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	IMAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	
123/45	½	2.0		4.6		Hydrogeology Unit record
1	¼	2.7	2.6	7.3	5.8	Close group of four boreholes (commercial)
2	¼	4.5		3.2		
3	¼	0.4		6.8		
4	¼	2.8		5.9		
Totals	$\Sigma w = 8$	$\Sigma wl_o = 20.2$		$\Sigma wl_m = 52.0$		
Means		$\overline{wl}_o = 2.5$		$\overline{wl}_m = 6.5$		

Calculation of confidence limits

wl_m	$\lvert(wl_m - \overline{wl}_m)\rvert$	$(wl_m - \overline{wl}_m)^2$
9.4	2.9	8.41
5.8	0.7	0.49
6.9	0.4	0.16
6.4	0.1	0.01
4.1	2.4	5.76
6.4	0.1	0.01
7.2	0.7	0.49
5.8	0.7	0.49

$\Sigma(wl_m - \overline{wl}_m)^2 = 15.82$

$n = 8$

t = 2.365

L_Y is calculated as

$1.05\ (t/\overline{wl}_m)\ \sqrt{[\Sigma(wl_m - \overline{wl}_m)^2 / n(n-1)]} \times 100$

$= 1.05 \times (2.365/6.5)\ \sqrt{[15.82/(8 \times 7)]} \times 100$

$= 20.3$

$\simeq 20$ per cent.

APPENDIX C

CLASSIFICATION AND DESCRIPTION OF SAND AND GRAVEL

For the purposes of assessing resources of sand and gravel a classification should take account of economically important characteristics of the deposit, in particular the absolute content of fines and the ratio of sand to gravel.

The terminology commonly used by geologists when describing sedimentary rocks (Wentworth, 1922) is not entirely satisfactory for this purpose. For example, Wentworth proposed that a deposit should be described as a 'gravelly sand' when it contains more sand than gravel and there is at least 10 per cent of gravel, provided that there is less than 10 per cent of material finer than sand (< $\frac{1}{16}$ mm) and coarser than pebbles (> 64 mm in diameter). Because deposits containing more than 10 per cent fines are not embraced by this system, a modified binary classification based on Willman (1942) has been adopted.

When the fines content exceeds 40 per cent the material is considered to be not potentially workable and falls outside the definition of mineral. Deposits which contain 40 per cent fines or less are classified primarily on the ratio of sand to gravel but qualified in the light of the fines content, as follows: less than 10 per cent fines - no qualification; 10 per cent or more but less than 20 per cent fines - 'clayey'; 20 to 40 per cent fines - 'very clayey'.

The term 'clay' (as written, with single quote marks) is used to describe all material passing $\frac{1}{16}$ mm. Thus it has no mineralogical significance and includes particles falling within the size range of silt. The normal meaning applies to the term clay where it does not appear in single quotation marks.

The ratio of sand to gravel defines the boundaries between sand, pebbly sand, sandy gravel and gravel (at 19:1, 3:1 and 1:1).

Thus it is possible to classify the mineral into one of twelve descriptive categories (see the accompanying Figure). The procedure is as follows:

1 Classify according to the ratio of sand to gravel.
2 Describe the fines.

For example, a deposit grading 11 per cent gravel, 70 per cent sand and 19 per cent fines is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Appendix D)

Many differing proposals have been made for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the $\frac{1}{16}$-mm size, which approximates to the generally accepted boundary between silt and sand. These and other requirements are met by a system based on Udden's geometric scale and a simplified form of Wentworth's terminology (see the accompanying table), which is used in the Report.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the qualitative assessments of the resource blocks. Three sizes of sand are recognised, fine (+$\frac{1}{16}$ -$\frac{1}{4}$ mm), medium (+$\frac{1}{4}$ -1 mm) and coarse (+1 -4 mm). The boundary at 16 mm distinguishes a range of finer gravel (+4 -16 mm), often characterised by abundance of worn tough pebbles of vein quartz, from larger pebbles, often of notably different materials. The boundary at 64 mm distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

The size distribution of borehole samples is determined by sieve analysis, which is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standards Institution, 1967). In this report the grading is tabulated on the borehole record sheets (Appendix E), the intercepts corresponding with the simple geometric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

Each bulk sample is described, subjectively, by a geologist at the borehole site. Being based on visual examination, the description of the grading is inexact, the accuracy depending on the experience of the observer. The descriptions recorded are modified, as necessary, when the laboratory results become available.

The relative proportions of the rock types present in the gravel fraction are indicated by the use of the words 'and' or 'with'. For example, 'flint and quartz' indicates roughly equal proportions with neither constituent accounting for less than about 25 per cent of the whole; 'flint with quartz' indicates that flint is dominant and quartz, the principal accessory rock type, comprises 5 to 25 per cent of the whole. Where the accessory material accounts for less than 5 per cent of the whole, but is still readily apparent, the phrase 'with some' has been used. Rare constitutents are referred to as 'trace'.

The terms used in the field to describe the degree of rounding of particles, which is concerned with the sharpness of the edges and corners of a clastic fragment and not the shape (after Pettijohn, 1975), are as follows.

Angular: showing little or no evidence of wear; sharp edges and corners.

Subangular: showing definite effects of wear. Fragments still have their original form but edges and corners begin to be rounded off.

Subrounded: showing considerable wear. The edges and corners are rounded off to smooth curves. Original grain shape is still distinct.

Rounded: original faces almost completely destroyed, but some comparatively flat surfaces may still remain. All original edges and corners have been smoothed off to rather broad curves. Original shape is still apparent.

Well rounded: not original faces, edges or corners left. The entire surface consists of broad curves; flat areas are absent. The original shape is suggested by the present form of the grain.

Classification of gravel, sand and fines

Size limits	Grain-size description	Qualification	Primary classification
	Cobble		
64 mm			
		Coarse	Gravel
16 mm	Pebble		
		Fine	
4 mm			
		Coarse	
1 mm			
	Sand	Medium	Sand
$\frac{1}{4}$ mm			
		Fine	
$\frac{1}{16}$ mm			
	Fines (silt and clay)		Fines

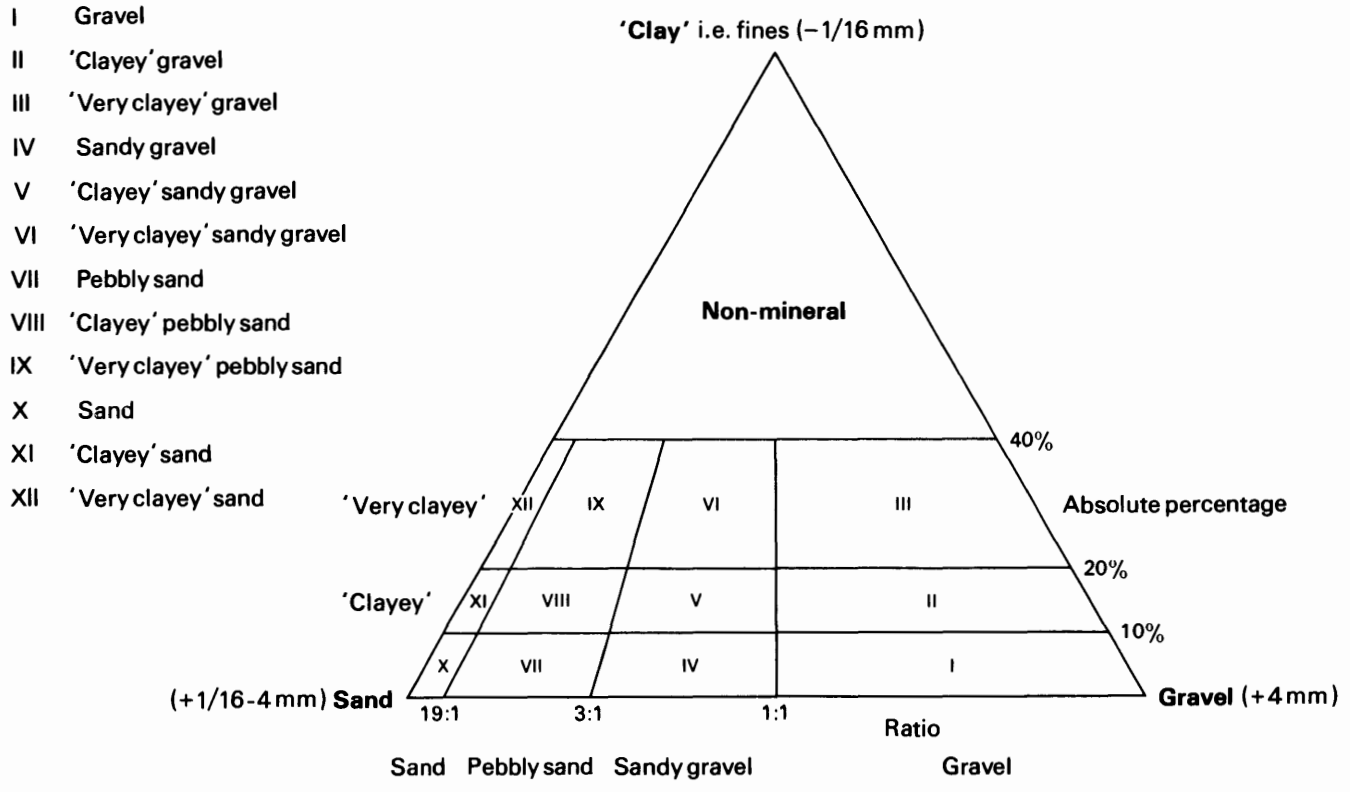


Diagram showing the descriptive categories used in the classification of sand and gravel

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated fictitious example

CK 66 NW 5[1] **6191 6962**[2] **Northfields**[3] **Block B**

Surface level +49.7 m[4]
Water struck at +45.9 m[5]
October 1972[6]

Overburden[7] 2.8 m
Mineral 5.4 m
Waste 1.1 m
Mineral 1.4 m
Bedrock 0.7 m+[8]

LOG

Geological classification	Lithology[9]	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, silty, dark brown	2.6	2.8
River Terrace Deposits	**a** Gravel Gravel: fine to coarse, with cobbles towards base, angular to rounded flint and limestone with ironstone and some quartz and chalk Sand: medium with coarse and some fine, quartz and limestone	5.4	8.2
Boulder Clay	Clay, sandy and pebbly, red-brown	1.1	9.3
Glacial Sand and Gravel	**b** Sand, 'clayey' in part: fine, subangular to rounded, quartz with some coal	1.4	10.7
Lias	Mudstone, blue-grey, fossiliferous	0.7+	11.4

GRADING[10]

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	5	46	49	2.8-3.9	20	14	62	2	2	0	0
				3.8-4.8	2	2	12	18	42	24	0
				4.8-5.8	1	3	24	13	35	24	0
				5.8-6.8	0	4	21	20	26	29	0
				6.8-8.2	4	3	23	10	23	30	7
				Mean	**5**	**5**	**28**	**13**	**25**	**22**	**2**
b	5	95	0	9.3-10.3	3	73	23	1	0	0	0
				10.3-10.7	9	85	5	1	0	0	0
				Mean	**5**	**77**	**17**	**1**	**0**	**0**	**0**
a+b	**5**	**56**	**39**	**Mean**	**5**	**20**	**26**	**10**	**20**	**17**	**2**

COMPOSITION[11]

Depth below surface (m)	percentages by weight in the +4 mm fraction					
	Flint	Quartz	Limestone	Chalk	Ironstone	Others
3.8-4.8	40	5	50	1	3	1
4.8-5.8	38	3	45	5	8	1
5.8-6.8	45	2	42	5	6	0
6.8-8.2	18	6	61	3	11	1
Mean	**34**	**4**	**51**	**3**	**7**	**1**

The numbered paragraphs below correspond with the annotations given on the specimen record opposite.

1 Borehole Registration Number
Each Industrial Minerals Assessment Unit (IMAU) borehole is identified by a Registration Number. This consists of two statements.

a The number of the 1:25 000 sheet on which the borehole lies, here CK 66.
b The quarter of the 1:25 000 sheet on which the borehole lies and the number of the borehole in a series for that quarter, here NW 5.

Thus the full Registration Number is CK 66 NW 5.

2 National Grid Reference
All National Grid References fall in the 100 km square identified by the first two letters of the Registration Number. Grid references are given to eight figures, accurate to within 10 m.

3 Location
The position of the borehole is generally referred to the nearest named locality on the 1:25 000 base map and the resource block in which the borehole lies is stated.

4 Surface level
The surface level at the borehole site is given in metres above Ordnance Datum.

5 Groundwater conditions
If groundwater was present the level at which it was encountered is normally given (in metres relative to Ordnance Datum).

6 Type of drill and date of drilling
Unless otherwise stated, a modified shell and auger rig, in conjunction with 152 mm diameter casing, was used. The month and year of completion of drilling are stated.

7 Overburden, mineral, waste and bedrock
Mineral is sand and gravel which, as part of a deposit, falls within the arbitrary definition of potentially workable material (see p. 1). Bedrock is the 'formation', 'country rock' or 'rock head' below which potentially workable sand and gravel will not be found. Waste is any material other than bedrock or mineral. Where waste occurs between the surface and mineral it is classified as overburden.

8 The plus sign (+) indicated that the base of the deposit was not reached during drilling.

9 Lithological description
When sand and gravel is recorded a general description based on the grading characteristics (for details see Appendix C) is followed by more detailed particulars. Where more than one bed of mineral is recognised each is designated by a letter, e.g. **a, b,** etc. The description of other deposits is based on visual examination in the field.

10 Grading data
A continuous series of bulk samples is taken throughout the thickness of sand and gravel. A new sample is commenced whenever there is an appreciable lithological change or at every 1 m of depth.

For each bulk sample the percentages of fines ($-\frac{1}{16}$ mm), fine sand ($+\frac{1}{16}$-$\frac{1}{4}$ mm), medium sand ($+\frac{1}{4}$-1 mm), coarse sand (+1-4 mm), fine gravel (+4-16 mm), coarse gravel (+16-64 mm) and cobble gravel (+64 mm) are stated. Due to the diameter of the boreholes (152 mm), gravel larger than 64 mm, which is rarely present in the Thaxted district, is likely to be unrepresentatively sampled.

The mean grading of groups of samples making up an identified bed of mineral are also given in detail and in summary. Where more than one bed is recognised the mean grading for the whole of the mineral in the borehole may be given. Where necessary, in calculating mean gradings, data for individual samples are weighted by the thickness represented.

Fully representative sampling of sand and gravel is difficult to achieve, particularly where groundwater levels are high. Comparison between boreholes and adjacent exposures commonly suggests that in borehole samples the proportion of sand may be higher and the proportion of fines and coarse gravel may be lower.

11 Composition
Details of the composition of selected samples or groups of samples may be given. In Appendix E, the category 'Angular Flint' includes flint ranging from angular to sub-rounded.

APPENDIX E

INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLE RECORDS

TL 63 NW 11 **6053 3913** **Paynes Farm** **Block A**

Surface level +94.1 m
Water struck at +87.2 m and +86.1 m
July 1981

Waste 20.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with flint pebbles, becoming grey with pebbles of chalk from 0.9 m	6.7	6.9
Glacial Sand and Gravel	**a** Clayey sandy gravel Gravel: coarse and fine, rounded chalk with subangular limestone and angular flint Sand: medium and coarse with fine, mostly chalk with quartz, light grey	0.1	7.0
Boulder Clay	Clay, grey, with chalk and some flint pebbles	1.0	8.0
Glacial Sand and Gravel	**b** Sandy gravel Gravel: fine and coarse, rounded chalk with subangular limestone and angular flint Sand: coarse and medium with fine, largely chalk, light grey	0.9	8.9
Boulder Clay	Clay, grey, with chalk pebbles and chalky sand seams at 15.2 m and 16.0 m	11.1+	20.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	15	51	34	6.9-7.0	15	11	22	18	16	18	0
b	9	50	41	8.0-8.9	9	8	20	22	27	14	0
a+b	**9**	**51**	**40**	**Mean**	**9**	**9**	**20**	**22**	**26**	**14**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartzite	Sandstone	Limestone	Fossil debris	Ironstone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	8.0-8.9	0	4	10	61	1	2	1	15	3	3	0	trace

TL 63 NW 12 **6045 3823** **Lower House** **Block A**

Surface level +88.0 m
Water struck at +81.2 m and +75.0 m
July 1981

Waste 22.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, mottled orange-brown and light grey, with chalk pebbles	0.6	0.8
	Silt, sandy, brown with some pebbles	0.4	1.2
	Clay, mottled brown and grey, with chalk pebbles, becoming grey from 3.5 m	5.3	6.5
	Clay, silty, laminated	0.3	6.8
Glacial Sand and Gravel	**a** Gravel Gravel: fine and coarse, angular flint and rounded chalk with limestone and sandstone Sand: coarse and medium with some fine, chalk and flint, light grey	1.6	8.4
Boulder Clay	Clay, grey, with pebbles of chalk and some flint	4.6	13.0
Glacial Sand and Gravel	**b** Clayey sandy gravel Gravel: fine and coarse, angular flint and rounded chalk with limestone and sandstone Sand: coarse and medium with fine, chalk and flint, light grey	0.5	13.5
Boulder Clay	Clay, grey, with pebbles of chalk and some flint	8.5+	22.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	3	38	59	6.8-7.8	2	2	18	21	36	21	0
				7.8-8.4	3	2	13	17	37	28	0
				Mean	**3**	**2**	**16**	**20**	**36**	**23**	**0**
b	14	48	38	13.0-13.5	14	10	16	22	25	13	0
a+b	**5**	**40**	**55**	**Mean**	**5**	**4**	**16**	**20**	**34**	**21**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartzite	Sandstone	Limestone	Fossil debris	Ironstone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	6.8-8.4	0	15	22	34	trace	1	6	14	1	3	1	3

TL 63 NW 13 **6054 3823** **Lower House** **Block A**

Surface level +86.1 m
Water not struck
July 1981

Waste	2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.9	0.9
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles.	1.1+	2.0
	Borehole terminated because adequate local data available at depth.		

TL 63 NW 14 **6042 3785** **Radwinter** **Block A**

Surface level +85.3 m
Water struck at +61.3 m
July 1981

Waste	24.0 m
Bedrock	2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, silty, sandy, dark brown, with scattered fine pebbles of flint and chalk	0.2	0.5
Glacial Sand and Gravel	Clay, sandy, yellow-brown, with pebbles of flint and chalk	1.5	2.0
Boulder Clay	Clay, mottled grey and orange-brown, with chalk pebbles, becoming grey from 3.0 m	22.0	24.0
Upper Chalk	Chalk, soft	2.0+	26.0

TL 63 NW 15 **6099 3759** **Radwinter** **Block A**

Surface level +87.0 m
Water struck at +85.2 m
July

Overburden	1.3 m
Mineral	1.3 m
Waste	9.2 m
Bedrock	1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown, with pebbles of chalk and some flint	0.9	1.3
Glacial Sand and Gravel	Gravel Gravel: fine and coarse, angular flint with some rounded sandstone and angular ironstone Sand: coarse and medium with fine, flint quartz and chalk	1.3	2.6
	Clay, sandy, brown, with pebbles of chalk and flint	1.4	4.0
Boulder Clay	Clay, grey, with chalk pebbles	7.8	11.8
Upper Chalk	Chalk	1.0+	12.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
6	41	53	1.3-2.6	6	5	16	20	27	26	0

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
1.3-2.6	0	71	16	0	trace	4	4	0	0	3	1	1

TL 63 NW 16 **6181 3724** **Radwinter Hill Farm** **Block A**

Surface level +98.0 m
Water struck at +86.5 m
July 1981

Overburden 6.5 m
Mineral 2.5 m
Waste 11.5 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.5	0.5
Boulder Clay	Clay, brown, with pebbles of chalk and flint	4.9	5.4
Glacial Silt	Silt, grey, laminated	1.1	6.5
Glacial Sand and Gravel	**a** 'Clayey' sandy gravel Gravel: fine and coarse mainly angular flint and rounded chalk Sand: medium and coarse with fine	2.5	9.0
Boulder Clay	Clay, brown, with chalk and flint pebbles	2.5	11.5
Glacial Sand and Gravel	**b** 'Very clayey' sand Gravel: coarse and fine Sand: fine and medium with some coarse, red-brown	0.6	12.1
Boulder Clay	Clay, brown, with chalk pebbles, becoming olive grey from 12.7 m	5.6	17.7
	Silt, sandy, laminated	0.5	18.2
Crag	**c** Pebbly sand Gravel: fine with coarse, angular and well rounded flint with rounded quartz and quartzite Sand: medium and fine with coarse, quartz with some flint in the coarse fraction	2.2	20.4
	Clay, sandy, brown, with flint pebbles	0.1	20.5
Upper Chalk	Chalk	1.0+	21.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
					Fines	Sand			Gravel		
	Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	19	45	36	6.5-7.5	21	10	20	17	24	8	0
				7.5-8.5	19	10	25	17	21	8	0
				8.5-9.0	15	7	11	14	35	18	0
				Mean	**19**	**9**	**20**	**16**	**26**	**10**	**0**
b	25	72	3	11.5-12.1	25	39	31	2	1	2	0
c	5	87	8	18.2-19.2	6	43	41	6	4	0	0
				19.2-20.4	4	8	60	17	8	3	0
				Mean	**5**	**24**	**51**	**12**	**6**	**2**	**0**
a+b+c	**14**	**65**	**21**	**Mean**	**14**	**19**	**33**	**13**	**15**	**6**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	6.5-9.0	0	45	10	31	1	2	2	6	2	trace	0	1
c	18.2-20.4	33	29	13	0	13	9	1	0	0	2	0	trace

TL 63 NW 17 **6121 3682** **Near Radwinter** **Block A**

Surface level +89.8 m
Water struck at +70.0 m
July 1981

Waste 19.8 m
Bedrock 2.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 7.0 m	16.7	17.0
Crag	Clay, sandy, with some large flint pebbles	1.0	18.0
	'Very clayey' pebbly sand Gravel: fine and coarse with cobbles, angular flint with rounded quartz, well rounded flint and rounded quartzite Sand: medium and fine with coarse, quartz	1.8	19.8
Upper Chalk	Chalk, soft	2.2+	22.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
				Fines	Sand			Gravel		
Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
30	57	13	18.0-19.0	27	26	26	4	8	5	4
			19.0-19.8	30	27	30	4	6	3	0
			Mean	**30**	**26**	**27**	**4**	**7**	**4**	**2**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
18.0-19.8	15	34	15	2	20	11	1	0	trace	2	0	trace

TL 63 NW 18 6129 3581 Little Brockholds **Block A**

Surface level +96.4 m
Water struck at +77.6 m
July 1981

Waste 18.8 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown with scattered flints, becoming mottled orange-brown to light grey with additional pebbles of chalk from 1.0 m	0.8	1.2
	Clay, sandy, yellow brown with many chalk pebbles	0.4	1.6
	Clay, grey, with pebbles of chalk, shale and flint	13.2	14.8
Kesgrave Sands and Gravels	**a** 'Clayey' sand Sand: medium and fine, subrounded quartz, pale yellow	1.0	15.8
Crag	**b** Pebbly sand with 'clayey' seams Gravel: fine and coarse, angular and well rounded flint with rounded quartz and quartzite and angular ironstone Sand: coarse with fine and medium subrounded quartz, becoming iron-stained with depth	3.0	18.8
Upper Chalk	Chalk, soft	1.4+	20.2

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	11	89	0	14.8-15.8	11	28	61	trace	trace	0	0
b	7	83	10	15.8-16.8	7	19	72	2	0	0	0
				16.8-17.6	6	14	75	3	2	0	0
				17.6-18.8	7	15	42	13	16	7	0
				Mean	**7**	**16**	**61**	**6**	**7**	**3**	**0**
a+b	8	85	7	14.8-18.8	8	19	61	5	5	2	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	15.8-18.8	35	25	17	0	7	6	trace	1	trace	6	2	1

TL 63 NW 19 6248 3972 Park Farm **Block A**

Surface level +110.0 m
Water not struck
July 1981

Waste 20.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.5	0.5
Boulder Clay	Clay, brown with flints, becoming mottled orange-brown and light grey with additional pebbles of chalk from 0.6 m. Passing down into grey from 3.5 m	19.5+	20.0

TL 63 NW 20 6256 3873 Wincelow Hall **Block A**

Surface level +100.4 m
Water struck at +84.9 m
July 1981

Waste 28.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with pebbles of chalk and some flint limestone and shale, becoming grey from 3.6 m	15.3	15.5
Glacial Sand and Gravel	Gravel, composed solely of chalk	0.2	15.7
Boulder Clay	Clay, grey, with pebbles of chalk and some flint, limestone and shale	12.3+	28.0

TL 63 NW 21 6256 3788 Hill Farm **Block A**

Surface level +104.8 m
Water not struck
July 1981

Waste 26.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 4.4 m	25.2	25.6
Kesgrave Sands and Gravels	Sand: fine with medium, quartz pale, yellow	0.7+	26.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
6	94	0	25.6-26.3	6	88	6	0	0	0	0

TL 63 NW 22 **6230 3682** **Near Anser Gallow's Farm** **Block A**

Surface level +88.8 m
Water struck at +71.0 m
July 1981

Overburden	7.5 m
Mineral	4.0 m
Waste	0.3 m
Mineral	18.0 m
Bedrock	1.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, brown, with scattered flint pebbles, becoming mottled from 0.7 m. Passing down into grey from 3.5 m	6.4	6.5
	Clay, sandy, orange-brown, with many chalk pebbles	1.0	7.5
Glacial Sand and Gravel	**a** 'Clayey' pebbly sand Gravel: found largely above 8.4m, fine with coarse, rounded chalk and angular flint with sandstone and limestone Sand: medium with fine and coarse, quartz with chalk in the coarser grades, grey-yellow	4.0	11.5
	Clay, silty, orange-brown, laminated with sand partings	0.3	11.8
Kesgrave Sands and Gravels	**b** Sand with 'clayey' seams Sand: fine and medium, subrounded quartz, orange becoming brown-orange from 19.8 m	15.0	26.8
Crag	**c** Sand Gravel: coarse with fine, mostly angular flint with some well rounded flint Sand: fine with medium and some coarse, subrounded quartz with some chalk grains, orange-yellow	3.0	29.8
Upper Chalk	Chalk, soft, sandy	1.8+	31.6

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
					Fines	Sand			Gravel		
	Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	16	75	9	7.5-8.4	23	9	22	9	27	10	0
				8.4-9.4	12	12	69	5	2	0	0
				9.4-10.4	16	14	62	7	1	0	0
				10.4-11.5	16	10	70	3	1	0	0
				Mean	**16**	**11**	**58**	**6**	**7**	**2**	**0**
b	7	93	0	11.8-12.8	19	28	51	1	1	0	0
				12.8-13.8	6	37	57	0	0	0	0
				13.8-14.8	4	21	73	1	1	0	0
				14.8-15.8	6	35	58	1	0	0	0
				15.8-16.8	4	25	70	1	0	0	0
				16.8-17.8	4	28	67	1	0	0	0
				17.8-18.8	6	77	16	0	1	0	0
				18.8-19.8	8	88	4	0	0	0	0
				19.8-20.8	9	87	4	0	0	0	0
				20.8-21.8	8	88	4	0	0	0	0
				21.8-22.8	7	84	9	0	0	0	0
				22.8-23.8	6	85	9	0	0	0	0
				23.8-24.8	6	84	10	0	0	0	0
				24.8-25.8	6	85	9	0	0	0	0
				25.8-26.8	6	85	9	0	0	0	0
				Mean	**7**	**63**	**30**	**	**	**0**	**0**
c	5	91	4	26.8-28.0	5	86	7	1	1	0	0
				28.0-28.8	5	75	7	1	2	10	0
				28.8-29.8	5	84	7	1	1	2	0
				Mean	**5**	**83**	**7**	**1**	**1**	**3**	**0**
a+b+c	**8**	**89**	**3**	**Mean**	**8**	**56**	**32**	**1**	**2**	**1**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	7.5-11.5	trace	9	19	55	1	3	5	5	1	2	0	trace
c	11.8-29.8	1	33	66	trace	trace	trace	trace	0	trace	trace	0	trace

TL 63 NW 23 **6222 3654** **Clay Wood** **Block A**

Surface level +77.9 m
Water struck at +72.8 m
July 1981

Waste 5.1 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Crag	Clay, brown, with scattered flint pebbles, becoming sandy from 0.4 m. Passing down into a pebbly sandy clay with pebbles of flint, ironstone chalk and quartz	5.0	5.1
Upper Chalk	Chalk, soft	0.1+	5.2

TL 63 NW 24 **6296 3628** **Anser Gallow's Farm** **Block A**

Surface level +73.0 m
Water struck at +68.7 m
July 1981

Waste 12.4 m
Bedrock 5.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Alluvium	Silt, clayey, yellow-brown, becoming mottled dark brown and orange-brown with peat from 1.6 m and shell debris from 3.6 m	3.4	3.9
	Silt, sandy, with plant debris and pebbles of chalk and flint	0.4	4.3
	'Clayey' sandy gravel, with plant debris to 4.5 m Gravel: fine with coarse, angular flint and rounded chalk Sand: medium, coarse and fine, quartz with chalk, brown-grey	0.9	5.2
	Silt, sandy, grey, with pebbles of chalk and flint and some plant debris, becoming pebble-free from 8.0 m	5.6	10.8
Boulder Clay	Clay, grey, with pebbles of chalk and flint, becoming very largely composed of chalk from 11.4 m	1.6	12.4
Upper Chalk	Chalk	5.9+	18.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
16	48	36	4.3-4.8	25	16	16	12	25	6	0
			4.8-5.2	5	9	28	16	33	9	0
			Mean	**16**	**13**	**21**	**14**	**29**	**7**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
4.3-5.2	1	50	14	28	1	1	1	1	1	1	0	1

TL 63 NW 25 **6274 3579** **Sparrow's Farm** **Block A**

Surface level +84.9 m
Water struck at +78.9 m and +63.8 m
June 1981

Waste 21.1 m
Bedrock 6.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown with scattered pebbles, becoming grey with chalk pebbles from 2.3 m. Thin seam of chalk gravel at 6.0 m	20.8	21.1
Upper Chalk	Chalk, soft	6.2+	27.3

TL 63 NW 26 **6352 3873** **Hempstead** **Block A**

Surface level +99.5 m
Water struck at +94.1 m and +83.7 m
July 1981

Waste 23.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, mottled brown, grey and orange, with peat	0.7	1.0
Boulder Clay	Clay, brown, with chalk pebbles	2.5	3.5
Glacial Silt	Clay, silty, grey, with seams of fine chalk pebbles from 5.0 m	1.9	5.4
Glacial Sand and Gravel	Gravel: mostly chalk with some flints	0.2	5.6
Boulder Clay	Clay, grey, with chalk pebbles	10.2	15.8
Glacial Sand and Gravel	'Clayey' gravel composed largely of chalk	0.2	16.0
Boulder Clay	Clay, grey, with chalk pebbles	7.0+	23.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
					Fines	Sand			Gravel		
	Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	10	90	0	17.8-18.8	12	64	24	0	0	0	0
				18.8-19.8	9	78	13	0	0	0	0
				19.8-20.8	10	64	25	1	0	0	0
				Mean	**10**	**69**	**21**	**trace**	**trace**	**0**	**0**
b	24	67	9	20.8-21.8	33	34	31	1	1	0	0
				21.8-22.6	12	31	36	4	7	8	2
				Mean	**24**	**33**	**32**	**2**	**4**	**4**	**1**
a+b	15	83	2	17.8-22.6	15	57	25	1	1	1	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	20.8-22.6	23	56	7	0	3	3	0	0	0	3	5	0

Tl 63 NW 27 **6328 3762** **Folly Hall** **Block A**

Surface level +96.0 m
Water struck at +73.3 m
July 1981

Waste 22.7 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown, with pebbles of chalk and flint, becoming grey from 4.0 m	17.4	17.8
Kesgrave Sands and Gravels	**a** 'Clayey' sand with some silty seams from 18.8 m Sand: fine with medium, subrounded quartz, yellow	3.0	20.8
Crag	**b** 'Very clayey' pebbly sand, with silt and clay seams Gravel: fine and medium with some cobbles, angular flint with well rounded flint, some well rounded phospatic nodules, angular ironstone, rounded quartz and quartzite Sand: fine and medium with some coarse, quartz, yellow-brown	1.8	22.6
	Clay, sandy, brown, with flint pebbles	0.1	22.7
Upper Chalk	Chalk, soft	1.3+	24.0

TL 63 NW 28 **6306 3729** **Moss's Farm** **Block A**

Surface level +86.3 m
Water struck at +72.5 m
July 1981

Overburden 4.5 m
Mineral 9.2 m
Waste 0.1 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with chalk pebbles	4.0	4.2
Kesgrave Sands and Gravels	Clay, sandy, orange-brown	0.3	4.5
	a Sand with thin clay seams from 10.5 m Sand: fine and medium, subrounded quartz, pale yellow becoming brown-yellow towards the base	8.0	12.5
Crag	**b** Sand with thin clay seams Gravel: present below 13.5 m; fine and coarse, well rounded and angular flint with rounded quartzite and quartz Sand: medium and coarse with fine, becoming increasingly coarse towards the base, yellow-brown becoming rusty brown below 13.5 m	1.2	13.7
	Clay, sandy, with many pebbles	0.1	13.8
Upper Chalk	Chalk	0.2+	14.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
					Fines	Sand			Gravel		
	Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	7	93	0	4.5-5.5	11	62	26	0	1	0	0
				5.5-6.5	6	72	22	0	0	0	0
				6.5-7.5	5	48	47	0	0	0	0
				7.5-8.5	4	37	59	0	0	0	0
				8.5-9.5	4	49	47	0	0	0	0
				9.5-10.5	7	78	15	0	0	0	0
				10.5-11.5	8	36	56	0	0	0	0
				11.5-12.5	10	32	58	0	0	0	0
				Mean	**7**	**52**	**41**	**trace**	**trace**	**0**	**0**
b	9	88	3	12.5-13.5	9	52	38	1	0	0	0
				13.5-13.7	8	16	51	8	10	7	0
				Mean	**9**	**46**	**40**	**2**	**2**	**1**	**0**
a+b	7	93	0	4.5-13.7	7	52	41	trace	trace	trace	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	12.5-13.7	44	32	5	0	8	11	trace	0	trace	trace	0	0

TL 63 NW 29 **6347 3507** **Ivy Todd's Farm** **Block A**

Surface level +79.6 m
Water struck at +64.3 m
June 1981

Overburden	16.0 m
Mineral	1.5 m
Waste	0.3 m
Mineral	1.5 m
Waste	0.5 m
Mineral	9.7 m
Bedrock	1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 4.8 m and sandy from 15.3 m	15.7	16.0
Glacial Sand and Gravel	**a** Gravel Gravel: coarse with fine, angular flint with rounded chalk Sand: medium and fine with coarse, quartz	1.5	17.5
	Clay, sandy, with pebbles of flint and chalk	0.3	17.8
	b 'Clayey' pebbly sand Gravel: coarse and fine, angular flint and rounded chalk Sand: fine and medium with coarse, quartz	1.5	19.3
	Clay, silty, stiff, mottled, yellow-brown and grey	0.5	19.8
	c Sandy gravel Gravel: fine and coarse with some cobbles, angular quartzite and quartz Sand: medium with coarse and fine, quartz with a trace of chalk	9.7	29.5
Upper Chalk	Chalk	1.3+	30.8

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
					Fines	Sand			Gravel		
	Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	9	39	52	16.0-16.3	No grading data available						
				16.3-17.5	9	14	18	8	12	39	0
				Mean	**9**	**14**	**18**	**8**	**12**	**39**	**0**
b	12	70	18	17.8-18.8	13	45	34	3	1	4	0
				18.8-19.3	10	18	18	11	15	28	0
				Mean	**12**	**36**	**29**	**5**	**6**	**12**	**0**
c	3	58	39	19.8-20.8	5	19	22	7	15	31	1
				20.8-21.8	2	18	32	14	13	17	4
				21.8-22.8	7	27	46	13	4	3	0
				22.8-23.8	3	14	26	11	19	27	0
				23.8-24.8	1	10	28	14	21	23	3
				24.8-25.8	2	12	57	10	12	7	0
				25.8-26.8	5	16	54	10	9	6	0
				26.8-27.8	2	2	14	17	43	22	0
				27.8-28.8	2	1	6	19	43	29	0
				28.8-29.5	4	8	22	23	25	18	0
				Mean	**3**	**13**	**32**	**13**	**20**	**18**	**1**
a+b+c	**5**	**57**	**38**	**Mean**	**5**	**16**	**29**	**12**	**17**	**20**	**1**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
c	19.8-29.5	20	41	17	trace	9	10	1	0	0	1	0	1

TL 63 NW 30 **6458 3992** **Blagden Farm** **Block A**

Surface level +87.7 m
Water not struck
July 1981

Waste 35.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, brown, with pebbles of chalk and some flint, sandstone shale and quartzite, becoming grey from 4.5 m	35.3+	35.4

TL 63 NW 31 **6393 3840** **Hophouse Farm** **Block A**

Surface level +106.7 m
Water struck at +94.9 m
July 1981

Waste 25.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, brown, with pebbles of chalk and some flint and shale, becoming grey from 3.5 m. Thin seam of chalk gravel at 11.8 m	24.7+	25.0

TL NW 32 **6416 3700** **Near Dark Lane** **Block A**

Surface level +86.4 m
Water struck at +84.1 m and +70.4 m
July 1981

Overburden	16.0 m
Mineral	1.6 m
Waste	1.0 m
Mineral	4.3 m
Waste	0.9 m
Mineral	1.0 m
Bedrock	0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Head	Clay, sandy, brown, with scattered flint pebbles	1.4	1.6
	a 'Very clayey' sandy gravel Gravel: fine and coarse, angular flint with some subangular chalk Sand: medium and fine with coarse, mainly subrounded quartz, brown	0.7	2.3
Boulder Clay	Chalk, soft, with angular chalk pebbles and pale brown clayey seams	2.5	4.8
	Clay, brown, with chalk pebbles, becoming black from 5.3 m and grey from 8.0 m	11.2	16.0
Glacial Sand and Gravel	**b** Pebbly sand Gravel: fine and coarse, angular and well rounded flint with rounded quartzite and angular ironstone Sand: medium with coarse and fine, subrounded flint with some chalk and quartz	1.6	17.6
	Clay, stiff, brown, with some chalk pebbles	0.2	17.8
	Chalk, soft, with pebbles of chalk and flint	0.8	18.6
Crag	**c** Pebbly sand Gravel: coarse and fine, angular with well rounded flint, angular ironstone and some rounded quartz and quartzite Sand: medium and fine with coarse, subrounded quartz, orange-brown	4.3	22.9
	Clay, sandy, brown, with clay and chalky seams	0.9	23.8
	d 'Clayey' sandy gravel Gravel: coarse and fine, angular with well rounded flint, angular ironstone and some rounded quartz and quartzite Sand: medium and fine with coarse, subrounded quartz, orange-brown	1.0	24.8
Upper Chalk	Chalk, soft	0.6+	25.4

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	27	42	31	1.6-2.3	27	16	19	7	17	14	0
b	8	75	17	16.0-17.6	8	13	42	20	9	8	0
c	8	85	7	18.6-18.9	18	15	23	13	17	14	0
				18.9-19.9	9	26	38	11	6	10	0
				19.9-20.9	6	32	53	8	1	0	0
				20.9-21.9	6	29	52	10	2	1	0
				21.9-22.9	9	35	51	4	0	1	0
				Mean	**8**	**29**	**47**	**9**	**3**	**4**	**0**
d	11	64	25	23.8-24.8	11	26	29	9	8	17	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	16.0-17.6	27	20	35	3	3	6	0	0	trace	5	1	0
c+d	18.6-24.8	17	17	39	trace	6	6	0	0	trace	13	1	1

TL 63 NW 33 **6408 3611** **Great Sampford** **Block A**

Surface level +86.6 m
Water struck at +68.6 m
June 1981

Overburden	3.6 m
Mineral	3.1 m
Waste	3.1 m
Mineral	18.0 m
Bedrock	1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles, becoming grey from 2.0 m	3.4	3.6
Barham Sands and Gravels	**a** 'Clayey' sandy gravel Gravel: fine and coarse, angular flint and rounded quartz with rounded quartzite and well rounded flint Sand: medium with fine and coarse, subrounded quartz	3.1	6.7
	Clay, stiff, mottled brown-yellow and orange	2.3	9.0
	Clay, sandy, orange	0.8	9.8
Kesgrave Sands and Gravels	**b** Sand, with clayey and silty seams above 12.8 m Gravel: a little fine gravel above 12.8 m; flint with sandstone, quartz and phosphatic nodules Sand: fine and medium with some coarse, subrounded quartz with some mica, yellow-orange becoming pale yellow	10.0	19.8
Crag	**c** Pebbly sand, with some soft chalk from 25.0 m Gravel: coarse and fine, angular and well rounded flint with rounded sandstone, quartzite and angular ironstone Sand: medium and fine with coarse, subrounded quartz, rusty brown	8.0	27.8
Uppper Chalk	Chalk, soft	1.0+	28.8

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	16	59	25	3.6-4.6	18	14	24	12	16	16	0
				4.6-5.6	12	5	30	12	25	16	0
				5.6-6.7	17	11	66	2	2	2	0
				Mean	**16**	**10**	**41**	**8**	**14**	**11**	**0**
b	9	91	0	9.8-10.8	13	22	64	1	0	0	0
				10.8-11.8	6	17	71	4	2	0	0
				11.8-12.8	9	21	67	2	1	0	0
				12.8-13.8	10	84	6	0	0	0	0
				13.8-14.8	14	84	2	0	0	0	0
				14.8-15.8	8	62	30	0	0	0	0
				15.8-16.8	7	55	38	0	0	0	0
				16.8-17.8	8	61	31	0	0	0	0
				17.8-18.8	5	77	17	1	0	0	0
				18.8-19.8	6	54	40	0	0	0	0
				Mean	**9**	**53**	**37**	**1**	**trace**	**0**	**0**
c	4	91	5	19.8-20.8	4	28	62	4	1	1	0
				20.8-21.8	4	35	50	5	4	2	0
				21.8-22.8	5	37	46	5	2	5	0
				22.8-23.8	4	35	52	6	3	0	0
				23.8-24.8	4	31	50	7	3	5	0
				24.8-25.8	5	29	58	5	1	2	0
				25.8-26.8	5	27	56	7	3	2	0
				26.8-27.8	4	28	55	5	3	5	0
				Mean	**4**	**31**	**54**	**6**	**2**	**3**	**0**
a+b+c	**8**	**86**	**6**	**Mean**	**8**	**39**	**43**	**4**	**3**	**3**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	3.6-6.7	16	5	30	trace	26	19	1	0	0	trace	0	3
c	19.8-27.8	32	22	30	trace	trace	5	6	0	trace	4	0	1

TL 63 NW 34 **6400 3569** **Great Sampford** **Block A**

Surface level +69.7 m
Water struck at +54.7 m
June 1981

Waste	15.0 m
Bedrock	5.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Clay, silty, mottled brown and orange-brown	1.4	1.5
	Peat with silt, brown, becoming increasingly silty with depth	5.0	6.5
	Silt, peaty, brown, with some sand and shell debris	8.5	15.0
Upper Chalk	Chalk, soft	5.0+	20.0

TL 63 NW 35 **6478 3661** **Great Sampford** **Block A**

Surface level +85.3 m
Water struck at +68.5 m and +60.3 m
June 1981

Overburden	14.2 m
Mineral	4.7 m
Waste	5.3 m
Mineral	6.3 m
Waste	0.3 m
Bedrock	0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.4	0.4
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 3.7 m	13.8	14.2
Kesgrave Sands and Gravels	**a** Sand Gravel: found mainly below 16.8 m; fine and coarse with some cobbles, angular and well rounded flint with rounded quartz and quartzite and angular ironstone Sand: fine and medium with coarse, rounded quartz	4.7	18.9
	Silt, sandy, mottled red-brown and grey-yellow	5.1	24.0
	Chalk, rubbly	0.2	24.2
Crag	**b** 'Clayey' pebbly sand Gravel: coarse and fine, angular flint with well rounded flint and rounded quartzite and some rounded quartz and angular ironstone Sand: medium and fine with coarse, quartz, orange-brown	6.3	30.5
	Clay, brown, with flint pebbles	0.3	30.8
Upper Chalk	Chalk	0.9+	31.7

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	7	89	4	14.2-15.3	8	62	28	1	1	0	0
				15.3-16.3	7	74	19	0	0	0	0
				16.3-16.8	9	50	39	2	0	0	0
				16.8-17.8	4	13	53	18	8	4	0
				17.8-18.9	6	21	56	10	4	1	2
				Mean	**7**	**43**	**39**	**7**	**3**	**1**	**trace**
b	17	75	8	24.2-25.0	No grading data available						
				25.0-27.0	19	27	36	14	3	1	0
				27.0-28.0	19	25	42	12	2	0	0
				28.0-28.5	14	23	49	13	1	0	0
				28.5-29.5	9	11	45	20	6	9	0
				29.5-30.5	19	16	34	15	2	14	0
				Mean	**17**	**21**	**40**	**14**	**3**	**5**	**0**
a+b	**12**	**82**	**6**	**Mean**	**12**	**31**	**40**	**11**	**3**	**3**	**trace**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	14.2-18.9	33	33	10	0	8	7	1	0	0	6	0	2
b	24.2-30.5	17	45	21	trace	8	3	1	0	1	2	0	2

TL 63 NE 12 **6590 3990** **Little Bulls Farm** **Block A**

Surface level +78.0 m
Water struck at +56.3 m and +47.0 m
July 1981

Waste	32.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, brown, with pebbles of chalk and some flint, becoming grey from 4.5 m	27.7	27.8
Glacial Silt	Silt, grey	2.2	30.0
Boulder Clay	Clay, grey, with chalk pebbles	2.3+	32.3

TL 63 NE 13 **6542 3688** **Calthorp's Farm** **Block A**

Surface level +108.6 m
Water struck at +98.6 m
June 1981

Waste 27.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.8	0.8
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 5.2 m. Thin seam of grey quartz sand at 10.0 m	26.1	26.9
Kesgrave Sands and Gravels	Sand Gravel: rare fine well rounded flint pebbles Sand: medium and fine with some coarse, quartz, orange-yellow	0.1+	27.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages							
Fines	Sand	Gravel		Fines	Sand			Gravel			
				$\sim\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm	
6	93	1	26.9-27.0	6	28	64	1	1	0	0	

TL 63 NE 14 **6582 3518** **The Maynards** **Block C**

Surface level +92.5 m
Water not struck
June 1981

Waste 28.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.4	0.4
Boulder Clay	Clay, brown with flint pebbles, becoming mottled brown and grey with additional pebbles of chalk from 0.9 m. Passing down into grey from 4.0 m	10.0	10.4
Glacial Sand and Gravel	Gravel, largely chalk pebbles with some quartz sand	0.2	10.6
Glacial Silt	Silt, brown, laminated with fine sand partings	1.7	12.3
Boulder Clay	Clay, grey with chalk pebbles, becoming brown	0.9	13.2
Glacial Silt	Silt, brown, with seams of fine quartz sand and chalk sand	2.8	16.0
Boulder Clay	Clay, grey, with chalk pebbles	12.0+	28.0

TL 63 NE 15 **6615 3811** **Lake House Farm** **Block A**

Surface level +109.0 m
Water not struck
June 1981

Waste 31.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.2	0.2
Boulder Clay	Clay, mottled brown and grey, with chalk pebbles, becoming grey with additional pebbles of flint from 4.3 m	23.8	24.0
	Chalk, soft	0.4	24.4
	Clay, grey, with pebbles of chalk and some flint	6.6+	31.0

TL 63 NE 16 **6658 3641** **Boarded Barns** **Block A**

Surface level +92.4 m
Water struck at +68.7 m
June 1981

Waste 31.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.7	0.7
Boulder Clay	Clay, mottled brown and grey, with chalk pebbles, becoming grey from 4.0 m with additional pebbles of flint. Thin seam of chalk gravel at 23.7 m	28.9	29.6
	Clay, sandy, brown, with chalk and flint pebbles	1.9+	31.5

TL 63 NE 17 **6735 3959** **Latchleys Farm** **Block A**

Surface level +81.3 m
Water struck at +79.9 m
June 1981

Waste 21.8 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Clay, silty, brown, with scattered flints	0.8	0.9
	Silt, grey-brown with fine flint pebbles and plant debris. Seam of flint pebbles at the base	1.6	2.5
Boulder Clay	Clay, brown, with chalk and some flint pebbles, becomes grey from 4.0 m	19.3	21.8
Upper Chalk	Chalk, soft, with flints	2.1+	23.9

TL 63 NE 18 **6750 3557** **Unwin's Farm** **Block C**

Surface level +79.3 m
Water struck at 73.5 m
June 1981

Overburden 6.3 m
Mineral 2,3 m
Waste 19.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown with flints, becoming mottled grey and brown with additional pebbles of chalk from 1.2 m. Passing down into grey from 2.0 m	5.5	5.8
Glacial Sand and Gravel	a 'Clayey' pebbly sand Gravel: fine and coarse, chalk and flint with quartz and sandstone Sand: medium fine and coarse, chalk and quartz	0.2	6.0
Boulder Clay	Clay, brown, with chalk pebbles	0.3	6.3
Glacial Sand and Gravel	**b** Gravel Gravel: fine sand coarse with some cobbles, rounded chalk with angular flint and subangular limestone Sand: medium and coarse with fine, quartz with some chalk, grey-brown	2.3	8.6
Boulder Clay	Clay, grey, with pebbles of chalk and flint	19.4+	28.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
a	17	68	15	5.8–6.0	17	24	26	18	9	6	0
b	7	45	48	6.3–7.3	9	9	18	18	28	14	4
				7.3–8.3	6	4	20	18	37	15	0
				8.3–8.6	7	9	30	21	19	14	0
				Mean	**7**	**7**	**20**	**18**	**32**	**14**	**2**
a+b	**8**	**47**	**45**	**Mean**	**8**	**8**	**21**	**18**	**29**	**14**	**2**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	6.3–8.6	0	19	3	62	trace	2	1	12	trace	1	0	trace

TL 63 NE 19 **6816 3749** **Lopham's Farm** **Block A**

Surface level +95.5 m
Water not struck
June 1981

Waste 28.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with flint pebbles, becoming mottled brown and grey with additional pebbles of chalk. Passing down into grey from 4.5 m	17.3	17.5
Glacial Sand and Gravel	Sand: fine quartz, silty, grey	0.3	17.8
Boulder Clay	Clay, grey, with chalk and flint pebbles	10.2+	28.0

TL 63 NE 20 **6847 3603** **Whitley's Farm** **Block C**

Surface level +95.3 m
Water struck at +77.3 m
June 1981

Waste 25.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with flint pebbles, becoming mottled with additional pebbles of chalk from 1.2 m. Passing down into grey from 3.8 m; sandy and gravelly seams from 15.0 m	17.8	18.0
Glacial Sand and Gravel	Pebbly sand Gravel: fine with coarse, rounded chalk with angular flint and subangular limestone Sand: medium and fine with coarse, chalk, flint and quartz, grey	2.1	20.1
Glacial Silt	Silt, clayey, brown, laminated	3.9	24.0
Boulder Clay	Clay, brown-grey, with chalk pebbles, capped by a thin seam of chalky gravel	1.4+	25.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
9	75	16	18.0-19.0	11	18	23	19	23	6	0
			19.0-20.1	7	38	39	12	4	0	0
			Mean	**9**	**28**	**32**	**15**	**13**	**3**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
18.0-20.1	0	15	2	61	0	1	2	8	2	trace	trace	9*

*Includes 4% pyrite and 2% argillaceous rocks

TL 63 NE 21 **6842 3520** **Little London** **Block C**

Surface level +76.9 m
Water not struck
June 1981

Waste 26.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Head	Clay, brown, with pebbles	0.5	0.5
Boulder Clay	Clay, brown, with chalk and some flint pebbles, becoming grey from 4.0 m	6.3	6.8
	Clay, sandy, brown-grey, with flints and fine chalk pebbles	0.2	7.0
	Clay, grey, with chalk and flint pebbles	14.3	21.3
	Chalk, soft	1.0	22.3
	Clay, grey, with chalk pebbles	2.9	25.2
	'Very clayey' pebbly sand Gravel: coarse, fine and cobbles, flint Sand: medium and fine with coarse, quartz, brown	0.8	26.0
	Silt, sandy, mottled grey-brown, purple and green	0.5+	26.5

TL 63 NE 22 **6920 3995** **Coote's Farm** **Block A**

Surface level +89.7 m
Water struck at +66.2 m
July 1981

Waste 23.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, mottled orange-brown and light grey, with chalk pebbles, becoming grey from 2.5 m	9.3	9.6
Glacial Silt	Clay, silty, light grey, laminated	3.2	12.8
Boulder Clay	Clay, light grey, with chalk pebbles, becomes grey with some additional pebbles of shale and flint from 14.0 m	10.1	22.9
Glacial Sand and Gravel	'Clayey' pebbly sand, with a sandy clay seam from 23.4 m to 23.5 m Gravel: fine with coarse, angular flint with rounded quartz, quartzite and sandstone and well rounded flint Sand: fine and medium with some coarse, quartz, yellow-brown	0.9+	23.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
18	70	12	22.9-23.4	18	40	26	4	10	2	0
			23.4-23.8	No grading data available						
			Mean	**18**	**41**	**26**	**3**	**10**	**2**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
22.9-23.4	6	14	32	1	21	14	11	0	0	trace	0	1

TL 63 NE 23 **6978 3626** **Hole Farm** **Block C**

Surface level +82.1 m
Water struck at +67.3 m
June 1981

Waste 25.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with chalk and some flint pebbles	1.4	1.6
	Clay, sandy, brown	0.1	1.7
	Clay, mottled grey and brown with pebbles of chalk and some flint, becoming grey from 4.0 m	13.1	14.8
Glacial Sand and Gravel	'Clayey' pebbly sand Gravel: fine with coarse, chalk with flint Sand: medium, coarse and fine, grey-brown	0.3	15.1
Boulder Clay	Clay, grey with chalk and flint, pebbles	10.4+	25.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
12	70	18	14.8-15.1	12	18	31	21	16	2	0

TL 63 NE 24 **6908 3569** **Jekyll's Farm** **Block C**

Surface level +93.0 m
Water not struck
June 1981

Waste 28.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, brown with flint pebbles, becoming mottled grey and brown with additional pebbles of chalk from 1.0 m. Passing down into grey from 4.0 m with a thin sandy seam at 17.1 m	27.5+	28.0

TL 63 SW 13 **6029 3489** **Lower Green** **Block A**

Surface level +101.6 m
Water not struck
July 1981

Waste 34.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, brown, with scattered flint pebbles, becoming mottled brown and light grey with additional pebbles of chalk from 1.1 m. Passing down into grey from 2.5 m, with silty sandy seams	34.4+	34.5

TL 63 SW 14 **6023 3342** **Causewayend Farm** **Block A**

Surface level +94.0 m
Water struck at +83.7 m & +67.7 m
July 1981

Overburden 10.3 m
Mineral 6.9 m
Waste 11.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 4.8 m	9.9	10.3
Glacial Sand and Gravel	Gravel Gravel: coarse and fine with some cobbles, angular flint and rounded chalk with rounded quartzite and sandstone, subangular limestone, well rounded flint and angular ironstone Sand: medium and coarse with fine, quartz and chalk	6.9	17.2
Glacial Silt	Clay, silty, sandy, laminated, grey, with some chalk pebbles from 19.5 m	2.8	20.0
Boulder Clay	Clay, grey, with chalk pebbles; seam of pebbly sandy silt from 26.3 m to 27.0 m	8.2+	28.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	46	51	10.3-11.3	4	6	14	12	27	37	0
			11.3-12.3	5	8	25	18	19	25	0
			12.3-13.3	4	8	20	13	16	32	7
			13.3-14.3	3	3	18	17	28	28	3
			14.3-15.3	3	4	19	19	27	26	2
			15.3-16.3	1	2	30	22	21	24	0
			16.3-17.2	3	8	45	14	15	13	2
			Mean	**3**	**5**	**24**	**17**	**22**	**27**	**2**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
10.3-17.2	4	28	15	27	2	6	5	5	2	3	0	3

TL 63 SW 15 **6054 3185** **Watling Lane** **Block B**

Surface level +78.0 m
Waste not Struck
June 1981

Waste	6.4 m
Bedrock	2.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown	0.3	0.6
Glacial Sand and Gravel	Gravel, largely composed of chalk	0.3	0.9
Boulder Clay	Clay, brown, with chalk and flint pebbles, becoming grey from 3.7 m	5.5	6.4
Woolwich and Reading Beds	Clay, mottled brown and yellow	0.5	6.9
	Silt, clayey, brown, becoming mottled green and brown with a seam of stiff brown clay from 7.8 m to 8.0 m	2.1+	9.0

TL 63 SW 16 **6044 3100** **Thaxted** **Block B**

Surface level +83.0 m
Water struck at + 60.2 m
June 1981

Waste	23.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 4.8 m	20.6	21.0
Barham Sands and Gravels	Clay, sandy, mid-brown, with sand seams, becoming brown and very sandy with quartz and flint gravel from 22.8 m	2.1+	23.1

TL 63 SW 17 **6044 3070** **Thaxted** **Block B**

Surface level +88.5 m
Water not struck
June 1981

Waste	10.7 m
Bedrock	1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 3.0 m	7.3	8.0
Glacial Sand and Gravel	Clay, with many pebbles, largely of chalk	0.8	8.8
Boulder Clay	Clay, brown, with chalk pebbles	0.4	9.2
	Clay, sandy and silty, with plant debris near the top, becoming increasingly sandy towards the base	1.5	10.7
London Clay	Silt, sandy, brown, with shell debris and pyrite nodules	1.4+	12.1

TL 63 SW 18 **6046 3013** **Near Thaxted** **Block B**

Surface level +92.5 m
Water struck at +74.5 m
June 1981

Waste 21.3 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with chalk and flint pebbles, becoming grey with additional pebbles of shale and limestone	17.7	18.0
Glacial Sand and Gravel	Pebbly sand Gravel: coarse with fine, angular flint and rounded chalk with well rounded flint and subangular ironstone Sand: medium and fine with coarse, quartz with some chalk, grey	3.3	21.3
London Clay	Silt, sandy, grey, with some fragile shell debris	0.5+	21.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
8	75	17	18.0-19.0	10	5	77	4	1	3	0
			19.0-20.0	8	36	55	1	0	0	0
			20.0-21.3	7	17	27	7	10	32	0
			Mean	**8**	**19**	**52**	**4**	**4**	**13**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
18.0-21.3	8	52	2	26	trace	1	1	6	1	trace	trace	3

TL 63 SW 19 **6131 3367** **Friar's Farm** **Block A**

Surface level 94.9 m
Water not struck
July 1981

Waste 36.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey with additional pebbles of flint, shale and derived Jurassic fossils from 4.0 m	35.6+	36.0

TL 63 SW 20 **6120 3245** **Goddard's Farm** **Block B**

Surface level +85.0 m
Water not struck
June 1981

Waste 6.6 m
Bedrock 5.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles, becoming grey from 4.0 m	6.1	6.6
Woolwich and Reading Beds	Clay, stiff, mottled brown, yellow, red and grey becoming a brown clayey silt from 7.5 m	1.4	8.0
	'Very clayey' sand Sand: fine with some medium, quartz, brown	1.0	9.0
	Clay, stiff, brown, becoming mottled brown and grey	2.7	11.7
Thanet Beds	Silt, sandy, grey	0.3+	12.0

TL 63 SW 21 **6110 3162** **Thaxted** **Block B**

Surface level +99.7 m
Water not struck

Waste 30.3 m
Bedrock Touched

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.7	0.7
Boulder Clay	Clay, brown, with scattered flint pebbles and chalk pebbles from 1.1 m, becoming grey from 2.9 m	29.5	30.2
	Gravel composed solely of chalk	0.1	30.3
Woolwich and Reading Beds	Clay, stiff, grey-brown	Touched	

TL 63 SW 22 **6137 3121** **Thaxted** **Block B**

Surface level +92.9 m
Water struck at +85.9 m
June 1981

Overburden 2.5 m
Mineral 3.5 m
Waste 4.5 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Silt, sandy, brown, becoming a clay with chalk pebbles from 1.5 m	2.2	2.5
Glacial Sand and Gravel	'Clayey' sandy gravel, becoming less 'clayey' with depth Gravel: fine and coarse with some cobbles, rounded chalk and angular flint with subangular limestone and some sandstone and quartzite Sand: medium sand coarse with fine, mainly chalk, light grey	5.5	8.0
Boulder Clay	Clay, brown, with chalk pebbles, becoming black from 8.3 m with a seam of chalk pebbles from 9.9 m to 10.3 m and a similar seam of chalk gravel from 11.7 m to 12.5 m	4.5	12.5
London Clay	Silt, clayey, yellow-orange becoming grey from 12.7 m	0.7+	13.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
15	44	41	2.5-3.5	20	7	12	14	28	19	0
			3.5-4.5	17	7	16	14	31	15	0
			4.5-5.5	17	8	22	15	27	11	0
			5.5-6.5	16	7	26	16	25	10	0
			6.5-7.0	15	6	28	13	18	20	0
			7.0-8.0	6	4	30	18	19	21	2
			Mean	**15**	**7**	**22**	**15**	**26**	**15**	**trace**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
2.5-8.0	1	26	14	45	1	2	3	6	1	1	0	trace

TL 63 SW 23 **6148 3021** **Prior's Hall** **Block B**

Surface level +94.5 m
Water struck at +80.5 m
July 1981

Overburden 7.1 m
Mineral 9.8 m
Bedrock 2.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with chalk pebbles, becoming mottled grey and brown from 4.7 m	6.9	7.1
Kesgrave Sands and Gravels	**a** Sand Gravel: rare fine pebbles Sand: medium with fine and some coarse, quartz, yellow-brown	4.0	11.1
Crag	**b** Sand Gravel: fine with some coarse, well rounded and angular flint with rounded quartzite and quartz Sand: medium and fine with coarse, quartz, orange brown	5.8	16.9
London Clay	Silt, sandy, brown, becoming grey from 18.6 m	2.6+	19.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	6	94	0	7.1-8.1	5	25	69	1	0	0	0
				8.1-9.1	4	21	71	4	0	0	0
				9.1-10.1	7	20	71	1	1	0	0
				10.1-11.1	7	22	70	1	0	0	0
				Mean	**6**	**22**	**70**	**2**	**trace**	**0**	**0**
b	6	92	2	11.1-12.1	7	21	70	2	0	0	0
				12.1-13.1	6	16	76	1	1	0	0
				13.1-14.0	10	31	59	0	0	0	0
				14.0-15.0	6	23	57	12	2	0	0
				15.0-16.0	4	51	29	12	4	0	0
				16.0-16.9	4	47	32	8	6	3	0
				Mean	**6**	**31**	**55**	**6**	**2**	**trace**	**0**
a+b	6	93	1	7.1-16.9	6	27	62	4	1	trace	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	11.1-16.9	51	28	8	trace	6	7	trace	trace	trace	trace	0	0

TL 63 SW 24 **6235 3154** **Copthall Lane** **Block B**

Surface level +98.4 m
Water struck at +81.6 m
June 1981

Waste 18.6 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey with additional pebbles of shale and flint from 2.8 m	14.3	14.6
Glacial Sand and Gravel	Clay, sandy, orange-brown	0.2	14.8
	a 'Clayey' pebbly sand, with clay seams Gravel: fine and coarse, angular flint and rounded chalk with rounded quartzite and quartz Sand: medium with fine and coarse, chalk, flint and quartz, yellow-brown	0.8	15.6
Boulder Clay	Clay, brown, with chalk pebbles	0.3	15.9
Crag	**b** Pebbly, sand with silty seams Gravel: fine and coarse, well rounded with angular flint and some rounded quartzite and quartz and angular ironstone Sand: medium and fine with coarse, subrounded quartz, yellow-orange becoming rusty brown	2.7	18.6
London Clay	Silt, clayey, micaceous, orange becoming grey from 18.9 m	0.8+	19.4

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
a	15	71	14	14.8-15.1	20	14	32	11	16	7	0
				15.1-15.6	11	15	58	7	7	2	0
				Mean	**15**	**15**	**48**	**8**	**10**	**4**	**0**
b	7	88	5	15.9-16.9	11	39	49	1	0	0	0
				16.9-17.9	5	42	44	6	3	0	0
				17.9-18.6	5	22	52	9	6	6	0
				Mean	**7**	**36**	**47**	**5**	**3**	**2**	**0**
a+b	**9**	**85**	**6**	**Mean**	**9**	**31**	**48**	**6**	**4**	**2**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	14.8-15.6	trace	32	17	28	7	10	2	1	trace	1	0	2
b	15.9-18.6	56	24	5	trace	4	6	1	0	0	4	0	0

TL 65 SW 25 **6305 3390** **Road Farm** **Block A**

Surface level +92.4 m
Water struck at +84.2 m
May 1981

Overburden 6.3 m
Mineral 2.7 m
Waste 12.2 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles, becoming brown from 1.2 m	3.9	4.0
	Clay, sandy, brown	0.1	4.1
	Clay, grey, with chalk pebbles	2.2	6.3
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine and coarse with some cobbles, angular flint and rounded chalk with some rounded quartz and quartzite subangular limestone, rounded sandstone and angular ironstone Sand: medium coarse and fine, flint and chalk with subrounded quartz in the fine grade	2.7	9.0
Boulder Clay	Clay, brown-grey, with chalk pebbles	1.9	10.9
	Clay, sandy, stiff, red-brown, with fine flint pebbles	0.3	11.2
	Clay, grey, with chalk pebbles	10.0	21.2
Thanet Beds	Sand: fine and medium with some coarse, subrounded quartz, rusty orange, becoming clayey from 21.4 m and mottled green and yellow-green	0.3+	21.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
17	40	43	6.3-7.2	29	19	17	10	20	5	0
			7.2-8.2	16	11	12	12	29	18	2
			8.2-9.0	3	3	18	20	34	22	0
			Mean	**17**	**11**	**15**	**14**	**27**	**15**	**1**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
6.3-9.0	trace	28	17	36	4	4	3	4	1	2	0	1

TL 63 SW 26 **6340 3264** **Great Clark's Farm** **Block B**

Surface level +102.9 m
Water struck at +80.8 m
June 1981

Waste 22.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles, becoming brown from 2.5 m and grey from 5.7 m	21.6	22.1
Glacial Sand and Gravel	'Clayey' sandy gravel Gravel: coarse and fine, rounded chalk with angular flint and subangular limestone Sand: medium with fine and coarse, chalk and flint, light grey	0.4+	22.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
12	47	41	22.1-22.5	12	15	24	8	18	23	0

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
22.1-22.5	0	15	9	54	trace	2	4	9	2	0	0	5

TL 63 SW 27 **6340 3040** **Piggotts** **Block B**

Surface level +108.7 m
Water not struck
May 1981

Waste 25.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, brown, with scattered flints, becoming mottled brown and grey with chalk pebbles from 0.8 m. Passing down into grey from 5.0 m	24.7	25.0
Kesgrave Sands and Gravels	'Clayey' sand medium and fine with some coarse, subrounded quartz orange-brown	0.5+	25.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
17	82	1	25.0-25.5	17	21	60	1	1	0	0

TL 63 SW 28 **6416 3486** **Hill Farm** **Block A**

Surface level +81.0 m
Water struck at +62.2 m and +56.3 m
June 1981

Waste 24.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.7	0.7
Boulder Clay	Clay, brown, with chalk pebbles, becoming grey from 3.7 m	18.1	18.8
Glacial Sand and Gravel	Gravel, composed largely of chalk with some flint	1.3	20.1
Boulder Clay	Clay, grey, with chalk pebbles	4.6	24.7
Glacial Sand and Gravel	Sand, fine and medium composed largely of quartz with some chalk and flint, grey	0.2+	24.9

TL 63 SW 29 **6492 3473** **Millfield Plantation** **Block D**

Surface level +68.8 m
Water struck at +66.5 m and +59.8 m
May 1981

Overburden	1.9 m
Mineral	2.6 m
Waste	4.5 m
Mineral	2.0 m
Waste	2.3 m
Bedrock	0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Silt, sandy, brown	1.7	1.9
	a Gravel with a peat seam from 3.7 m to 3.9 m Gravel: fine and coarse with some cobbles, angular flint with rounded chalk Sand: coarse and medium with fine, flint with quartz, brown	2.6	4.5
Boulder Clay	Clay, brown, with pebbles of chalk and some flint, becoming grey from 4.7 m	4.5	9.0
Glacial Sand and Gravel	**b** Sandy gravel Gravel: fine and coarse, angular and well rounded flint with rounded quartz and quartzite Sand: medium with fine and coarse, quartz and flint, brown	2.0	11.0
Chalk Silt	Chalk flour with unworn nodular flint and quartz sand from 12.6 m	2.3	13.3
Upper Chalk	Chalk, soft	0.2+	13.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	5	41	54	1.9-2.3	12	6	15	10	25	28	4
				2.3-3.3	3	3	18	23	32	21	0
				3.3-3.7	3	2	19	18	36	22	0
				3.9-4.5	5	4	20	21	34	16	0
				Mean	**5**	**4**	**18**	**19**	**32**	**21**	**1**
b	4	57	39	9.0-10.3	2	3	26	15	36	18	0
				10.3-11.0	9	32	42	5	8	4	0
				Mean	**4**	**13**	**33**	**11**	**26**	**13**	**0**
a+b	**5**	**48**	**47**	**Mean**	**5**	**8**	**24**	**16**	**29**	**18**	**trace**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction										
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	1.9-4.5	3	57	12	11	2	4	3	2	1	3	trace	2
b	9.0-11.0	29	27	15	0	14	12	1	0	0	trace	0	2

TL 63 SW 30 **6410 3389** **Tewes Farm** **Block A**

Surface level +77.0 m
Water not struck
May 1981

Waste	13.3 m
Bedrock	0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, brown, with chalk pebbles, becoming mottled brown and grey from 0.5 m and grey from 2.9 m Passing down into sandy clay, with additional scattered pebbles of well rounded and angular flint and rounded quartz	13.2	13.3
Thanet Beds	Sand, silty, brown, with a trace of green mottling, becoming mottled yellow and dark green	0.8+	14.1

TL 63 SW 31 **6435 3321** **Star's Farm** **Block B**

Surface level +95.0 m
Water struck at +82.5 m
June 1981

Waste	21.4 m
Bedrock	0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles, becoming grey from 4.0 m	12.3	12.5
Glacial Sand and Gravel	'Clayey' sandy gravel Gravel: coarse with fine, angular flint and subrounded chalk Sand: medium and coarse with fine, chalk, flint and quartz	0.2	12.7
Boulder Clay	Clay, grey, with chalk, scattered flint and shale pebbles	8.5	21.2
	Clay, sandy, olive, with scattered pebbles of flint	0.2	21.4
Woolwich and Reading Beds	Clay, stiff, mottled brown and blue-grey	0.1+	21.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
11	57	32	12.5-12.7	11	12	23	22	9	23	0

TL 63 SW 32 **6490 3199** **The Hydes** **Block B**

Surface level +99.8 m
Water struck at +80.1 m
May 1981

Overburden 17.5 m
Mineral 7.3 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, mottled brown and light grey, with rounded chalk pebbles, becoming grey from 4.0 m	17.2	17.5
Kesgrave Sands and Gravels	**a** 'Clayey' sand Gravel: a trace of fine rounded flint pebbles Sand: medium and fine with some coarse, subrounded quartz, pale yellow-grey	3.2	20.7
Crag	**b** Sand Gravel: fine, well rounded with angular flint rounded quartz and quartzite, angular ironstone and rounded phosphatic nodules Sand: medium and fine with coarse, quartz, rusty brown, becoming green-brown from 21.7 m	4.1	24.8
London Clay	Silt, olive-grey	0.4+	25.2

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	13	86	1	17.5-18.6	16	19	63	2	0	0	0
				18.6-19.7	7	21	64	6	2	0	0
				19.7-20.7	15	69	15	1	0	0	0
				Mean	**13**	**35**	**48**	**3**	**1**	**0**	**0**
b	5	93	2	20.7-21.7	5	26	64	4	1	0	0
				21.7-22.7	7	29	62	2	0	0	0
				22.7-23.7	5	42	47	5	1	0	0
				23.7-24.8	4	17	64	11	4	0	0
				Mean	**5**	**28**	**59**	**6**	**2**	**0**	**0**
a+b	8	91	1	17.5-24.8	8	31	56	4	1	0	0

TL 63 SW 33 **6414 3123** **The Hydes** **Block B**

Surface level +89.2 m
Water struck at +80.3 m
June 1981

Overburden 7.7 m
Mineral 7.8 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with scattered flints, becoming mottled to light grey, with additional pebbles of chalk from 0.9 m	2.4	2.6
Glacial Silt	Silt, yellowish brown, with some fine chalk pebbles	1.7	4.3
Boulder Clay	Clay, mottled brown and light grey, with pebbles of chalk and some flint, becoming grey from 4.8 m	3.0	7.3
Glacial Silt	Silt, brown, with some fine chalk pebbles	0.4	7.7
Kesgrave Sands and Gravels	**a** 'Clayey' sand Sand: fine with medium and some coarse, subrounded quartz with some mica, pale yellow	3.2	10.9
Crag	**b** Sand Gravel: fine with some coarse, angular and well rounded flint with rounded quartz and quartzite and some angular ironstone Sand: medium and fine with coarse, subrounded quartz, yellow-brown becoming rusty brown	4.6	15.5
London Clay	Silt, clayey, mottled olive and rusty brown, becoming olive green from 15.7 m	0.4+	15.9

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	17	83	0	7.7-8.9	22	59	19	0	0	0	0
				8.9-9.9	14	85	1	0	0	0	0
				9.9-10.9	15	53	29	3	0	0	0
				Mean	**17**	**65**	**17**	**1**	**trace**	**0**	**0**
b	4	93	3	10.9-11.9	5	30	50	10	4	1	0
				11.9-12.9	4	31	54	10	1	0	0
				12.9-13.9	3	34	49	11	3	0	0
				13.9-14.9	5	29	47	16	2	3	0
				14.9-15.5	5	25	51	16	2	3	0
				Mean	**4**	**30**	**51**	**12**	**2**	**1**	**0**
a+b	10	89	1	7.7-15.5	10	44	37	8	1	trace	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	10.9-15.5	25	39	11	0	12	10	1	0	trace	2	trace	trace

TL 63 SW 34 **6470 3142** **The Hydes** **Block B**

Surface level +94.3 m
Water struck at +77.4 m
May 1981

Waste 21.0 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown and light grey, with chalk pebbles, becoming grey from 4.0 m	16.6	16.9
Glacial Sand and Gravel	**a** 'Clayey' sandy gravel Gravel: coarse and fine, angular flint and rounded chalk with subangular limestone Sand: medium with coarse and fine, quartz with chalk and flint, light grey	1.0	17.9
Crag	**b** Pebbly sand Gravel: coarse, fine and cobbles at the base, angular with well rounded flint and some angular ironstone Sand: medium and fine with coarse, subrounded quartz, light grey becoming olive green from 18.9 m	3.1	21.0
London Clay	Clay, olive-grey	0.4+	21.4

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages							
	Fines	Sand	Gravel		Fines	Sand			Gravel			
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm	
a	14	61	25	16.9-17.9	14	4	46	11	11	14	0	
b	9	84	7	17.9-18.9	15	23	54	3	1	4	0	
				18.9-19.9	7	31	51	10	1	0	0	
				19.9-21.0	4	25	49	9	2	5	6	
				Mean	**9**	**26**	**51**	**7**	**2**	**3**	**2**	
a+b	10	78	12	16.9-21.0	10	21	49	8	4	6	2	

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	16.9-17.9	trace	26	23	36	1	2	1	8	1	trace	0	2
b	17.9-21.0	23	70	3	trace	trace	trace	trace	0	0	4	0	trace

TL 63 SW 35 **6473 3045** **Furthermoor Hall** **Block B**

Surface level +93.3 m
Water struck at +83.5 m
May 1981

Overburden 9.8 m
Mineral 10.1 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles, becoming grey at 3.8 m with chalky seams at 3.0 m 4.0 m and 6.0 m	9.5	9.8
Kesgrave Sands and Gravels	**a** 'Clayey' sand Gravel: some coarse at the top Sand: medium and fine with some coarse, subrounded quartz, pale brown	4.0	13.8
Crag	**b** Sand Gravel: fine with some coarse, angular with well rounded flint, rounded quartzite and quartz with some angular ironstone, phosphatic nodules and sandstone Sand: medium and fine with coarse, rounded quartz, orange, becoming rusty brown from 16.8 m	6.1	19.9
London Clay	Clay, silty, orange-brown becoming olive green from 20.1 m	0.4+	20.3

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages							
	Fines	Sand	Gravel		Fines	Sand			Gravel			
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm	
a	10	90	0	9.8-10.8	13	19	65	1	0	2	0	
				10.8-11.8	8	42	49	1	0	0	0	
				11.8-12.8	7	24	69	0	0	0	0	
				12.8-13.8	10	45	44	1	0	0	0	
				Mean	**10**	**33**	**56**	**1**	**0**	**trace**	**0**	
b	6	91	3	13.8-14.8	10	43	42	5	0	0	0	
				14.8-15.8	7	34	54	5	0	0	0	
				15.8-16.8	9	37	39	14	1	0	0	
				16.8-17.8	4	18	57	15	6	0	0	
				17.8-18.8	3	17	46	25	7	2	0	
				18.8-19.9	4	23	43	26	4	0	0	
				Mean	**6**	**29**	**47**	**15**	**3**	**trace**	**0**	
a+b	7	91	2	9.8-19.9	7	30	52	9	2	trace	0	

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
b	13.8-19.9	18	30	32	trace	7	9	1	0	0	2	1	trace

TL 63 SE 13 **6526 3466** **Millfield Plantation** **Block C**

Surface level +85.2 m
Water struck at +71.2 m
May 1981

Waste 22.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, mottled brown and grey, with chalk pebbles, becoming grey from 4.6 m with additional scattered pebbles of shale	21.8+	22.0

TL 63 SE 14 **6553 3340** **Little Stampford** **Block B**

Surface level +68.3 m
Water struck at +65.9 m
May 1981

Overburden 1.6 m
Mineral 1.1 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Glacial Sand and Gravel	Clay, sandy, orange-brown, with flint pebbles	1.2	1.6
	'Very clayey' sandy gravel Gravel: fine and coarse, mainly angular flint with rounded chalk Sand: coarse and medium with fine, flint and chalk with quartz	1.1	2.7
Woolwich and Reading Beds	Clay, stiff, red-brown	0.2+	2.9

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
20	44	36	1.6-2.4	24	11	16	15	22	12	0
			2.4-2.7	7	5	20	25	26	17	0
			Mean	**20**	**9**	**17**	**18**	**23**	**13**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
1.6-2.7	0	23	31	24	2	4	3	4	3	5	trace	1

TL 63 SE 15 **6563 3246** **Salmon's Farm** **Block B**

Surface level +85.3 m
Water not struck
May 1981

Overburden 1.3 m
Mineral 9.2 m
Waste 1.8 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Glacial Sand and Gravel	Clay, sandy, orange-brown, with flint pebbles	0.9	1.3
	'Very clayey' sandy gravel Gravel: fine and coarse, mainly rounded chalk and angular flint Sand: medium with coarse and fine, chalk flint and quartz	9.2	10.5
Boulder Clay	Clay, stiff, grey, with fine chalk pebbles and scattered angular flints	1.8	12.3
London Clay	Silt, olive grey	1.0+	13.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
27	39	34	1.3-8.3	25	9	16	10	20	20	0
			8.3-9.5	24	14	51	8	3	0	0
			9.5-10.5	28	9	18	14	19	12	0
			Mean	**27**	**9**	**20**	**10**	**17**	**17**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
1.3-10.5	trace	31	15	50	trace	trace	1	1	trace	2	0	trace

TL 63 SE 16 **6578 3142** **Moor Hall** **Block B**

Surface level +79.8 m
Water struck at +72.5 m
May 1981

Overburden 1.0 m
Mineral 8.6 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Barham Sands and Gravels	Clay, sandy, brown, with flints	0.9	1.0
	a 'Very clayey' sandy gravel, with a waste seam of sandy clay with flint pebbles from 2.5 m to 2.6 m Gravel: coarse and fine with cobbles near the top, angular flint with sandstone and ironstone above 2.5 m. Below 2.6 m the deposit includes rounded chalk and subangular limestone Sand: medium and fine with coarse, quartz with flint in the coarse fraction, orange-brown	4.3	5.3
Kesgrave Sands and Gravels	**b** Sand Gravel: some pebbles at the top, angular and well rounded flint with quartzite and quartz Sand: fine with medium and some coarse, quartz, pale yellow	3.1	8.4
Crag	**c** Sand Gravel: fine and coarse, well rounded phosphatic nodules and flint with angular flint and some rounded quartz and quartzite Sand: fine and medium with coarse, subrounded quartz, rusty brown	1.2	9.6
London Clay	Silt, clayey, blue grey	0.4+	10.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
					Fines	Sand			Gravel		
	Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	27	50	23	1.0-2.0	15	9	15	10	22	22	7
				2.0-2.5	18	7	17	11	20	24	3
				2.6-3.5	39	22	25	3	3	8	0
				3.5-4.5	35	19	37	4	4	1	0
				4.5-5.3	23	29	38	4	3	3	0
				Mean	**27**	**18**	**26**	**6**	**10**	**11**	**2**
b	6	93	1	5.3-6.3	8	43	43	3	2	1	0
				6.3-7.3	6	88	4	2	0	0	0
				7.3-8.4	4	76	19	1	0	0	0
				Mean	**6**	**69**	**22**	**2**	**1**	**trace**	**0**
c	3	94	3	8.4-9.4	3	59	30	7	1	0	0
				9.4-9.6	4	26	50	7	8	5	0
				Mean	**3**	**54**	**33**	**7**	**2**	**1**	**0**
a+b+c	16	72	12	1.1-9.6	16	41	26	5	5	6	1

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	1.0-2.5	0	59	17	trace	2	2	10	0	trace	9	0	1
b	2.6-5.3	trace	21	9	33	1	6	4	15	3	3	1	4
c	8.4-9.6	25	13	7	0	6	4	1	0	1	1	42	0

TL 63 SE 17 **6579 3033** **Little Bardfield** **Block B**

Surface level +94.7 m
Water struck at +76.7 m
May 1981

Overburden 10.6 m
Mineral 12.0 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.4	0.4
Boulder Clay	Clay, brown, with chalk pebbles, becoming mottled brown and grey from 1.2 m	2.2	2.6
	Chalk gravel with chalk flour	0.3	2.9
	Clay, brown grey, with chalk pebbles	7.7	10.6
Kesgrave Sands and Gravels	**a** Sand with laminated silty seams from 16.0 m Sand: medium and fine with some coarse, quartz, pale brown becoming orange from 15.7 m	7.4	18.0
Crag	**b** Sand Gravel: mainly at the base, fine and coarse well rounded phosphatic nodules and some quartz ironstone and quartzite Sand: fine and medium with coarse, quartz, rusty brown	4.6	22.6
London Clay	Clay, silty, rusty brown, becoming olive grey from 22.7 m	0.2+	22.8

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					-$\frac{1}{16}$	+$\frac{1}{16}$ -$\frac{1}{4}$	+$\frac{1}{4}$ -1	+1 -4	+4 -16	+16 -64	+64 mm
a	9	91	0	10.6-11.6	5	21	73	1	0	0	0
				11.6-12.6	3	27	69	1	0	0	0
				12.6-13.6	7	17	75	1	0	0	0
				13.6-14.6	9	23	67	1	0	0	0
				14.6-15.2	10	19	70	1	0	0	0
				15.2-16.0	22	49	27	2	0	0	0
				16.0-17.0	11	45	43	1	0	0	0
				17.0-18.0	6	23	67	4	0	0	0
				Mean	**9**	**28**	**62**	**1**	**trace**	**0**	**0**
b	3	94	3	18.0-19.0	4	59	30	6	1	0	0
				19.0-20.0	5	82	8	3	2	0	0
				20.0-21.0	2	69	17	7	4	1	0
				21.0-22.0	2	29	57	10	2	0	0
				22.0-22.6	2	28	48	10	4	8	0
				Mean	**3**	**57**	**30**	**7**	**2**	**1**	**0**
a+b	7	91	2	10.6-22.6	7	39	48	4	1	1	0

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
18.0-22.6	44	15	14	0	4	2	trace	0	0	3	18	trace

TL 63 SE 18 **6684 3476** **Little Howe Wood** **Block C**

Surface level +85.6 m
Water not struck
June 1981

Waste 19.0 m
Bedrock 5.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, with chalk and some flint pebbles, becoming mottled brown and grey from 0.9 m	1.4	1.6
	Chalk, soft	0.9	2.5
	Clay, mottled brown and grey, with chalk pebbles, becoming grey with additional scattered pebbles of flint from 4.3 m	16.5	19.0
Lower London Tertiaries	Sand, fine, silty, green	1.0	20.0
	Silt, sandy, orange-brown, bioturbated	4.0+	24.0

TL 63 SE 19 **6642 3364** **Hawkins Hill** **Block C**

Surface level +96.7 m
Water not struck
June 1981

Waste 26.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, mottled brown and light grey, with chalk pebbles, becoming grey from 5.8 m	26.0+	26.3

TL 63 SE 20 **6620 3263** **Pitley Farm** **Block C**

Surface level +68.8 m
Water not struck
May 1981

Waste 2.1 m
Bedrock 2.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Head	Clay, sandy, mottled brown and orange-brown, with flint pebbles	2.0	2.1
Woolwich and Reading Beds	Silt, clayey, brown	2.2	4.3
	Clay, stiff, grey	0.7+	5.0

TL 63 SE 21 **6605 3185** **Brook House** **Block B**

Surface level +63.5 m
Water struck at +56.0 m
May 1981

Overburden 0.7 m
Mineral 8.4 m
Waste 5.7 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Glacial Sand and Gravel	Clay, sandy, brown, with fine chalk pebbles and some angular flints	0.5	0.7
	'Clayey' sandy gravel, becomes increasingly 'clayey' with depth Gravel: fine and coarse, angular flint with rounded chalk and well rounded flint Sand: medium coarse and fine, quartz with chalk and flint in the coarse fraction, brown becoming grey at the base	8.4	9.1
Glacial Silt	Silt, olive-grey, with a little peat and some fine flint, chalk and quartz pebbles	5.7	14.8
Upper Chalk	Chalk	1.3+	16.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages							
Fines	Sand	Gravel		Fines	Sand			Gravel			
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm	
18	44	38	0.7-1.4	12	20	21	14	26	7	0	
			1.4-2.4	17	17	20	15	24	7	0	
			2.4-3.4	21	10	22	15	27	5	0	
			3.4-4.5	17	9	19	13	28	14	0	
			4.5-5.5	22	8	19	13	27	11	0	
			5.5-6.5	17	7	19	11	23	23	0	
			6.5-7.5	17	6	20	12	26	19	0	
			7.5-8.0	6	9	30	24	27	4	0	
			8.0-9.1	30	13	16	10	21	10	0	
			Mean	**18**	**11**	**20**	**13**	**26**	**12**	**0**	

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.7-9.1	6	44	25	15	1	2	4	1	1	trace	0	1

TL 63 SE 22 **6661 3171** **Beslyns** **Block D**

Surface level +60.4 m
Water struck at +58.4 m and +43.0 m
May 1981

Overburden	3.8 m
Mineral	4.7 m
Waste	1.4 m
Mineral	2.7 m
Waste	3.7 m
Bedrock	1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, brown, becoming silt from 2.0 m	2.6	2.8
	Peat, dark brown, with fragments of wood	1.0	3.8
	a Sandy gravel Gravel: fine and coarse, angular flint with rounded chalk Sand: medium with coarse and fine, largely flint	4.7	8.5
	Peat, silty, brown	0.5	9.0
	Silt, grey, laminated	0.9	9.9
	b Gravel Gravel: fine and coarse, angular flint with rounded chalk Sand: coarse and medium with fine, flint and chalk with quartz, brown	2.7	12.6
	Silt, peaty, brown	3.7	16.3
Thanet Beds	Silt, sandy, olive green becoming grey, with a nodular flint pebble bed at the base	1.1	17.4
Upper Chalk	Chalk	0.1+	17.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages							
Fines	Sand	Gravel		Fines	Sand			Gravel			
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm	
a 4	60	36	3.8-4.8	3	2	16	14	38	27	0	
			4.8-5.8	3	3	25	20	36	13	0	
			5.8-6.8	2	5	31	15	23	24	0	
			6.8-7.8	6	17	56	15	6	0	0	
			7.8-8.5	9	26	52	10	3	0	0	
			Mean	**4**	**10**	**35**	**15**	**22**	**14**	**0**	
b 5	39	56	9.9-10.9	3	2	7	18	43	27	0	
			10.9-11.9	7	3	20	23	36	11	0	
			11.9-12.6	4	5	23	19	32	17	0	
			Mean	**5**	**3**	**16**	**20**	**38**	**18**	**0**	
a+b **4**	**52**	**44**	**Mean**	**4**	**7**	**28**	**17**	**29**	**15**	**0**	

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
a+b 3.8-12.6	3	56	20	8	1	4	2	4	1	trace	trace	1

TL 63 SE 23 **6670 3144** **Chequers** **Block B**

Surface level +61.9 m
Water struck at 59.7 m
May 1981

Overburden	1.2 m
Mineral	3.1 m
Bedrock	4.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Glacial Sand and Gravel	Clay, sandy, orange-brown, with scattered flint pebbles	1.0	1.2
	'Clayey', sandy gravel Gravel: fine and coarse, angular flint with well rounded flint and rounded chalk Sand: medium with coarse and fine, quartz with flint in the coarse fraction, orange brown	3.1	4.3
Woolwich and Reading Beds	Clay, stiff, brown-grey, becoming mottled olive-grey and red at the base	4.1+	8.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages							
Fines	Sand	Gravel		Fines	Sand			Gravel			
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm	
11	59	30	1.2-2.2	14	15	21	11	24	15	0	
			2.2-3.3	8	9	35	14	21	13	0	
			3.3-4.3	13	12	40	17	15	3	0	
			Mean	**11**	**12**	**33**	**14**	**20**	**10**	**0**	

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
1.2-4.3	10	43	23	10	1	5	2	2	trace	2	0	2

TL 63 SE 24 **6632 3112** **Wainfords Farm** **Block B**

Surface level +72.7 m
Water struck at +72.0 m
May 1981

Overburden 0.5 m
Mineral 1.0 m
Bedrock 6.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Crag	'Clayey' pebbly sand Gravel: fine, angular with well-rounded and quartzite Sand: medium and fine with coarse, subrounded quartz, orange-brown	1.0	1.5
London Clay	Clay, mottled orange-brown and light grey, becoming a grey clayey silt from 2.7 m	5.7	7.2
	Siltstone, grey	0.3+	7.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages							
Fines	Sand	Gravel		Fines	Sand			Gravel			
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm	
18	77	5	0.5-1.5	18	25	44	8	5	0	0	

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.5-1.5	14	36	37	1	5	3	2	0	0	1	0	

TL 63 SE 25 **6656 3045** **Cracknell's Farm** **Block B**

Surface level +75.4 m
Water struck at +74.5 m
May 1981

Overburden 0.5 m
Mineral 4.5 m
bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.5	0.5
Crag	Pebbly sand Gravel: fine with coarse, well rounded flint with well rounded phosphatic nodules, angular flint and angular ironstone and some rounded quartz and quartzite Sand: medium and fine with coarse, quartz, brown-yellow becoming rusty brown from 2.5 m	4.5	5.0
London Clay	Clay, silty, rusty brown becoming olive-grey from 5.3 m	0.5+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages							
Fines	Sand	Gravel		Fines	Sand			Gravel			
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm	
8	86	6	0.5-1.5	16	38	38	4	3	1	0	
			1.5-2.5	4	52	28	10	6	0	0	
			2.5-3.5	5	44	38	7	5	1	0	
			3.5-5.0	6	23	58	6	5	2	0	
			Mean	**8**	**37**	**42**	**7**	**5**	**1**	**0**	

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.5-5.0	41	10	4	0	7	4	1	0	trace	13	20	trace

TL 63 SE 26 **6787 3414** **Spains Hall Farm** **Block C**

Surface level +85.5 m
Water not struck
June 1981

Overburden 0.3 m
Mineral 2.9 m
Waste 14.9 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Glacial Sand and Gravel	'Very clayey' sandy gravel Gravel: fine and coarse, angular flint with some rounded chalk, quartzite, sandstone and angular ironstone Sand: medium and fine with coarse, quartz, chalk, flint, brown	2.9	3.2
Boulder Clay	Clay, brown, with chalk and scattered flint pebbles, becoming grey from 4.6 m	14.9	18.1
Woolwich and Reading Beds	Clay, stiff, mottled brown and red brown, with a seam of bioturbated olive silty clay from 18.3 m to 18.5 m	0.9+	19.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
23	44	33	0.3-0.7	32	11	15	11	17	14	0
			0.7-1.7	20	10	27	7	13	23	0
			1.7-2.7	23	18	28	9	17	5	0
			2.7-3.2	22	11	13	7	22	25	0
			Mean	**23**	**13**	**23**	**8**	**17**	**16**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.3-3.2	0	67	14	8	trace	3	2	1	1	3	0	1

TL 63 SE 27 **6725 3321** **The Thicket** **Block C**

Surface level +91.6 m
Water struck at +75.6 m
June 1981

Overburden 0.3 m
Mineral 2.1 m
Waste 11.6 m
Mineral 6.2 m
Waste 4.4 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Glacial Sand and Gravel	a 'Very clayey' sandy gravel Gravel: fine and coarse, angular flint Sand: medium and fine with coarse, orange-brown	2.1	2.4
Boulder Clay	Clay, brown, with pebbles of chalk and scattered flint, becoming grey from 4.3 m	11.4	13.8
Glacial Sand and Gravel	Clay, sandy, pale brown, with chalk and flint pebbles	0.2	14.0
	b 'Clayey' sandy gravel, with a seam of sandy silt from 15.9 m to 16.1 m Gravel: fine and coarse with some cobbles, mainly rounded chalk and angular flint Sand: coarse and medium with fine, flint and chalk with quartz in the fine grade, pale brown	6.2	20.2
Boulder Clay	Clay, stiff, olive-grey, with pebbles of chalk and flint	4.4	24.6
Woolwich and Reading Beds	Clay, stiff, olive brown, with blue-grey seams of silt	1.5+	26.1

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	32	48	20	0.3-2.4	32	16	25	7	11	9	0
b	10	47	43	14.0-15.0	22	9	23	16	25	5	0
				15.0-16.0	25	22	15	10	19	9	0
				16.0-17.0	6	11	16	19	26	21	1
				17.0-18.0	3	3	19	23	22	26	4
				18.0-19.0	2	6	23	19	19	31	0
				19.0-20.0	5	1	14	33	28	19	0
				Mean	**10**	**9**	**18**	**20**	**24**	**18**	**1**
a + b	**16**	**48**	**36**	**Mean**	**16**	**11**	**20**	**17**	**19**	**16**	**1**

TL 63 SE 28 **6795 3332** **Mill End** **Block C**

Surface level +81.4 m
Water struck at +76.5 m
June 1981

Overburden 0.8 m
Mineral 4.6 m
Waste 10.7 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Glacial Sand and Gravel	Clay, brown, with flint	0.5	0.8
	'Clayey' sandy gravel Gravel: fine and coarse, rounded chalk and angular flint Sand: medium and coarse with fine, quartz, flint and some chalk, orange-brown	4.6	5.4
Boulder Clay	Clay, brown, with flints at the top	0.6	6.0
	Chalk, soft	0.7	6.7
	Clay, grey, with pebbles of chalk and flint	9.4	16.1
London Clay	Silt, clayey, mottled purple, grey and green, with well-rounded flint pebbles at 16.5 m	0.4	16.5
Woolwich and Reading Beds	Silt, clayey, brown, with race nodules	0.7+	17.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
17	44	39	0.8-1.8	15	7	21	18	30	9	0
			1.8-2.2	15	10	22	17	27	9	0
			2.2-3.2	18	11	22	14	25	10	0
			3.2-4.2	18	8	20	12	26	16	0
			4.2-5.4	17	9	21	11	21	21	0
			Mean	**17**	**9**	**21**	**14**	**26**	**13**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.8-5.4	0	24	11	51	1	2	3	3	2	2	0	1

TL 63 SE 29 **6737 3235** **Great Winsey** **Block C**

Surface level +86.2 m
Water struck at +70.9 m
May 1981

Overburden 12.7 m
Mineral 5.5 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.7	0.7
Boulder Clay	Clay, mottled brown and grey, with chalk pebbles, becoming grey from 5.8 m	12.0	12.7
Crag	Sand Gravel: fine and coarse, well rounded flint and angular ironstone with angular flint and rounded quartz. Sand: medium and fine with coarse, quartz, orange	5.5	18.2
London Clay	Silt, mottled brown-grey and rusty-brown becoming olive-grey from 18.8 m	0.9+	19.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
8	89	3	12.7-13.7	11	22	63	3	1	0	0
			13.7-14.7	12	30	48	9	1	0	0
			14.7-15.3	11	62	24	3	0	0	0
			15.3-16.3	5	45	43	5	2	0	0
			16.3-17.3	5	33	47	7	5	3	0
			Mean	**8**	**37**	**47**	**5**	**2**	**1**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
12.7-18.2	43	8	4	0	8	1	3	0	0	33	trace	trace

TL 63 SE 30 **6702 3148** **Littles** **Block C**

Surface level +67.1 m
Water struck at +60.2 m, +52.1 m and +43.8 m
July 1981

Overburden 0.8 m
Mineral 1.6 m
Bedrock 21.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Glacial Sand and Gravel	Clay, sandy, brown, with scattered flint chalk pebbles	0.6	0.8
	'Very clayey' pebbly sand Gravel: fine with coarse, angular flint with some rounded sandstone, well rounded flint, rounded chalk and quartzite and angular ironstone Sand: fine and medium with coarse, subangular quartz with some angular flint	1.6	2.4
Woolwich and Reading Beds	Clay, silty, stiff, mottled brown, red, grey and green, with race nodules in the top metre and sand and sandy seams from 6.7 m to 15.8 m	13.4	15.8
	Sand, silty, olive-grey	6.8	22.6
Thanet Beds	Sand, silty, glauconitic, micaceous, olive-green, with a bed of nodular flints at the base	0.7	23.3
Upper Chalk	Chalk	0.9+	24.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
38	48	14	0.8-2.4	38	22	20	6	11	3	0

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.8-2.4	5	60	14	4	2	3	6	2	trace	3	0	1

TL 63 SE 31 **6711 3146** **Littles** **Block C**

Surface level +68.4 m
Water struck at +62.9 m and +51.6 m
May 1981

Waste 0.6 m
Bedrock 16.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and subsoil	0.6	0.6
London Clay	Clay, sandy, mottled orange-brown and light grey, becoming laminated sandy silt from 1.3 m with a basal bed of well rounded flint pebbles from 4.0 m	3.5	4.1
	Silt, grey-brown, with a second flint pebble bed from 5.0 m to 5.1 m	3.5	7.6
	'Clayey' sand: fine with medium, quartz, olive grey	0.7	8.3
Woolwich and Reading Beds	Clay, silty, stiff, olive-grey with race nodules, becoming mottled brown, black, red and light blue, with silt and sandy seams from 9.0 m	8.5+	16.8

TL 63 SE 32 **6789 3151** **Peak's Farm** **Block C**

Surface level +70.3 m
Water not struck
May 1981

Waste 28.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Glacial Sand and Gravel	Clay, sandy, brown with scattered flints	0.8	1.1
	'Very clayey' gravel Gravel: fine with coarse and cobbles, angular flint with some rounded quartzite, sandstone and quartz and angular ironstone Sand: medium coarse and fine, quartz with flint in the coarse fraction, orange-brown	0.6	1.7
Boulder Clay	Clay, mottled brown and light grey, with rounded chalk pebbles, becoming grey from 5.0 m	23.9	25.6
Glacial Silt	Silt, olive grey	0.7	26.3
Boulder Clay	Clay, grey, with chalk pebbles	0.2	26.5
Glacial Silt	Silt, olive grey	1.7+	28.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
22	37	41	1.1-1.7	22	9	17	11	25	10	6

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
1.1-1.7	trace	61	27	0	4	2	4	0	0	2	0	trace

TL 63 SE 33 **6705 3112** **Copford Hall** **Block B**

Surface level +60.0 m
Water struck at +56.3 m
May 1981

Overburden 0.3 m
Mineral 5.3 m
Bedrock 2.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Glacial Sand and Gravel	'Clayey' sandy gravel Gravel: fine and coarse, angular flint with rounded chalk, well rounded flint and rounded sandstone Sand: medium and coarse with fine, subrounded quartz, brown	5.3	5.6
Woolwich and Reading Beds	Silt, sandy, olive grey	0.4	6.0
	Clay, stiff brown, becoming mottled brown, pale blue and red-brown	2.0+	8.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
13	54	33	0.3-1.5	14	13	33	12	22	6	0
			1.5-2.3	9	11	27	15	30	8	0
			2.3-2.6	14	7	30	11	30	8	0
			2.6-3.7	26	7	23	10	27	7	0
			3.7-4.7	4	5	36	21	32	2	0
			4.7-5.6	5	7	33	22	30	3	0
			Mean	**13**	**8**	**31**	**15**	**28**	**5**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.3-5.6	3	52	26	10	2	1	3	1	1	1	trace	trace

TL 63 SE 34 **6728 3043** **Great Bardfield** **Block B**

Surface level +81.2 m
Water struck at +73.7 m
May 1981

Overburden 1.4 m
Mineral 9.4 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Barham Sands and Gravels	Clay, sandy, brown, with scattered flint pebbles, becoming orange-brown and less clayey from 0.8 m	1.3	1.4
	a 'Very clayey' gravel Gravel: coarse and fine, angular flint with some quartzite and ironstone Sand: fine, coarse and medium, flint with quartz, orange-brown	0.3	1.7
Crag	**b** 'Clayey' pebbly sand, with bands of ironstone Gravel: fine and coarse, well rounded and angular flint with angular ironstone and well rounded phosphatic nodules and some rounded quartz and quartzite Sand: medium and fine with coarse, subrounded quartz with some mica, orange-brown becoming rusty-orange	9.1	10.8
London Clay	Clay, micaceous, grey-brown, becoming silty and olive-grey from 11.0	0.4+	11.2

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	22	27	51	1.4-1.7	22	12	7	8	23	28	0
b	10	84	6	1.7-2.4	11	42	44	3	0	0	0
				2.4-3.4	24	25	48	3	0	0	0
				3.4-4.4	13	18	66	3	0	0	0
				4.4-5.4	6	19	65	7	1	2	0
				5.4-6.4	16	17	57	5	1	4	0
				6.4-7.5	8	39	50	2	1	0	0
				7.5-8.5	9	41	42	7	1	0	0
				8.5-9.5	8	35	47	8	2	0	0
				9.5-10.8	3	18	33	17	15	14	0
				Mean	**10**	**28**	**50**	**6**	**3**	**3**	**0**
a+b	11	82	7	1.4-10.8	11	27	49	6	4	3	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	1.4-1.7	0	62	31	0	1	3	0	0	0	3	0	0
b	1.7-10.8	31	23	8	0	4	2	trace	0	trace	16	16	trace

TL 63 SE 35 **6853 3425** **Tridgate Ley** **Block C**

Surface level +67.4 m
Water struck at +65.3 m
June 1981

Waste 2.8 m
Bedrock 3.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Alluvium	Clay, silty, mottled brown and grey	1.7	2.1
	Gravel: fine and coarse, angular flint with some rounded quartzite and chalk	0.7	2.8
	Sand: medium and fine with coarse, subrounded quartz, pale brown		
Woolwich and Reading Beds	Clay, sandy, mottled grey and brown, becoming mottled red to olive-grey from 3.3 m and more sandy from 5.8 m	3.2+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
19	51	30	2.1-2.8	19	20	23	8	19	11	0

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction										
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
2.1-2.8	0	64	26	2	1	4	1	trace	1	trace	0	1

TL 63 SE 36 **6883 3345** **Fancy Covert** **Block C**

Surface level +81.4 m
Water struck at +79.9 m
June 1981

Overburden 0.9 m
Mineral 1.0 m
Waste 13.1 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with flint pebbles	0.6	0.9
Glacial Sand and Gravel	'Very clayey' pebbly sand	1.0	1.9
	Gravel: fine, angular flint with rounded chalk and some rounded quartzite and sandstone, subangular limestone and rounded quartz		
	Sand: fine with medium and some coarse, quartz with flint, orange-brown		
Boulder Clay	Clay, brown, with chalk and flint pebbles, becoming grey from 4.0 m	13.1	15.0
London Clay	Silt, brown, becoming clayey and grey-blue from 15.2 m with well rounded flint pebbles	1.4+	16.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
21	72	7	0.9-1.5	21	50	18	4	7	0	0
			1.5-1.9	No grading data available						
			Mean	**21**	**50**	**18**	**4**	**7**	**0**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction										
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
0.9-1.5	0	22	29	23	4	9	7	6	trace	0	0	0

TL 63 SE 37 **6818 3259** **Winsey Chase** **Block C**

Surface level +76.3 m
Water struck at +69.7 m
May 1981

Overburden	0.9 m
Mineral	3.3 m
Waste	1.8 m
Mineral	3.8 m
Waste	12.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Glacial Sand and Gravel	Clay, sandy, brown, with scattered pebbles	0.6	0.9
	a 'Clayey' sandy gravel Gravel: fine and coarse, angular flint with rounded chalk and some rounded sandstone quartzite and quartz Sand: medium and fine with coarse, subangular flint and subrounded quartz	3.3	4.2
Boulder Clay	Clay, brown, with chalk pebbles, becoming mottled brown and light grey at the base	1.8	6.0
Glacial Sand and	**b** Gravel Gravel: fine and coarse, angular flint and rounded chalk with some sandstone, quartzite, limestone, fossil debris and quartz Sand: coarse and medium with fine, rounded chalk and angular flint with some subrounded quartz in the fine fraction, light grey	3.8	9.8
Boulder Clay	Clay, pale brown, with chalk pebbles, becoming grey from 10.5 m	12.9	22.7

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	19	54	27	0.9-1.9	24	17	24	7	14	14	0
				1.9-2.9	18	17	33	8	14	10	0
				2.9-4.2	16	19	31	8	15	11	0
				Mean	**19**	**18**	**28**	**8**	**15**	**12**	**0**
b	7	37	56	6.0-6.6	29	8	11	11	20	21	0
				6.6-7.6	6	3	20	24	30	17	0
				7.6-8.6	2	3	16	17	29	33	0
				8.6-9.6	2	2	11	15	34	36	0
				9.6-9.8	5	10	26	13	21	25	0
				Mean	**7**	**4**	**16**	**17**	**29**	**27**	**0**
a+b	**13**	**45**	**42**	**Mean**	**13**	**10**	**22**	**13**	**22**	**20**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	0.9-4.2	trace	45	28	12	3	4	5	1	trace	1	trace	1
b	6.0-9.8	0	29	12	40	2	4	4	3	3	1	0	2

TL 63 SE 38 **6878 3156** **Robjohns** **Block C**

Surface level 77.1 m
Water struck at +68.1 m
May 1981

Overburden	1.5 m
Mineral	8.4 m
Bedrock	1.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Barham Sands and Gravels	Clay, sandy, orange-brown, with scattered flint and quartz pebbles	1.2	1.5
	a 'Clayey' sand Gravel: fine, angular flint and rounded chalk Sand: medium and fine with some coarse, orange-brown	1.0	2.5
Kesgrave Sands and Gravels	**b** Sand: fine and medium, quartz, pale yellow	4.6	7.1
Crag	**c** 'Clayey' pebbly sand Gravel: fine and coarse, well rounded with angular flint and rounded quartz and quartzite Sand: fine and medium with coarse, quartz, orange, becoming rusty brown from 8.1 m	2.8	9.9
London Clay	Silt, clayey, brown-grey from 11.3 m	1.9+	11.8

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	14	85	1	1.5-2.5	14	23	61	1	1	0	0
b	7	93	0	2.5-4.0	7	36	57	0	0	0	0
				4.0-5.0	9	51	40	0	0	0	0
				5.0-6.0	6	60	34	0	0	0	0
				6.0-7.1	6	81	13	0	0	0	0
				Mean	**7**	**55**	**38**	**trace**	**0**	**0**	**0**
c	10	85	5	7.1-8.1	5	54	35	5	1	0	0
				8.1-9.0	21	39	30	7	3	0	0
				9.0-9.9	4	49	31	5	5	6	0
a+b+c	9	89	2	1.5-9.9	9	49	38	2	1	1	0

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
c	7.1-9.9	57	19	3	0	7	6	1	0	trace	7	trace	trace

TL 63 SE 39 **6860 3063** **School Farm** **Block B**

Surface level +71.7 m
Water struck at +69.6 m
May 1981

Overburden 1.1 m
Mineral 4.9 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.1	1.1
Crag	Pebby sand Gravel: fine with some coarse between 2.1 m and 3.1 m, well rounded and angular flint with rounded quartz and angular ironstone Sand: medium with fine and coarse, subrounded quartz, rusty brown	4.9	6.0
London Clay	Clay, brown, becoming an olive-grey micaceous clayey silt from 6.1 m	0.3+	6.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
6	87	7	1.1-2.1	13	22	55	6	4	0	0
			2.1-3.1	4	16	42	23	13	2	0
			3.1-4.1	4	15	54	19	8	0	0
			4.1-5.1	4	14	59	21	2	0	0
			5.1-6.0	No grading data available						
			Mean	**6**	**17**	**53**	**17**	**7**	**trace**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
1.1-6.0	29	18	7	trace	20	3	1	0	trace	18	1	3

TL 63 SE 40 **6989 3288** **Justice's Hill** **Block C**

Surface level +90.1 m
Water struck at +84.3 m and +75.6 m
June 1981

Overburden 12.7 m
Mineral 9.5 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.4	1.4
Boulder Clay	Clay, mottled brown and grey, with pebbles of chalk and flint	2.9	4.3
Glacial Silt	Silt, brown, with scattered chalk and flint pebbles	1.5	5.8
Boulder Clay	Chalk, soft, with some brown clay and chalk pebbles	1.2	7.0
	Clay, grey, with pebbles of chalk and flint, becoming mottled light brown and grey from 9.9 m	5.7	12.7
Crag	Sand, with bands of ironstone Gravel: fine with some coarse between 19.0 m and 20.0 m, angular and well rounded flint with rounded quartz and quartzite and some well rounded phosphatic nodules and ironstone Sand: medium and fine with some coarse, subrounded quartz, orange-yellow becoming orange-brown from 20.0 m	9.5	22.2
London Clay	Silt, clayey, brown	0.6+	22.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
8	91	1	12.7-14.0	14	21	60	4	1	0	0
			14.0-15.0	11	17	67	5	0	0	0
			15.0-16.0	9	40	47	3	1	0	0
			16.0-17.0	8	31	52	8	1	0	0
			17.0-18.0	7	36	50	6	1	0	0
			18.0-19.0	5	17	70	7	1	0	0
			19.0-20.0	2	25	65	6	1	1	0
			20.0-21.0	4	64	31	1	0	0	0
			21.0-22.0	8	87	4	1	0	0	0
			22.0-22.2	8	78	10	2	2	0	0
			Mean	**8**	**38**	**49**	**4**	**1**	**trace**	**0**

TL 63 SE 41 **6901 3246** **Finchingfield** **Block C**

Surface level +80.8 m
Water struck at +70.1 m
June 1981

Overburden	5.3 m
Mineral	3.1 m
Waste	0.7 m
Mineral	3.7 m
Bedrock	1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, brown with scattered flints, pebbles of chalk from 1.2 m	5.0	5.3
Glacial Sand and Gravel	**a** 'Clayey' sandy gravel Gravel: fine and coarse, rounded chalk and angular flint with some limestone, sandstone, quartzite and quartz Sand: medium with coarse and fine, subrounded quartz with some flint, yellow	3.1	8.4
Boulder Clay	Clay, brown, with chalk and scattered flint pebbles	0.7	9.1
Kesgrave Sands and Gravels	**b** Sand: fine with medium and some coarse, quartz, pale yellow	1.2	10.3
Crag	**c** Sand Gravel: fine, well rounded flint with angular ironstone Sand: medium and fine with some coarse, quartz, yellow orange, becoming rusty orange from 11.0 m	2.5	12.8
London Clay	Clay, silty, brown becoming grey from 13.0 m	1.0+	13.8

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
					Fines	Sand			Gravel		
	Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	10	65	25	5.3-6.3	9	13	50	7	12	9	0
				6.3-7.3	10	7	41	14	22	6	0
				7.3-8.4	10	8	42	12	18	10	0
				Mean	10	9	45	11	17	8	0
b	6	94	0	9.1-10.3	6	75	18	1	trace	0	0
c	5	94	1	10.3-10.7	7	44	45	1	3	0	0
				10.7-11.7	5	44	48	3	0	0	0
				11.7-12.8	3	36	59	1	1	0	0
				Mean	**5**	**41**	**51**	**2**	**1**	**0**	**0**
a+b+c	**7**	**81**	**12**	**Mean**	**7**	**32**	**43**	**6**	**8**	**4**	**0**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	5.3-8.4	1	26	14	44	2	3	3	4	1	1	0	1

TL 63 SE 42 **6993 3183** **Petches** **Block C**

Surface level +71.6 m
Water struck at +70.2 m
May 1981

Overburden	1.0 m
Mineral	4.3 m
Bedrock	4.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Crag	Clay, sandy, orange-brown	0.5	1.0
	Sand Gravel: fine with coarse, well rounded and angular flint with rounded quartz and some limestone, quartzite, phosphatic nodules and ironstone Sand: medium and fine with coarse, quartz with some angular flint in the coarse fraction, orange-brown	4.3	5.3
London Clay	Clay, silty, rusty brown becoming olive grey from 5.9 m	4.4+	9.7

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
				Fines	Sand			Gravel		
Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	91	4	1.0-1.4	13	33	51	2	1	0	0
			1.4-2.4	4	28	60	7	1	0	0
			2.4-3.4	5	38	50	6	1	0	0
			3.4-4.4	4	28	48	11	8	1	0
			4.4-5.3	4	22	57	7	5	5	0
			Mean	**5**	**29**	**55**	**7**	**3**	**1**	**0**

COMPOSITION

Depth below surface (m)	Percentages by weight in +4 mm fraction											
	Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
	Rounded	Angular	Patinated									
1.0-5.3	46	16	13	0	9	4	trace	5	0	2	3	2

TL 63 SE 43 **6934 3106** **Sculpin's Bridge** **Block D**

Surface level +53.6 m
Water struck at +51.5 m and +43.8 m
May 1981

Waste 2.1 m
Bedrock 9.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Alluvium	Clay, silty, brown, becoming mottled to grey at the base. Passing down into a grey-brown peaty silt from 2.0 m	1.7	2.1
Woolwich and Reading Beds	Clay, silty, mottled brown, yellow and light grey, becoming stiff clay from 2.6 m. Passing down into a sandy clayey silt from 3.8 m	7.2	9.3
	Sand and silt alternating with seams of clay and silt, brown, becoming mottled red and blue-grey	2.0+	11.3

TL 63 SE 44 **6943 3041** **Cross Farm** **Block B**

Surface level +80.2 m
Water struck at +67.2 m
May 1981

Overburden 4.3 m
Mineral 17.0 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with scattered flints and additional pebbles of chalk from 0.7 m	0.6	0.9
	Chalk gravel with chalk flour	0.4	1.3
	Clay, grey-brown, with chalk pebbles	2.7	4.0
Barham Sands and Gravels	Clay, sandy, orange-brown, with pebbles of well rounded flint and rounded quartz	0.3	4.3
	a Pebbly sand Gravel: fine with coarse and cobbles, angular flint and rounded quartzite Sand: medium with fine and some coarse, subrounded quartz, white	2.0	6.3
Kesgrave Sands and Gravels	b Sand, with silt seams Gravel: some fine flint, quartz and quartzite Sand: medium with fine and some coarse, subrounded quartz, white	3.0	9.3
Crag	c Pebbly sand, with bands of ironstone Gravel: coarse and fine, with cobbles of shelly sandstone at the base, angular ironstone with well rounded and angular flint above 18.7 m. Below 18.7 m mainly angular with some well rounded flint, quartzite and phosphatic nodules Sand: medium and fine with coarse, subrounded quartz with some glauconitic grains and shell fragments in the coarse fraction from 18.7 m	12.0	21.3
London Clay	Silt, brown-grey and bioturbated from 21.4 m	0.3+	21.6

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
a	4	87	9	4.3-5.3	3	5	78	4	8	2	0
				5.3-6.3	5	13	70	3	5	2	2
				Mean	**4**	**9**	**75**	**3**	**6**	**2**	**1**
b	6	94	0	6.3-7.3	5	30	65	0	0	0	0
				7.3-8.3	7	24	66	2	1	0	0
				8.3-9.3	5	16	75	3	1	0	0
				Mean	**6**	**23**	**69**	**2**	**trace**	**0**	**0**
c	7	88	5	9.3-10.3	8	18	71	3	0	0	0
				10.3-11.4	12	18	64	2	1	3	0
				11.4-12.4	8	27	58	4	3	0	0
				12.4-13.0	8	30	52	8	2	0	0
				13.0-14.0	5	18	64	8	4	1	0
				14.0-15.0	3	78	18	1	0	0	0
				15.0-16.0	3	85	11	1	0	0	0
				16.0-17.0	5	38	47	8	2	0	0
				17.0-18.0	7	20	57	9	3	4	0
				18.0-18.7	4	26	48	14	1	7	0
				18.7-19.7	14	17	44	21	2	1	1
				19.7-20.7	4	19	47	20	6	4	0
				20.7-21.3	5	22	27	10	9	24	3
				Mean	**7**	**32**	**48**	**8**	**2**	**3**	**trace**

COMPOSITION

	Depth below surface (m)	Percentages by weight in +4 mm fraction											
		Flint			Chalk	Quartz	Quartz-ite	Sand-stone	Lime-stone	Fossil debris	Iron-stone	Phosph. nodules	Others
		Rounded	Angular	Patinated									
a	4.3-6.3	20	20	15	0	31	12	1	0	0	0	0	1
c	9.3-18.7	18	8	2	0	1	1	0	0	trace	69	1	trace
c	18.7-21.3	5	89	trace	0	trace	2	trace	0	trace	trace	1	3

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INSTITUTE OF GEOLOGICAL SCIENCES

INDUSTRIAL MINERALS ASSESSMENT UNIT

THE SAND AND GRAVEL RESOURCES OF THE COUNTRY NORTH-EAST OF THAXTED, ESSEX

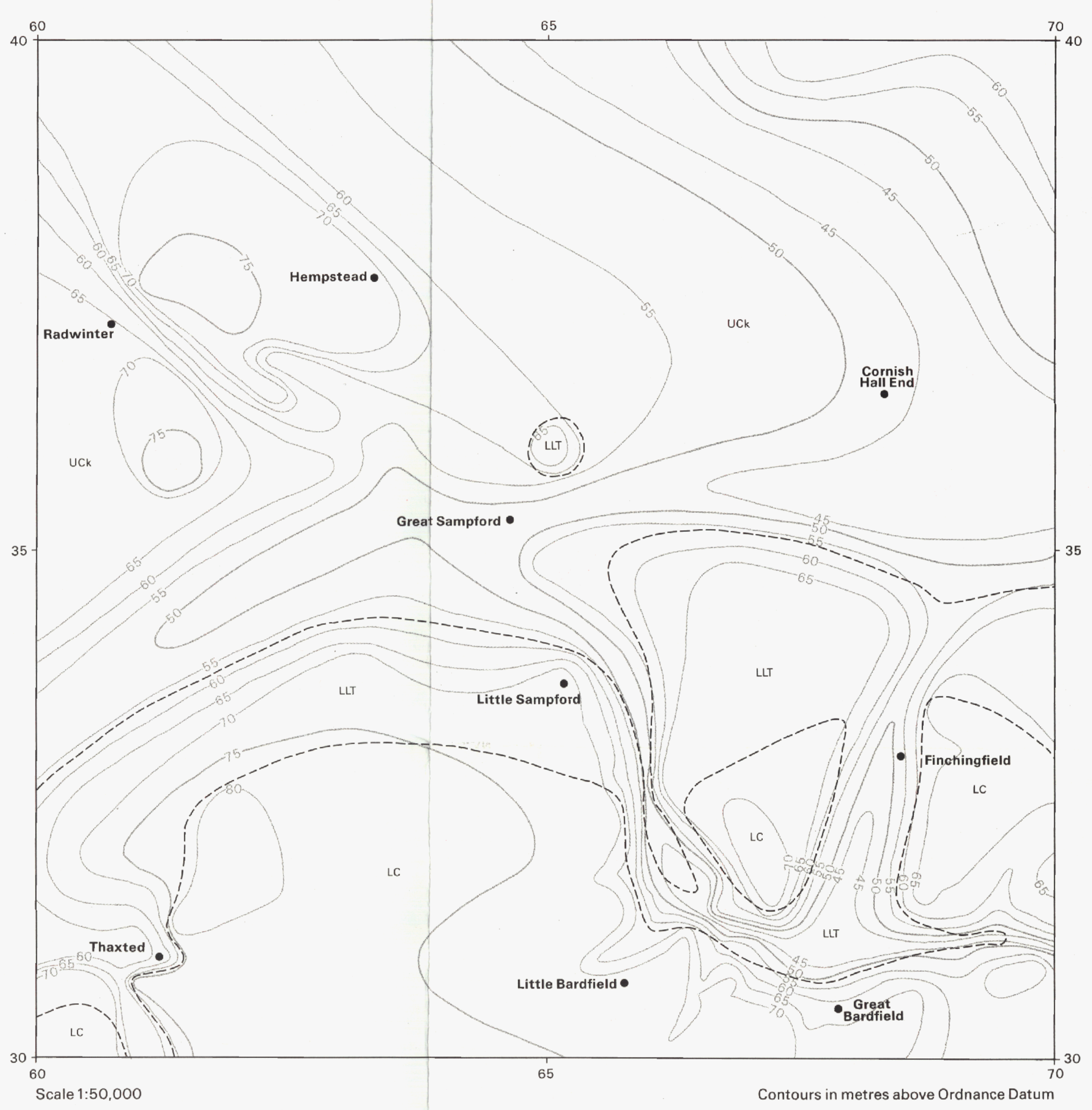
Scale 1:25 000 or about 2½ Inches to 1 Mile

ORDNANCE SURVEY SHEET TL63 PROVISIONAL EDITION

THE SAND AND GRAVEL RESOURCES OF SHEET TL 63 (NORTH-EAST OF THAXTED, ESSEX)

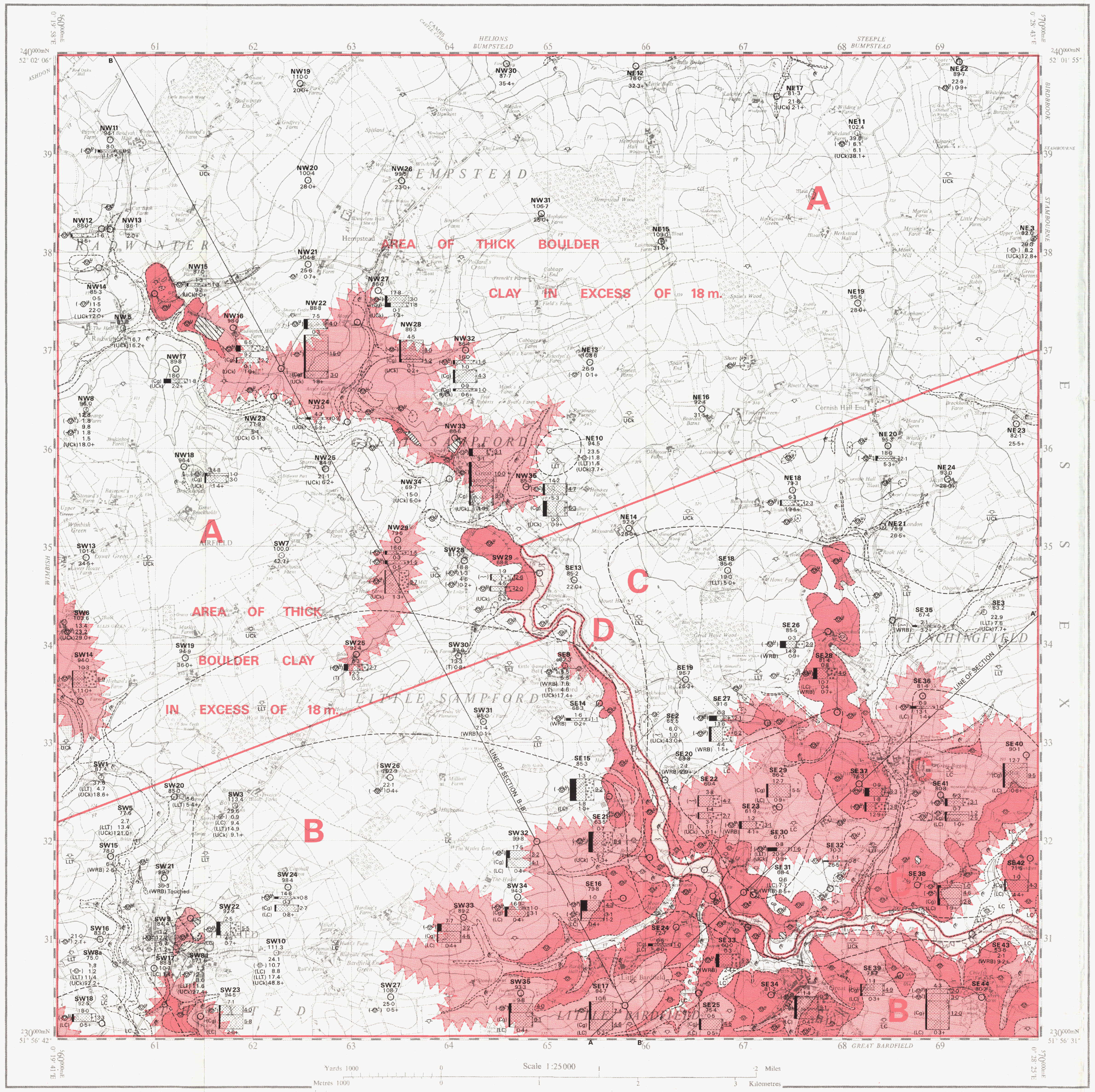
133

CONTOURS ON THE TERTIARY-CRETACEOUS BEDROCK SURFACE



Scale 1:50,000

Contours in metres above Ordnance Datum



Scale 1:25 000

Yards 1000 0 1 2 Miles

Metres 1000 0 1 2 3 Kilometres

The representation on this map of a Road, Track, or Footpath, is no evidence of the existence of a right of way.

Geological lines from a six-inch survey by B. S. P. Moorlock and J. A. Zalasiewicz 1979-80, R. A. Bazley, District Geologist. Included in one-inch Geological Sheets 205, 206, 222 and 223.

Sand and gravel survey by R. J. Marks, P. H. A. Nancarrow and D. W. Murray in 1981, R. G. Thurrell, Head, Industrial Minerals Assessment Unit.

1:25,000 Sand and Gravel Resource Sheet published 1982. G. M. Brown, D.Sc., F.R.S., Director, Institute of Geological Sciences.

The GRID lines on this sheet are at 1 Kilometre interval. Heights are in feet above Mean Sea Level at Newlyn. Contour values are in feet. 1 square inch on this map represents 99·639 acres on the ground.

Compiled from 6" sheets last fully revised 1916-19. Other partial systematic revision 1946-52 has been incorporated.

Made and published by the Director General of the Ordnance Survey, Southampton. Reprinted with minor corrections 1960.

Data quoted for an individual borehole refer strictly to that site, reliable conclusions cannot be drawn about the thickness and grading elsewhere in the deposit, particularly in material as variable as sand and gravel. However, estimates of the volume and mean grading of the mineral as a whole in each Resource Block are given in the Report.

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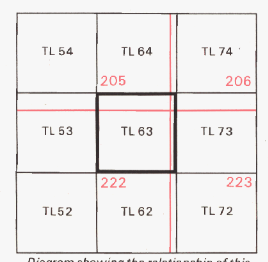
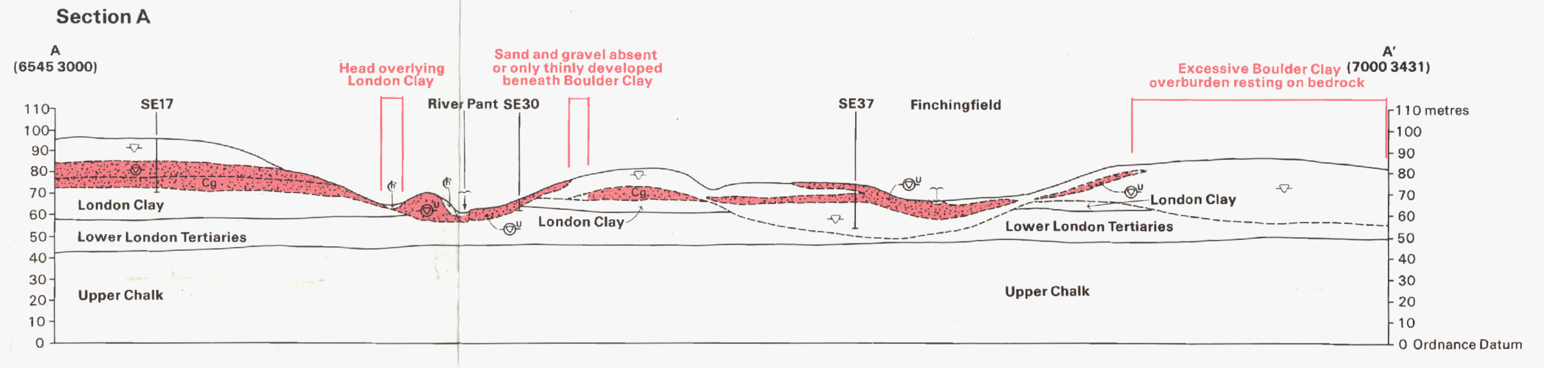


Diagram showing the relationship of this sheet to the National Grid 1:25,000 sheets, and the one-inch Geological Sheets 205, 206, 222 and 223.

SCHEMATIC SECTIONS SHOWING THE RELATIONSHIP OF THE DRIFT DEPOSITS AND SOLID FORMATIONS WITH THE POTENTIALLY WORKABLE SAND AND GRAVEL

Section A



KEY TO SECTIONS

For symbols see map legend

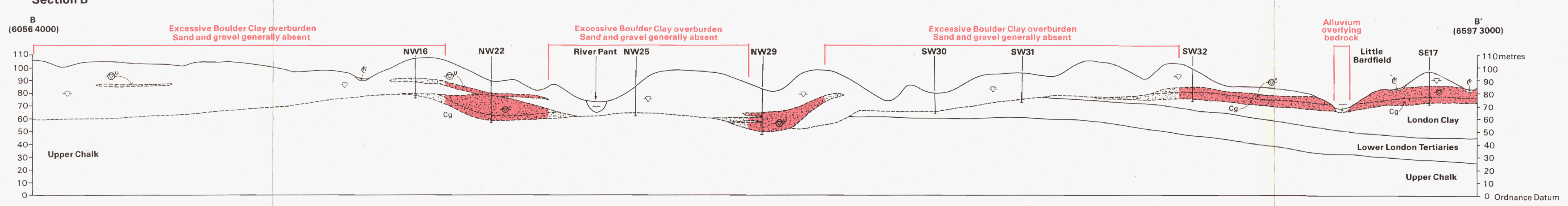
Deposits of sand and gravel

Potentially workable sand and gravel

Horizontal scale 1:25,000

Vertical scale: x10

Section B



This map should be read in conjunction with the accompanying Report which contains details of the assessment of resources.

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

RECENT AND PLEISTOCENE

Alluvium – silts, clays and peats with basal sand and gravel A-20

Head – poorly sorted pebbly sandy clay H-33

Glacial Sand and Gravel, upper – poorly sorted often clayey sands and gravels with pebbles of chalk and flint GS-85

Boulder Clay – brown and grey clay with pebbles of chalk and flint BC-30

Glacial Silt – clayey sandy silt, often laminated, with chalk pebbles GSI-14

Barham Sands and Gravels – poorly sorted clayey sandy gravel BSG-5

Kesgrave Sands and Gravels – well sorted fine and medium sands K-12

Barham Sands and Gravels, Kesgrave Sands and Gravels, and Crag, undifferentiated – while the individual deposits are identified in I.M.A.U. borehole records these sub-Boulder Clay sands and gravels are mapped as a single unit due to their similar lithologies BSG-6

SOLID

Crag – red-brown sand with some pebbles CG-2

EOCENE, PALAEOCENE

London Clay – olive grey silty clay

Woolwich and Reading Beds – mottled clays and sandy clays

Thanet Beds – silty sand

LLT **Lower London Tertiaries**

CRETACEOUS

Upper Chalk – soft white limestone

Made ground MG-2

Worked-out areas of sand and gravel WO-9

The superposition of symbols indicates the deposit at the surface and the solid formation (UCk) beneath the drift; other drift deposits may intervene

BOUNDARY LINES

Geological boundary, Drift

Geological boundary, Solid

Inferred boundary between recognised categories of deposits

Resource Block boundary

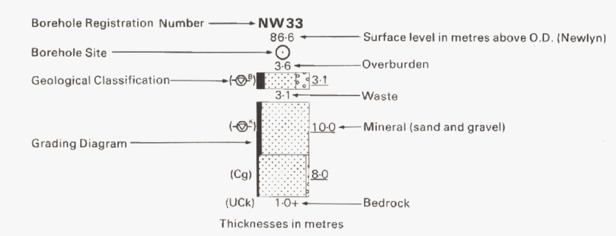
BOREHOLE DATA

SITE LOCATIONS

Industrial Minerals Assessment Unit (I.M.A.U.) Boreholes

Other Boreholes

I.M.A.U. BOREHOLES



Note:
(i) Figures underlined denote thicknesses used in the assessment of resources
(ii) The + sign indicates that the base of the deposit was not reached
(iii) The Geological Classification is given only for mineral and bedrock

Borehole Registration Number

Each I.M.A.U. borehole is identified by a Registration Number, e.g. **NW33.** The letters refer to the quarter sheet and the figures to the I.G.S. serial number for that quarter. The unique designation for the borehole **NW33** is **TL 63 NW33.**

Grading Diagram

Each grading diagram shows the mean particle size distribution of a distinct deposit of sand and gravel

Sand (+1/16 – 4mm)
Fines (–1/16mm)
Gravel (+4mm)

The height of the diagram is proportional to the thickness of sand and gravel. The widths of the divisions show the proportions of **Fines, Sand** and **Gravel**

OTHER BOREHOLES

The layout of information is the same as for I.M.A.U. boreholes although the data available may not be as comprehensive. They are registered in the same series. The final depth of deep boreholes is given in metres above (+) or below (–) O.D. (Newlyn).

CATEGORIES OF DEPOSITS

Exposed mineral (average thickness of overburden less than 1·0m) CAT E-10

Continuous or almost continuous spreads of mineral beneath overburden (average thickness of overburden greater than 1·0m) CAT C-3

Discontinuous spreads of mineral beneath overburden CAT-D1

Sand and gravel either not potentially workable (see Report) or absent CAT-A2

RESOURCE BLOCKS

For the purpose of assessment the mineral-bearing land is divided into Resource Blocks (see Report). Each is designated by a letter.

Detailed records may be consulted on application to the Head, Industrial Minerals Assessment Unit, Institute of Geological Sciences, Keyworth, Nottingham, NG12 5GG.

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