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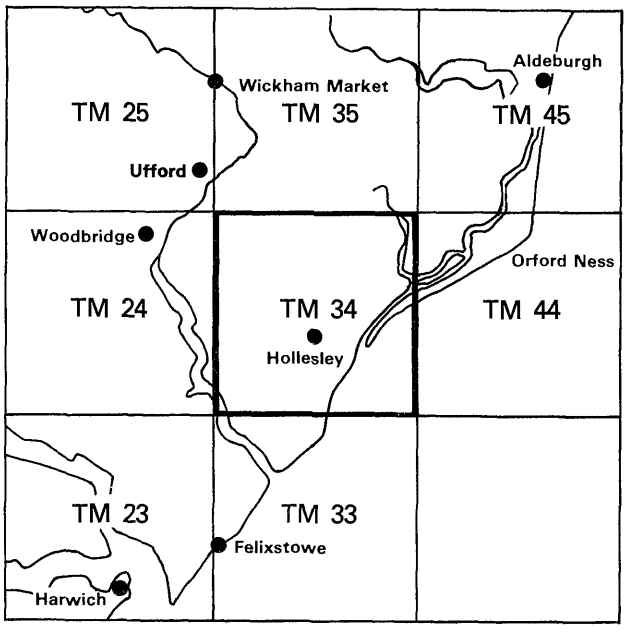

The sand and gravel resources of the country around Hollesley, Suffolk

Description of 1:25 000 resource sheet TM 34

S. E. Hollyer and R. Allender

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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 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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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 aggregate 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 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 resources of sand and gravel of 77.4 km^2 of country around Hollesley, Suffolk, shown on the accompanying resource map. The survey was conducted in 1969 and 1971 by the late Dr R. Allender and by Mr S. E. Hollyer, who supervised the drilling and sampling programme, assisted for short periods by Mr S. Booth and Mr S. Machin. The work is based on one-inch geological surveys by W. Whitaker and W. H. Dalton, published on the old-series sheets 48 NE in 1882 and 50 SE in 1883. The geological lines were transferred to the new-series sheets 208 and 225 and published in 1928. These were published as a combined sheet in 1956 and reprinted in 1967.

Mr D. L. Dundas has contributed extensively to the text of this report and has been responsible for its compilation.

Mr J. W. Gardner, CBE (Land Agent) was responsible for negotiating access to land for drilling. The ready cooperation of landowners and tenants, and the assistance of the Forestry Commission is gratefully acknowledged.

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SUMMARY

The geological maps of the Institute of Geological Sciences, 70 boreholes drilled for the Industrial Minerals Assessment Unit and some reconnaissance field work by the authors to confirm certain geological lines, form the basis of the assessment of sand and gravel resources in the Hollesley area, Suffolk.

All deposits in the area which might be potentially workable for sand and gravel (mineral) have been investigated geologically and a simple statistical method has been used to estimate their volume. The reliability of the volume estimates is given at the symmetrical 95 per cent confidence level.

The 1:25 000 map is divided into seven resource blocks containing between 5.3 and 10.0 km^2 of sand and gravel. For each block the mineral-bearing area, the mean thickness of overburden and mineral and the mean grading are given, and the geomorphology and geology of the deposits described.

The position of the boreholes and exposures, the geology and topography and the outlines of the blocks are shown on the accompanying resource sheet, TM 34. Detailed borehole data are given.

Bibliographical reference

HOLLYER, S. E. and ALLENDER, R. 1982. The sand and gravel resources of the country around Hollesley, Suffolk: description of 1:25 000 resource sheet TM 34. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 83.

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Note

National Grid references are given in square brackets. In this publication all lie within the 100-km square TM.

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, both the economic and the social factors used to decide whether a deposit may be workable in the future cannot 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; Thurrel, 1971; 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 geological evidence. The sites available for inspection, measurement, and sampling are too widely-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 BS sieve, about $\frac{1}{16}$ mm) should not exceed 40 per cent.
d The deposit must 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 which 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.

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 has

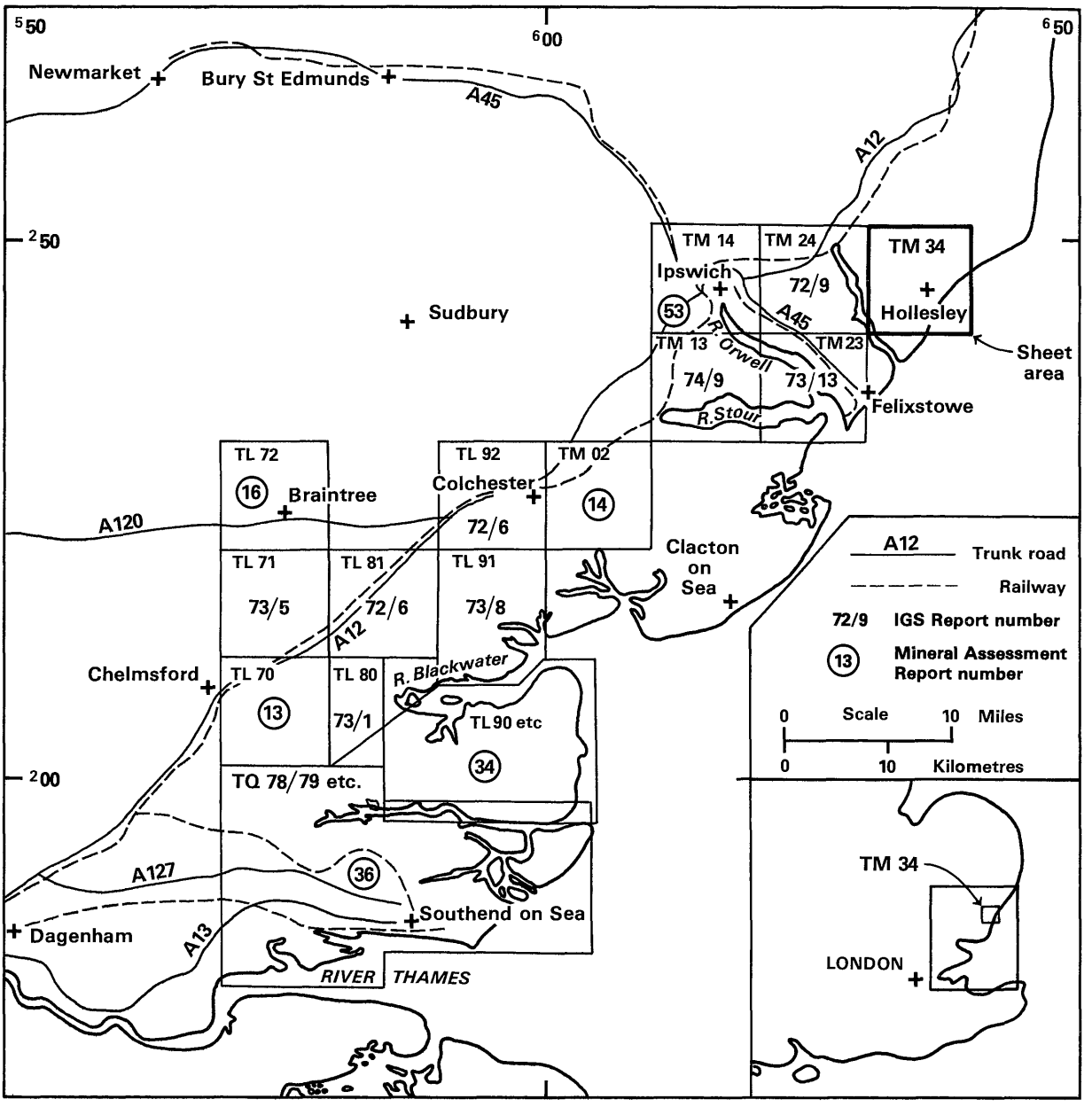

Figure 1 Map showing the location of sheet TM 34 and of adjacent sheets already published.

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 4mm respectively (see Appendix C).

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 and 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 the mineral in parts of a block, except in the immediate vicinity of the actual sample points.

DESCRIPTION OF THE RESOURCE SHEET

GENERAL

The district described in this report lies almost entirely between the River Deben in the south-west and the River Butley, a tributary of the Ore, in the north-east; it is bounded by the North Sea in the south-east. The relief is subdued with most of the ground lying below 30 m above Ordnance Datum; the highest elevation, 31.1 m above Ordnance Datum, is attained in the extreme north-west.

Flanking the sea and the river estuaries is a broad, flat plain mantled with extensive spreads of alluvium. Inliers of Red Crag project through this alluvium as 'islands', as, for example, at Barrow Hill [390 485], where the Red Crag is capped by Glacial Sand and Gravel, and around Buchanay Farm [356 424].

The shingle spit of Orford Ness is a prominent feature of the North Sea coast: due to its south-westward growth, the River Ore now enters the sea some 16 km south-west of the original mouth.

The Hollesley district is almost entirely devoted to agriculture and forestry.

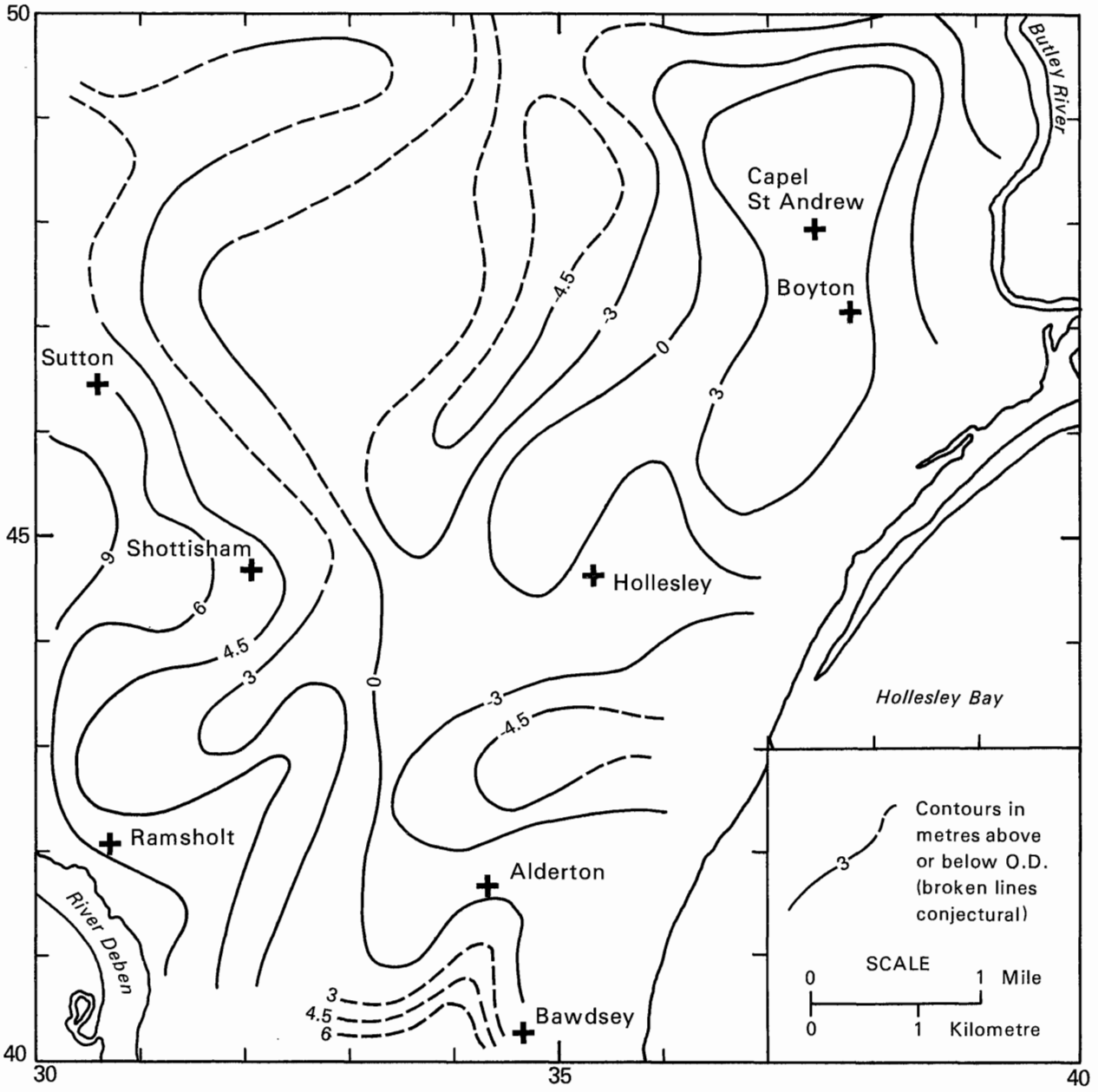

Figure 2 Contour map showing the form of the London Clay surface beneath the Red Crag.

A total area of 77.4 km^2 has been assessed and 59.1 km^2 of this contains potentially workable sand and gravel. Seven resource blocks have been outlined; the uncoloured areas on these, amounting to some 18.3 km^2, consist of bedrock (London Clay and Coralline Crag) and of Alluvium, beneath which sand and gravel are either absent or not potentially workable on the basis of the criteria adopted for this survey (p. 1). An area of 22.6 km^2 has been excluded from the assessment: it comprises all the area below high-water mark, the areas of marine beach deposits, and small areas of land east of the Butley River and west of the Deben.

GEOLOGY

The bedrock of the district is everywhere London Clay; its surface beneath the Red Crag slopes gently eastwards but is not an even plane: it is dissected into several shallow basins separated by low ridges (Figure 2). These features predate the Red Crag, the lower, shelly part of which is well developed in the basins, but is thin or absent over the ridges.

The Red Crag in this district is commonly much thicker than in the areas to the west: in one IMAU borehole (NW 20) 24.4 m of Red Crag was proved without reaching bedrock, whereas thickness estimates given in the Woodbridge, Felixstowe and Orford memoir (Boswell, 1928) suggest a maximum thickness for the formation of 12.2 m.

The Red Crag is overlain in many places by fluvioglacial deposits (Glacial Sand and Gravel). However, IMAU boreholes have shown that the latter formation is less widespread in the sheet area than is depicted on the One-inch Geological Map and on the resource map, but no attempt has been made to remap its boundaries.

Both the Red Crag and the Glacial Sand and Gravel show a marked uniformity of grain size: sand is overwhelmingly predominant, with gravel only rarely forming a significant fraction.

The deposits proved in the district are listed in stratigraphical order in Table 1.

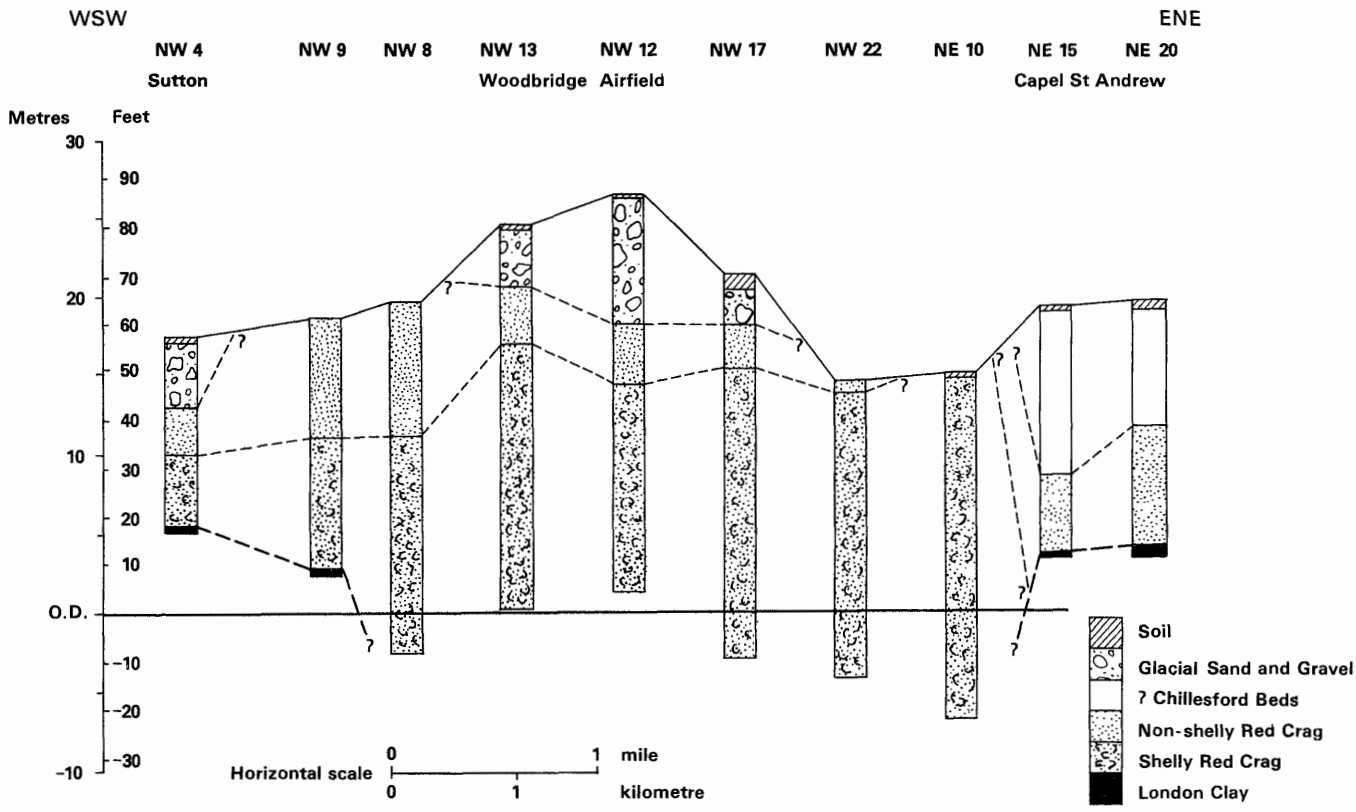

Figure 3 Correlation diagram of borehole sections between Sutton and Capel St Andrew.

Table 1 Geological succession

FORMATION
Quaternary (Pleistocene and **Recent)**
Alluvium
Marine beach deposits
Boulder Clay
Glacial Sand and Gravel
Chillesford Beds
Red Crag
Pliocene
Coralline Crag
Eocene
London Clay

London Clay The London Clay is a brown-weathering, dark bluish grey sandy clay with some calcareous layers and occasional concretions of argillaceous limestone; it forms the bedrock to the Pliocene and Quaternary deposits throughout the sheet area. Only its lower part, up to about 30 m thick, is here preserved, the upper part having been removed by pre-Pliocene erosion. Its fossil fauna of molluscs and sharks' teeth indicates its marine origin.

Coralline Crag This formation forms an outcrop of about 11 hectares south-west of Shottisham [304 440], comprising reddish brown and green fine sand with silt, ironstone nodules, and rock and shell fragments. A thickness of 10.7 m, of which the lower 5.2 m was markedly calcareous, was proved in a borehole (SW 1) on this outcrop, but elsewhere the Coralline Crag was eroded away before the deposition of the Red Crag, which directly overlies the London Clay in the remainder of the sheet area. A former exposure in a sand pit on the northern side of the outcrop showed the Red Crag banked against a cliff of Coralline Crag. A similar relationship between the two formations is found in the Ipswich area (Boswell, 1927, p. 35).

Red Crag The Red Crag is a predominantly reddish brown medium-grained sand which owes its colour to staining by hydrated iron sesquioxide. Current bedding is common and there are occasional thin layers of gravel. The pebbles are not abundant, and consist mainly of small chips and rolled fragments of flint and vein quartz. The lower part of the formation contains abundant shells, either entire or more or less comminuted, whereas shells are absent in the upper part. However, these two parts of the formation, the non-shelly upper and the shelly lower, show considerable variation in thickness and one or the other may be absent altogether (Figures 3 and 4). The junction between the two parts of the Red Crag is exposed in sand pits [318 457 and 371 495] east of Ablitt's Farm and at Broom Covert. The lowermost few metres of the Red Crag are commonly green, probably indicating reducing conditions during deposition. The total thickness of the formation is usually between 10 and 20 m; the maximum thickness proved was over 24.4 m in borehole NW 20.

Chillesford Beds Strata proved in four IMAU boreholes (NW 7 and 21 and NE 15 and 20) between the Glacial Sand and Gravel and the Red Crag have been correlated with the Chillesford Beds of Chillesford [382 522], which lies some 2 km north of the sheet area; varying between 4.0 m and 9.4 m in thickness, they consist of strongly micaceous fine sand with intercalations of pale green, yellow, red or brown silt and green, brown or dark red clay. A brown clay proved in

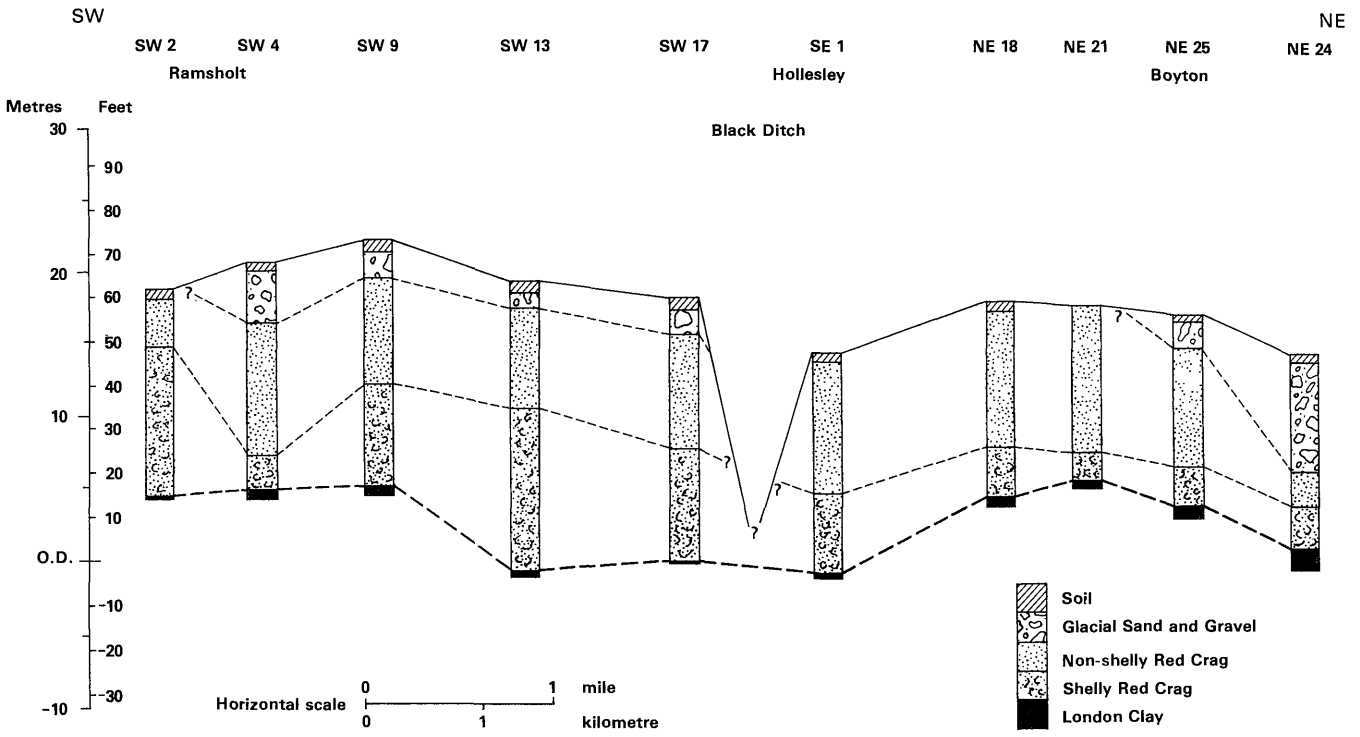

Figure 4 Correlation diagram of borehole sections between Ramsholt and Boyton.

borehole SW 7 and an orange-brown clay in borehole NW 17 may also belong to the Chillesford Beds. However, a borehole (NE 19) drilled on an outcrop [373 497] mapped as Chillesford Beds proved only Red Crag on London Clay, indicating the unreliability in places of the old Survey map.

Glacial Sand and Gravel This deposit consists mainly of yellowish brown moderately iron-stained sand, usually with slightly higher proportions of fines and gravel than are present in the Red Crag. The pebbles consist principally of angular to subrounded flint with subordinate amounts of vein quartz and quartzite, the latter occurring mainly in the fine gravel fraction. The deposit was probably laid down by outwash streams, and includes some reworked Red Crag material.

Seventeen of the 49 IMAU boreholes that were drilled on areas mapped as Glacial Sand and Gravel penetrated Red Crag rather than Glacial Sand and Gravel, whilst one borehole (NE 26) drilled on an area mapped as Red Crag proved 5.5 m of Glacial Sand and Gravel overlying the Red Crag. However, since it was decided for the purposes of the assessment to treat the Glacial Sand and Gravel and the Red Crag as a single potentially workable deposit, it was not considered worthwhile to attempt to remap the formation boundaries.

?Boulder Clay On the One-inch Geological Map, six outcrops of Boulder Clay are shown, but none of these has been penetrated by an IMAU borehole. Five of the outcrops are very small (each less than 8 hectares in area); the other, east of Shottisham, has an area of about 0.6 km^2; three boreholes (SW 6, 7 and 12) sited within a few hundred metres of the mapped boundary of this outcrop proved a brown clay, in one case containing chalk pebbles, between 0.6 m and 3.0 m thick. There is some doubt about the origin of this material, which may be true Boulder Clay, or, perhaps more likely, may be a solifluxion deposit.

Alluvium The Alluvium consists mainly of silt and clay with some peat and, rarely, thin gravel layers.

Marine Beach Deposits These comprise the shingle spit of Orford Ness, south-east of the River Ore, and beach shingle deposits that extend south-westwards from Shingle Street. No attempt has been made to assess the resources of these shingles, which are subject to constant tidal re-sorting and longshore drift.

COMPOSITION OF THE SAND AND GRAVEL DEPOSITS

Four of the formations described above contain potentially workable mineral deposits within the sheet area: the Glacial Sand and Gravel, the ?Chillesford Beds, the Red Crag and the Marine Beach Deposits. The Marine Beach Deposits have been excluded from the assessment; the remaining three have been treated as a single mineral deposit for the purposes of volume assessment, since the old geological survey mapping did not accurately delimit the outcrops of the individual deposits. Moreover, since the three formations are very similar to each other in their mean gradings (Figure 6) throughout the sheet area, resurveying of the formation boundaries would not have been worthwhile.

The mean grading of the Glacial Sand and Gravel on the sheet area is fines 3 per cent, sand 91 per cent and gravel 6 per cent. The deposit is thus classified as pebbly sand. It here contains considerably less gravel-size material than in the sheet areas to the west (TM 24) and south-west (TM 23) where the gravel content of the formation is 14 and 19 per cent respectively.

The ?Chillesford Beds are somewhat finer-grained, with a mean grading of fines 7 per cent, sand 91 per cent and gravel 2 per cent, than either the Glacial Sand and Gravel or the Red Crag.

The Red Crag has a mean grading of fines 4 per cent, sand 94 per cent and gravel 2 per cent. This mean grading is very uniform throughout the sheet area and

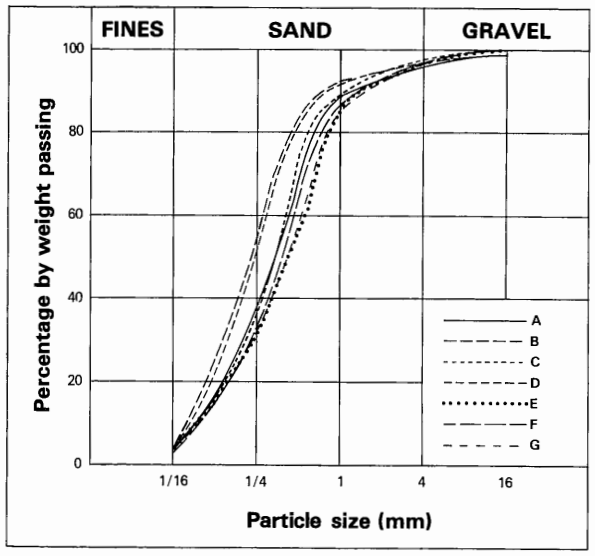

Figure 5 Mean particle size distributions for the assessed thickness of mineral in resource blocks A to G.

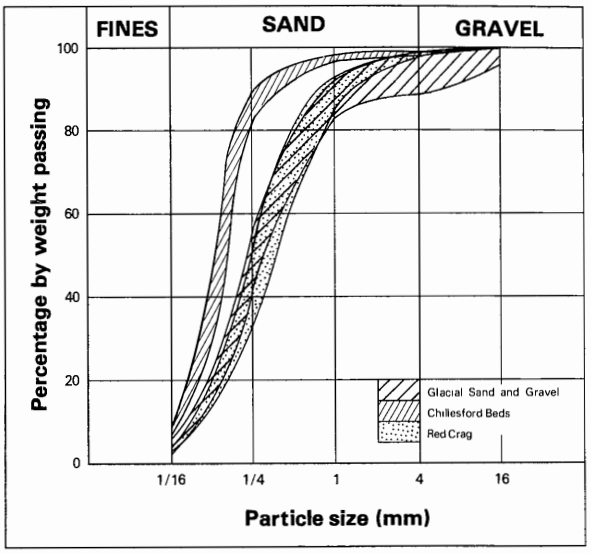

Figure 6 Comparison of the particle size distributions for the assessed thickness of mineral of the various deposits in resource blocks A to G.

such variations as are found between the seven resource blocks—not more than plus or minus one percentage point for any one component—are well within the limits of experimental error.

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, on which the topography is shown by contours in grey, the geological data in black and mineral resource information in shades of red.

Geological data The geological boundary lines, symbols, etc., shown are taken from the published geological map (Woodbridge and Felixstowe sheet 208 and 225), which was surveyed on a scale of one inch to the mile in 1882 and 1883 on Old Series Sheets, and transferred to the One-inch New Series in 1928. Borehole data, which include the stratigraphic relations and mean particle size distributions of the sand and gravel for the Glacial Sand and Gravel and Chillesford Beds samples collected during the assessment survey, are also shown. Sand and gravel samples of Red Crag were also collected, but the grading results showed little variation in the particle size distribution in this formation throughout the district.

The inaccuracies of the published map are discussed above in the section on Glacial Sand and Gravel, and the reasons for treating the Glacial Sand and Gravel, ?Chillesford Beds and Red Crag as one unit for assessment purposes are given there.

The mapped boundary between this composite mineral body and the underlying London Clay is important in area/volume calculations and its validity was checked at a number of localities during the assessment survey. The junction is very commonly marked by a distinct feature (with, in some cases, a spring line at the base of the mineral) and it was concluded that the boundary line had originally been mapped with an accuracy fully adequate for assessment purposes. The junction is exposed in river cliffs at a number of localities, e.g. near Ramsholt Lodge [300 431].

Site investigation borehole records show that, in places, mineral extends beneath the Alluvium: the mineral is, in all cases, Red Crag. However, as considerable field investigation would be needed to position accurately the sub-alluvial boundary between the bedrock and Red Crag and the volume of mineral involved is thought to be small compared to that in the area as a whole, it has been excluded from the assessment calculations.

Mineral resource information The mineral-bearing ground is divided into resource blocks (see Appendix A). Within a resource block the mineral may be subdivided into areas where it is 'exposed' and areas where it is present in continuous (or almost continuous) spreads beneath overburden. The mineral is identified as 'exposed' where the overburden, commonly consisting only of soil and subsoil, averages less than 1.0 m in thickness. Most of the mineral on this sheet is regarded as 'exposed'.

Beneath overburden the mineral may be continuous (or almost continuous), or discontinuous. 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 'almost continuous' category only is recognised on the present sheet.

Areas where bedrock crops out, and where sand and gravel is interpreted to be not potentially workable, are uncoloured on the map; where appropriate the relevant criterion is noted. In such areas 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 east of the Butley River, are indicated by a red stipple.

The area of the exposed sand and gravel is measured from the mapped geological boundary lines. The whole of this area is considered as mineral, although it may include small areas where sand and gravel is not present or is not potentially workable.

Table 2 The sand and gravel resources of the country around Hollesley, Suffolk: summary of statistical results

Block	Area		Mean thickness		Volume of mineral			Mean grading percentage				
	Block	Mineral	Over-burden	Mineral		Limits at the 95% confidence level		Fines	Sand			Gravel
	km²	km²	m	m	10^6m^3	±%	± volume 10^6m^3	$-\frac{1}{16}$ mm	$+\frac{1}{16}-\frac{1}{4}$ mm	$+\frac{1}{4}-1$ mm	+1−4 mm	+4−16 mm
A	10.0	10.0	0.5	22.9	229	6	14	4	34	51	7	4
B	11.1	8.1	0.7	16.7	135	26	35	4	51	38	4	3
C	10.0	10.0	0.4	20.9	209	15	31	4	33	52	9	2
D	13.7	9.4	0.5	15.0	141	16	23	4	48	40	5	3
E	9.0	7.3	1.0	15.7	115	33	38	4	30	52	11	3
F	12.9	9.0	0.9	17.5	158	14	22	3	31	53	10	3
G	10.7	5.3	0.7	11.2	59	24	14	4	29	52	12	3
A–G	77.4	59.1	0.7	17.7	1046	8	84	4	37	48	8	3

RESULTS

The mineral-bearing ground has been divided into seven resource blocks. The calculation of the mineral resources is based upon a simple statistical procedure described in Appendix B.

The results are summarised in Table 2 and more detailed particulars of the grading are shown in Figures 5 and 6.

Accuracy of the results For the seven resource blocks (A to G) assessed statistically, the accuracy of the results at the symmetrical 95 per cent probability level (that is, it is probable that nineteen times out of twenty the true volume lies within the given limits) varies from 6 per cent to 33 per cent. However, the true values are more likely to be nearer the volume calculated than either of the limits. Moreover, it is probable that roughly the same percentage limits would apply for the estimate of volume of a 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 the quotation of reserves of part of a block, it can be expected that data from more than 10 sample points will be required, even if the area is quite small. This point can be illustrated by considering the whole of the statistically assessed sand and gravel on the sheet. The volume, 1046 million m^3, can be estimated to limits of ±8 per cent at the 95 per cent probability level, by a calculation based on the data from 69 sample points in blocks A to G.

However, it must be emphasised that this quoted volume of sand and gravel bears no single relationship to 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 land for mineral working.

NOTES ON THE RESOURCE BLOCKS

In view of the regional homogeneity of the mineral-bearing formations, the boundaries of the resource blocks were drawn somewhat arbitrarily so as to include about ten IMAU borehole sites and about 10 km^2 of mineral.

Block A

This block, with an area of exactly 10 km^2, contains almost 10 km^2 of mineral and 10 IMAU boreholes were drilled in it. An area of 0.015 km^2 of London Clay is exposed in the north-west.

The London Clay surface beneath the Red Crag varies in height from 3.5 m above Ordnance Datum in NW 2 to more than 4.0 m below Ordnance Datum in NW 22. A ridge trends east-north-eastwards over the western two-thirds of the block, east of which area the surface drops to its lowest point, in the extreme south-east.

Glacial Sand and Gravel was proved in 9 of the 10 IMAU boreholes (NW 2 and 11), where the respective deposit ranged in thickness from 1.8 m in NW 21 to 11.0 m in NW 7, with a mean value of 6.6 m.

Red Crag was proved in all ten IMAU boreholes and ranged in thickness from more than 5.9 m in NW 7 to more than 21.4 m in NW 17, with a mean value in excess of 16.3 m. The upper (non-shelly) Red Crag ranged from 0.9 m in NW 22 to 7.3 m in NW 1 with a mean of 3.2 m. This upper deposit was not proved at NW 7. The base of the lower (shelly) Red Crag was proved in only two IMAU boreholes (NW 2 and 11) where the respective thicknesses were 13.9 m and 9.8 m. In the other eight boreholes, the thicknesses proved ranged from more than 5.9 m in NW 7 to more than 18.6 m in NW 17.

?Chillesford Beds were found to overlie the Red Crag in two IMAU boreholes (NW 7 and 21), their thickness being 4.1 m and 4.0 m respectively. The 0.3-m layer of clay overlying the Red Crag in NW 17 may also be part of the Chillesford Beds.

The mineral, as a whole, grades as 'sand' (Figure 9): only in borehole NW 7 does the mineral fall into the category of 'pebbly sand'; further details of grading are given in Table 3.

The estimated total volume of mineral (comprising Glacial Sand and Gravel, ?Chillesford Beds and Red Crag) is 229 ± 14 million m^3.

Table 3 Mean grading percentages: Block A

	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
GLACIAL SAND AND GRAVEL	4	40	45	4	4	3
CHILLESFORD REDS	9	80	8	1	2	0
RED CRAG	4	30	56	8	2	0
TOTAL MINERAL	4	34	51	7	3	1

Table 4 Mean grading percentages: Block B

	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
GLACIAL SAND AND GRAVEL	3	52	37	3	3	2
?CHILLESFORD REDS	7	74	17	1	1	0
RED CRAG	4	48	41	5	2	0
GLACIAL SAND AND GRAVEL	3	52	37	3	3	2
?CHILLESFORD BEDS	7	74	17	1	1	0
RED CRAG	4	48	41	5	2	0
TOTAL MINERAL	4	51	38	4	2	1

Table 5 Mean grading percentages: Block C

	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
GLACIAL SAND AND GRAVEL	3	49	40	4	3	1
RED CRAG	4	30	54	10	2	0
TOTAL MINERAL	4	33	52	9	2	0

Block B

Block B has an area of 11.1 km^2 of which 8.1 m^2 are mineral-bearing. The remaining 3.0 km^2 consists of outcropping London Clay, and of Alluvium beneath which no mineral is believed to occur.

From borehole evidence the London Clay surface beneath the Red Crag varies in elevation from 4.3 m above Ordnance Datum in NE 20 to more than 6.7 m below Ordnance Datum in NE 10. There is a ridge trending north–south through Capel St Andrew, over which the lower (shelly) Crag is thin and, in places, absent: the southern part of the ridge trends south-westwards into the area of Block D. To the west of this ridge is a basin or depression in which borehole NE 10 proved the shelly Red Crag to be at least 21.6 m thick, the basin not having been reached.

Only four IMAU boreholes (NE 9, NE 11, 11A and 26) proved Glacial Sand and Gravel in the block, the proved thicknesses being 6.4 m, 8.2 m, 8.2 m and 5.5 m respectively.

The upper (non-shelly) Red Crag was present in 9 of the 11 assessment boreholes in the block, the two exceptions being boreholes NE 10 and 14. The thicknesses ranged from 1.8 m in NE 11 to 16.8 m in the NE 19 with a mean value of 7.5 m. The lower (shelly) Red Crag was proved in seven IMAU boreholes (it was absent in NE 15, 19, 20 and 23) and the deposits ranged in thickness from 1.5 m in NE 26 to more than 21.6 m in NE 10, in which the base was not reached. The recorded thickness of the Red Crag ranged from 2.1 m in NE 23 to more than 21.6 m in NE 10. Three boreholes (NE 9, 10 and 11) failed to reach the base of the Red Crag.

?Chillesford Beds were proved in two boreholes, NE 15 and NE 20, where they were respectively 9.4 m and 7.3 m thick. These boreholes were sited on the mapped outcrop of the Glacial Sand and Gravel.

The mean grading of the mineral in the block indicates a classification of 'sand' (Figure 11). Only the samples from borehole NE 26 grade as 'pebbly sand'. Details of grading for each mineral deposit are given in Table 4.

The estimated total volume of mineral in the block is 135 ± 35 million m^3.

Block C

This block has an area of 10 km^2 and is composed of mineral, apart from 0.05 km^2 of alluvium; ten IMAU boreholes were drilled. The surface of the London Clay below the Red Crag slopes generally eastwards from 5.5 m above Ordnance Datum in NW 4 in the west to 4.6 m below Ordnance Datum NW 24 in the extreme east.

Glacial Sand and Gravel was proved in seven of the 10 IMAU boreholes in this block. Its thickness ranges from 2.7 m in NW 18 to 7.3 m in NW 23 with a mean value of 4.6 m.

The Red Crag was proved in all ten IMAU boreholes

Table 6 Mean grading percentages: Block D

	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
GLACIAL SAND AND GRAVEL	2	53	36	3	3	3
RED CRAG	4	48	41	5	2	0
TOTAL MINERAL	4	48	40	2	2	1

Table 7 Mean grading percentages: Block E

	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
GLACIAL SAND AND GRAVEL	6	35	42	6	7	4
RED CRAG	4	30	52	1	3	0
TOTAL MINERAL	4	30	52	11	3	0

and ranged in thickness from 7.6 m in NW 4 to 21.9 m in NW 8. Four boreholes (NW 13, 18, 19 and 23) did not reach the base of the Red Crag. The upper Red Crag ranged in thickness from 2.7 m in NW 9 to 8.5 m in NW 8 with a mean of 4.9 m. The thickness of the lower (shelly) Red Crag ranged from 3.7 m in NW 4 to more than 18.3 m in NW 18.

The mean grading of all the mineral proved in Block C indicates a classification of 'sand' (Figure 9): only in borehole NW 3 was the pebble content sufficient to lift the mean grading to 'pebbly sand'. Mean grading percentages for the two beds of mineral and for the mineral as a whole are given in Table 5.

The estimated total volume of mineral is 209 ± 31 million m^3.

Block D

Block D has an area of 13.7 km^2, of which 9.4 km^2 are mineral bearing. The remaining 4.3 km^2 consists of London Clay at outcrop and Alluvium.

The London Clay surface beneath the Red Crag ranges in elevation from 4.9 m above Ordnance Datum in NE 21 to 1.5 m below Ordnance Datum in SE 3, the main feature being the south-westward extension of the ridge described in the section on Block B.

The Glacial Sand and Gravel, which was proved in five of the 11 IMAU boreholes, ranged in thickness from 1.8 m in borehole NE 25 to 8.2 m in boreholes NW 25 and NE 12; the calculated mean thickness is 4.9 m.

The Red Crag was proved in all boreholes in Block D, the thickness ranging from 5.5 m in NE 24 to 20.1 m in NE 13, with a mean value of 12.3 m.

The upper (non-shelly) Red Crag ranged in thickness from 2.4 m in NE 24 to 16.5 m in NE 13 with a mean value of 8.7 m. The lower (shelly) Red Crag ranged from 1.5 m in NE 17 to 8.5 m in SE 3 with a mean value of 3.7 m.

The mean grading for the block as a whole, based on data from the 11 IMAU boreholes indicates that the mineral as a whole is 'sand'. However, in borehole NE 25 it grades as 'pebble sand'. Details of the grading results are given in Table 6.

The estimated total volume of mineral is 141 ± 23 m^3.

Block E

Block E has an area of 9.0 km^2, of which 7.3 km^2 are mineral-bearing, the remaining 1.7 km^2 consisting of Alluvium with outcrops of Coralline Crag and London Clay.

The London Clay surface beneath the Red Crag falls in elevation from 9.2 m above Ordnance Datum in NW 5 in the north-west to more than 3.7 m below Ordnance Datum in NW 20 in the north-east, indicating a fairly constant slope of about 1 in 230 towards the east.

The recorded thickness of the Glacial Sand and Gravel, which was proved only in boreholes NW 15, SW 6, 12 and 17, was 5.8 m, 0.9 m, 4.6 m and 1.8 m respectively, giving a mean of 3.4 m.

The Red Crag was proved in all ten IMAU boreholes and ranged in thickness from 4.3 m in SW 1A to more than 24.4 m in NW 20, in which the base was not reached. The upper (non-shelly) Red Crag ranged from 0.9 m in NW 26 to 9.4 m in NW 20 with a mean value of 4.9 m. The lower (shelly) Red Crag ranged from 1.5 m in SW 1A to a recorded thickness of more than 16.5 m in NW 15, in which the base was not reached.

Borehole SW 1, sited on the small outcrop of Coralline Crag south of Bettistree Hall, proved 10.7 m of Coralline Crag resting on London Clay. Quite apart from its small extent (Appendix B), this deposit was regarded as non-mineral because of its high content of clay, silt and shell debris.

The mean grading of the mineral as a whole indicates that it is 'sand', although in borehole SW 17 the content of pebbles is sufficient to give a mean grading of 'pebbly sand'. Details of mean grading results for the block are given in Table 7.

The estimated total volume of mineral is 115 ± 38 million m^3.

Block F

This block has an area of 12.9 km^2, of which 9.0 km^2 are mineral-bearing, the remaining 3.9 km^2 consisting of Alluvium, London Clay at outcrop and two small outcrops of Red Crag that were not assessed.

The London Clay surface beneath Red Crag varies in elevation from 5.2 m above Ordnance Datum in

Table 8 Mean grading percentages: Block F

	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
GLACIAL SAND AND GRAVEL	4	41	40	7	4	4
RED CRAG	3	30	54	10	3	0
TOTAL MINERAL	3	31	53	10	3	0

borehole SW 9 to 6.1 m below Ordnance Datum in SW 19. There is a marked depression in the London Clay surface in the area north of Alderton where, in borehole SW 14, the Red Crag exceeds 19.4 m in thickness.

The recorded thickness of the Glacial Sand and Gravel, which was proved in four assessment boreholes (SW 4, 9, 13 and 18), ranged from 0.9 m in SW 13 to 5.5 m in SW 18. The calculated mean thickness is 3.0 m.

The Red Crag was proved in all nine IMAU boreholes, and ranged in thickness from 11.4 m in SW 4 to more than 23.8 m in SW 14, where the base was not reached. The upper (non-shelly) Red Crag was proved in eight IMAU boreholes and ranged in thickness from 3.4 m in SW 2 to 9.1 m in SW 4 with a mean value of 6.2 m. The upper Red Crag was absent in SW 19.

The lower (shelly) Red Crag was proved in all nine IMAU boreholes, and ranged in thickness from 2.3 m in SW 4 to more than 19.4 m in SW 14, where the base was not reached.

The mean grading of the mineral as a whole in Block F indicates a classification of 'sand'. Details of the grading results are given in Table 8.

The estimated total volume of mineral is $158 \pm 22\,m^3$.

Block G

Block G has an area of $10.7\,km^2$, of which $5.3\,km^2$ are Red Crag classified as mineral. The remaining $5.4\,km^3$ consists of Alluvium, London Clay at outcrop, and three small patches of Red Crag which were not assessed (see Appendix B).

The elevation of the London Clay surface beneath the Red Crag varies from 8.2 m above Ordnance Datum in SW 16 to 2.7 m below Ordnance Datum in SE20. The basin described under Block F extends into the block and is bounded on the south-east by a complementary ridge.

Although one of the eight IMAU boreholes (SW 5) was sited on the mapped outcrop of the Glacial Sand and Gravel, none of that formation was proved in it.

Red Crag was proved in all the IMAU boreholes: it varied in thickness from 0.9 m in SW 16 to 13.7 m in SW 15 and SW 20. The mean value is 10.7 m. The upper (non-shelly) Red Crag, which was proved in five of the eight boreholes, ranged in thickness from 0.9 m in SW 10 to 9.1 m in SW 5, the mean value being 3.4 m; it was absent in SW 16, 20 and SE 2. The lower (shelly) Red Crag was proved in all the boreholes and ranged from 0.9 m in SW 16 to 13.7 m in SW 20, with a mean of 8.5 m.

Although the mineral in boreholes SW 16 and SE 2 graded as 'clayey pebbly sand' and 'pebbly sand' respectively, the mineral in the block as a whole is classified as 'sand'. The mean grading of the mineral, which is entirely Red Crag, is: fines 4 per cent, fine sand 29 per cent, medium sand 52 per cent, coarse sand 12 per cent and fine gravel 3 per cent. No coarse gravel was found.

The estimated total volume of mineral is 59 ± 14 million m^3.

SAND AND GRAVEL WORKINGS

At the time of this survey there were no working pits in the Hollesley district. There are, however, three abandoned pits (all in the Red Crag) at Broom Covert [371 495] and Capel Green [364 491], Capel St Andrew, and near Abblitt's Farm [318 457], Sutton.

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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, 10 km^2, 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; otherwise division is by arbitrary lines, which may bear no relationship to the geology.

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 and powered auger rigs were used in this survey.

The shell-and-auger 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 British Standard 1377 (1967). Random checks on 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 F.

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

APPENDIX B

STATISTICAL PROCEDURE

Statistical assessment

1 A statistical assessment is made of an area of mineral greater than 2 km^2, if there is a minimum of 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. Conventional symmetrical confidence limits are calculated for the 95 per cent probability level, that is, there is a 5 per cent or one in twenty chance of a result falling outside the stated limits.

3 The volume estimate (V) for the mineral in a given block is the product of the 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

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

4 The above relationship may be transposed such that

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

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 mean 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

$$\Sigma(l_{m_1} + l_{m_2} \cdots l_{m_3})/n.$$

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 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 usually small relative to those in thickness. The relationship $S_A/S_{\bar{l}_m} \leqslant \frac{1}{3}$ is assumed in all cases. It follows from equation [2] that

$$S_{\bar{l}_m} \leqslant S_V \leqslant 1.05\, S_{\bar{l}_m} \quad . \qquad [3]$$

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.)

Block calculation

1:25 000 block: Fictitious

Area
Block 11.08 km^2
Mineral: 8.32 km^2

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m^3
Mineral: 54 million m^3

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 m^3

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	Hydrogeology Unit record
123/45	½	2.0		4.6		
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_V is calculated as

$$1.05(t/\overline{wl}_m)\sqrt{(\Sigma(wl_m - \overline{wl}_m)^2/n(n-1)]} \times 100$$
$$= 1.05 \times (2.365/6.5)\sqrt{[15.82/(8 \times 7)]} \times 100$$
$$= 20.3$$
$$\simeq 20 \text{ per cent}$$

Figure 7 Example of resource block assessment: calculation and results.

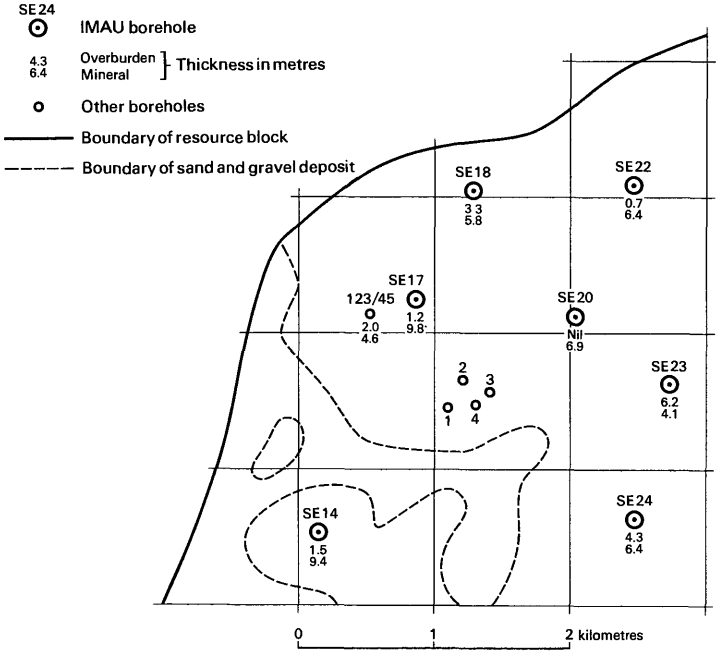

Figure 8 Example of resource block assessment: map of a fictitious block.

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, 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: $L\bar{l}_m \leqslant LV \leqslant 1.05\ L\bar{l}_m$

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 (weighting factors may be included: see paragraph 15).

11 The application of this procedure to a fictitious area is illustrated in Figures 7 and 8.

Inferred assessment

12 If the sampled area of mineral in a resource block is between 0.25 km^2 and 2 km^2 an assessment is inferred, based on 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 km^2.

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 need 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 within the zone as the weighting factor.

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 (less than $\frac{1}{16}$ mm) and coarser than pebbles (more than 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 not considered to be 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 Figure 9). The procedure is as follows:

1 Classify according to ratio of sand to gravel.
2 Describe 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 Note 10, Appendix D).

Many differing proposals exist 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 (Table 9), which is used in this 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 Standard 1377:1967). 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 very approximately 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 constituents 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, 1957), 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: no 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.

Table 9 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

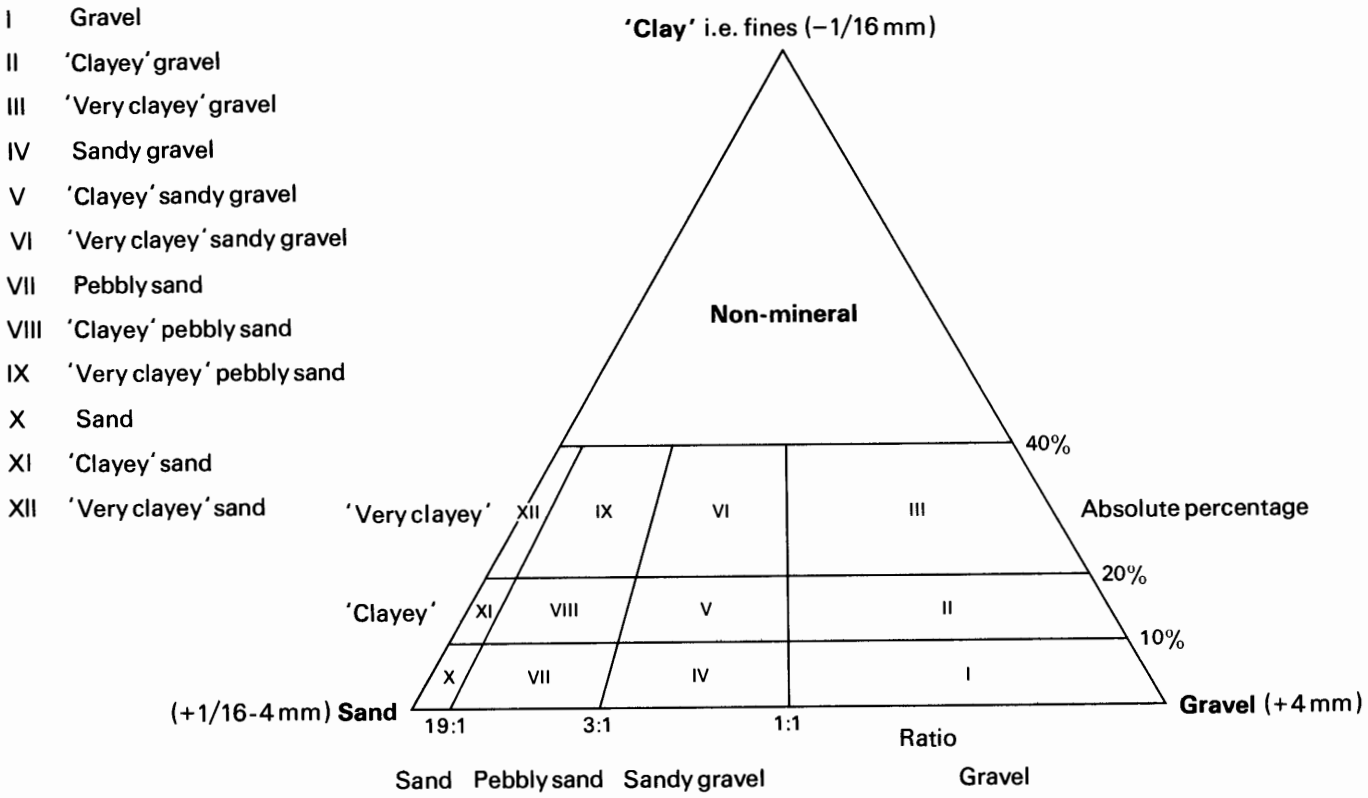

Figure 9 Diagram showing the descriptive categories used in the classification of sand and gravel.

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated example

TM 34 NW 11[1] **3242 4947**[2] **Eyke, Suffolk**[3] **Block A**

Surface level (+26.8 m)[4]
Water struck at +16.8 m[5]
Wirth B0/Pilcon Shell 203/152 mm diameter[6]
April 1970/September 1971[6]

Overburden[7] 0.7 m
Mineral[7] 3.6 m
Bedrock[7] 0.1 m +[8]

LOG

Geological classification[9]	Lithology[10]	Thickness[11] m	Depth[11] m
Soil	Sandy clay	0.9	0.9
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium, orange to yellow-brown sand with some sub-angular to sub-rounded flint and rounded quartz gravel	7.3	8.2
Red Crag	**b** Sand Fine to medium, orange to red-brown rather silty sand with a trace of gravel. Scattered iron-rich nodules present	5.5	13.7
	Mainly medium, orange-brown shelly sand. Some ironstone layers present. Basal 1.1 m grey-green	9.8	23.5
London Clay	Clay	0.3 +	23.8

GRADING[12]

	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
a	2	89	9	0.9–1.8	2	16	57	7	6	12
				1.8–2.7	2	35	47	7	6	3
				2.7–3.7	8	55	29	5	2	1
				3.7–4.6	3	83	12	1	1	0
				4.6–5.5	0	78	20	0	0	2
				5.5–6.4	0	23	52	12	10	3
				6.4–7.3	No grading information available[13]					
				7.3–8.2	0	18	58	7	8	7
				Mean	2	44	39	6	5	4
b	5	92	3	8.2–23.5[14]	5	32	52	8	2	1

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

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

1 The number of the 1:25 000 sheet on which the borehole lies, for example TM 34.

2 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, for example NW 11.

Thus the full registration number is TM 34 NW 11.
Usually this is abbreviated to NW 11 in the text.

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

3 Location
The position of the borehole is generally referred to the parish in which it is located.

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 above Ordnance Datum).

6 Type of drill and date of drilling
Drilling and sampling were carried out in two phases: the first phase, using a powered auger rig, was completed in 1969; with this rig, difficult drilling and sampling conditions were encountered, particularly in the northern part of the district, and many boreholes had to be abandoned before reaching the required depth. Hence a second phase of drilling, using a shell-and-auger rig, was commissioned during the latter part of 1971 in order to complete the sampling of deposits in those boreholes that were prematurely abandoned. For these boreholes a composite log is given which incorporates the results from both phases of drilling and sampling.

The month of completion of each phase of drilling of the borehole is given.

7 Overburden, mineral and bedrock
Overburden is waste material found between the surface and the top of a mineral deposit.

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.

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

9 Geological classification
The geological classification (Table 1) is given whenever possible.

10 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. The description of other rocks is based on visual examination, in the field. Where more than one mineral deposit is recognised, each is designated by a letter, eg **a, b,** etc.

11 Thickness and depth
These measurements were originally made in feet. They have been converted to metric measurements.

12 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) and coarse gravel (+16 mm) are stated. The mean grading of groups of samples making up an identified mineral horizon are also given in detail and, to the left, in summary. Where more than one horizon is recognized the mean grading for the whole of the mineral in the borehole is also given. Where necessary in calculating the mean grading, 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 suggests that in borehole samples the proportion of sand may be higher and the proportion of fines and coarse gravel may be lower.

13 Exceptionally, the result of the grading of a sample or mineral bed may not be available. No attempt has been made to estimate the probable grading of such samples.

14 Although bulk samples representing successive 3 ft (0.9 m) intervals were taken from all mineral-bearing formations, preliminary results of the grading analyses of the Red Crag showed so little variation in the particle size distribution that only the mean grading, for the whole of that formation in each borehole is quoted.

APPENDIX E

INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLES

TM 34 NW 1 **3058 4929** **Bromeswell, Suffolk** **Block A**

Surface level (+27.4 m)
Groundwater conditions not recorded
Wirth B0/Pilcon shell 203/152 mm diameter
April 1970/September 1971

Overburden 0.6 m
Mineral 23.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium yellow-brown sand with fine to coarse angular to subangular flint and rounded quartz gravel. Gravel concentrated in top 2.7 m	7.3	7.9
Red Crag	**b** Sand		
	Fine to medium yellow-brown sand with a trace of gravel	7.3	15.2
	Fine to medium orange-brown sand with shell material	9.0+	24.2

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
a	5	88	7	0.6-1.5	1	32	42	7	10	8
				1.5-2.4	3	15	57	7	10	8
				2.4-3.4	3	30	50	5	7	5
				3.4-4.3	22	41	32	2	3	0
				4.3-5.2	5	32	58	1	2	2
				5.2-6.1	0	60	37	0	1	2
				6.1-7.0	2	68	28	0	1	1
				7.0-7.9	0	82	18	0	0	0
				Mean	5	45	40	3	4	3
b	4	92	4	7.9-24.2	4	39	48	5	3	1

TM 34 NW 2 **3072 4815** **Sutton, Suffolk** **Block A**

Surface level (+27.4 m)
Water struck at +15.2 m
Wirth B1/Pilcon Shell, 152 mm diameter
August 1969/October 1971

Overburden 0.6 m
Mineral 23.3 m+
?Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium sand with some subrounded flint and rounded quartz gravel	8.2	8.8
Red Crag	**b** Sand		
	Fine to medium red-brown sand	1.2	10.0
	Fine to medium orange to red-brown sand with shell and occasional ironstone bands. Shells becoming grey-green at 22.5 m	13.9	23.9
?London Clay	Siltstone	0.1+	24.0

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
a	3	91	6	0.6–1.5	No grading information available					
				1.5–2.4	3	46	50	0	1	0
				2.4–3.4	3	37	55	1	2	2
				3.4–4.3	2	21	67	4	5	1
				4.3–5.2	5	30	52	5	6	2
				5.2–6.1	3	32	51	9	4	1
				6.1–7.0	3	20	75	1	1	0
				7.0–7.9	3	11	78	4	2	2
				7.9–8.8	3	11	59	12	9	6
				Mean	3	26	61	4	4	2
b	3	95	2	8.8–23.9	3	30	55	10	2	0

TM 34 NW 3 3060 4752 Sutton, Suffolk **Block C**

Surface level (+24.1 m)
Water struck at +12.5 m
Pilcon Shell, 203/152 mm diameter
May 1970

Overburden 0.3 m
Mineral 19.5 m+
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Sandy topsoil	0.3	0.3
Glacial Sand and Gravel	**a** Pebbly sand Mineral divided by 0.3 m clay band at 2.1 m. Above clay band mineral is orange-yellow medium sand. Below clay band is medium with fine and coarse sand, and fine to medium gravel. Gravel of angular to subangular flint	4.0	4.3
Red Crag	**b** Sand Orange-brown medium sand becoming fine to medium dark grey-brown with depth. Little gravel of fine to coarse subangular flint	7.3	11.6
	Dark-brown mainly medium sand becoming coarser and reddish brown with depth. Contains comminuted shells	8.2	19.8
London Clay	Clay	0.9+	20.7

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
a	4	84	12	0.3–1.2	4	24	71	1	0	0
				1.2–2.1	3	16	79	2	0	0
				2.1–3.4	6	12	35	14	25	8
				3.4–4.3	1	12	57	14	10	6
				Mean	4	16	60	8	9	3
b	3	94	3	4.3–19.8	3	26	53	15	2	1

TM 34 NW 4 **3035 4643** **Sutton, Suffolk** **Block C**

Surface level (+17.7 m) estimated
Water struck at +8.2 m, estimated
Wirth B1, 152 mm diameter
June 1969

Overburden 0.3 m
Mineral 11.9 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.3	0.3
Glacial Sand and Gravel	**a** Sand Medium brown to yellow-brown sand becoming finer with depth. A trace of flint gravel	4.3	4.6
Red Crag	**b** Sand		
	Fine to medium red-brown sand	3.9	8.5
	Mainly medium to fine but some coarse red-brown sand with comminuted shells	3.7	12.2
London Clay	Clay	0.3+	12.5

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	
a	4	92	4	0.3–1.2	5	35	52	4	3	1	
				1.2–2.1	2	15	75	4	3	1	
				2.1–3.0	7	42	46	2	2	1	
				3.0–4.0	4	43	39	7	5	2	
				4.0–4.9	3	77	17	1	2	0	
				Mean	4	43	45	4	3	1	
b	6	92	2	4.9–12.2	6	35	48	9	2	0	

TM 34 NW 5 3048 4576 Sutton, Suffolk **Block E**

Surface level (+18.3 m)
Water struck at +12.2 m
Wirth B1, 152 mm diameter
June 1969

Overburden 0.3 m
Mineral 8.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.3	0.3
Red Crag	Sand		
	Fine to medium sand, ochreous and red-brown, with occasional rounded pebbles	6.4	6.7
	Fine to medium with coarse sand, some quartz gravel and high percentage of shell debris	2.4	9.1
London Clay	Brown clay becoming blue at 9.3 m	0.9+	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
5	93	2	0.3–9.1	5	50	36	7	2	0

TM 34 NW 6 3137 4932 Bromeswell, Suffolk **Block A**

Surface level (+28.0 m)
Groundwater conditions not recorded
Wirth B0/Pilcon Shell, 203/152 mm diameter
April 1970/September 1971

Overburden 0.3 m
Mineral 24.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Glacial Sand and Gravel	**a** Sand Fine to medium yellow-brown sand with a trace of flint and quartz gravel	7.5	7.8
Red Crag	**b** Sand Fine to medium brown sand	1.8	9.6
	Mainly medium with some fine sand, brown to orange-brown, with shell material	15.1+	24.7

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	
a	7	89	4	0.3–1.2	13	52	29	2	1	3	
				1.2–2.1	20	31	41	4	4	0	
				2.1–3.0	6	52	40	1	0	1	
				3.0–4.0	4	77	18	0	1	0	
				4.0–5.2	2	71	25	1	0	1	
				5.2–6.1	4	27	64	1	3	1	
				6.1–7.0	3	30	63	1	2	1	
				7.0–7.9	2	16	60	7	7	8	
				Mean	7	45	42	2	2	2	
b	4	92	4	7.9–24.7	4	25	59	8	3	1	

TM 34 NW 7 3125 4869 Sutton Common, Suffolk **Block A**

Surface level (+28.0 m) Mineral 21.0 m+
Water struck at +12.5 m
Pneumatic Hammer and Shell, 152 mm diameter
July 1969

LOG

Geological classification	Lithology	Thickness m	Depth m
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium red-brown to yellow-brown sand with gravel. Gravel fine to medium composed of subangular flint and rounded quartz and quartzite concentrated towards the base of the deposit	11.0	11.0
Chillesford Beds	**b** Sand Fine pale green, yellow, brown and red sand with occasional clay and silt seams. Highly micaceous	4.1	15.1
Red Crag	**c** Sand Fine to medium dark red-brown sand with shell debris	5.9+	21.0

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
a	3	89	8	0-0.9	6	84	8	1	1	0
				0.9-1.8	5	31	57	2	3	2
				1.8-2.7	4	19	57	6	7	7
				2.7-3.7	2	63	30	2	2	1
				3.7-4.6	1	42	54	1	1	1
				4.6-5.5	1	69	26	1	2	1
				5.5-6.4	3	79	16	1	1	0
				6.4-7.3	2	40	53	2	2	1
				7.3-8.2	No grading information available					
				8.2-9.1	2	23	50	11	9	5
				9.1-10.1	6	36	23	8	17	10
				10.1-11.0	3	42	25	13	10	7
				Mean	3	48	37	4	5	3
b	6	92	2	11.0-11.9	5	91	1	2	1	0
				11.9-12.8	7	87	4	0	2	0
				12.8-13.7	7	84	7	1	1	0
				13.7-14.6	6	84	9	1	1	1
				Mean	6	86	5	1	2	0
c	8	90	2	14.6-21.0	8	45	39	6	1	1

TM 34 NW 8 3175 4711 Sutton, Suffolk **Block C**

Surface level (+19.8 m)
Water struck at +13.4 m
Wirth B1/Pilcon Shell, 152 mm diameter
August 1969/October 1971

Mineral 21.9 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Red Crag	Sand		
	Fine to medium med-brown to dark brown sand	8.5	8.5
	Medium to coarse med to orange-brown sand with shell. Shelly material becoming grey-green at 16.5 m	13.4	21.9
London Clay	Clay	0.2+	22.1

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
3	95	2	0–21.9	3	24	57	14	2	0

TM 34 NW 9 3150 4656 Sutton, Suffolk **Block C**

Surface level (+18.9 m)
Ground water conditions not recorded
Wirth B1/Pilcon Shell, 152 mm diameter
August 1969/October 1971

Mineral 15.8 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Red Crag	Sand		
	Fine, red and yellow-brown sand becoming fine to medium towards base	2.7	2.7
	Fine to medium with some coarse orange to red-brown sand, shells, and hard ironstone bands present	13.1	15.8
London Clay		0.6+	16.5

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
5	93	2	0–15.8	5	51	33	9	2	0

TM 34 NW 10 3175 4589 Sutton, Suffolk **Block E**

Surface level (+20.1 m)
Water struck at +8.8 m
Wirth B1, 152 mm diameter
August 1969

Overburden 0.3 m
Mineral 15.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Red Crag	Sand		
	Fine to medium red-brown sand with scattered black ?phosphatic pebbles	5.2	5.5
	Fine, medium and coarse red-brown sand with shell material and, towards the base, hard ironstone bands	10.3+	15.8

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
4	93	3	0.3–15.8	4	25	55	13	2	1

TM 34 NW 11 3242 4947 Eyke, Suffolk **Block A**

Surface level (+26.8 m)
Water struck at +16.8 m
Wirth B0/Pilcon Shell, 203/152 mm diameter
April 1969/September 1971

Overburden 0.9 m
Mineral 22.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Sandy clay	0.9	0.9
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium, orange to yellow-brown sand with some subangular to subrounded flint and rounded quartz gravel	7.3	8.2
Red Crag	**b** Sand		
	Fine to medium, orange to red-brown rather silty sand with a trace of gravel. Scattered iron-rich nodules present	5.5	13.7
	Mainly medium sand, orange-brown, shelly. Some ironstone layers present. Basal 1.1 m grey-green	9.8	23.5
London Clay	Clay	0.3+	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
a	2	89	9	0.9–1.8	2	16	57	7	6	12
				1.8–2.7	2	35	47	7	6	3
				2.7–3.7	8	55	29	5	2	1
				3.7–4.6	3	83	12	1	1	0
				4.6–5.5	0	78	20	0	0	2
				5.5–6.4	0	23	52	12	10	3
				6.4–7.3	No grading information available					
				7.3–8.2	2	18	58	7	8	7
				Mean	2	44	39	6	5	4
b	5	92	3	8.2–23.5	5	32	52	8	2	1

TM 34 NW 12 3294 4832 Sutton, Suffolk **Block A**

Surface level (+26.5 m)
Water struck at +12.5 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.3 m
Mineral 24.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.3	0.3
Glacial Sand and Gravel	**a** Sand Fine to medium yellow and orange-brown sand with a trace of fine flint gravel	7.9	8.2
Red Crag	**b** Sand Fine to medium red-brown and yellow-brown sand	3.7	11.9
	Fine to medium brown sand with some coarse sand and a trace of gravel. Abundant shell debris	13.1+	25.0

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	
a	4	93	3	0.3–1.2	4	35	55	3	2	1	
				1.2–2.1	5	49	43	2	1	0	
				2.1–3.0	8	61	30	1	0	0	
				3.0–4.0	1	39	51	5	2	2	
				4.0–4.9	2	18	67	8	5	0	
				4.9–5.8	1	18	61	10	8	2	
				5.8–6.7	2	35	58	3	2	0	
				6.7–7.6	2	38	58	2	0	0	
				7.6–8.5	8	48	34	4	4	2	
				Mean	4	38	51	4	2	1	
b	3	95	2	8.5–25.0	3	35	49	11	2	0	

TM 34 NW 13 3250 4758 Sutton, Suffolk **Block C**

Surface level (+24.7 m)
Water struck at +14.6 m
Pneumatic Shell/Pilcon Shell, 152 mm diameter
October 1969/October 1971

Overburden 0.3 m
Mineral 24.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.3	0.3
Glacial Sand and Gravel	**a** Sand Fine to medium yellow-brown sand with scattered flint pebbles	3.4	3.7
Red Crag	**b** Sand Medium with fine sand, red-brown	4.0	7.6
	Medium sand, orange to red-brown with shell material and scattered flint and quartz pebbles. Colour change to grey-green in basal 0.8 m	16.8+	24.4

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
a	3	95	2	0.3–1.2	1	46	51	1	1	0
				1.2–2.1	4	26	67	2	1	0
				2.1–3.0	0	10	74	9	1	6
				3.0–4.0	7	86	6	0	1	0
				Mean	3	42	49	4	1	1
b	3	94	3	4.0–24.4	3	24	62	8	3	0

TM 34 NW 14 3254 4653 Sutton, Suffolk **Block C**

Surface level (+20.7 m)
Water struck at +13.4 m
Wirth B1/Pilcon Shell, 152 mm diameter
August 1969/October 1971

Overburden 0.6 m
Mineral 21.3 m
Bedrock 0.21 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Dark brown sand	0.6	0.6
Red Crag	Sand		
	Fine to medium red to dark brown sand, rather silty. Some ironstone nodules present	6.7	7.3
	Medium red to orange-brown sand with shell fragments and ironstone bands present throughout. Colour change in basal 2.6 m to grey-green	14.6	21.9
London Clay	Grey clay	0.2+	22.1

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
4	94	2	0.6–21.9	4	24	63	7	2	0

TM 34 NW 15 3273 4541 Shottisham, Suffolk **Block E**

Surface level (+21.9 m)
Groundwater conditions not recorded
Wirth B1/Pilcon Shell, 152 mm diameter
October 1969/October 1971

Overburden 0.3 m
Mineral 24.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Brown silty sand	0.3	0.3
Glacial Sand and Gravel	**a** Sand	5.8	6.1
	Fine and medium brown to reddish-orange sand with subangular flint gravel. Gravel concentrated in basal 1.8 m. Deposit rather silty with layers of green and brown clay in lower 4.3 m		
Red Crag	**b** Sand		
	Fine to medium brown sand with scattered pebbles	1.8	7.9
	Mainly medium, (some fine and coarse) sand with shell material. Red to orange-brown but becoming grey-green at 22.0 m. Scattered pebbles of ironstone and flint throughout	16.5+	24.4

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	
a	9	83	8	0.9–1.8	9	30	55	4	2	0	
				1.8–2.7	4	42	50	2	0	2	
				2.7–3.7	6	66	26	1	1	0	
				3.7–4.6	6	87	5	1	1	0	
				4.6–5.5	12	23	35	15	13	2	
				5.5–6.4	15	10	33	16	17	9	
				Mean	9	43	34	6	6	2	
b	4	93	3	6.4–24.4	4	22	59	12	3	0	

TM 34 NW 16 3333 4957 Eyke, Suffolk **Block A**

Surface level (+28.7 m)
Water struck at +14.7 m
Wirth B0/Pilcon Shell, 203/152 mm diameter

Overburden 0.9 m
Mineral 23.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.9	0.9
Glacial Sand and Gravel	**a** Sand Fine to medium orange to yellow-brown sand with some subangular to rounded flint gravel	6.4	7.3
Red Crag	**b** Sand Fine to medium dark orange-brown sand with some angular flint gravel	3.7	11.0
	Medium with fine sand, orange to red-brown, containing shell material	13.2+	24.2

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
a	4	92	4	0.9–1.8	3	34	48	7	5	3
				1.8–2.7	No grading information available					
				2.7–3.7	2	39	53	3	2	1
				3.7–4.6	2	76	18	2	1	0
				4.6–5.5	9	63	28	0	0	0
				5.5–6.4	3	37	56	2	2	0
				6.4–7.3	2	12	67	8	3	8
				Mean	4	43	45	4	2	2
b	3	94	3	7.3–24.2	3	31	57	6	3	0

TM 34 NW 17 3376 4840 Capel St Andrew **Block A**

Surface level (+21.6 m)
Water struck at +10.6 m
Wirth B0/Pilcon Shell, 203/152 mm diameter
April 1970/October 1971

Overburden 0.9 m
Mineral 23.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.9	0.9
Glacial Sand and Gravel	**a** Pebbly sand Medium yellow-brown sand with subangular flint gravel. A 0.3 m band of clay at base	2.1	3.0
Red Crag	**b** Sand		
	Fine to medium dark yellow-brown sand	2.7	5.8
	Mainly medium sand with shelly material. Red to orange-brown to 22.3 m then grey-green	18.6+	24.4

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	
a	2	86	12	0.9–1.8	2	12	75	3	6	2	
				1.8–2.7	1	12	63	8	11	5	
				Mean	2	12	69	5	9	3	
b	3	94	3	3.0–24.4	3	26	61	7	2	1	

TM 34 NW 18 3333 4736 Sutton, Suffolk **Block C**

Surface level (+23.8 m)
Water struck at +12.5 m
Pneumatic Shell/Pilcon Shell, 152 mm diameter
November 1969/October 1971

Overburden 0.3 m
Mineral 24.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.3	0.3
Glacial Sand and Gravel	**a** Sand Fine to medium yellow-brown sand with scattered flint and quartz pebbles	2.7	3.0
Red Crag	**b** Sand Fine to medium yellow-orange and brown sand	3.0	6.1
	Mainly medium with some fine sand, shelly. Orange to red-brown becoming slightly grey-green in basal 1.1 m	18.3+	24.4

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
a	3	93	4	1.2–2.1	3	64	24	3	4	2
				2.1–3.0	4	26	60	8	2	0
				Mean	3	45	42	6	3	1
b	4	94	2	3.0–24.4	4	28	58	8	2	0

TM 34 NW 19 3379 4649 Hollesley, Suffolk **Block C**

Surface level (+21.3 m)
Groundwater conditions not recorded
Wirth B1/Pilcon Shell, 152 mm diameter
September 1969/October 1971

Overburden 0.6 m
Mineral 23.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium yellow-brown sand with some fine to coarse subangular flint and rounded quartz gravel. Gravel concentrated in top 1.8 m	5.2	5.8
Red Crag	**b** Sand		
	Fine to medium dark brown sand, rather silty	4.6	10.4
	Fine to medium sand, becoming medium to coarse with depth; shelly material present. Red to orange-brown. Ironstone bands from 10.7 m and ?coprolites present in basal 3.4 m	14.0+	24.4

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
a	4	89	7	0.6-1.5	2	22	50	9	10	7
				1.5-2.4	2	11	52	19	9	7
				2.4-3.4	8	62	28	1	1	0
				3.4-4.3	1	57	32	6	3	1
				4.3-5.2	6	38	46	8	1	1
				5.2-6.1	6	57	27	8	2	0
				Mean	4	41	39	9	4	3
b	7	90	3	6.1-24.4	7	22	53	15	3	0

TM 34 NW 20 3350 4561 Shottisham, Suffolk **Block E**

Surface level (+20.7 m)
Water struck at +8.8 m
Wirth B1/Pilcon Shell, 152 mm diameter
August 1969/October 1971

Mineral 24.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Red Crag	Sand		
	Fine to medium sand, yellow-brown to 2.7 m then red-brown to dark brown	9.4	9.4
	Fine to medium sand to 18.0 m, becoming medium to coarse towards base. Shell material present throughout. Deposit mainly red to orange-brown but turning grey-green at 21.9 m	15.0+	24.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$	
5	92	3	0–24.4	5	29	50	13	3	0	

TM 34 NW 21 3442 4962 Eyke, Suffolk **Block A**

Surface level (+22.9 m)
Water struck at +11.4 m
Wirth B0/Pilcon Shell, 203/152 mm diameter
March 1970/September 1971

Overburden 0.6 m
Mineral 1.8 m
Waste 1.2 m
Mineral 22.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Glacial Sand and Gravel	**a** Sandy gravel Fine to coarse orange to light brown sand with fine to coarse subangular to subrounded quartz gravel	1.8	2.4
?Chillesford Beds	Silt, light brown to grey with some sand and clay	1.2	3.7
	b 'Clayey' sand Fine orange sand with grey-green silty clay seams. Highly micaceous	2.7	6.4
Red Crag	**c** Sand		
	Fine to medium orange-brown sand	1.8	8.2
	Mainly fine sand, orange to red-brown with shells present throughout. Deposit becoming grey-green at 23.2 m	17.7+	25.9

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
a	8	65	27	0.6–1.5	No grading information available					
				1.5–2.4	8	24	26	15	10	17
b	13	84	3	3.7–4.6	12	80	4	1	3	0
				4.6–5.5	15	72	6	2	4	1
				5.5–6.4	12	60	27	0	1	0
				Mean	13	71	12	1	3	0
c	3	95	2	6.4–25.9	3	21	65	9	2	0

TM 34 NW 22 3470 4821 Capel St Andrew **Block A**

Surface level (+14.9 m)
Water struck at +10.4 m
Wirth B1, 203 mm diameter
March 1970

Mineral 18.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Red Crag	Sand		
	Fine to medium dark brown sand	0.9	0.9
	Mainly medium sand, yellow to red-brown with shells present throughout	18.0+	18.9

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
3	95	2	0–16.2	3	30	58	7	2	0

TM 34 NW 23 3459 4728 Capel St Andrew **Block C**

Surface level (+20.7 m)
Water struck at +7.0 m
Wirth B0/Pilcon Shell, 203/152 mm diameter
April 1970/September 1971

Overburden 0.9 m
Mineral 23.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.9	0.9
Glacial Sand and Gravel	**a** Sand	7.3	8.2
	Mainly fine sand, pale grey to yellow-brown		
Red Crag	**b** Sand		
	Fine to medium, dark orange, yellow and red-brown	3.7	11.9
	Mainly medium sand, orange to red-brown with shells throughout. Deposit becoming grey-green at 23.0 m	12.5+	24.4

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
a	3	96	1	0.9–1.8	0	84	15	0	1	0
				1.8–2.7	1	94	4	0	1	0
				2.7–3.7	13	71	15	1	0	0
				3.7–4.6	5	40	54	0	1	0
				4.6–5.5	No grading information available					
				5.5–6.4	2	45	52	1	0	0
				6.4–7.3	0	72	28	0	0	0
				7.3–8.2	1	55	42	1	1	0
				Mean	3	66	30	0	1	0
b	2	97	1	8.2–24.4	2	34	56	7	1	0

TM 34 NW 24 **3458 4656** **Hollesley, Suffolk** **Block C**

Surface level (+19.5 m)
Water struck at +7.9 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.6 m
Mineral 23.5 m
Bedrock just touched

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Glacial Sand and Gravel	**a** Sand Fine to medium yellow and orange-brown sand	5.5	6.1
Red Crag	**b** Sand Fine and medium red-brown sand, rather silty	4.0	10.1
	Fine and medium brown sand with shell fragments; becoming coarser and shell fraction increasing with depth. Basal 4.6 m grey-green in colour	14.0	24.1
London Clay	Grey clay	Just touched	

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	
a	2	98	0	0.6-1.5	1	92	6	1	0	0	
				1.5-2.4	0	80	18	2	0	0	
				2.4-3.4	3	51	40	6	0	0	
				3.4-4.3	1	60	35	4	0	0	
				4.3-5.2	4	61	32	2	1	0	
				5.2-6.1	3	73	22	1	1	0	
				Mean	2	69	26	3	0	0	
b	3	95	2	6.1-24.1	3	35	45	11	2	0	

TM 34 NW 25 3461 4555 Hollesley, Suffolk **Block D**

Surface level (+21.0 m)
Water struck at +8.3 m
Wirth B1, 203 mm diameter
September 1969

Overburden 0.6 m
Mineral 18.0 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Glacial Sand and Gravel	**a** Sand Fine to medium light brown and orange sand. Some sub-angular flint gravel in top 1.8 m, otherwise occasional pebbles	8.2	8.8
Red Crag	**b** 'Clayey' sand Fine to medium brown to red-brown sand with occasional subrounded and rounded flint and quartz pebbles. Rather clayey	4.6	13.4
	Fine to medium, red-brown sand with shell fragments	5.2	18.6
London Clay	Clay	0.6+	19.2

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
a	3	93	4	0.6–1.5	1	14	62	13	7	3
				1.5–2.4	0	28	45	12	9	6
				2.4–3.4	0	81	14	3	2	0
				3.4–4.3	3	40	54	2	1	0
				4.3–5.2	1	57	36	5	1	0
				5.2–6.1	0	60	38	1	1	0
				6.1–7.0	2	56	40	1	1	0
				7.0–7.9	15	58	23	2	2	0
				7.9–8.8	2	56	39	2	1	0
				Mean	3	50	39	4	3	1
b	10	88	2	8.8–18.6	10	33	49	6	2	0

TM 34 NW 26 3108 4550 Sutton, Suffolk **Block E**

Surface level (+13.4 m)
Water struck at +9.1 m
Wirth B1, 152 mm diameter
June 1969

Overburden 0.3 m
Mineral 7.3 m
Bedrock just touched

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.3	0.3
Red Crag	Sand		
	Fine to medium silty dark brown sand	0.9	1.2
	Medium to coarse red-brown shelly sand. Shell content increasing with depth. Coprolites and black phosphatic pebbles in basal 1.8 m	6.4	7.6
London Clay	Blue clay	Just touched	

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
4	92	4	0.3–7.6	4	18	59	15	4	0

TM 34 NE 9 3551 4934 Rendlesham Forest, Suffolk **Block B**

Surface level (+23.8 m)
Water struck at +2.4 m
Wirth B0, 203 mm diameter
March 1970

Overburden 0.6 m
Mineral 23.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Mainly spongy vegetable matter	0.6	0.6
Glacial Sand and Gravel	**a** Sand Fine to medium sand, yellow-brown to 3.4 m then grey-brown to base. Scattered pebbles throughout	6.4	7.0
Red Crag	**b** Sand Fine to medium sand, yellowish red becoming reddish brown with depth	3.7	10.7
	Fine to medium sand, reddish brown, with comminuted shells	13.7+	24.4

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	
a	4	93	3	0.6–1.5	1	39	56	2	1	1	
				1.5–2.4	17	55	26	1	1	0	
				2.4–3.4	2	52	40	2	2	2	
				3.4–4.3	2	56	39	1	1	1	
				4.3–5.2	3	41	48	4	3	1	
				5.2–6.1	3	42	50	2	2	1	
				6.1–7.0	2	19	74	3	1	1	
				Mean	4	43	48	2	2	1	
b	5	92	3	7.0–24.4	5	42	45	5	2	1	

TM 34 NE 10 3545 4857 Rendlesham Forest, Suffolk **Block B**

Surface level (+15.2 m)
Water struck at +8.5 m
Wirth B0, 203 mm diameter
March 1970

Overburden 0.3 m
Mineral 21.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Spongy humic soil	0.3	0.3
Red Crag	Sand Fine to medium red-brown sand becoming medium to coarse with depth. Shell material present throughout	21.6+	21.9

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	
2	95	3	0.3–21.9	2	27	57	11	2	1	

TM 34 NE 11 3527 4739 Capel St Andrew, Suffolk **Block B**

Surface level (+20.4 m)
Water struck at +10.7 m
Wirth B0/Pilcon Shell, 203/152 mm diameter
March 1970/October 1971

Overburden 0.9 m
Mineral 23.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Sand with decayed vegetation	0.9	0.9
Glacial Sand and Gravel	**a** Sand Fine to medium yellow-brown sand with scattered sub-angular to rounded flint pebbles. Some clay seams present	8.2	9.1
Red Crag	**b** Sand Fine to medium dark brown sand with scattered angular flint and rounded quartz pebbles	1.8	11.0
	Fine to medium dark brown to red-brown sand with shelly material. Shell content increasing with depth and from about 18.3 m taking on a greenish-grey hue	13.4+	24.4

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
a	2	95	3	0.9–1.8	3	22	64	5	4	2
				1.8–2.7	1	31	63	3	1	1
				2.7–3.7	4	75	19	1	1	0
				3.7–4.6	1	32	58	5	3	1
				4.6–5.5	3	43	48	3	2	1
				5.5–6.4	4	21	68	5	2	0
				6.4–7.3	4	31	62	2	1	0
				7.3–8.2	2	42	54	1	1	0
				8.2–9.1	4	46	49	1	0	0
				Mean	2	38	54	3	3	0
b	3	95	2	9.1–24.4	3	40	50	5	2	0

TM 34 NE 11A 3592 4729 Rendlesham Forest, Suffolk **Block B**

Surface level (+18.9 m)
Groundwater conditions not recorded
Wirth B1/Pilcon Shell, 203/152 mm diameter
March 1970/October 1971

Overburden 0.9 m
Mineral 19.4 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Sandy peat	0.9	0.9
Glacial Sand and Gravel	**a** Sand Mainly fine pale yellow to buff sand	8.2	9.1
Red Crag	**b** Sand		
	Fine to medium orange to red-brown sand	7.3	16.5
	Fine to medium brown and grey-green sand with grey-green shell material. Basal 0.8 m contains rounded black pebbles and numerous whole specimens of *Glycimeris* sp.	3.8	20.3
London Clay	Blue-grey clay	0.8+	21.1

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
a	2	98	0	0.9–1.8	3	84	10	1	1	1
				1.8–2.7	2	88	9	1	0	0
				2.7–3.7	1	92	6	0	1	0
				3.7–4.6	1	94	5	0	0	0
				4.6–5.5	2	92	6	0	0	0
				5.5–6.4	1	91	8	0	0	0
				6.4–7.3	3	83	14	0	0	0
				7.3–8.2	1	85	14	0	0	0
				8.2–9.1	3	85	12	0	0	0
				Mean	2	88	9	1	0	0
b	3	95	2	9.1–20.3	3	68	25	2	2	0

TM 34 NE 12 3562 4436 Hollesley, Suffolk **Block D**

Surface level (+20.4 m)
Groundwater conditions not recorded
Wirth B1, 203 mm diameter
April 1970

Overburden 0.6 m
Mineral 19.2 m
?Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Decayed vegetation	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Medium pale yellow sand, becoming fine to medium with depth. Some fine to coarse angular to sub-rounded flint gravel, mainly in top 3.7 m	8.2	8.8
Red Crag	**b** Sand Fine to medium dark red-brown sand with scattered pebbles Fine to medium red-brown sand with shell fragments, becoming grey-green at 18.9 m	11.0	19.8
?London Clay	Pale blue-grey clay	0.3+	20.1

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	
a	1	93	6	0.6–1.5	1	12	51	9	8	19	
				1.5–2.4	1	11	78	5	4	1	
				2.4–3.4	4	19	63	9	4	1	
				3.4–4.3	2	51	36	1	1	9	
				4.3–5.2	1	43	56	0	0	0	
				5.2–6.1	1	57	42	0	0	0	
				6.1–7.0	1	64	35	0	0	0	
				7.0–7.9	1	62	35	1	1	0	
				7.9–8.8	1	69	29	0	1	0	
				Mean	1	43	47	3	3	3	
b	2	94	4	8.8–19.8	2	44	45	5	2	2	

TM 34 NE 13 3584 4568 Hollesley, Suffolk **Block D**

Surface level (+21.0 m)
Water struck at +9.4 m
Pneumatic Shell/Pilcon Shell, 152/152 mm diameter
December 1969/October 1971

Overburden 0.6 m
Mineral 20.1 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Red Crag	Sand		
	Mainly fine to medium red-brown to orange-brown sand, with occasional thin clay bands and scattered pebbles	16.5	17.1
	Medium sand, orange-brown with shell material. Shells becoming grey-green and coarser, with rounded black pebbles present at 20.6 m	3.7	20.7
London Clay	Blue-grey clay	0.8+	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
3	95	2	0.6–20.7	3	43	48	4	2	0

TM 34 NE 14 3641 4969 Butley, Suffolk **Block B**

Surface level (+15.2 m)
Water struck at +9.1 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.6 m
Mineral 17.4 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Red Crag	Sand	17.4	18.0
	Fine to medium brown to red-brown sand with shell fragments. Deposit becoming grey-green at 14.9 m with numerous rounded black pebbles present in basal 0.9 m		
London Clay	Blue -grey clay	0.3+	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
2	96	2	0.6–18.0	2	34	56	6	2	0

TM 34 NE 15 3628 4845 Rendlesham Forest, Suffolk **Block B**

Surface level (+19.2 m)
Water struck at +6.7 m
Wirth B0, 203 mm diameter
March 1970

Overburden 0.9 m
Mineral 14.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil	Sand with decayed vegetation	0.9	0.9
Chillesford Beds	**a** Sand Fine yellow-ochre sand with occasional clay bands. Rather silty and becoming yellow-green towards base	9.5	10.4
Red Crag	**b** Sand Fine to medium red to dark brown sand	5.1	15.5
London Clay	Light blue-green clay	0.3+	15.8

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	
a	4	95	1	0.9–1.8	1	49	48	1	1	0	
				1.8–2.7	1	85	13	0	0	1	
				2.7–3.7	1	88	10	0	1	0	
				3.7–4.6	1	88	9	1	1	0	
				4.6–5.5	8	88	2	1	1	0	
				5.5–6.4	4	79	14	1	1	1	
				6.4–7.3	10	84	3	2	1	0	
				7.3–8.2	7	81	9	1	1	1	
				8.2–9.1	6	46	45	1	2	0	
				9.1–10.1	2	36	58	2	2	0	
				Mean	4	73	21	1	1	0	
b	4	95	1	10.1–15.5	4	63	30	2	1	0	

TM 34 NE 16 3663 4779 Capel St Andrew, Suffolk **Block B**

Surface level (+17.1 m)
Water struck at +10.4 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.6 m
Mineral 15.1 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Red Crag	Sand		
	Fine to medium sand, becoming mainly fine below 3.4 m. Red-brown to yellow-brown	12.4	13.0
	Red shelly sand becoming blue-green at 13.4 m. Rounded black pebbles towards base	2.7	15.7
London Clay	Blue clay	0.5+	16.2

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	
5	94	1	0.6–15.7	5	66	25	3	1	0	

TM 34 NE 17 3681 4677 Boyton, Suffolk **Block D**

Surface level (+15.5 m)
Water struck at +7.9 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.3 m
Mineral 10.4 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.3	0.3
Red Crag	Sand		
	Fine to medium orange-brown sand with few pebbles	8.8	9.1
	Fine to medium brown sand with shell material	1.6	10.7
London Clay	Blue-grey clay	0.6+	11.3

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	
4	94	2	0.3–10.7	4	48	41	5	2	0	

TM 34 NE 18 3672 4586 Hollesley, Suffolk **Block D**

Surface level (+17.4 m)
Water struck at +7.6 m
Pneumatic Shell, 152 mm diameter
December 1969

Overburden 0.6 m
Mineral 12.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Red Crag	Sand		
	Fine to medium sand becoming finer with depth, brown to orange-brown. Ironstone band present between 7.6 m and 8.8 m	10.4	11.0
	Medium to coarse sand, red-brown, with shell material	2.4	13.4
London Clay	Clay	0.9+	14.3

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
3	94	3	0.6–13.4	3	50	38	6	3	

TM 34 NE 19 3755 4964 Butley, Suffolk **Block B**

Surface level (+16.5 m)
Water struck at +6.4 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.9 m
Mineral 16.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.9	0.9
Red Crag	Sand	16.8	17.7
	Mainly fine sand to 5.5 m becoming fine to medium then medium with depth. Yellowish brown becoming orange to red-brown. Ironstone layers present between 5.8 m and 7.3 m		
London Clay	Clay	0.9+	18.6

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
6	92	2	0.9–17.7	6	50	38	4	2	0

TM 34 NE 20 3704 4831 Capel St Andrew, Suffolk **Block B**

Surface level (+19.8 m)
Water struck at +7.3 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.6 m
Mineral 4.9 m
Waste 2.4 m
Mineral 7.6 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Chillesford Beds	**a** 'Clayey' sand Fine pale yellow to orange-brown sand with clay and silt. Some flint gravel in top 0.3 m	4.9	5.5
	Greenish brown silty clay becoming mainly reddish brown but with green mottling in basal 1.8 m	2.4	7.9
Red Crag	**b** Sand Fine to medium brown to orange-brown sand	7.6	15.5
London Clay	Clay	0.9+	16.5

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	
a	12	86	2	0.6–1.5	7	53	27	2	6	5	
				1.5–2.4	1	93	5	0	1	0	
				2.4–3.4	23	74	2	0	1	0	
				3.4–4.3	20	76	3	0	0	1	
				4.3–5.5	8	90	1	1	0	0	
				Mean	12	77	8	1	1	1	
b	3	93	1	7.9–15.5	6	48	44	1	1	0	

TM 34 NE 21 3729 4640 Boyton, Suffolk **Block D**

Surface level (+17.1 m)
Water struck at +8.8 m
Wirth B1, 152 mm diameter
September 1969

Mineral 12.2 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Red Crag	**a** Sand		
	Fine with some medium sand, brown to orange-brown. Some sub-rounded to rounded flint gravel in top 0.3 m	10.1	10.1
	Fine to medium sand, brown, with shell fragments	2.1	12.2
London Clay	Clay	0.6+	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
4	94	2	0–12.2	4	64	27	3	2	0

TM 34 NE 22 3729 4585 Hollesley, Suffolk **Block B**

Surface level (+17.7nm)
Water struck at +5.5 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.6 m
Mineral 13.1 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand	3.4	4.0
	Fine to medium yellow sand with fine to coarse subangular flint gravel		
Red Crag	**b** Sand		
	Fine sand, becoming fine to medium with depth, orange to red-brown	7.6	11.6
	Fine to medium brown sand with shell fragments	2.1	13.7
London Clay	Clay	0.2+	13.9

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
a	3	86	11	0.6–1.5	4	28	56	4	4	4
				1.5–2.4	2	22	52	6	5	13
				2.4–3.4	5	27	50	6	6	6
				3.4–4.3	2	55	34	3	3	3
				Mean	3	33	48	5	5	6
b	5	94	1	4.3–13.7	5	70	21	3	1	0

TM 34 NE 23 3838 4942 Butley, Suffolk **Block B**

Surface level (+6.1 m)
Water struck at +4.6 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.9 m
Mineral 2.1 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.9	0.9
Red Crag	Sand Fine sand, yellow, white and red-brown	2.1	3.0
London Clay	Clay	1.5+	4.6

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
4	94	2	0.9–3.0	4	78	15	1	1	1

TM 34 NE 24 3838 4763 Boyton, Suffolk **Block D**

Surface level (+13.7 m)
Water struck at +3.1 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.6 m
Mineral 13.1 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Glacial Sand and Gravel	**a** Sand Mainly fine sand, yellow-brown with a trace of gravel A 0.3 m band of clay at base	7.6	8.2
Red Crag	**b** Sand Fine to medium red-brown to dark brown with a trace of gravel	2.5	10.7
	Medium to coarse brown sand with shells	3.0	13.7
London Clay	Clay	1.5+	15.2

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
a	1	98	1	0.6–1.5	No grading information available					
				1.5–2.4	1	82	14	1	2	0
				2.4–3.4	1	88	10	0	1	0
				3.4–4.3	1	89	5	3	2	0
				4.3–5.2	2	89	6	2	1	0
				5.2–6.1	1	95	3	0	1	0
				6.1–7.0	1	90	8	0	0	1
				7.0–7.9	1	64	35	0	0	0
				Mean	1	85	12	1	1	0
b	4	92	4	7.9–13.7	4	31	45	16	3	1

TM 34 NE 25 3806 4672 Boyton, Suffolk **Block D**

Surface level (+16.5 m)
Groundwater conditions not recorded
Wirth B1, 152 mm diameter
September 1969

Overburden 0.6 m
Mineral 12.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Glacial Sand and Gravel	**a** Sandy gravel	1.8	2.4
	Medium sand, yellow-brown with fine to coarse subangular flint/gravel		
Red Crag	**b** Sand		
	Fine to medium sand red ochre to red-brown with scattered pebbles	9.2	11.6
	Fine, medium and coarse brown sand with shells	1.8	13.4
London Clay	Blue clay	0.9+	14.3

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	
a	1	70	29	0.6–2.4	1	7	54	9	11	18	
b	6	91	3	2.4–13.4	6	49	37	5	2	1	

TM 34 NE 26 3903 4859 Butley, Suffolk **Block B**

Surface level (+15.2 m)
Water struck at +0.9 m
Wirth B1, 152 mm diameter
September 1969

Overburden 0.6 m
Mineral 17.4 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium yellow to orange-brown sand with fine to coarse subrounded to rounded flint gravel. Gravel concentrated in top 3.7 m. Some quartz pebbles present	5.5	6.1
Red Crag	**b** Sand Mainly fine, with some medium orange-brown sand. Trace of gravel	10.4	16.5
	Fine to medium brown sand with shells	1.5	18.0
London Clay	Clay	1.2+	19.2

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
a	6	77	17	0.6-1.5	No grading information available					
				1.5-2.4	4	24	61	5	5	1
				2.4-3.4	1	12	34	7	16	30
				3.4-4.3	4	24	43	7	9	13
				4.3-5.2	13	64	21	1	1	0
				5.2-6.1	10	33	40	7	8	2
				Mean	6	32	40	5	8	9
b	6	92	2	6.1-18.0	6	70	19	3	2	0

TM 34 SW 1 **3046 4396** **Shottisham, Suffolk** **Block E**

Surface level (+ 18.6 m)
Water struck at + 10.7 m
Wirth B1, 152 mm diameter
October 1969

Waste 11.3 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Coralline Crag	Reddish brown slightly shelly sand with abundant ironstone fragments	1.8	2.4
	Greenish brown sandy silt with scattered shell fragments	3.7	6.1
	Green, calcareous silt and clay with scattered shell fragments and black pebbles throughout but more common towards base	5.2	11.3
London Clay	Brown clay becoming blue-grey with depth	0.8 +	12.2

TM 34 SW 1A **3043 4414** **Shottisham, Suffolk** **Block E**

Surface level (+ 11.9 m)
Ground water conditions not recorded
Wirth B1, 152 mm diameter
October 1969

Overburden 0.6 m
Mineral 4.3 m
Bedrock 1.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Red Crag	?Sand		
	Fine yellow-brown sand	2.8	3.4
	Fine yellow-brown sand with comminuted shells	1.5	4.9
London Clay	Blue-grey clay	1.2 +	6.1

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	

No grading information available

TM 34 SW 2 3058 4258 Ramsholt, Suffolk **Block F**

Surface level (+18.9 m)
Water struck at +7.3 m
Wirth B1, 152 mm diameter
December 1969

Overburden 0.6 m
Mineral 13.7 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Red Crag	Sand		
	Fine to medium brown sand	3.4	4.0
	Fine to medium and occasionally medium to coarse sand with shell fragments. Numerous ironstone nodules at 6.1 m	10.3	14.3
London Clay	Blue clay	0.3+	14.6

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
5	93	2	0.6–14.3	5	24	60	9	2	0

TM 34 SW 3 3161 4307 Shottisham, Suffolk **Block F**

Surface level (+20.1 m)
Water struck at +7.6 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.6 m
Mineral 16.8 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Red Crag	**a** Sand		
	Fine to medium sand, yellow-brown to 2.1 m then ochreous-brown or brown to base. Scattered large flints 75 mm in top 0.9 m	8.2	8.8
	Medium to coarse brown sand with shell fragments. Shell content increasing with depth	8.6	17.4
London Clay	Blue clay	0.3+	17.7

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
2	95	3	0.6–17.4	2	30	51	14	3	0

TM 34 SW 4 3143 4235 Ramsholt, Suffolk **Block F**

Surface level (+20.7 m)
Water struck at +16.5 m
Wirth B1, 152 mm diameter
December 1969

Overburden 0.6 m
Mineral 15.1 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Mainly medium sand, brown, with fine to coarse flint and quartz gravel	3.7	4.3
Red Crag	**b** Sand Fine to medium red-brown sand with scattered pebbles, mainly in top 2.7 m	9.1	13.4
	Fine to medium brown sand with comminuted shells	2.3	15.7
London Clay	Clay	0.8+	16.5

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
a	3	81	16	0.6–1.5	6	27	53	11	3	0
				1.5–2.4	2	11	74	10	3	0
				2.4–3.4	2	13	42	9	8	26
				3.4–4.3	2	12	53	9	9	15
				Mean	3	16	55	10	6	10
b	4	94	2	4.3–15.7	4	31	57	6	2	0

TM 34 SW 5 3153 4169 Ramsholt, Suffolk **Block G**

Surface level (+18.3 m)
Water struck at +8.5 m
Wirth B1, 203 mm diameter
December 1969

Overburden 0.6 m
Mineral 11.9 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Red Crag	'Clayey' sand		
	Sand, brown, fine becoming fine to medium with depth. Rather silty. Occasional flint pebbles	9.2	9.8
	Brown, silty sand with a trace of shell fragments	2.7	12.5
London Clay	Clay	0.9+	13.4

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
12	86	2	0.6–12.5	12	52	26	8	2	0

TM 34 SW 6 3202 4413 Shottisham, Suffolk **Block E**

Surface level (+23.2 m)
Water struck at +10.1 m
Wirth B1, 152 mm diameter
October 1969

Overburden 1.2 m
Mineral 16.5 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
?Boulder Clay	Brown clay with chalk pebbles	0.6	1.2
Glacial Sand and Gravel	**a** Sand	0.9	2.1
	Medium yellow-brown sand with occasional large flint 50 mm		
Red Crag	**b** Sand		
	Fine to medium, brown and orange-brown sand with some flint and quartz gravel in top 0.9 m	4.0	6.1
	Red-brown, mainly medium to fine sand, but including a considerable amount of coarse sand; with shell fragments	11.6	17.7
London Clay	Clay	1.2+	18.9

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
a	5	94	1	1.2–2.1	5	10	79	5	1	0
b	3	94	3	2.1–17.7	3	30	51	13	3	0

TM 34 SW 7 3246 4453 Shottisham, Suffolk **Block E**

Surface level (+26.5 m)
Water struck at +14.0 m
Wirth B1, 152 mm diameter
October 1969

Overburden 2.4 m
Mineral 19.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
?Boulder Clay	Brown clay, stoneless	1.8	2.4
Red Crag	Sand		
	Fine to medium brown and orange-brown sand with occasional flint pebbles	6.7	9.1
	Medium yellow and red-brown sand with shell fragments. Shell fraction inacreasing with depth	13.1+	22.3

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
3	95	2	2.4–17.1	3	27	60	8	2	0

TM 34 SW 8 3258 4356 Shottisham, Suffolk **Block F**

Surface level (+19.8 m)
Water struck at +9.8 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.9 m
Mineral 15.3 m
Bedrock 1.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.9	0.9
Red Crag	Sand		
	Fine to medium light brown and orange-brown sand. Iron concentrations towards the base	5.5	6.4
	Mainly medium sand, light brown, with shell fragments. Shell content increasing with depth. Deposit pale green at base	9.8	16.2
London Clay	Clay	1.8+	18.0

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
4	93	3	0.9–16.2	4	34	53	6	3	0

TM 34 SW 9 3230 4275 Ramsholt, Suffolk **Block F**

Surface level (+22.3 m)
Water struck at +10.4 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.9 m
Mineral 16.2 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Soil		0.9	0.9
Glacial Sand and Gravel	**a** Sand Fine yellow brown sand	1.8	2.7
Red Crag	**b** Sand Fine to medium brown sand with scattered pebbles	7.4	10.1
	Brown sand, fine to medium becoming medium to coarse with depth. Shell material present. Hard ironstone bands with cemented shells found below 11.9 m. Black rounded pebbles at base	7.0	17.1
London Clay	Clay	0.6+	17.7

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
a	7	93	0	0.9–1.8	5	89	3	2	1	0
				1.8–2.7	8	88	2	2	0	0
				Mean	7	88	3	4	0	0
b	4	92	4	2.7–17.1	4	31	51	10	4	0

TM 34 SW 10 3255 4134 Ramsholt, Suffolk **Block G**

Surface level (+15.5 m)
Water struck at +7.0 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.3 m
Mineral 13.4 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.3	0.3
Red Crag	Sand Fine to medium yellow-brown sand with occasional pebbles	0.9	1.2
	Medium, brown to dark brown sand with shell fragments. Shell content increasing with depth.	12.5	13.7
London Clay	Clay	1.5+	15.2

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
2	95	3	0.3–13.7	2	19	66	10	3	0

TM 34 SW 11 3226 4082 Ramsholt, Suffolk **Block G**

Surface level (+13.1 m)
Water struck at +4.9 m
Wirth B1, 203 mm diameter
December 1969

Overburden 0.9 m
Mineral 9.8 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.9	0.9
Red Crag	Sand		
	Medium, brown sand, rather silty	1.5	2.4
	Fine to medium brown sand with shell fragments. Some coarse sand in top 4.9 m. Shell percentage increases with depth	8.3	10.7
London Clay	Clay	1.5+	12.2

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
5	93	2	0.9–10.7	5	28	54	11	2	0

TM 34 SW 12 3343 4451 Shottisham, Suffolk **Block E**

Surface level (+22.6 m)
Water struck at +9.4 m
Wirth B1, 152 mm diameter
October 1969

Overburden 4.0 m
Mineral 18.9 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.9	0.9
?Boulder Clay	Clay with red sand and some gravel passing at 1.5 m into brown, green and blue stoneless clay	3.1	4.0
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium brown and fawn sand with flint gravel in basal 0.9 m	4.5	8.5
Red Crag	**b** Sand		
	Fine to medium brown sand	4.6	13.1
	Fine to medium brown sand with shell fragments. Some coarse sand between 14.0 m and 17.7 m. Shell content fairly constant	9.8	22.9
London Clay	Clay	1.2+	24.1

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
a	5	85	10	4.0–5.8	5	31	54	4	6	0
				5.8–6.7	4	40	44	4	7	1
				6.7–7.6	4	43	45	4	4	5
				7.6–8.8	9	27	38	6	15	0
				Mean	5	35	45	5	8	2
b	3	94	3	8.8–21.3	3	36	47	11	3	0

TM 34 SW 13 3343 4342 Alderton, Suffolk **Block F**

Surface level (+19.2 m)
Water struck at +9.1 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.9 m
Mineral 19.2 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.9	0.9
Glacial Sand and Gravel	**a** Sand Fine to medium brown sand with occasional flint pebbles	0.9	1.8
Red Crag	**b** Sand Fine to medium brown and red-brown sand becoming dark yellow-brown towards base	6.9	8.7
	Fine to medium yellow-brown and red-brown sand with shell fragments. Basal 3.2 m grey-green in colour. Numerous black pebbles at base of deposit	11.4	20.1
London Clay	Clay	0.3+	20.4

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
a	8	88	4	0.9–1.8	8	52	30	6	4	0
b	3	95	2	1.8–20.1	3	38	48	9	2	0

TM 34 SW 14 3359 4259 Alderton, Suffolk **Block F**

Surface level (+20.7 m)
Water struck at +7.0 m
Pneumatic Shell, 152 mm diameter
November 1969

Overburden 0.6 m
Mineral 23.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Red Crag	Sand Fine to medium yellow sand becoming brown to red-brown at 1.5 m. Occasional pebbles of flint and white quartz. Rather silty	4.4	5.0
	Fine, medium and coarse yellow-brown sand with abundant shell fragments. Deposit red-brown between 11.6 m and 14.3 m. Basal 0.9 m slightly green with numerous black pebbles	19.4+	24.4

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
2	95	3	0.6–24.4	2	29	53	13	3	0

TM 34 SW 15 3326 4154 Alderton, Suffolk **Block G**

Surface level (+ 14.0 m)
Water struck at + 7.6 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.9 m
Mineral 13.7 m
Bedrock 0.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.9	0.9
Red Crag	Sand		
	Medium dark chocolate brown silty sand	2.1	3.0
	Medium to coarse red-brown sand with shell fragments. Basal 0.3 m grey-green in colour	11.6	14.6
London Clay	Clay	0.2 +	14.8

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
2	95	3	0.9–14.6	2	18	64	13	3	0

TM 34 SW 16 3396 4032 Bawdsey, Suffolk **Block G**

Surface level (+ 10.4 m)
Groundwater conditions not recorded
Wirth B1, 152 mm diameter
October 1969

Overburden 1.2 m
Mineral 0.9 m
Bedrock 1.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	1.2	1.2
Red Crag	'Clayey' pebbly sand	0.9	2.1
	Fine to medium brown sand with shell fragments and numerous black pebbles. Very silty		
London Clay	Grey clay	1.5 +	3.7

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
19	66	15	1.2–2.1	19	28	33	5	13	2

TM 34 SW 17 **3425 4456** **Hollesley, Suffolk** **Block E**

Surface level (+18.0 m)
Groundwater conditions not recorded
Wirth B1, 152 mm diameter
November 1969

Overburden 0.9 m
Mineral 17.4 m
Bedrock just touched

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.9	0.9
Glacial Sand and Gravel	**a** Sandy gravel Fine to medium brown sand with medium to coarse flint and quartz gravel. Flint up to 75 mm	1.8	2.7
Red Crag	**b** Sand Fine to medium sand, yellow-brown to 3.7 m then red-brown, with a dark chocolate-brown layer 0.3 m thick at base	7.7	10.4
	Medium red-brown sand with shell fragments, becoming coarser with depth	7.9	18.3
London Clay	Clay	Just touched	

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
a	1	74	25	0.9–1.8	1	11	41	11	11	25
				1.8–2.7	1	32	45	8	9	5
				Mean	1	21	43	10	10	15
b	3	94	3	2.7–14.6	3	38	49	7	2	1

TM 34 SW 18 **3441 4371** **Alderton, Suffolk** **Block F**

Surface level (+17.4 m)
Water struck at +6.7 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.6 m
Mineral 18.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Fine to medium brown and yellow-brown sand with some coarse rounded to subangular flint gravel in top 0.9 m Maximum pebble size 50 mm	5.5	6.1
Red Crag	**b** Sand		
	Fine to medium brown and red-brown silty sand	4.9	11.0
	Mainly medium sand, red-brown, with shell fragments, becoming grey-green in basal 2.7 m. Black pebbles at base of deposit	8.2	19.2
London Clay	Clay	0.3+	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	
a	3	91	6	0.6–1.5	0	26	44	12	8	10	
				1.5–2.4	4	30	51	11	4	0	
				2.4–3.4	4	23	60	9	4	0	
				3.4–4.3	5	40	44	6	3	2	
				4.3–5.2	3	74	19	3	1	0	
				5.2–6.1	3	47	39	5	3	3	
				Mean	3	40	43	8	4	2	
b	3	95	2	6.1–19.2	3	25	60	10	2	0	

TM 34 SW 19 3453 4247 Alderton, Suffolk **Block F**

Surface level (+13.1 m)
Water struck at +2.4 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.6 m
Mineral 18.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Red Crag	Sand	18.6	19.2
	Fine to medium brown and orange-brown sand with shell fragments. Shells noticeably coarser between 2.4 m and 6.1 m. Basal 2.4 m grey-green in colour		
London Clay	Clay	0.3+	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
2	95	3	0.6–19.2	2	30	55	10	3	0

TM 34 SW 20 3463 4176 Alderton, Suffolk **Block G**

Surface level (+13.1 m)
Water struck at +3.4 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.6 m
Mineral 13.7 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Red Crag	Sand	13.7	14.3
	Brown and orange-brown sand with shell fragments. Medium to coarse in top 4.6 m then fine to medium. Highest concentration of shell fragments also in upper 4.6 m		
London Clay	Clay	0.6+	14.9

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
3	95	2	0.6–14.3	3	30	51	14	2	0

TM 34 SW 21 3458 4056 Bawdsey, Suffolk **Block G**

Surface level (+ 10.7 m)
Water struck at +4.3 m
Wirth B1, 152 mm diameter
October 1969

Overburden 0.9 m
Mineral 9.8 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.9	0.9
Red Crag	Sand		
	Fine to medium orange, red, brown and red-brown sand with iron concretions and occasional flints	2.8	3.7
	Fine to medium brown sand with shell fragments. Concentration of black pebbles at base	7.0	10.7
London Clay	Clay	0.3+	11.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
2	96	2	0.9–10.7	2	42	48	6	2	0

TM 34 SE 1 3548 4492 Hollesley, Suffolk **Block D**

Surface level (+ 14.0 m)
Water struck at +8.8 m
Wirth B1, 152 mm diameter
December 1969

Overburden 0.6 m
Mineral 14.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Red Crag	Sand		
	Fine yellow-brown sand to 4.3 m then fine to medium brown and red-brown sand	9.1	9.7
	Medium red-brown sand with shell fragments. Colour change to green in basal 0.6 m with occasional black pebbles	5.5	15.2
London Clay	Clay	0.3+	15.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
3	94	3	0.6–15.2	3	43	46	5	3	0

TM 34 SE 2 3559 4232 Alderton, Suffolk **Block G**

Surface level (+9.1 m)
Water struck at +0.9 m
Wirth B1, 152 mm diameter
October 1969

Mineral 11.9 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Red Crag	Pebbly sand Mainly medium brown to orange-brown sand with some coarse sand in top 3.7 m and basal 1.8 m, and fine sand from 3.7 m to 6.4 m. Abundant shell fragments, proportion increasing with depth. Gravel mainly of shells	11.9	11.9
London Clay	Clay	0.9+	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
2	92	6	0–11.0	2	20	49	23	5	1

TM 34 SE 3 3615 4461 Hollesley, Suffolk **Block D**

Surface level (+18.6 m)
Water struck at +6.1 m
Pneumatic Shell, 152 mm diameter
November 1969

Overburden 0.6 m
Mineral 19.5 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Red Crag	Sand		
	Fine, red, brown and yellow sand with occasional pebbles, becoming fine to medium dark red-brown from 8.8 m	11.0	11.6
	Medium red-brown sand with shell fragments. Change in basal 0.3 m to green with numerous black flint pebbles	8.5	20.1
London Clay	Clay	0.6+	20.7

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
3	96	1	0.6–20.1	3	45	46	5	1	0

The following reports of the Institute relate particularly to bulk mineral resources

Reports of the Institute of Geological Sciences

Assessment of British Sand and Gravel Resources

1 The sand and gravel resources of the country south-east of Norwich, Norfolk: Resource sheet TG 20.
E. F. P. Nickless.
Report 71/20 ISBN 0 11 880216 X £1.15

2 The sand and gravel resources of the country around Witham, Essex: Resource sheet TL 81. H. J. E. Haggard.
Report 72/6 ISBN 0 11 880588 6 £1.20

3 The sand and gravel resources of the area south and west of Woodbridge, Suffolk: Resource sheet TM 24.
R. Allender and S. E. Hollyer.
Report 72/9 ISBN 0 11 880596 7 £1.70

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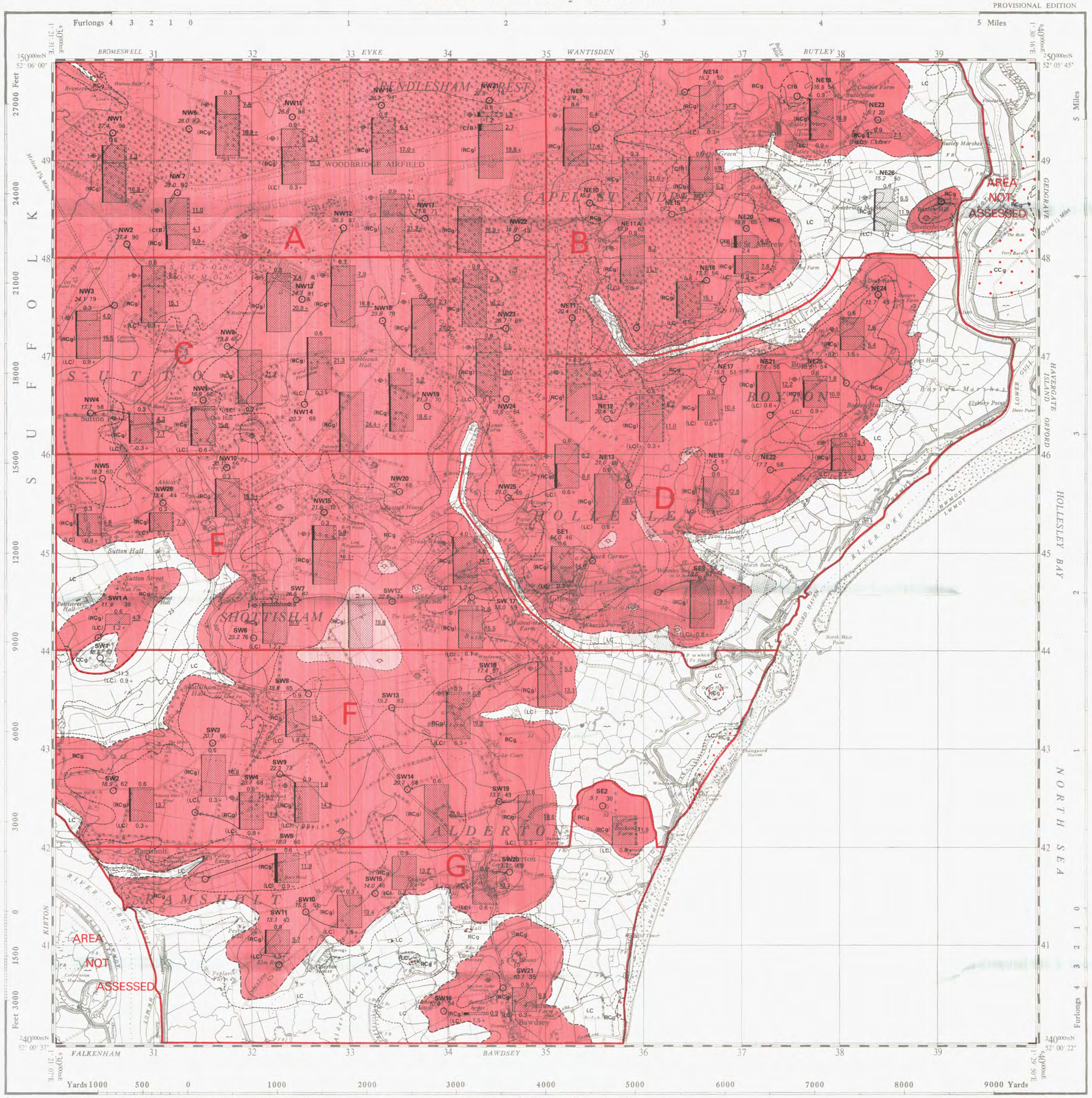
INSTITUTE OF GEOLOGICAL SCIENCES

INDUSTRIAL MINERALS ASSESSMENT UNIT

THE SAND AND GRAVEL RESOURCES OF SHEET TM 34 (HOLLESLEY, SUFFOLK)

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

ORDNANCE SURVEY
SHEET TM 34
PROVISIONAL EDITION



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Geological lines from surveys by W.H.Dalton and W. Whitaker. Published on Old Series Sheets 48 NE and 50 SE in 1882 - 3.

Sand and Gravel Survey by R. Allender, S.E. Hollyer, S.J.Booth and S. Machin in 1968 to 1971. 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.*
1100/82

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.

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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Compiled from 6" sheets last revised 1902 - 25. Other partial systematic revision 1953 has been incorporated.
Major roads revised 1969.
Woodbridge Airfield revised 1970.

Made and published by the Ordnance Survey, Southampton.

TM25	TM35	TM45
TM24 207	TM34	TM44 208 & 225
TM23 224	TM33	TM43

Diagram showing the relation of the National Grid 1:25 000 sheets with the One-inch Geological Sheets 207, 224, and with the 1:50 000 Geological Sheet 208 | 225

THE SAND AND GRAVEL RESOURCES OF SHEET TM 34 (HOLLESLEY, SUFFOLK)

83

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

- **Alluvium** - sands, silts and thin gravels. A-54
- **Marine Beach Deposits** - mainly gravel. MB-6
- **? Boulder Clay** - stiff bluish grey brown - weathering with erratics of chalk and flint, occasionally gravelly at base, with sand lenticles.
- **Glacial Sand and Gravel** - principally yellow sand with variable amounts of flint and quartz gravel; the latter is usually in a lenticular form. Occasionally intercalated silt and clay bands.

SOLID

- **?Chillesford Beds** - green and yellow fine sands, silts and clays, usually highly micaceous. (proved in boreholes only).
- **Red Crag** - reddish - brown ferruginous sands, with ironstone bands and nodules. Shelly in lower part. Phosphatic nodules often at base.
- **Coralline Crag** - greenish brown shelly sand with silt.
- **London Clay** - stiff bluish grey clay.

RECENT AND PLEISTOCENE — PLIOCENE — EOCENE

BC-31
GS-12
CH-1
RC-1

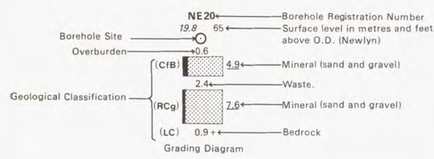
BOUNDARY LINES

- Geological boundary, Drift.
- Geological boundary, Solid.
- Resource Block boundary.

Broken lines denote uncertainty.

BOREHOLE DATA

All the boreholes represented on the map were drilled for I.M.A.U.



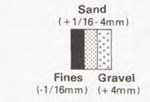
Note:
(i) Figures underlined denote thicknesses used in the assessment of resources.
(ii) The + sign indicates that the base of the deposit was not reached.
(iii) The figures in *italics* are the metric conversions of the measurements recorded in feet.
(iv) The Geological Classification is given only for the mineral and bedrock.

Borehole Registration Number

Each I.M.A.U. borehole is identified by a Regisration Number, eg. SW 18. The letters refer to the quarter of this sheet, and the figures to the I.G.S. serial number for that quarter. The unique designation for borehole SW 18 is TM 34 SW 18.

Grading Diagram

Each grading diagram shows the mean particle size distribution of a distinct deposit of mineral.



The height of the diagram is proportional to the mineral thickness.

The widths of the divisions show the proportions of **Fines**, **Sand** and **Gravel**, but small amounts may be omitted or exaggerated.

CATEGORIES OF DEPOSITS

- **Exposed mineral, assessed.** CAT-E2
- **Continuous or almost continuous spreads of mineral beneath overburden.** CAT-C1
- **Sand and gravel either not potentially workable (see Report) or absent.** CAT-A2
- **Sand and gravel not assessed.** CAT-N1

RESOURCE BLOCKS

For the purpose of assessment the mineral-bearing ground 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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