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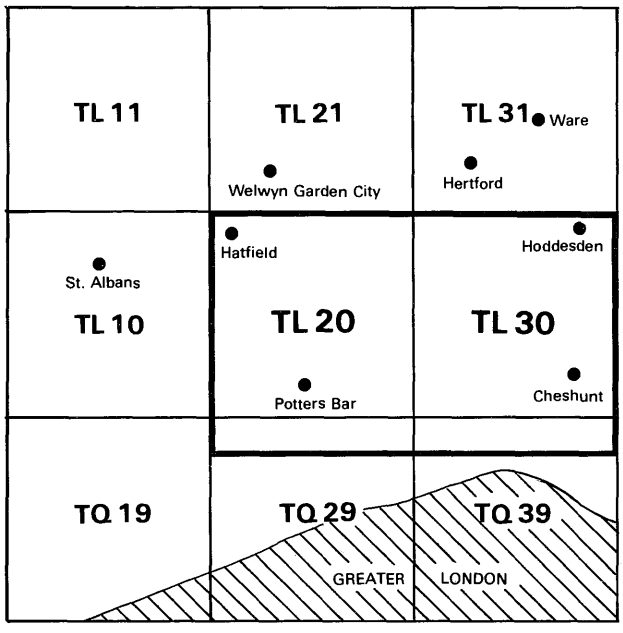

The sand and gravel resources of the country around Hatfield and Cheshunt, Hertfordshire

Description of 1:25 000 sheets TL 20 and 30, and parts of TQ 29 and 39

J. R. Gozzard

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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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The asterisk on the cover indicates that parts of sheets adjacent to the ones cited are described in this report.

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 resources of alternative aggregates are available. Following a short feasibility project, initiated in 1966 by the Ministry of Land and Natural Resources, the Mineral Assessment Unit (now the Industrial Minerals Assessment Unit) began systematic surveys in 1968. The work is now being financed by the Department of the Environment and is being undertaken with the co-operation of the Sand and Gravel Association of Great Britain.

This report describes the resources of sand and gravel of 240 km^2 of country between Hatfield and Cheshunt, Hertfordshire, shown on the accompanying 1:25 000 resource map TL 20, TL 30 with part of TQ 29 and TQ 39. The survey was conducted by Mr D. R. Parker and Mr S. Machin. The work is based on six-inch scale geological surveys carried out by Mr J. A. Howe in 1902 and Messrs H. G. Dines, R. W. Pocock, T. Robertson and R. L. Sherlock in 1912–22 and published on one-inch geological sheets 239 (Hertford) and 256 (North London).

Mr J. W. Gardner CBE, (Land Agent) negotiated access to land for drilling, The co-operation of land owners and tenants is gratefully acknowledged.

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SUMMARY

The geological maps of the Institute of Geological Sciences, pre-existing borehole information and 85 boreholes drilled for the Industrial Minerals Assessment Unit form the basis of the assessment of sand and gravel resources in the area around Hatfield and Cheshunt, Hertfordshire.

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

The 1:25 000 map is divided into five resource blocks, containing between 5.6 and 17.1 km^2 of sand and gravel. For each block the geology of the deposits is described and the mineral-bearing area, the mean thicknesses of overburden and mineral and the mean gradings are stated. Detailed borehole data are also given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying map.

Bibliographical reference
GOZZARD, J. R. 1981. The sand and gravel resources of the country around Hatfield and Cheshunt, Hertfordshire: Description of 1:25 000 sheets TL 20, TL 30 and parts of TQ 29 and TQ 39. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 67.

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INTRODUCTION

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, 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; Thurrell, 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 geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout' (Bureau of Mines and Geological Survey, 1948, p. 15).

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

The following arbitrary physical criteria have been adopted:

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

A deposit of sand and gravel 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 geo-

metric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm has been adopted. The boundaries between fines (that is, the clay and silt fractions) and sand, and between sand and gravel-grade material, are placed at $\frac{1}{16}$ mm and 4 mm 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.

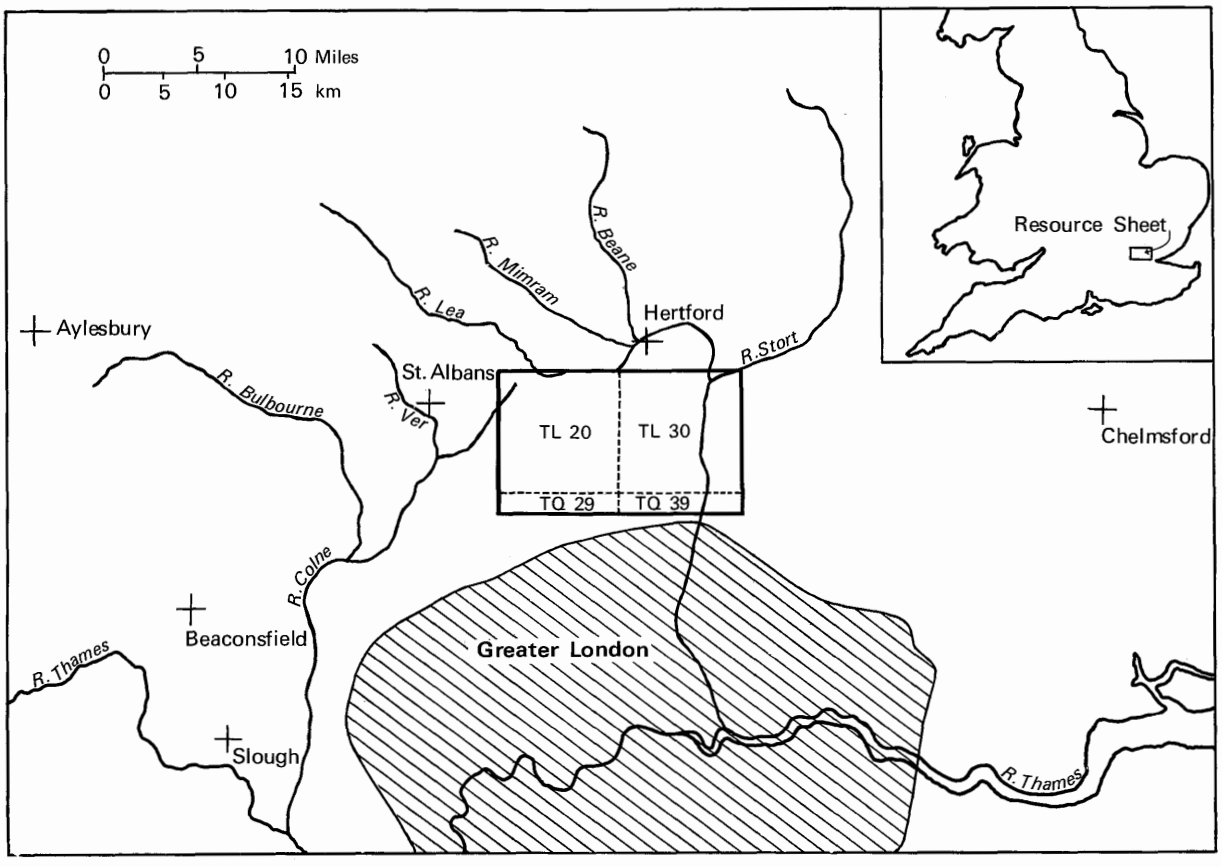


Figure 1 Sketch-map showing the location of the district described.

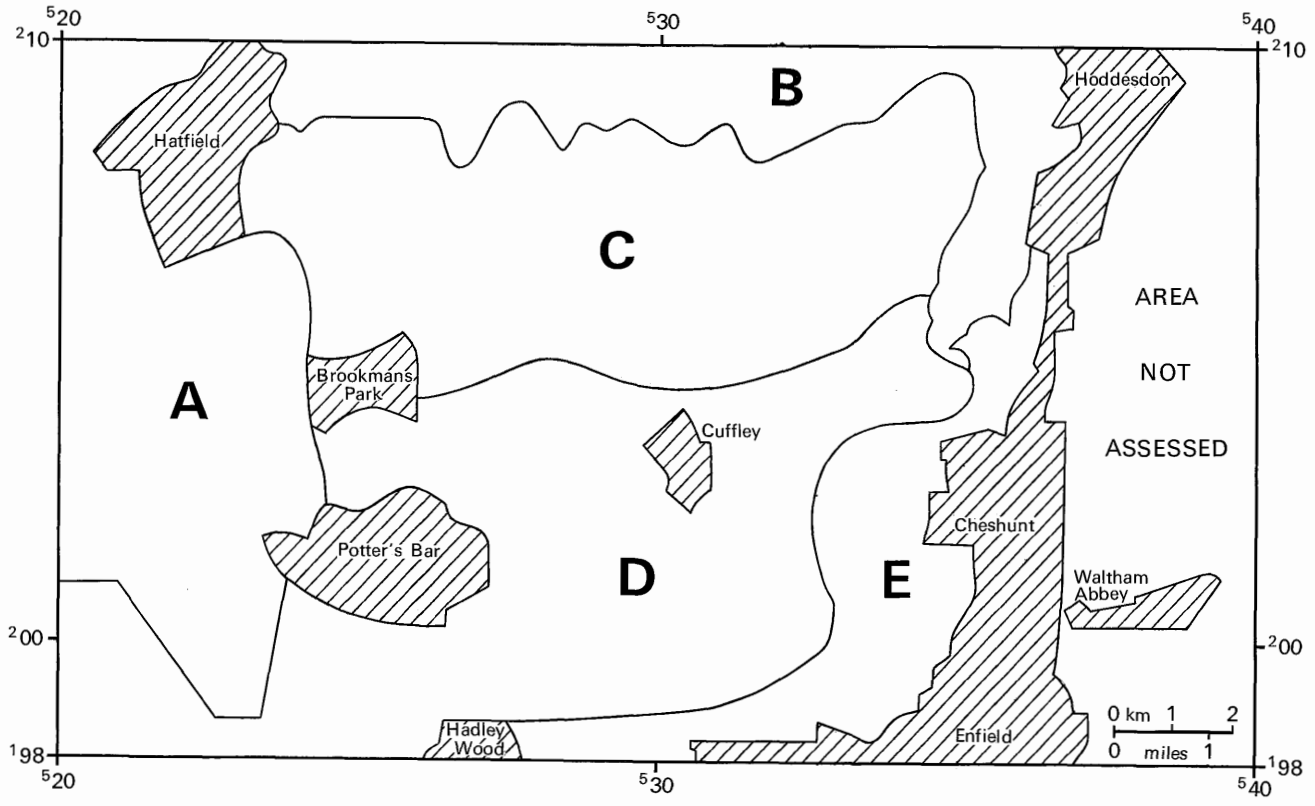


Figure 2 Sketch-map showing resource block boundaries and main localities mentioned in the text.

DESCRIPTION OF THE RESOURCE SHEET

GENERAL

The district described (Figures 1 and 2) lies to the north of Greater London and is dominated by the London Clay plateau which rises to 128 m (420 ft) above OD north-east of Potter's Bar. The plateau is strongly dissected by tributary valleys of the River Lea, which is the major stream of the area, flowing along the northern and eastern margins of the district. Hatfield, Potter's Bar, Hoddesdon and Cheshunt are the main commercial and residential centres and the remainder of the area is devoted primarily to agriculture and market gardening.

GEOLOGY

The geological sequence is summarised in Table 1. The deposits (see also Sherlock and Pocock, 1924) are listed as far as possible in order of increasing age and their relationships are illustrated in the cross-section (Figure 3).

Table 1 Stratigraphy

DRIFT
Recent and Pleistocene
Alluvium
Valley Gravel
Brickearth
Terrace deposits of the Lea Valley
Undivided and Flood-plain Gravel
Taplow Gravel
Boyn Hill Gravel
Glacial Gravel
Boulder Clay
Pebble Gravel
SOLID
Eocene
Claygate Beds
London Clay
Palaeocene
Lower London Tertiaries
Upper Cretaceous
Upper Chalk

SOLID

Upper Chalk Up to 79 m thick, the Upper Chalk is the oldest deposit exposed in the area described. It forms the bedrock to the drift deposits along the northern and western margins of the district. The chalk is a white limestone and contains many nodular flints.

Lower London Tertiaries Lower London Tertiaries unconformably overlie the Upper Chalk and may be up to 15 m thick; they comprise pale grey and pale yellow basal sands overlain by grey silty clays. Thin beds of small black rounded flint pebbles occur throughout, and at the base, a bed of unworn flints (?the 'Bullhead Bed') has been recorded in boreholes in Little Berkhampstead and South Mimms.

London Clay Conformably overlying the Lower London Tertiaries, the London Clay is the most extensive bedrock in the district. It may be over 46 m thick in the

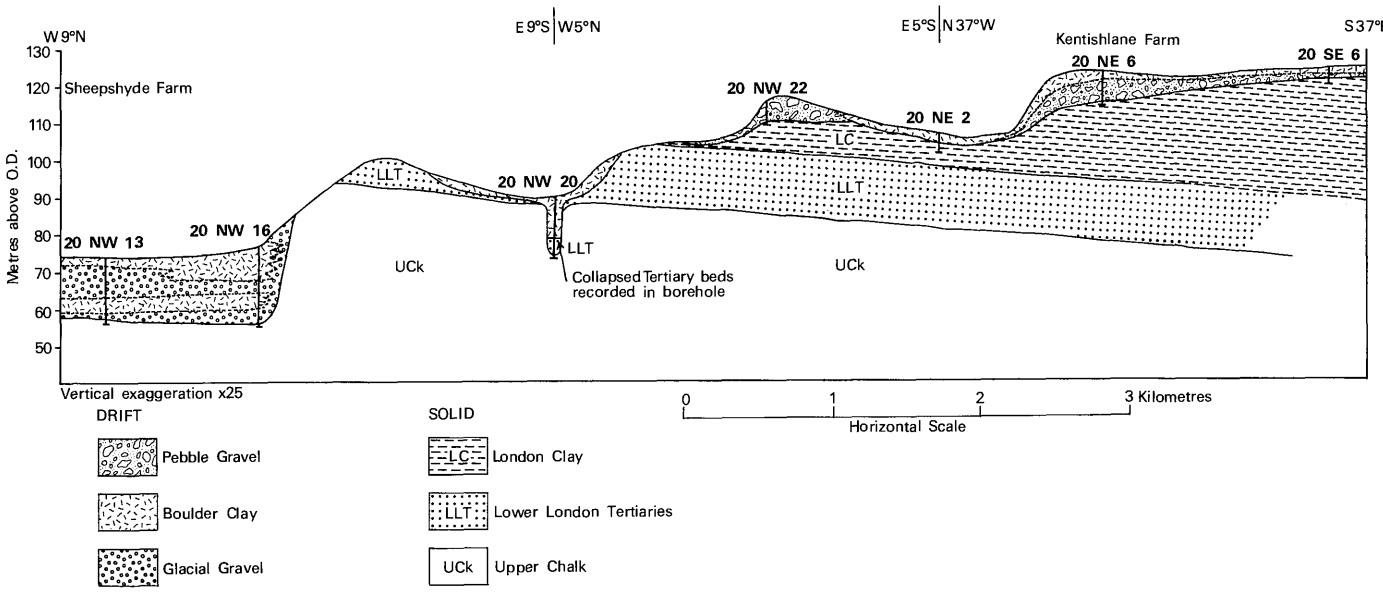


Figure 3 Cross-section showing the relationship of the drift deposits to the solid rocks south of Hatfield.

area and consists of dark grey or bluish grey stiff clay which, owing to weathering, often becomes yellowish brown near the surface.

Claygate Beds These sandy transition beds overlying the London Clay crop out only in one small area near Enfield Chase [288 981]. They consist of well-defined alternations of sand and clay, with sand predominating above and clay below.

Drift

Pebble Gravel The Pebble Gravel caps the Tertiary plateau from Hatfield in the north-west towards Cheshunt in the south-east. It probably once formed a continuous cover over the Tertiaries and may have extended over and beyond the Vale of St Albans onto the southern Chilterns to the north-west. The Pebble Gravel has since been dissected by glacial and fluviatile action and now occurs in isolated patches. The deposit is thickest around Little Berkhampstead [290 080] and generally thins towards the south.

The genesis of the Pebble Gravel has been variously described as glacial, fluviatile and marine (Wooldridge, 1960). The presence of numerous rounded pebbles suggests an origin other than simply glacial.

Boulder Clay Boulder Clay occurs to the west of Hatfield and as isolated patches on the higher ground west of the River Lea. When fresh, it consists of stiff dark grey silty clay with chalk and flint pebbles together with some pebbles of quartz, quartzite, schist and Jurassic fossils. Where Boulder Clay crops out, and at its contact with other deposits, it is commonly decalcified and dull brown in colour.

Glacial Gravel Glacial Gravel is found in patches in the Hatfield area, along the flanks of the Lea Valley, and as small isolated patches near Hawkshead House [237 032] and on Enfield Chase [290 983]. It is thought (Wooldridge and Linton, 1955, p. 117) that these gravels were derived from an ice-sheet to the north but that some of their constituents, notably the Triassic pebbles, were introduced by the Thames.

Boyn Hill Gravel This deposit is restricted to one small patch near Fortyhill [335 985] where borehole 39 NW 8 proved 3 m of gravel overlying London Clay.

Taplow Gravel The Taplow Gravel, lying at a lower level than the Boyn Hill Gravel but at a higher level than the younger Flood Plain Gravel, is found along the western flank of the Lea Valley in the Cheshunt area (Sherlock, 1935).

Undivided and Flood Plain Gravel These deposits are found on either side of the Lea Valley between Hoddesdon and Cheshunt and are probably continuous beneath the Alluvium of the modern River Lea. Beds containing arctic plant fossils have been found in the Flood Plain Gravel at several localities in the Lea Valley; they also contain mammalian fossils belonging to species that indicate a cold climate, including the mammoth *Mammuthus primigenius* (Sherlock, 1935).

Brickearth Covering and associated with the Lea Valley Terraces, the Brickearth is a silty or fine sandy clay, which may contain scattered pebbles of fine and medium flint. It is usually buff, brown or grey in colour and can be considered a 'fossil' alluvium.

Valley Gravel The main occurrence of Valley Gravel is found in the Mimms Valley between Water End [230 043] and South Mimms [220 010]. Restricted deposits also occur along the Lea Valley along the northern margin of the district. It is thought (Sherlock, 1935) that the Valley Gravel may have been laid down by overspill streams issuing from a glacial lake impounded to the north-west of the Chilterns.

Alluvium Found along the present course of the River Lea and its tributary valleys, the Alluvium consists of silts and clays with associated peat horizons and occasional sand seams.

Table 2 Selected analyses of the lithology of the gravel fraction in the various formations

Borehole number	Percentages by weight in the gravel fraction				
	Flint	Chert	Quartz	Quartzite	Others
PEBBLE GRAVEL					
20 NW 22	72	2	21	3	3
20 SE 4	81	2	10	3	4
20 SE 8	86	3	3	1	7
29 NW 52	86	–	12	–	2
30 NW 23	96	–	1	–	3
30 SW 28	87	–	3	1	9
GLACIAL GRAVEL					
20 NW 15	84	7	4	4	1
20 NE 4	78	5	7	3	7
20 SW 1	80	3	8	–	9
30 NW 15	69	12	12	–	7
30 NE 11	85	2	2	2	9
BOYN HILL GRAVEL					
39 NW 8	94	–	5	–	1
TAPLOW GRAVEL					
30 NE 15	92	–	5	–	3
FLOOD PLAIN GRAVEL					
30 SW 33	79	11	6	–	4
VALLEY GRAVEL					
20 SW 5	82	7	7	2	2

COMPOSITION OF THE SAND AND GRAVEL DEPOSITS

The Pebble Gravel, Glacial Gravel, Valley Gravel and the Lea Valley terrace gravels (Boyn Hill, Taplow and Flood Plain) constitute the main resources of mineral in the district, although the Lea Valley desposits have largely been worked out.

Pebble Gravel
The Pebble Gravel has a mean grading of fines 11 per cent, sand 40 per cent and gravel 49 per cent. The gravel fraction is composed of equal proportions of fine and coarse material with occasional cobbles and comprises, on average, over 80 per cent flint with significant amounts of 'Bunter'-derived quartz and other sedimentary rocks (Table 2). The sand fraction is mainly medium with lesser amounts of fine and coarse grades in approximately equal proportions. Quartz predominates in the sand fraction with a smaller proportion of flint. The Pebble Gravel is a clean deposit in that the fines content occurs in well-defined thin seams of grey silty clay.

Glacial Gravel
The mean grading of the Glacial Gravel is fines 9 per cent, sand 48 per cent and gravel 43 per cent. The gravel fraction consists of approximately equal amounts of fine and coarse material with cobbles scattered throughout. Over 70 per cent of the gravel by weight consists of angular and rounded flint, the remainder being composed largely of quartz, quartzite, chert and other materials. The sand fraction is predominantly medium with subsidiary amounts of fine and coarse grades and comprises mainly quartz in the fine to medium fraction and quartz and flint in the medium to coarse fraction.

Boyn Hill Gravel
Only one borehole, 39 NW 8, sampled the Boyn Hill Gravel; its gravel fraction consists of over 90 per cent subangular to rounded flint divided approximately equally between the fine and coarse grades and comprises quartz with some flint. The mean grading of the deposit is fines 8 per cent, sand 41 per cent, gravel 51 per cent.

Taplow Gravel
Compositional information for this formation is limited to one borehole, 30 NE 15, which gives a mean grading of fines 1 per cent, sand 21 per cent and gravel 78 per cent. The gravel in this borehole consists of fine and coarse fractions in equal proportions with flint predominating. The sand consists of equal amounts of medium and coarse material and consists mainly of quartz.

Undivided and Flood Plain Gravel
Only one borehole, 30 SW 33, encountered this deposit: 2.7 m of Flood Plain Gravel was found below 2.2 m of Brickearth. This deposit has a mean grading of fines 6 per cent, sand 37 per cent and gravel 57 per cent. As with the Boyn Hill and Taplow Gravels, flint dominates the gravel fraction and quartz the sand fraction.

Valley Gravel
This formation has a mean grading of fines 16 per cent, sand 36 per cent and gravel 48 per cent; fine gravel predominates over coarse in the proportion 3:2, while the sand is mainly of medium grade. Angular and rounded flints dominate the gravel fraction with quartz and chert in subsidiary amounts, while quartz is the main constituent of the sand fraction.

THE MAP
The sand and gravel resource map is folded into the pocket at the end of this report. The base map is the Ordnance Survey 1:25 000 Outline Edition in grey, on which the topography is shown by contours in green, the

Table 3 The sand and gravel resources: a statistical assessment

Block	Area		Mean thickness		Volume of mineral			Mean grading percentage		
	Block	Mineral	Over-burden	Mineral		Limits at the 95% probability level		Fines	Sand	Gravel
	km^2	km^2	m	m	$m^3 \times 10^6$	±%	$\pm m^3 \times 10^6$	$-\frac{1}{16}$ mm	$+\frac{1}{16}$ -4 mm	+4 mm
A	30.9	10.2	2.7	9.4	95.9	17	16.3	10	42	48
B	21.8	12.2	5.6	6.0	73.2	34	24.9	9	47	44
C	45.8	17.1	2.4	3.8	65.0	22	14.3	11	40	49
D	54.5	9.4	1.2	1.7	16.0	21	3.4	10	37	53
E	16.8	5.6	1.6	2.7	15.1	33	5.0	10	39	51
Blocks A to E	169.8	54.5	2.8	4.9	267.0	17	45.4	10	43	47

geological data in black and the mineral resource information in red.

Geological data

The geological boundary lines are based on six–inch geological surveys made between 1902 and 1922 and published on the one-inch scale on sheets 239 (Hertford) and 256 (North London). There is a very small overlap onto sheets 240 (Epping) and 257 (Romford) on the east. Borehole data, which include the stratigraphical relations and mean particle-size distributions of sand and gravel samples collected during the assessment survey, are also shown.

The geological boundaries are the best available interpretation of the information available at the time of survey. However, it is inevitable that local irregularities or discrepancies will be revealed by some boreholes. These are taken into account in the assessment of resources.

Mineral resource information

The mineral-bearing ground is subdivided into resource blocks (see Appendix A). Within a resource block the mineral is 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 overburden, commonly consisting only of soil and subsoil, averages less than 1.0 m in thickness.

Areas where bedrock outcrops, or where evidence indicates the absence of potentially workable sand and gravel are uncoloured on the map. In such areas, it has been assumed that the mineral is absent except, possibly, in infrequent and relatively minor patches, which can neither be outlined nor assessed in the context of this survey. Areas of unassessed sand and gravel, for example, in built-up areas, are indicated by a red stipple.

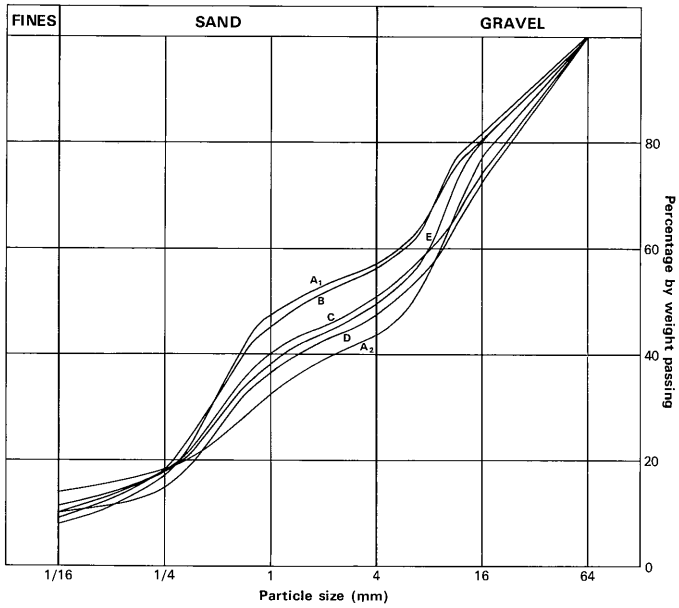
For the most part the depicted distribution of the various categories of deposits is based on the mapped geological boundaries, Where there is transition from one category to another, which cannot be related to the geological map and which cannot be delineated accurately, inferred boundaries, shown by a distinctive symbol, have been inserted. The symbol is intended to convey an approximate location within a likely zone of occurrence rather than represent the breadth of the zone, its size being limited only by cartographic considerations. For the purpose of measuring area the centre line of the symbol is used.

RESULTS

The statistical results of the survey are summarised in Table 3. Further grading particulars are given in Figures 5 to 9 and Tables 4 to 8, All limits quoted in this report have been calculated at the symmetrical 95 per cent probability level.

Accuracy of results

For the five resource blocks the accuracy of the results at the 95 per cent probability level varies between 17 per



Resource Block	Percentages by weight					
	-1/16mm	+1/16mm -1/4mm	+1/4mm -1mm	+1mm -4mm	+4mm -16mm	+16mm
A_1 (Glacial Gravel)	8	9	30	10	23	20
A_2 (Valley Gravel)	14	4	14	11	34	23
B	9	9	27	11	25	19
C	11	7	22	11	24	25
D	10	5	21	11	27	26
E	10	8	20	11	31	20

Figure 4 Mean particle-size distribution for the assessed thickness of sand and gravel in resource blocks A to E.

Table 4 Block A: data from IMAU boreholes

Borehole	Recorded thickness			Mean grading percentage					
	Mineral m	Overburden m	Waste partings m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$–$\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
20 NW 11	6.7	5.4	3.3	8	9	33	7	17	26
20 NW 12	8.4	1.7	3.9	6	7	26	11	25	25
20 NW 13	10.4	2.0	4.2	12	15	33	7	21	12
20 NW 14	12.1	5.9	2.0	10	5	42	6	23	14
20 NW 15	14.1	1.2	3.4	5	7	24	14	23	27
20 NW 16	8.7	8.8	4.0	8	10	34	13	25	10
20 NW 17	5.0	0.9	4.0	25	6	24	6	16	23
20 NW 18	absent								
20 NW 20	2.7	8.1	6.0	3	5	19	11	21	41
20 SW 1	11.9	0.7	4.5	12	21	34	7	18	8
20 SW 2	6.6	1.6		15	3	15	2	38	27
20 SW 3	absent								
20 SW 4	3.0	1.0	0.5	26	59	2	1	4	8
20 SW 5	14.4	0.6	0.9	13	4	11	15	33	24
20 SW 6	8.8	1.3	2.3	16	6	16	11	33	18

cent and 34 per cent (that is, it is probable that nineteen times out of twenty the true volumes present lie within these limits). However, the true values are more likely to be nearer the figures estimated than the limits. Moreover, it is probable that in each block approximately the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say, 1 km^2) 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 ten sample points will be required, even if the area is quite small. This point can be illustrated by considering the whole of the potentially workable sand and gravel on this sheet. The volume (267 million m^3) can be estimated to limits of ± 17 per cent at the 95 per cent probability level, by a calculation based on the data from 85 sample points spread across the five resource blocks. However, it must be emphasised that the quoted volume of sand and gravel has no simple relationship with the amount that could be extracted in practice, as no allowance has been made in the calculations for any restraints (such as existing buildings and roads) on the use of the land for mineral working.

NOTES ON THE RESOURCE BLOCKS

Block A (Table 4; Figure 5)

Block A lies to the west of Potters Bar and to the south and west of Hatfield. The low ground to the west of Hatfield is occupied by spreads of Glacial Gravel and Boulder Clay resting on Upper Chalk and abutting the Tertiary scarp which rises to over 107 m (350 ft) above OD. Valley Gravel extends southwards from Water End [229 043] and occupies a deep channel cut through the Tertiary deposits and into the Chalk. Pebble Gravel caps the high ground around Ridgehill Farm [207 026] and around Redwell Wood [214 026]. The dissected north-western edge of the Tertiary scarp, which falls within the block, consists of London Clay resting on Lower London Tertiaries.

Mineral occupies a third of the block area and is composed of both Glacial Gravel and Valley Gravel. Where overburden on the Glacial Gravel is other than a thin sandy soil, it occurs as Boulder Clay with a mean thickness of 4.3 m, ranging in thickness from 0.9 m in 20 NW 17 to 8.8 m in 20 NW 16. The mineral in the Glacial Gravel usually occurs in two, and occasionally three, horizons separated by boulder clay. Mineral thicknesses range from 4.8 m in Hydrogeology Unit Record 239/63 to 14.1 m in 20 NW 15, with a mean thickness of 9.4 m. The boulder clay waste parting is present over much of the mineral area and ranges in thickness from 2.0 m in 20 NW 14 to 7.2 m in the Hydrogeology Unit Record with a mean of 3.9 m. The weighted mean grading of the mineral is fines 8 per cent, sand 49 per cent and gravel 43 per cent, giving a classification of sandy gravel.

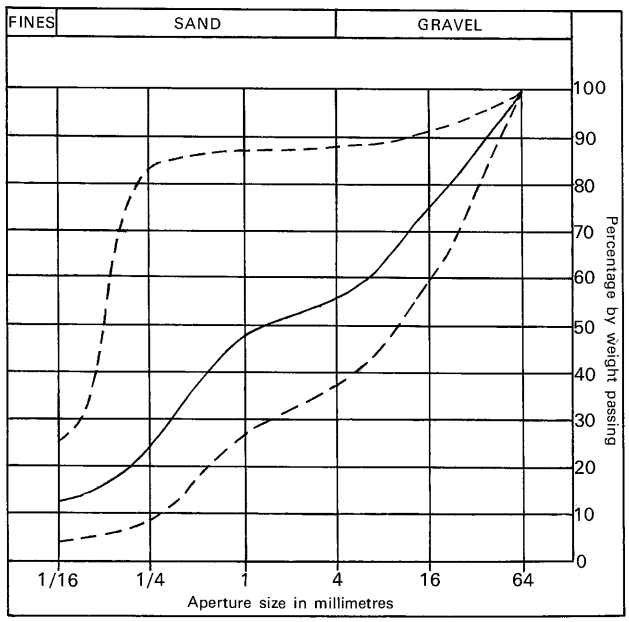


Figure 5 Grading characteristics of the mineral in Block A. The continuous line represents the weighted mean gradient of the block, and the broken lines denote the envelope within which the mean grading curves for individual boreholes fall.

Table 5 Block B: data from IMAU boreholes

Borehole	Recorded thickness			Mean grading percentage					
	Mineral m	Over-burden m	Waste partings m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$–$\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
20 NE 4	8.0	1.7	7.2	6	8	27	9	25	25
20 NE 7	12.7	2.4		6	11	34	12	25	12
20 NE 11	absent								
30 NW 15	6.1	10.6		16	12	15	13	27	17
30 NW 18	absent								
30 NW 21	7.0	17.3		11	6	20	13	31	19
30 NW 24	4.0	14.5		10	23	27	9	17	14
30 NE 11	10.2	0.5		10	2	37	6	22	13
30 NE 12	12.4	0.5		5	5	31	11	25	23
30 NE 14	4.6	0.8	0.9	22	5	33	8	15	17

The Valley Gravel is usually covered by a thin layer of alluvium, and, although of restricted occurrence, it shows the greatest thickness of mineral in the block: 14.4 m in 20 SW 5. The formation thins northwards to 6.6 m in 20 SW 2. The mean grading for the Valley Gravel is fines 14 per cent, sand 29 per cent and gravel 57 per cent giving a classification of 'clayey' gravel.

The estimation of resources in the block is based on eleven IMAU boreholes and nine other records including Hydrogeology Unit records and commercial information. The estimated volume of mineral in the block is 95.9 ± 16.3 million m^3 with a mean grading of fines 10 per cent, sand 42 per cent and gravel 48 per cent.

Block B (Table 5, Figure 6)

This block lies to the east of Hatfield along the northern margin of the area and includes the glacial deposits bordering the River Lea. Mineral occupies 12.2 km^2 of the total area of the block (21.8 km^2) and is composed of Glacial Gravel and Valley Gravel. In some instances the Lower London Tertiaries were penetrated and sampled.

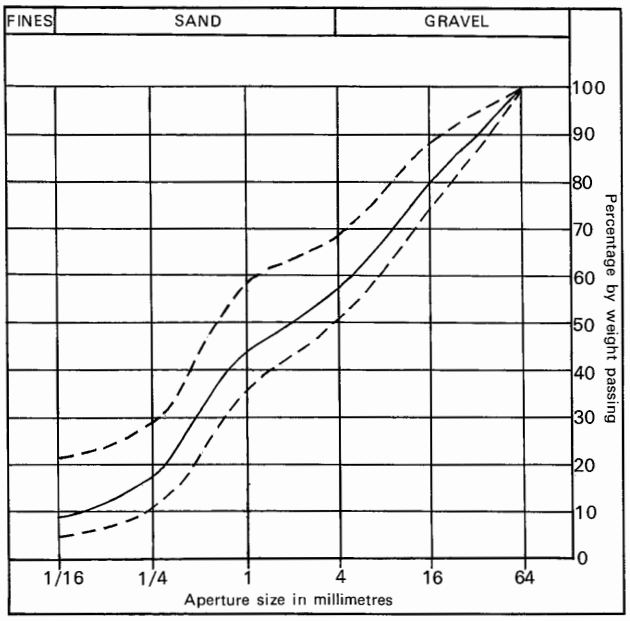


Figure 6 Grading characteristics of the mineral in Block B. The continuous line represents the weighted mean gradient of the block, and the broken lines denote the envelope within which the mean grading curves for individual boreholes fall.

Information on the Valley Gravel is limited to two Hydrogeology Unit boreholes, 239/57 and 239/193, which proved 2.1 m and 1.5 m of gravel respectively. Overburden, as Alluvium along the Lea Valley and Boulder Clay on the higher ground, ranges in thickness from 0.3 m in Hydrogeology Unit borehole 239/57 to 17.3 m in 30 NW 21 with a weighted mean thickness of 5.6 m for the block as a whole. The maximum thickness of mineral was found in 20 NE 7 where 12.7 m of Glacial Gravel rests on Chalk. The minimum thickness proved was 4.0 m in 30 NW 24. For the purposes of calculations borehole 30 NW 18 has been regarded as barren; however, it does contain a total of 5.8 m of Glacial Gravel but in seams with an overburden ratio greater than 3:1. The weighted mean thickness of mineral in the block is 6.0 m and the weighted mean grading is fines 9 per cent, sand 47 per cent and gravel 44 per cent, giving a classification of sandy gravel.

The estimate of resources in the block is based on 12 IMAU boreholes and 20 other records. The estimated volume of mineral is 73.2 ± 25 million m^3.

Block C (Table 6, Figure 7)

Block C covers the relatively high ground formed by the Tertiary escarpment between Brookmans Park [255 046] and Hoddesdon. The deposits consist of Pebble Gravel and Boulder Clay resting on London Clay, with Lower London Tertiaries being exposed at the edge of the escarpment and in the more deeply incised valleys.

The Pebble Gravel is the only source of mineral in the block and occurs as dissected patches resting on high ground formed by the London Clay. Mineral occupies 17.1 km^2 of the block area of 45.8 km^2. It comprises one horizon, usually with boulder clay or clay with gravel overburden. The weighted mean thickness of the overburden is 2.4 m. The mineral ranges in thickness from 1.0 m in 30 NW 19 to 7.3 m in Hydrogeology Unit Record 239/56 with a weighted mean thickness of 3.8 m. The mineral generally thins eastwards towards the main Lea Valley. The weighted mean grading of the mineral is fines 11 per cent, sand 40 per cent and gravel 49 per cent giving a classification of 'clayey' gravel. The fines content varies between 4 and 18 per cent and usually consists of thin silty clay seams within the gravel.

Fifteen IMAU boreholes and six other records were used in the assessment of resources. The estimated volume of mineral is 65.0 ± 14.3 million m^3.

Table 6 Block C: data from IMAU boreholes

Borehole	Recorded thickness			Mean grading percentage					
	Mineral m	Overburden m	Waste partings m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$–$\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
20 NW 19	2.6	1.9	1.2	10	4	14	14	26	32
20 NW 21	3.1	6.0		5	5	18	9	23	40
20 NW 22	4.2	0.8		10	6	13	11	27	33
20 NE 1	3.0	0.7		13	5	18	12	33	19
20 NE 2	absent								
20 NE 3	absent								
20 NE 5	absent								
20 NE 6	5.9	2.0		13	3	18	8	31	27
20 NE 8	2.4	0.8	2.2	6	14	52	10	11	7
20 NE 9	4.1	2.6		8	12	21	10	26	23
20 NE 10	2.6	5.5		17	6	12	22	20	23
20 NE 12	5.9	3.2		18	6	39	9	14	14
20 NE 13	absent								
30 NW 16	absent								
30 NW 17	absent								
30 NW 19	1.0	2.8	0.4	4	7	34	16	25	14
30 NW 20	absent								
30 NW 22	2.0	2.1	0.5	7	6	25	10	17	35
30 NW 23	2.0	1.8	0.9	18	25	21	5	11	20
30 NW 25	3.0	0.7	0.4	10	4	16	13	28	29
30 NW 26	2.0	1.6	0.3	4	7	13	10	38	28
30 NW 27	absent								
30 SW 21	absent								

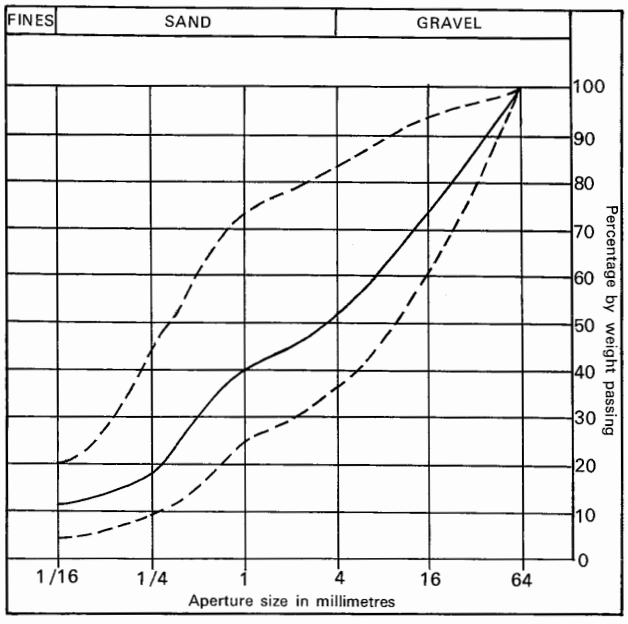


Figure 7 Grading characteristics of the mineral in Block C. The continuous line represents the weighted mean gradient of the block, and the broken lines denote the envelope within which the mean grading curves for individual boreholes fall.

Block D (Table 7, Figure 8)

Covering 54.5 km^2, Block D is the largest block in the area. The ground falls eastward from more than 128 m (420 ft) above OD around Buckettsland Farm [208 987] to around 61 m (200 ft) above OD in Cheshunt Park [347 043] and Crews Hill [309 002].

Overburden usually consists of Boulder Clay or pebbly clay and silt (?Head) with a weighted mean thickness of 1.2 m, but as the thickness is commonly 1.0 m or less, most of the underlying mineral has been classified as exposed.

Mineral occupies 9.4 km^2 and occurs as isolated patches of Pebble Gravel on London Clay. Cuffley Brook

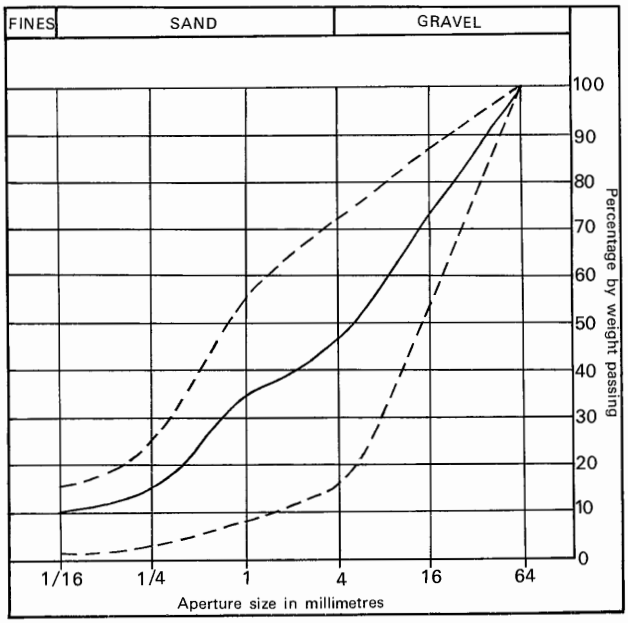


Figure 8 Grading characteristics of the mineral in Block D. For explanation, see Figure 7.

Table 7 Block D: data from IMAU boreholes

Borehole	Recorded thickness (m)			Mean grading percentage					
	Mineral m	Over-burden m	Waste partings m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$–$\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
20 SE 4	1.9	0.7		13	6	35	5	18	23
20 SE 5	absent								
20 SE 6	1.4	1.2		6	7	28	11	27	21
20 SE 7	1.4	1.5		8	4	19	15	31	23
20 SE 8	1.3	0.8		14	3	11	12	29	31
20 SE 9	2.6	1.4		9	4	16	9	27	35
30 NW 28	absent								
30 SW 20	1.5	2.6		9	5	13	8	32	33
30 SW 22	absent								
30 SW 23	absent								
30 SW 24	absent								
30 SW 25	absent								
30 SW 26	absent								
30 SW 27	absent								
30 SW 31	absent								
29 NW 51	2.0	1.0		15	4	12	10	31	28
29 NW 52	2.0	1.0		8	4	21	11	32	24
29 NW 54	1.0	1.7	0.6	1	2	6	7	39	45
29 NE 1	absent								
29 NE 2	2.0	0.6	1.6	4	2	19	20	30	25
29 NE 3	2.5	1.1		12	9	36	14	16	13
29 NE 4	absent								
29 NE 6	1.0	0.2		10	16	24	8	23	19

and its tributaries have cut down through the London Clay to expose the Lower London Tertiaries beneath. Mineral ranges in thickness from 1.0 m in 29 NW 54 and 29 NE 6 to 2.6 m in 20 SE 9 giving a weighted mean thickness of 1.7 m.

The weighted mean grading of the mineral is fines 10 per cent, sand 37 per cent and gravel 53 per cent. The fines content varies from 1 to 15 per cent and usually consists of fairly stiff greyish brown clay.

Twelve IMAU boreholes were used in the assessment of resources. The estimated volume of mineral is 16.0 ± 3.4 million m^3.

Block E (Table 8, Figure 9)

Block E covers an area of 16.8 km^2 and lies immediately to the west of Wormley [365 055] and Cheshunt. The block flanks the River Lea and the mineral-bearing deposits include Pebble Gravel, Glacial Gravel and the Terrace Gravels of the Lea Valley. Overburden is sometimes merely a thin sandy soil but usually it consists of soft, silty clay with flints. Its weighted mean thickness for the block is 1.6 m. Mineral occupies 5.6 km^2 and ranges in thickness from 1.0 m in borehole 30 SW 28 to 5.2 m in Hydrogeology Unit Record 239/145a. The overall weighted mean grading for the mineral is fines 10 per cent, sand 39 per cent and gravel 51 per cent giving a classification of 'clayey' sandy gravel. The two boreholes drilled in Pebble Gravel, 30 SW 28 and 30 SW 30, show the mineral to have a higher fines content, about 14 per cent, than that of the fluviatile deposits which is about 5 per cent.

Five IMAU boreholes and 30 other records were used in the calculation of resources. The estimated volume of mineral is 15.1 ± 5 million m^3.

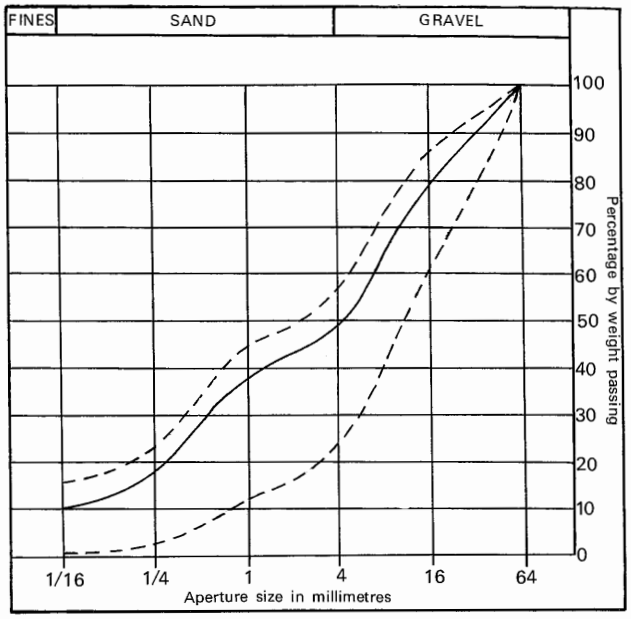


Figure 9 Grading characteristics of the mineral in Block E. The continuous line represents the weighted mean gradient of the block, and the broken lines denote the envelope within which the mean grading curves for individual boreholes fall.

Table 8 Block E: data from IMAU boreholes

Borehole	Recorded thickness			Mean grading percentage					
	Mineral m	Overburden m	Waste partings m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}$–$\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$–1 mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
30 NE 13	absent								
30 NE 15	2.0	3.4		1	2	9	10	40	38
30 SW 28	1.0	0.3		14	8	17	13	26	22
30 SW 29	absent								
30 SW 30	5.1	2.6		13	9	22	11	30	15
30 SW 32	absent								
30 SW 33	2.7	2.2		6	4	20	13	39	18
30 SE 47	absent								
39 NW 7	absent								
39 NW 8	3.0	1.0		8	13	21	7	25	26

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 so that, for example, glacial and river terrace gravels are separated. Otherwise division is by arbitrary lines, which may bear no relationship to the geology. The blocks are drawn provisionally before drilling begins.

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

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

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

A continuous series of bulk samples is taken throughout the sand and gravel. Ideally samples are composed exclusively of the whole of the material encountered in the borehole between stated depths. However, care is taken to discard, as far as possible, material which has caved or has been pumped from the bottom of the hole. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel, or at every 1 m (3.3 ft) depth. The samples, each weighing between 25 and 45 kg (55 and 100 lb), are despatched in heavy duty polythene bags to a laboratory for grading. The grading procedure is based on 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}, . . . l_{m_n}, then the best estimate of mean thickness, $\bar{l}_m$, is given by

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

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

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

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 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 Block 1:25 000 } Fictitious

Area
Block: 11.08 km²
Mineral: 8.32 km²

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m³
Mineral: 54 million m³

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

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

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	IMAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	–	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	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		$wl_o = 2.5$		$wl_m = 6.5$		

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

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

Figure 10 Example of resource block assessment: calculation and results.

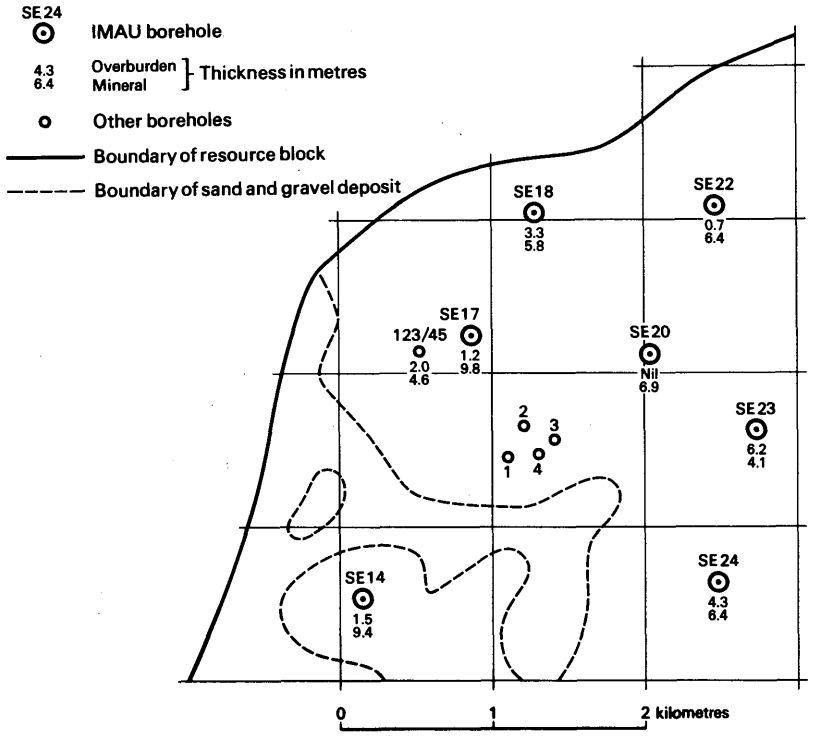


Figure 11 Example of resource block assessment: map of fictitious block.

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: $L_{\bar{l}_m} \leq L_V \leq 1.05\ L_{\bar{l}_m}$

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

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

per cent, and when n is greater than 20, as

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

per cent.

11 The application of this procedure to a fictitious area is illustrated in Figures 10 and 11.

Inferred assessment

12 If the sampled area of mineral in a resource block is between 0.25 km² and 2 km² an assessment is inferred, 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 km².

15 *Note on weighting* The thickness of a deposit at any point may be governed solely by the position of the point in relation to a broad trend. However, most sand and gravel deposits also exhibit a random pattern of local, and sometimes considerable, variation in thickness. Thus the distribution of sample points 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 12). 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 9, 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 F), 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 approximate 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

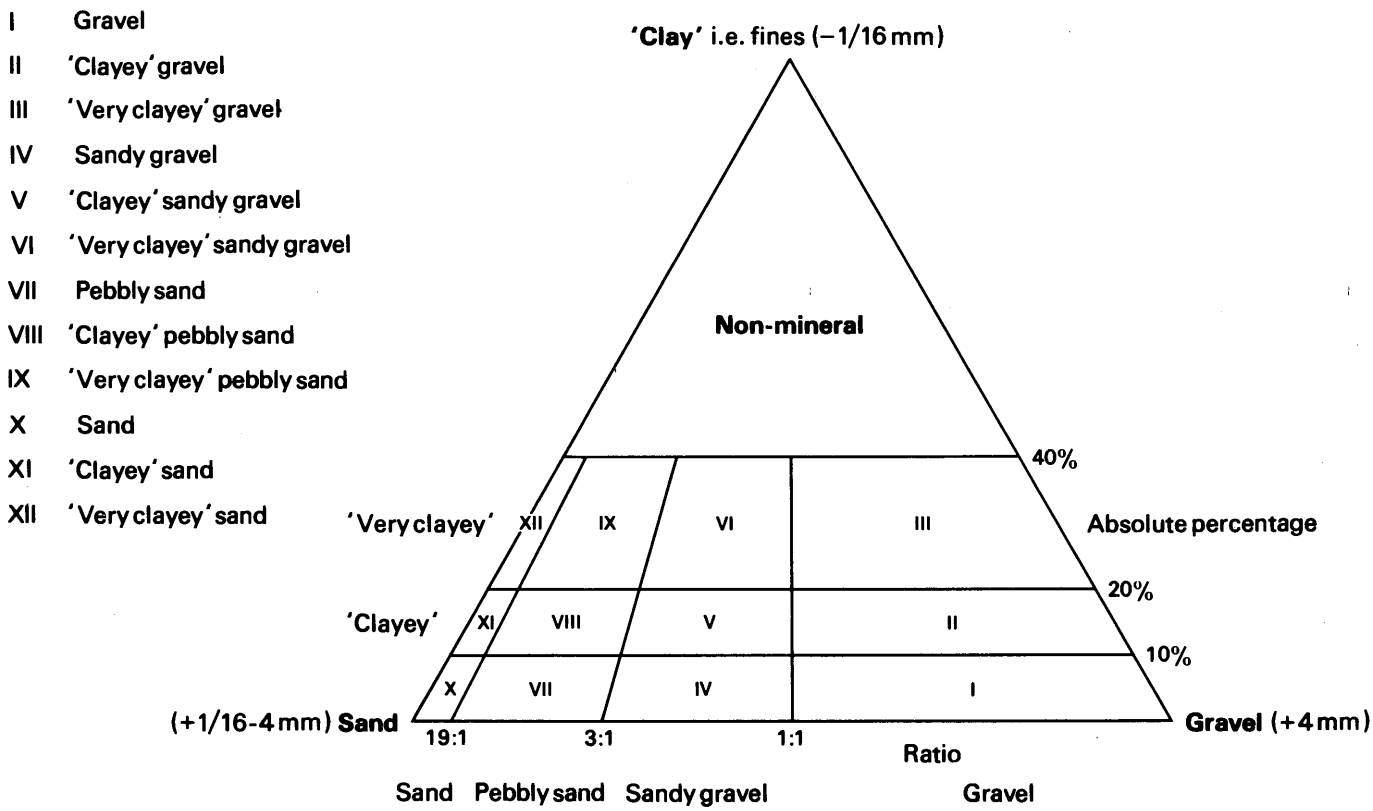


Figure 12 Diagram to show the descriptive categories used in the classification of sand and gravel.

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

ANNOTATED EXAMPLE

TL 20 NW 13[1] **2031 0697**[2] **Sleepshyde Farm, Colney Heath** **Block A**[3]

Surface level (+72.8 m) +239 ft[4]
Water from (+67.8 m) to (+62.2 m)[5]
March 1972[6]

Overburden[7] 2.0 m
Mineral 8.6 m
Waste 4.2 m
Mineral 1.8 m
Bedrock 1.1 m+[8]

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.3	0.3
Boulder Clay	[9]Clay, soft, brown with black mottling, scattered flint pebbles	1.7	2.0
Glacial Gravel	**a** 'Clayey' sandy gravel Gravel: fine and coarse, subangular, subrounded, rounded and nodular flint with subrounded and rounded quartz. Gravel rare below 8.0 m. Sand: medium with fine and some coarse, brown, sharp becoming soft below 8.0 m Fines: brown, soft, silty; content decreases with depth	8.6	10.6
Boulder Clay	Clay, stiff, dark grey with small flint, quartz, and shale pebbles with fossil fragments to 14.4 m, then brown and without chalk to 14.8 m	4.2	14.8
Glacial Gravel	**b** Gravel Gravel: fine and coarse, subangular, subrounded and rounded flint with quartz Sand: fine, medium and coarse, sharp, pale-brown	1.8	16.6
Upper Chalk	Chalk, soft becoming firm	1.1+	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	+16–64
a	14	57	29	2.0–3.0	41	1	3	2	33	20
				3.0–4.0	25	6	27	10	24	8
				4.0–5.0	22	9	32	8	20	9
				5.0–6.0	2	2	17	20	37	22
				6.0–7.0	2	3	32	20	29	14
				7.0–8.0	5	5	51	11	18	10
				8.0–10.0	10	32	34	23	1	0
				10.0–10.6	7	58	33	1	1	0
				Mean	14	15	36	6	19	10
b	4	48	48	14.8–15.8	5	20	21	11	31	12
				15.8–16.6	2	9	17	15	36	21
				Mean	4	15	19	14	32	16
a + b	12	55	33	Mean	12	15	33	7	21	12

The numbered paragraphs below correspond to 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 TL 20.

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 13.

Thus the full Registration Number is TL 20 NW 13. Usually this is abbreviated to 20 NW 13 in the text.

2 The National Grid reference
All National Grid references within this publication lie within the 100 km square TL and TQ 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 nearest named locality on the 1:25 000 base map and the resource block in which it lies is stated.

4 Surface level
The surface level at the borehole site is given in metres and feet above Ordnance Datum. Although measurements were made in feet, approximate conversions to metres are given in the logs. Original logs may be consulted on request.

5 Groundwater conditions
Two kinds of entry are made: the record indicates the level at which groundwater stood on completion of drilling (in metres above or below OD); or that water was not encountered.

6 Type of drill and date of drilling
Unless otherwise started, all boreholes were drilled by a shell and auger rig using 6-inch casing. The month and year of completion of the hole are stated.

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

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

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

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

11. Grading Results
The limits are as follows: gravel, +4 mm; sand +1/16 −4 mm; fines, −1/16 mm.

12. Mean Grading
The grading of the full thickness of the mineral horizon identified in the log is the mean of the individual sample gradings weighted by the thicknesses represented, if these vary. The classification used is shown in Table 9.

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

APPENDIX E

LIST OF BOREHOLES USED IN THE ASSESSMENT OF RESOURCES

Borehole* No.	Grid reference
1 INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLES	
TL20	
NW 11	2019 0907
12	2007 0802
13	2031 0697
14	2045 0551
15	2145 0970
16	2134 0684
17	2143 0517
18	2291 0517
19	2351 0748
20	2327 0656
21	2455 0740
22	2471 0667
TL 20	
NE 1	2577 0816
2	2587 0640
3	2527 0547
4	2619 0942
5	2607 0730
6	2642 0544
7	2751 0949
8	2760 0733
9	2733 0541
10	2860 0558
11	2948 0899
12	2925 0786
13	2941 0654
TL 20	
SW 1	2051 0434
2	2198 0473
3	2173 0257
4	2294 0442
5	2293 0195
6	2310 0290
TL 20	
SE 4	2667 0368
5	2655 0019
6	2742 0431
7	2781 0385
8	2791 0097
9	2980 0309
TL 30	
NW 15	3075 0925
16	3050 0766
17	3017 0698
18	3112 0980
19	3185 0763
20	3096 0650
21	3249 0923
22	3228 0797
23	3284 0690
24	3359 0990
25	3338 0854
26	3482 0962
27	3444 0749
28	3411 0544
TL 30	
NE 11	3580 0780
12	3546 0677
13	3518 0519
14	3611 0875
15	3616 0570
TL 30	
SW 20	
21	3039 0090
22	3157 0460
23	3176 0298
24	3286 0456
25	3217 0254
26	3429 0146
27	3236 0049
28	3365 0430
29	3355 0269
30	3375 0140
31	3326 0090
32	3445 0448
33	3448 0264
TL 30	3482 0055
SE 47	3552 0420
TQ 29	
NW 51	2038 9971
52	2079 9868
53	2193 9548
54	2482 9959
TQ 29	
NE 1	2552 9934
2	2506 9863
3	2781 9966
4	2836 9962
5	2882 9706
6	2974 9904
7	2959 9723
TQ 29	
SW 21	2354 9411
TQ 39	
NW 7	3189 9890
8	3355 9862

2 Fourteen other borehole records registered in the records of the IGS and eighteen Hydrogeology Unit records have also been used.

* By sheet quadrant.

APPENDIX F

INDUSTRIAL MINERAL ASSESSMENT UNIT

BOREHOLE RECORDS

TL 20 NW 11 2019 0907 Hatfield Aerodrome, Hatfield **Block A**

Surface level (+78.3 m) +257 ft
Water struck at (+66.3 m)
April 1972

Overburden 5.4 m
Mineral 2.6 m
Waste 3.3 m
Mineral 4.1 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, brown and orange–brown mottled grey, chalky to 5.2 m, decalcified to 5.4 m	5.4	5.4
Glacial Gravel	**a** 'Clayey' Sand: medium with some fine and traces of coarse, brown with occasional flint pebbles	2.6	8.0
Boulder Clay	Clay, grey–brown becoming dark grey and chalky with flint and quartz pebbles	3.3	11.3
Glacial Gravel	**b** Gravel Gravel: coarse and fine with occasional cobbles, subangular, subrounded and rounded flint with quartz Sand: coarse and medium with some fine, brown	4.1	15.4
Upper Chalk	Chalk	0.1+	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	+16–64	+64
	10	86	4	5.4–6.4	13	7	71	5	1	3	0
				6.4–7.4	5	22	71	0	2	0	0
				7.4–8.0	12	28	50	4	2	4	0
				Mean	10	17	68	1	2	2	0
	6	25	69	11.3–11.9	9	3	5	9	40	34	0
				11.9–12.0	clay seam*						
				12.0–13.0	3	2	20	21	20	34	0
				13.0–14.0	4	8	13	10	31	34	0
				14.0–15.0	1	2	5	6	27	59	0
				15.0–15.4	1	2	5	10	37	35	10
				Mean	6	4	10	11	29	39	1
a + b	8	49	43	Mean	8	9	33	7	17	25	1

* Assumed to comprise 100 per cent fines.

Surface level (+76.2 m) +250 ft
Water from (+71.9 m) to (+69.6 m) + from (+66.4 m)
April 1972

Overburden 1.7 m
Mineral 1.9m
Waste 0.7 m
Mineral 2.3 m
Waste 3.2 m
Mineral 5.2 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.7	0.7
Glacial Gravel	Clay, stiff brown with flint and quartz pebbles	1.0	1.7
	a 'Clayey' Sandy gravel Gravel: fine and coarse, angular, subangular and subrounded flint with quartz Sand: medium and coarse with fine, includes some stiff brown clay	1.9	3.6
Boulder Clay	Clay, dark–grey, brown near top and base, stiff with occasional flint and quartz pebbles, chalky	0.7	4.3
Glacial Gravel	**b** Pebbly sand Gravel: fine with coarse flint and quartz Sand: medium with some fine and coarse, brown.	2.3	6.6
Boulder Clay	Clay, stiff, brown–black becoming dark grey then red–brown and decalcified at 9.0 m. Scattered flint and quartz pebbles with Jurassic fossil debris, chalky	3.2	9.8
Glacial Gravel	**c** Gravel: fine and coarse, subangular, subrounded and nodular flint with some quartz; chalk pebbles below 13.8 m Sand: medium and coarse with some fine, sharp texture, brown	5.2	15.0
Upper Chalk	Chalk, white	0.1+	15.1

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
	10	48	42	1.7–2.7	15	6	20	20	27	12	0
				2.7–3.6	4	11	25	16	26	18	0
				Mean	10	8	23	17	27	15	0
b	8	72	20	4.3–5.0	6	15	68	6	4	1	0
				5.0–5.8	13	5	16	13	36	17	0
				5.8–6.6	6	10	79	3	1	1	0
				Mean	8	10	54	8	13	7	0
c	3	30	67	9.8–10.8	2	3	12	14	37	32	0
				10.8–11.8	6	11	16	13	32	22	0
				11.8–12.8	6	6	10	8	22	48	0
				12.8–13.8	0	5	19	7	24	45	0
				13.8–15.0	1	3	14	12	32	38	0
				Mean	3	5	15	10	30	37	0
a + **b** + **c**	6	44	50	Mean	6	7	26	11	25	25	0

TL 20 NW 13 2031 0697 Sleepshyde Farm, Colney Heath **Block A**

Surface level (+72.8 m) +239 ft
Water from (+67.8 m) to (+62.2 m)
March 1972

Overburden 2.0 m
Mineral 8.6 m
Waste 4.2 m
Mineral 1.8 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.3	0.3
Boulder Clay	Clay, soft, brown with black mottling, scattered flint pebbles	1.7	2.0
Glacial Gravel	**a** 'Clayey' sandy gravel Gravel: fine and coarse, subangular, subrounded, rounded and nodular flint with subrounded and rounded quartz. Gravel rare below 8.0 m Sand: medium with fine and some coarse brown sharp becoming soft below 8.0 m Fines: brown, soft, silty; content decreases with depth	8.6	10.6
Boulder Clay	Clay, stiff, dark grey with small flint, quartz and shale pebbles with fossil fragments to 14.4 m, then brown and without chalk to 14.8 m	4.2	14.8
Glacial Gravel	**b** Gravel Gravel: fine and coarse, subangular, subrounded and rounded flint with quartz Sand: fine, medium and coarse, sharp, pale brown	1.8	16.6
Upper Chalk	Chalk, soft becoming firm	1.1+	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	+16–64	+64
a	14	57	29	2.0–3.0	41	1	3	2	33	20	0
				3.0–4.0	25	6	27	10	24	8	0
				4.0–5.0	22	9	32	8	20	9	0
				5.0–6.0	2	2	17	20	37	22	0
				6.0–7.0	2	3	32	20	29	14	0
				7.0–8.0	5	5	51	11	18	10	0
				8.0–10.0	10	32	34	23	1	0	0
				10.0–10.6	7	58	33	1	1	0	0
				Mean	14	15	36	6	19	10	0
b	4	48	48	14.8–15.8	5	20	21	11	31	12	0
				15.8–16.6	2	9	17	15	36	21	0
				Mean	4	15	19	14	32	16	0
a + b	12	55	33	Mean	12	15	33	7	21	12	0

TL 20 NW 14 2045 05510 Colney Heath Mill, Colney Heath Block A

Surface level (+76.5 m) +251 ft
Water from (+70.5 m) to (+65.5 m)
Shell and auger, 8-inch (203 mm) diameter
February 1972

Overburden 5.9 m
Mineral 5.1 m
Waste 2.0 m
Mineral 7.0 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.1	0.1
	Soil	0.7	0.8
Boulder Clay	Clay, stiff, yellow and grey with small chalk pellets	5.1	5.9
Glacial Gravel	**a** 'Clayey' sand: orange becoming yellow and brown from 7.9 m. Medium with traces of fine and coarse, rare small flint and quartz pebbles.	5.1	11.0
Boulder Clay	Clay, stiff, silty, dark grey becoming orange–grey and sandy in lower 0.2 m, chalky	2.0	13.0
Glacial Gravel	**b** Gravel Gravel: fine and coarse, subangular, subrounded and rounded flint with quartz and chalk Sand: medium and coarse with traces of fine, grey	7.0	20.0
Upper Chalk	Chalk, soft, with flint cobbles	1.0+	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	+16–64	+64
a	17	82	1	5.9–6.9	no grading information						
				6.9–7.9	15	8	73	1	2	1	0
				7.9–8.9	18	6	75	1	0	0	0
				8.9–9.9	no grading information						
				9.9–11.0	no grading information						
				Mean	17	7	74	1	1	0	0
b	5	31	64	13.0–14.0	13	6	13	18	40	10	0
				14.0–15.0	1	3	11	9	44	32	0
				15.0–16.0	11	2	25	8	24	30	0
				16.0–17.0	1	3	23	8	35	30	0
				17.0–18.0	0	3	8	10	50	29	0
				18.0–19.0	3	2	25	9	43	18	0
				19.0–20.0	no grading information						
				Mean	5	3	18	10	39	25	0
a + b	10	53	37	Mean	10	5	42	6	23	14	0

TL 20 NW 15 2148 0970 Hatfield Aerodrome, Hatfield **Block A**

Surface level (+76.2 m) +250 ft
Water from (+69.6 m) to (+65.0 m)
April 1972

Overburden 1.2 m
Mineral 10.0 m
Waste 3.4 m
Mineral 4.1 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Head	Clay, brown, stiff	1.0	1.2
Glacial Gravel	**a** Sandy gravel Gravel: fine and coarse, subangular and subrounded flint with quartz Sand: medium and coarse with some fine, smooth, brown. Very sandy from 2.2 m to 3.2 m Fines: brown and grey–brown smooth clay	10.0	11.2
Clay Boulder	Clay, brown with a little chalk, becoming dark grey, chalky with occasional flint and quartz pebbles below 11.3 m	3.4	14.6
Glacial Gravel	**b** Gravel Gravel: coarse and fine, subangular, subrounded and rounded flint with quartz Sand: medium and coarse with some fine, clean	4.1	18.7
Upper Chalk	Chalk, white	0.3+	19.0

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
a	6	49	45	1.2–2.2	6	6	20	18	32	18	0
				2.2–3.2	no grading information						
				3.2–4.2	8	9	24	10	20	29	0
				4.2–5.2	13	4	33	20	14	16	0
				5.2–6.2	no grading information						
				6.2–7.2	6	9	31	19	25	10	0
				7.2–8.2	3	17	40	11	19	10	0
				8.2–9.2	4	7	26	15	21	27	0
				9.2–10.2	2	4	27	14	23	30	0
				10.2–11.2	9	4	16	7	21	43	0
				Mean	6	8	27	14	22	23	0
b	2	38	60	14.6–15.6	0	1	9	19	31	40	0
				15.6–16.6	1	9	26	11	25	28	0
				16.6–17.6	3	9	24	16	22	26	0
				17.6–18.7	3	7	14	8	30	38	0
				Mean	2	6	18	14	27	33	0
a + b	5	45	50	Mean	5	7	24	14	23	27	0

TL 20 NW 16 2134 0684 Roehyde Farm, Colney Heath **Block A**

Surface level (+75.9 m) +249 ft
Water from (+66.1 m) to (+63.7 m)
May 1972

Overburden 8.8 m
Mineral 3.4 m
Waste 4.0 m
Mineral 5.3 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, stiff with scattered flint and quartz pebbles, brown to 3.2 m then grey, chalky from 5.2 m, sandy from 6.0 m to 6.2 m	8.5	8.8
Glacial Gravel	**a** 'Clayey Pebbly sand Gravel: fine and coarse, flint, quartz and chalk, pebble content decreases with depth Sand: medium with some fine and traces of coarse, grey	3.4	12.2
Boulder Clay	Clay, stiff with chalk and flint pebbles, dark grey, becoming brown below 15.8 m	4.0	16.2
Glacial Gravel	**b** Sandy Gravel Gravel: fine with coarse, subangular, subrounded and rounded flint with quartz Sand: medium and coarse with fine, sand content increases with depth	5.3	21.5
Upper Chalk	Chalk, white, soft	0.2+	21.7

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
a	10	73	17	8.8–9.8	15	16	28	3	23	15	0
				9.8–10.8	16	21	41	8	10	4	0
				10.8–11.8	3	8	78	5	3	3	0
				11.8–12.2	2	9	83	4	1	1	0
				Mean	10	14	54	5	11	6	0
b	7	48	45	16.2–17.2	6	5	15	15	36	23	0
				17.2–18.2	3	4	7	26	48	12	0
				18.2–19.2	8	8	17	26	33	8	0
				19.2–20.2	6	20	36	7	25	6	0
				20.2–21.5	9	8	27	20	29	7	0
				Mean	7	8	21	19	34	11	0
a + b	8	57	35	Mean	8	10	34	13	25	10	0

TL 20 NW 17 2143 0517 Tollgate Road, North Mymms **Block A**

Surface level (+78.6 m) +258 ft
Water not struck
Shell and auger, 8 inch (203 mm) diam
February 1972

Overburden 0.9 m
Mineral 5.0 m
Waste 4.0 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Glacial Gravel	Pebbly clay	0.7	0.9
	'Very clayey' gravel Gravel: fine and coarse with some cobbles, subangular and subrounded flint and chert with rounded quartz Sand: medium with fine and coarse, orange, sand content increases with depth	5.0	5.9
Lake Deposit	Clay, silty, brown with plant remains	0.6	6.5
Boulder Clay	Clay, stiff, chalk and flint pebbles, dark grey, becoming brown at 8.7 m	3.2	9.7
	Sand: fine and medium, grey with small subangular flint pebbles	0.2	9.9
Upper Chalk	Chalk, soft, weathered, with flints	0.3+	10.2

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
25	36	39	0.9–1.9	31	10	34	4	7	8	6
			1.9–2.9	41	3	16	5	15	7	13
			2.9–3.9	16	7	17	11	22	23	4
			3.9–4.9	no grading information						
			4.9–5.9	11	3	28	7	17	22	12
			Mean	25	6	24	6	16	15	8

TL 20 NW 18 2291 0517 Welham Manor, North Mymms **Block A**

Surface level (c. +125 m) c, +410 ft
Water not struck
April 1972

Waste 5.0 m
Bedrock 7.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, stiff, orange–brown and dark brown mottled grey with flint, quartz and chalk pebbles and sand pockets	4.9	5.0
London Clay	Clay, brown becoming dark grey with pale blue streaks at 9.5 m, sandy patches	7.7+	12.7

TL 20 NW 19 2351 0748 Home Farm, Hatfield **Block C**

Surface level (+112.8 m) +370 ft
Water not struck
April 1972

Overburden 1.9 m
Mineral 2.6 m
Waste 1.2 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Pebble Gravel	Sand, orange–brown, clayey	0.2	0.5
	'Very clayey' sand and gravel	1.4	1.9
	'Clayey' Gravel Gravel: coarse and fine with some cobbles, subangular, subrounded and rounded flint and quartz Sand: medium and coarse with some fine, brown	2.6	4.5
	Clay, orange–brown mottled red and green, stiff, micaceous, silty	1.2	5.7
London Clay	Clay, dark grey, stiff	0.2+	5.9

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
10	32	58	1.9–2.9	14	5	16	12	26	27	0
			2.9–3.9	6	3	11	17	25	33	5
			3.9–4.5	11	2	17	13	25	32	0
			Mean	10	4	14	14	26	30	2

TL 20 NW 20 2327 0656 Marshmoor Nurseries, North Mymms **Block A**

Surface level (+89.6 m) +294 ft
Water from (+81.6 m) to (+78.8 m)
April 1972

Overburden 8.1 m
Mineral 2.7 m
Waste 6.0 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
	Made Ground	0.6	0.8
Boulder Clay	Clay, chalky 3.4 m to 8.1 m with flints throughout, grey 5.9 m to 7.9 m, otherwise brown, soft, becoming stiff below 3.4 m	7.3	8.1
Glacial Gravel	Gravel Gravel: coarse and fine Sand: medium and coarse with fine brown, clean deposit	2.7	10.8
Boulder Clay	Clay, chalky with flints, grey 11.1 m to 14.8 m otherwise brown, stiff	4.3	15.1
Lower London Tertiaries	Sand: fine, brown to grey–brown, with small rounded black flints and occasional shell fragments	0.2	15.3
'Bullhead Bed'	Clay, brown with large angular flints and occasional small rounded flints, stiff	1.5	16.8
Upper Chalk	Chalk, soft, cream	0.3+	17.1
	The strata recorded between 15.1 and 16.8 metres depth probably represent material which has collapsed into a solution hollow or pipe in the surface of the Upper Chalk		

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
3	35	62	8.1–9.1	3	7	20	4	26	40	0
			9.1–10.1	4	6	23	12	19	36	0
			10.1–10.8	2	3	12	18	35	30	0
			Mean	3	5	19	11	21	41	0

TL 20 NW 21 2455 0740 Hatfield Park, Hatfield **Block C**

Surface level (+121.3 m) +398 ft
Water from (+114.7 m) to (+112.2 m)
April 1972

Overburden 6.0 m
Mineral 3.1 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, orange–brown mottled grey, sandy patches and scattered flints, stiff	4.4	4.8
Pebble Gravel	Clay, as above but with higher sand and gravel content	1.2	6.0
	Gravel Gravel: coarse and fine, subrounded and rounded flints and quartz Sand: medium with coarse and fine, sharp, orange–brown and pale brown Fines: clay content decreases with depth	3.1	9.1
London Clay	Clay, brown mottled grey to 9.8 m, probably disturbed, dark grey below 9.8 m	1.1+	10.2

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
5	32	63	6.0–7.0	10	8	26	10	20	26	0
			7.0–8.0	3	6	14	13	30	34	0
			8.0–9.1	1	2	14	7	17	59	0
			Mean	5	5	18	9	23	40	0

TL 20 NW 22 2471 0667 St Michael's, Hatfield **Block C**

Surface level (+116.1 m) +381 ft
Water not struck
April 1972

Overburden 0.8 m
Mineral 4.2 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Pebble Gravel	Clay, silty, stiff, orange–brown and grey with some pebbles	0.7	0.8
	'Clayey' Gravel Gravel: coarse and fine, subrounded and rounded flint and quartz with some chert Sand: medium and coarse with some fine grey–brown Fines: stiff grey clay, decreases with depth	4.2	5.0
London Clay	Clay, brown to 5.4 m then grey, stiff	0.7+	5.7

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
10	30	60	0.8–1.5	27	8	10	4	27	24	0
			1.5–2.5	9	8	13	15	33	22	0
			2.5–3.5	5	6	16	12	26	35	0
			3.5–4.5	7	3	11	13	24	42	0
			4.5–5.0	8	3	11	8	23	47	0
			Mean	10	6	13	11	27	33	0

TL 20 NE 1 2577 0816 Hatfield Park, Hatfield **Block C**

Surface level (+109.4 m) +359 ft
Water not struck
April 1972

Overburden 0.7 m
Mineral 3.0 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Pebble Gravel	'Clayey' gravel Gravel: fine and coarse, subrounded and rounded flint and quartz Sand: medium and coarse with fine, pale brown Fines: thin clay bands throughout	3.0	3.7
London Clay	Clay, brown to 4.3 m, then dark brown and grey, stiff with occasional pebbles to 4.3 m	1.1+	4.8

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
13	35	52	0.7–1.7	9	5	20	15	35	16	0
			1.7–2.7	19	5	20	8	31	17	0
			2.7–3.7	12	3	15	13	32	25	0
			Mean	13	5	18	12	33	19	0

TL 20 NE2 2587 0640 Wildhill, Hatfield **Block C**

Surface level (+107.0 m) +351 ft
Water not struck
Shell and auger, 8-inch (203 mm) diameter
February 1972

Waste 3.0 m
London Clay 2.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, silty, brown and grey with plant remains	2.4	2.7
	Sand, silty, fine and medium	0.3	3.0
London Clay	Clay, silty becoming shaley, brown becoming dark blue below 5.0 m	2.7+	5.7

TL 20 NE 3 2527 0547 Bell Bar, Hatfield **Block C**

Surface level (+114.6 m) +376 ft
Water not struck
February 1972

Waste 1.2 m
Bedrock 4.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Pebble Gravel	'Very clayey' sand: grey with orange streaks with small rounded quartz pebbles	0.5	1.2
London Clay	Clay, silty, stiff, brown to 5.0 m then dark blue	4.8+	6.0

TL 20 NE 4 2619 0942 Near Hillend Farm, Essendon **Block B**

Surface level (+70.7 m) +232 ft
Water not struck
April 1972

Overburden 1.7 m
Mineral 2.6 m
Waste 5.4 m
Mineral 5.4 m
Waste 1.8 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown to 0.5 m then pale brown mottled grey with scattered pebbles	1.5	1.7
Glacial Gravel	**a** 'Clayey' sandy gravel Gravel: fine and coarse, subangular and subrounded flint with quartz Sand: medium with fine and coarse, brown, sharp to 2.7 m, then smooth Fines: brown clay	2.6	4.3
Boulder Clay	Clay, chalky with flint and quartz pebbles, brown to 5.6 m and from 9.2 m, otherwise dark grey	5.4	9.7
Glacial Gravel	**b** Gravel Gravel: fine and coarse with cobbles in lower 2.4 m, subrounded and rounded flint and quartz Sand: medium with fine and coarse pale brown, soft Fines: dark brown clay	5.4	15.1
	Clay, flint and quartz pebbles, brown, with some coarse sand	1.8	16.9
Upper Chalk	Chalk, soft, white with nodular flints	0.1+	17.0

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
a	10	58	32	1.7–2.7	14	6	36	11	26	7	0
				2.7–3.7	6	8	38	13	19	16	0
				3.7–4.3	9	16	41	8	18	8	0
				Mean	10	9	38	11	21	11	0
b	4	37	59	9.7–10.7	5	11	34	6	22	22	0
				10.7–11.7	5	12	24	7	24	28	0
				11.7–12.7	5	10	27	8	21	29	0
				12.7–15.1	3	3	13	9	32	33	7
				Mean	4	7	22	8	27	29	3
a + b	6	44	50	Mean	6	8	27	9	25	23	2

TL 20 NE 5 2607 0730 Green Street, Hatfield **Block C**

Surface level (+114.0 m) +374 ft
Water not struck
Shell and auger, 8-inch (203 mm) diameter
February 1972

Waste 3.0 m
Bedrock 4.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.1	0.1
	Soil	0.2	0.3
Boulder Clay	Clay with sand and pebbles, orange–brown, mottled grey	2.7	3.0
London Clay	Clay, silty, brown becoming dark grey at 7.0 m stiff, shaley texture below 6.0 m	4.5+	7.5

TL 20 NE 6 2642 0544 Kentishlane Farm, Hatfield **Block C**

Surface level (+127.1 m) +417 ft
Water struck at (+123.2 m)
Shell and auger, 8-inch (203-mm) diameter
February 1972

Overburden 2.0 m
Mineral 5.9 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay with sand and gravel seams, orange–brown, silty	1.9	2.0
Pebble Gravel	'Clayey' gravel Gravel: fine and coarse with cobbles throughout, subrounded and rounded flint and rounded quartz Sand: medium with fine and coarse Fines: brown and grey clay	5.9	7.9
London Clay	Silty clay, brown to 8.5 m then blue–grey, pebbles to 8.5 m	1.3+	9.2

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
13	29	58	2.0–3.0	39	4	30	14	12	1	0
			3.0–4.0	17	6	17	6	21	25	8
			4.0–5.0	2	3	20	6	35	34	0
			5.0–6.0	11	2	12	4	29	27	15
			6.0–7.0	3	3	12	8	42	32	0
			7.0–7.9	3	1	14	14	43	23	2
			Mean	13	3	18	8	31	23	4

TL 20 NE 7 2751 0949 Essendonburg, Essendon **Block B**

Surface level (+63.1 m) +207 ft
Water not struck
May 1972

Overburden 2.4 m
Mineral 12.7 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, stiff with scattered flint and quartz pebbles concentrated in upper 0.5 m, dark brown becoming orange–brown mottled grey	2.1	2.4
Glacial Gravel	Sandy gravel Gravel: fine and coarse, subangular and subrounded flint with quartz, gravel content decreases with depth. Sand: medium with fine and coarse, soft, brown Fines: stiff brown clay	12.7	15.1
Upper Chalk	Chalk, soft, white	0.1+	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	+16–64	+64
6	57	37	2.4–3.4	10	13	17	12	36	12	0
			3.4–4.4	5	13	26	13	26	17	0
			4.4–5.4	5	7	27	13	26	22	0
			5.4–6.4	6	7	14	17	27	19	0
			6.4–7.4	7	11	26	13	29	14	0
			7.4–8.4	10	12	20	17	30	11	0
			8.4–9.4	7	18	32	8	26	9	0
			9.4–10.4	5	8	33	14	28	12	0
			10.4–11.4	3	3	42	12	26	14	0
			11.4–12.4	3	13	56	10	14	4	0
			12.4–13.4	2	18	42	7	22	9	0
			13.4–14.4	8	9	49	6	18	10	0
			14.4–15.1	6	7	61	8	13	3	0
			Mean	6	11	34	12	25	12	0

TL 20 NE 8 2760 0733 Bedwell Park, Essendon Block C

Surface level (+106.7 m) +350 ft
Water not struck
March 1972

Overburden 0.8 m
Mineral 2.4 m
Waste 2.2 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Pebble Gravel	Clay, brown, with some medium and coarse sandy and flint quartz pebbles	0.6	0.8
	Pebbly sand Gravel: fine and coarse, subrounded and rounded flint and quartz, concentrated in upper 1.0 m Sand: medium with fine and coarse, sharp Fines: stiff brown clay	2.4	3.2
? London Clay	Clay, brown, pale blue and orange–brown, stiff, with carbonaceous material	2.2	5.4
London Clay	Clay, brown becoming dark grey	0.4+	5.8

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
6	76	18	0.8–1.8	4	2	29	22	27	16	0
			1.8–2.8	6	23	68	3	0	0	0
			2.8–3.2	10	20	68	2	0	0	0
			Mean	6	14	52	10	11	7	0

TL 20 NE 9 2733 0541 Barberslodge Farm, Hatfield **Block C**

Surface level (+122.2 m) +401 ft
Water struck at (+118.6 m)
April 1972

Overburden 2.6 m
Mineral 4.1 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Pebble Gravel	Clay brown and grey, stiff with some medium and coarse orange–brown sand and some fine, flint and quartz pebbles	1.5	1.7
	Clay silty, orange–brown, red and grey with some flint and quartz pebbles	0.9	2.6
	Gravel Gravel: fine and coarse, subrounded and rounded flint and quartz, becoming coarser and more common with depth Sand: medium, fine and coarse Fines: grey–brown, stiff clay, micaceous. Fines content decreases with depth	4.1	6.7
London Clay	Clay, orange–brown and brown to 7.2 m then dark grey	0.7+	7.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
8	43	49	2.6–3.6	22	21	19	8	21	9	0
			3.6–4.6	7	15	36	7	26	9	0
			4.6–5.6	2	4	17	12	28	37	0
			5.6–6.7	3	10	10	14	28	35	0
			Mean	8	12	21	10	26	23	0

TL 20 NE 10 2860 0558 Near Birchwood Cottages, Hatfield **Block C**

Surface level (+126.5 m) +415 ft
Water struck at (+120.5 m)
Shell and auger, 8-inch (203-mm) diameter
February 1972

Overburden 5.5 m
Mineral 2.6 m
Bedrock 2.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, mottled orange and grey, with seams of coarse grey sand and scattered flint, quartz, quartzite pebbles in upper 2.0 m. Becoming silty with fine sand laminae towards the base	5.3	5.5
Pebble Gravel	'Clayey' gravel Gravel: coarse and fine, subrounded and rounded flint, quartz with quartzite jasper and chert. Gravel most common in lower 0.6 m Sand: coarse and medium with fine, yellow and grey with iron staining Fines: yellow clay cementing material becoming less common with depth	2.6	8.1
London Clay	Clay, brown becoming blue–grey to 10.0 m then dark blue; shaley from 8.5 m to 10.0 m then silty	2.4+	10.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
17	40	43	5.5–6.5	29	6	23	10	16	16	0
			6.5–7.5	12	7	32	11	17	21	0
			7.5–8.1	6	3	12	7	32	40	0
			Mean	17	6	12	22	20	23	0

TL 20 NE 11 2948 0899 Culver Wood, Little Berkhamsted **Block B**

Surface level (+81.4 m) +267 ft
Water not struck
May 1972

Waste 17.5 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, orange–brown and grey to 3.4 m then dark grey, stiff with scattered flint and quartz pebbles, chalky below 1.8 m	6.4	6.9
Glacial Gravel	Sand, silty, brown, soft with scattered pebbles	0.7	7.6
? London Clay	Clay, silty from 8.6 m, stiff, brown with scattered flint and quartz pebbles	4.2	11.8
Lower London Tertiaries	Sand: fine, pale grey, soft with seams of grey waxy clay and occasional black rounded flints	5.4	17.2
? 'Bullhead Bed'	Clay, brown large flints	0.3	17.5
Upper chalk	Chalk, yellow–white, soft	0.3+	17.8

TL 20 NE 12 2925 0786 Little Berkhampstead, Little Berkhamsted **Block C**

Surface level (+114.0 m) +374 ft
Water struck at (+108.5 m)
May 1972

Overburden 3.2 m
Mineral 5.9 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, stiff, brown becoming orange–brown, mottled buff, with scattered flint and quartz pebbles	2.3	2.5
Pebble Gravel	Clay, sandy, orange–brown	0.7	3.2
	'Clayey' sandy gravel Gravel: fine and coarse, subrounded and rounded flint and quartz Sand: medium with fine and coarse, orange–brown and brown Fines: stiff brown clay, generally decreasing with depth	5.9	9.1
London Clay	Clay, orange–brown to 10.1 m then grey, stiff	1.1+	10.2

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
18	54	28	3.2–4.2	22	5	52	7	10	4	0
			4.2–4.4	19	3	43	20	8	7	0
			4.4–5.0	clay seam*						
			5.0–6.0	4	16	44	8	18	10	0
			6.0–7.0	7	5	56	12	14	6	0
			7.0–8.0	7	8	54	11	16	4	0
			8.0–9.1	2	2	14	10	21	51	0
			Mean	18	6	39	9	14	14	0

* Assumed to comprise 100% fines

TL 20 NE 13 2941 0654 Epping Green Farm, Little Berkhamsted **Block C**

Surface level (+123.7 m) +406 ft
Water from (+118.9 m) to (+118.2 m)
May 1972

Waste 5.5 m
Bedrock 6.1 m

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, silty, brown becoming orange–brown with occasional small pebbles, stiff	3.5	3.8
Pebble Gravel	Clay, silty, stiff with subrounded and rounded flint and quartz gravel	0.8	4.6
	Clay, sandy micaceous	0.2	4.8
	Gravel Gravel: coarse and fine subrounded and rounded flint and quartz Sand: medium and coarse with fine	0.7	5.5
London Clay	Clay, brown mottled pale blue and grey, waxy	5.0	10.5
	Clay, dark brown, becoming grey–brown below 11.4 m	1.1+	11.6

TL 20 SW1 **2051 0434** **Coursers Farm, Ridge** **Block A**

Surface level (+75.9 m+) +249 ft
Water from (+63.9 m) to (+60.1 m)
March 1972

Overburden 0.7 m
Mineral 8.1 m
Waste 3.2 m
Mineral 3.8 m
Waste 1.3 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Head	Sandy clay with some flint pebbles	0.5	0.7
Glacial Gravel	**a** 'Clayey' sandy gravel Gravel: fine and coarse, subrounded and rounded flint and quartz Sand: fine and medium with coarse, very sandy from 6.9 m, pale brown to brown Fines: clay seam from 3.7 m to 4.1 m	8.1	8.8
Lake Deposits	Clay, silty, soft, brown, grey and red becoming uniform grey. Micaceous and with carbonaceous material from 8.9 m to 11.6 m, sandy below 11.6 m	3.2	12.0
Glacial Gravel	**b** Sand: medium with fine and traces of coarse, pale brown becoming grey–brown in bottom 0.8 m	3.8	15.8
Boulder Clay	Clay, stiff, dark brown, chalky with flints and quartz pebbles	1.3	17.1
Upper Chalk	Chalk, yellow–white	0.74	17.3

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
a	14	46	40	0.7–1.7	17	8	7	3	60	5	0
				1.7–2.7	8	7	15	14	30	26	0
				2.7–3.7	3	7	26	16	34	14	0
				3.7–4.1	clay seam*						
				4.1–5.1	8	2	10	7	33	40	0
				5.1–6.1	7	8	28	14	25	18	0
				6.1–6.9	3	12	20	20	30	15	0
				6.9–7.9	19	61	18	1	1	0	0
				7.9–8.8	10	45	37	3	3	2	0
				Mean	14	18	19	9	26	14	0
b	7	93	0	12.0–13.0	8	39	51	2	0	0	0
				13.0–14.0	3	27	68	2	0	0	0
				14.0–15.0	6	19	72	3	0	0	0
				15.0–15.8	10	20	68	2	0	0	0
				Mean	7	26	65	2	0	0	0
a + b	12	62	26	Mean	12	21	34	7	18	8	0

* Assumed to comprise 100% fines.

TL 20 SW 2 2192 0473 North Mymms Park, North Mymms Block A

Surface level (+72.8 m) +239 ft
Water not struck
Shell and auger, 8-inch (203-mm) diameter
February 1972

Overburden 1.6 m
Mineral 6.6 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Silt, clayey, brown	1.4	1.6
Valley Gravel	'Clayey' gravel Gravel: fine and coarse with some cobbles subangular flint and with chert, iron stained in places Sand: medium with traces of fine and coarse, orange–red Fines: silty, grey clay, laminated and with carbonaceous material from 3.6 m to 5.8 m, very clayey from 5.8 m to 6.4 m	6.6	8.2
Upper Chalk	Chalk, soft, white with brown streaks	0.1+	8.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
15	20	65	1.6–2.6	16	3	13	10	30	21	7
			2.6–3.6	12	1	13	8	35	31	0
			3.6–4.6	11	1	10	8	31	36	3
			4.6–5.6	7	4	13	6	53	17	0
			5.6–6.6	30	3	27	6	17	11	6
			6.6–7.6	no information available						
			7.6–8.2	10	5	15	7	23	26	14
			Mean	15	3	15	2	38	23	4

TL 20 SW3 2173 0257 Hawkshead Wood, North Mymms **Block A**

Surface level (+129.2 m) +424 ft
Water not struck
Shell and auger, 8-inch (203-mm) diameter
February 1972

Waste 0.2 m
Bedrock 6.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
London Clay	Clay, soft, yellow–grey mottled	2.8	3.0
	Silty clay, dark grey–blue, compact	3.5+	6.5

TL 20 SW 4 2294 0442 Water End, North Mymms **Block A**

Surface level (+125.9 m) +413 ft
Water not struck
April 1972

Overburden 1.0 m
Bedrock 5.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Valley Gravel	Clay, brown, stiff, with fine and coarse flint and quartz pebbles	0.9	1.0
Lower London Tertiaries	'Very clayey' pebbly sand Gravel: traces of fine and coarse, black rounded flints Sand: fine with rare medium and coarse pale brown and green Fines: stiff grey clay seams	3.0	4.0
	Clay, grey, stiff with some fine sand	0.5	4.5
Upper Chalk	Chalk, white but with brown clay to 6.1 m	1.9+	6.4

TL 20 SW 5 2293 0195 Near Mimm's Hall, South Mimms **Block A**

Surface level (+79.9 m) +262 ft
Water struck at (+66.9 m)
May 1972

Overburden 0.6 m
Mineral 14.4 m
Waste 0.9 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Valley Gravel	Clay with fine gravel	0.5	0.6
	'Clayey' gravel Gravel: fine and coarse, angular, subangular and subrounded flint with quartz Sand: coarse and medium with some fine, brown Fines: stiff brown clay with seams from 9.1 m to 9.3 m and from 13.6 m to 13.7 m	14.4	15.0
	Clay, brown and black, stiff with small flint and quartz pebbles and coarse sand grains	0.9	15.9
Upper Chalk	Chalk, soft	0.1+	16.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64
13	30	57	0.6–1.2	8	5	19	16	38	14	0
			1.2–2.2	22	4	12	12	33	17	0
			2.2–3.2	8	3	6	20	43	20	0
			3.2–4.2	5	3	16	18	42	16	0
			4.2–5.2	no information available						
			5.2–6.2	8	3	9	26	44	10	0
			6.2–7.2	8	4	11	17	36	24	0
			7.2–8.2	10	3	11	14	29	33	0
			8.2–9.1	8	8	11	8	37	28	0
			9.1–9.3	clay seam*						
			9.3–10.3	18	4	11	9	34	24	0
			10.3–11.3	2	3	15	15	35	30	0
			11.3–12.3	15	8	11	11	22	33	0
			12.3–13.0	27	5	5	7	31	25	0
			13.0–13.6	4	2	4	9	48	33	0
			13.6–13.7	clay seam*						
			13.7–14.7	7	7	17	20	13	36	0
			14.7–15.0	5	3	13	17	24	38	0
			Mean	13	4	11	15	33	24	0

* Assumed to comprise 100% fines.

TL 20 SW 6 2310 0290 Near A1 (T), South Mimms **Block A**

Surface level (+76.5 m) +251 ft
Water not struck
September 1972

Overburden 1.3 m
Mineral 7.3 m
Waste 1.4 m
Mineral 1.5 m
Waste 0.9 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Head	Clay, stiff, orange–brown and grey with scattered flint and quartz pebbles	0.9	1.3
Valley Gravel	**a** 'Clayey' gravel Gravel: fine with coarse, subangular, subrounded and rounded flint with quartz Sand: medium and coarse with fine, brown, quartz with flint Fines: soft, brown and grey clay occurring in seams, very clayey from 2.3 m to 2.6 m	7.3	8.6
	Clay, sandy, orange–brown and red–brown	1.4	10.0
	b 'Clayey' gravel Similar to upper mineral deposit but with slightly lower fines content	1.5	11.5
? 'Bullhead Bed'	Clay, dark brown and black clay with large nodular flints	0.9	12.4
Upper Chalk	Chalk, soft, dirty white	0.3+	12.7

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
a	17	34	49	1.3–2.3	22	1	14	9	35	19	0
				2.3–2.6	clay seam*						
				2.6–4.6	13	7	13	13	37	17	0
				4.6–6.6	8	5	15	14	40	18	0
				6.6–8.6	16	11	23	12	24	14	0
				Mean	17	6	16	12	33	16	0
b	11	32	57	10.0–11.5	11	7	18	7	33	24	0
a + b	16	33	51	Mean	16	6	16	11	33	18	0

* Assumed to comprise 100% fines

TL 20 SE 4 2667 0368 Shepherds Way, North Mymms **Block D**

Surface level (+125.9 m) +413 ft
Water not struck
May 1972

Overburden 0.7 m
Mineral 2.9 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Pebble Gravel	Clay, sandy, grey–brown	0.2	0.7
	'Clayey' sandy gravel Gravel: coarse and fine, subrounded and rounded quartz and flint, most gravelly is upper 0.8 m Sand: medium with fine and coarse, grey Fines: grey clay	1.9	2.6
London Clay	Clay, silty in upper 0.6 m, orange–brown mottled grey–blue, becoming dark grey below 3.2 m	0.9+	3.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
13	46	41	0.7–1.5	15	5	21	6	24	29	0
			1.5–2.6	11	7	45	5	13	19	0
			Mean	13	6	35	5	18	23	0

TL 20 SE 5 2655 0019 Stagg Ridge, South Mimms **Block D**

Surface level (+120.4 m) +395 ft
Water struck at (+113.6 m)
July 1972

Waste 7.5 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.6	0.6
Boulder Clay	Clay, stiff, pale brown and buff becoming dark grey and chalky below 1.6 m	6.2	6.8
Pebble Gravel	Sandy gravel Gravel: subangular, subrounded and rounded flint and quartz Sand: medium, light brown	0.7	7.5
London Clay	Clay, stiff, brown becoming blue–grey	0.5+	8.0

TL 20 SE 6 2742 0431 Woodlands, Northaw **Block D**

Surface level (+124.1 m) +407 ft
Water struck at (+122.0 m)
May 1972

Overburden 1.2 m
Mineral 1.4 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown becoming orange–brown and grey, silty becoming pebbly near base	1.0	1.2
Pebble Gravel	Gravel Gravel: fine and coarse subangular, subrounded and rounded flint and quartz Sand: medium with fine and coarse Fines: brown sticky clay	1.4	2.6
London Clay	Clay, stiff, orange–brown mottled grey–blue becoming darker	1.1+	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	+16–64	+64
6	46	48	1.2–2.1	7	8	28	10	28	19	0
			2.1–2.6	5	5	27	13	26	24	0
			Mean	6	7	28	11	27	21	0

TL 20 SE 7 2781 0385 The Ridgeway, Northaw **Block D**

Surface level (+124.1 m) +407 ft
Water not struck
May 1972

Overburden 1.5 m
Mineral 1.4 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, silty, orange–brown and grey, with small flint and quartz pebbles	1.0	1.5
Pebble Gravel	Gravel Gravel: fine with coarse and occasional cobbles, subrounded, rounded and nodular flints and quartz Sand: medium and coarse with traces of fine	1.4	2.9
London Clay	Clay, brown becoming grey below 3.5 m	1.1+	4.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
8	38	54	1.5–2.9	8	4	19	15	31	14	9

TL 20 SE 8 2791 0097 The Hook Kennels, Northaw **Block D**

Surface level (+105.8 m) +347 ft
Water not struck
May 1972

Overburden 0.8 m
Mineral 1.3 m
Bedrock 1.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Pebble Gravel	Clay, orange–brown and grey stiff, with medium sand and fine and coarse flint and quartz gravel	0.6	0.8
	'Clayey' gravel Gravel: coarse and fine, subrounded, rounded and nodular flint and quartz Sand: medium and coarse with traces of fine Fines: orange–brown and buff stiff clay	1.3	2.1
London Clay	Clay, stiff, brown and grey–blue	1.9+	4.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
14	26	60	0.8–1.8	10	3	14	13	30	30	0
			1.8–2.1	28	4	1	9	24	34	0
			Mean	14	3	11	12	29	31	0

TL 20 SE 9 2980 0309 New Cuffley village, Northaw **Block D**

Surface level (+108.0 m) +357 ft
Water not struck
September 1972

Overburden 1.4 m
Mineral 2.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, orange–brown and grey, stiff with flint and quartz pebbles	1.1	1.4
Pebble Gravel	Gravel Gravel: coarse and fine, subangular, subrounded and rounded flint and quartz Sand: medium with coarse and traces of fine Fines: grey–brown stiff clay, very clayey in lower 0.6 m	2.6	4.0
London Clay	Clay, stiff, brown	0.3+	4.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
9	29	62	1.4–2.4	8	4	20	10	23	35	0
			2.4–3.4	7	4	15	9	28	37	0
			3.4–4.0	16	4	9	9	32	30	0
			Mean	9	4	16	9	27	35	0

TL 30 NW 15 3075 0925 Bayfordhall Farm, Bayford **Block B**

Surface level (+70.4 m) +231 ft
Water not struck
Shell and auger, 8-inch (203-mm) diameter
September 1972

Overburden 10.6 m
Mineral 6.1 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.9	0.9
Boulder Clay	Clay, grey and brown to 2.5 m, and brown from 10.1 m to 10.6 m, otherwise grey, chalky	9.7	10.6
Glacial Gravel	'Clayey' gravel Gravel: fine and coarse, gravel content increases with depth Sand: fine, medium and coarse, generally brown Fines: brown clay, very clayey in upper 1.0 m	6.1	16.7
Upper Chalk	Chalk	0.3+	17.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
16	40	44	10.6–11.6	30	17	10	9	25	9	0
			11.6–12.6	16	16	9	13	30	16	0
			12.6–13.6	13	10	14	16	30	17	0
			13.6–14.6	no information available						
			14.6–15.6	3	7	27	13	23	27	0
			15.6–16.7	no information available						
			Mean	16	12	15	13	27	17	0

TL 30 NW 16 3050 0766 Newpond Farm, Bayford **Block C**

Surface level (+106.4 m) +349 ft
Water struck at (+101.0 m)
August 1972

Waste 5.6 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, soft, dark brown to 0.7 m, yellow–white to 1.0 m then grey with brown. Chalky from 0.7 m	5.0	5.4
Glacial Gravel	'Very clayey' sand with chalk fragments and flint pebbles	0.2	5.6
London Clay	Clay, stiff, brown	0.5+	6.1

TL 30 NW 17 3017 0698 Ashendene, Bayford **Block C**

Surface level (+118.9 m) +390 ft
Water not struck
April 1972

Waste 6.1 m
Bedrock 5.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, sandy to 4.6 m, chalky from 0.4 m to 3.1 m, soft, brown and grey throughout	5.9	6.1
London Clay	Silty clay, stiff, brown to 7.6 m then dark grey	5.5+	11.6

TL 30 NW 18 3112 0980 Hook's Grove, Bayford **Block B**

Surface level (+75.3 m) +247 ft
Water from (+71.8 m) to (+70.7 m) and from (+68.5 m) to (+67.5 m)
Shell and auger, 8-inch (203-mm) diameter
September 1972

Waste 21.5 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, chalky with flints, very stiff, brown to 2.0 m, then grey	3.5	3.5
Glacial Gravel	'Very clayey' gravel Gravel: fine with coarse, angular Sand: coarse, medium and fine, brown Fines: brown clay	1.1	4.6
Boulder Clay	Clay, chalky with few flints, grey	2.2	6.8
Glacial Gravel	Sandy gravel Gravel: fine and coarse, clean Sand: medium with coarse and fine, brown	1.0	7.8
Boulder Clay	Clay, chalky with a few flints, generally stiff, grey to 17.6 m then brown	10.0	17.8
Glacial Gravel	Gravel Gravel: fine and coarse, fairly clean Sand: coarse, medium and fine, brown	3.7	21.5
Upper Chalk	Chalk, soft, cream becoming white	0.2+	21.7

TL 30 NW 19 3185 0763 Brickendon Grange, Brickendon Liberty **Block C**

Surface level (+103.6 m) +340 ft
Water not struck
August 1972

Overburden 2.8 m
Mineral 1.0 m
Waste 0.4 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Pebble Gravel	Clay with sand and well rounded flint pebbles, grey–brown	2.6	2.8
	Sandy Gravel Gravel: fine and coarse, subrounded to well rounded black flints Sand: medium with coarse and fine, white and brown, clayey	1.0	3.8
	Clay, brown with sand and gravel	0.4	4.2
London Clay	Clay, stiff, brown becoming grey–brown	1.1+	5.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
4	57	39	2.8–3.8	4	7	34	16	25	14	0

TL 30 NW 20 3096 0650 Calves Grove, Bayford **Block C**

Surface level (+113.4 m) +372 ft
Water struck at (+103.4 m)
April 1972

Waste 11.5 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, sandy, soft, brown to 3.1 m then grey, chalky with flints from 0.4 m	9.1	9.3
Pebble Gravel	Gravel Gravel: fine with coarse, flint Sand: medium and coarse with fine, grey Fines: grey clay	2.2	11.5
London Clay	Clay, stiff, brown and pebbly to 11.8 m, then blue–grey	0.6+	12.1

TL 30 NW 21 3249 0923 Owls Hatch Cottages, Brickendon Liberty Block B

Surface level (+78.6 m) +258 ft
Water from (+74.6 m) to (+73.8 m)
August 1972

Overburden 17.3 m
Mineral 7.0 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, soft, generally brown, but grey from 2.0 m to 9.7 m and from 10.6 m to 16.2 m. Chalky with silt and sand partings. Sand and gravel bed 9.7 m to 10.6 m	17.1	17.3
Glacial Gravel	'Clayey' Gravel Gravel: fine and coarse, angular and subangular flint with occasional subrounded to well rounded quartz and flint Sand: medium and coarse with fine, very sandy from 18.3 m to 19.3 m, brown Fines: soft brown clay, 'very clayey' from 18.3 m to 19.3 m and from 21.3 m to 22.3 m	7.0	24.3
Lower London Tertiaries	'Clayey' pebbly sand Sand: fine with traces of medium and coarse, grey, green and brown, with occasional well rounded or subangular flint pebbles	1.0+	25.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
11	39	50	17.3–18.3	9	9	22	13	33	14	0
			18.3–19.3	39	41	18	2	0	0	0
			19.3–20.3	3	4	7	12	50	24	0
			20.3–21.3	3	3	17	19	38	20	0
			21.3–22.3	15	6	16	14	33	16	0
			22.3–23.3	5	5	18	13	30	29	0
			23.3–24.3	3	4	10	18	33	32	0
			Mean	11	6	20	13	31	19	0

TL 30 NW 22 3228 0797 Farmer's Boy (P.H.), Brickendon Liberty Block C

Surface level (+104.9 m) +344 ft
Water struck at (+101.3 m)
May 1972

Overburden 2.1 m
Mineral 2.0 m
Waste 0.5 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, soft, grey–brown, sandy and with well-rounded quartz pebbles and chalk fragments from 1.5 m	1.8	2.1
Pebble Gravel	Gravel Gravel: coarse and fine, subangular, subrounded and well rounded flint and quartz. Gravel mainly in lower 1.0 m Sand: medium with coarse and fine, white	2.0	4.1
	Clay, brown, pebbly	0.5	4.6
London Clay	Clay, stiff, silty and brown to 5.2 m, then blue–grey	0.9+	5.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64
7	41	52	2.1–3.1	11	9	39	11	13	17	0
			3.1–4.1	3	3	11	8	22	53	0
			Mean	7	6	25	10	17	35	0

TL 30 NW 23 3284 0690 Ettridge Farm, Brickendon Liberty **Block C**

Surface level (+97.2 m) +319 ft
Water struck at (+94.4 m)
April 1972

Overburden 1.8 m
Mineral 2.0 m
Waste 0.9 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
? Head	Clay, soft, brown with well-rounded flint pebbles	1.5	1.8
Pebble Gravel	'Clayey' sandy gravel Gravel: coarse and fine, well-rounded flint Sand: fine and medium with coarse, brown with grey streaks Fines: brown clay	2.0	3.8
? Lake deposits	Clay, grey, sandy, with brown peat	0.9	4.7
London Clay	Clay, brown to 5.1 m, then blue–grey, stiff	0.8+	5.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
18	51	31	1.8–2.8	21	10	25	7	11	26	0
			2.8–3.8	14	41	16	3	12	14	0
			Mean	18	25	21	5	11	20	0

TL 30 NW 24 3359 0990 Blackfield House, Brickendon Liberty **Block B**

Surface level (+73.5 m) +241 ft
Water not struck
August 1972

Overburden 14.5 m
Mineral 4.0 m
Bedrock 5.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, soft, brown from 0.4 m to 2.8 m and from 13.5 m, otherwise grey, chalky	14.1	14.5
Glacial Gravel	'Clayey' sandy gravel Gravel: fine and coarse, subrounded and rounded flint with quartz. Mainly in lower 2.0 m Sand: medium and fine with coarse, brown	4.0	18.5
Lower London Tertiaries	'Clayey' sand Sand: fine with medium and traces of coarse, grey–green Fines: brown and grey clay	4.0	22.5
	Clay, grey sandy, with coarse angular flints from 23.2 m (Bullhead Bed ?)	1.1	23.6
Upper Chalk	Chalk, soft, white	0.4+	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	+16–64	+64
10	59	31	14.5–15.5	24	67	9	0	0	0	0
			15.5–16.5	7	11	74	3	4	1	0
			16.5–17.5	4	3	9	19	41	24	0
			17.5–18.5	3	11	17	14	25	30	0
			Mean	10	23	27	9	17	14	0

TL 30 NW 25 3338 0854 Monk's Green, Brickendon Liberty **Block C**

Surface level (+99.7 m) +327 ft
Water not struck
August 1972

Overburden 0.7 m
Mineral 3.0 m
Waste 0.4 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
? Head	Clay, soft, brown with flints	0.4	0.7
Pebble Gravel	'Clayey' gravel Gravel: fine and coarse, subangular, angular and well rounded flint Sand: medium and coarse with traces of fine, grey–brown Fines: grey and brown clay	3.0	3.7
	Clay with sand and gravel	0.4	4.1
London Clay	Clay, stiff, brown to 4.6 m then grey	0.9+	5.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
10	33	57	0.7–1.7	10	3	21	12	25	29	0
			1.7–2.7	11	5	14	13	33	24	0
			2.7–3.7	10	4	13	13	25	35	0
			Mean	10	4	16	13	28	29	0

TL 30 NW 26 3482 0962 Elbowlane Farm, Great Amwell **Block C**

Surface level (+94.8 m) +311 ft
Water struck at (+92.0 m)
August 1972

Overburden 1.6 m
Mineral 2.0 m
Waste 0.3 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Pebble Gravel	Clay, soft, grey–brown, becoming sandy and with well rounded pebbles	1.5	1.6
	Gravel Gravel: fine and coarse, subrounded to well-rounded flint with quartz, more gravelly in upper 1.0 m Sand: medium and coarse with fine, grey	2.0	3.6
	Clay, stiff, brown, slightly sandy with some gravel	0.3	3.9
London Clay	Clay, stiff, brown becoming grey at 4.6 m	0.8+	4.7

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
4	30	66	1.6–2.6	4	4	9	5	45	33	0
			2.6–3.6	4	10	17	14	32	23	0
			Mean	4	7	13	10	38	28	0

TL 30 NW 27 3444 0749 Great Grove, Brickendon Liberty **Block C**

Surface level (+84.4 m) +277 ft
Water not struck
July 1972

Waste 2.4 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Pebble Gravel	'Clayey' sand: brown with flint gravel	0.9	1.0
	Clay, sandy, grey–brown with well-rounded flints	1.4	2.4
London Clay	Clay, stiff, brown with grey streaks to 3.3 m, then brown	2.1+	4.5

TL 30 NW 28 3411 0544 Thunderfield Grove, Cheshunt **Block D**

Surface level (+76.5 m) +251 ft
Water not struck
August 1972

Waste 1.7 m
Bedrock 1.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
? Head	Clay, brown, earthy with angular flints	0.8	0.9
	Clay, sandy, brown with rounded and angular flints	0.8	1.7
London Clay	Clay, silty, stiff, brown with grey streaks	1.8+	3.5

TL 30 NE 11 3580 0780 Lucern Warren, Hoddesdon **Block B**

Surface level (+63.4 m) +208 ft
Water not struck
August 1972

Overburden 0.5 m
Mineral 10.2 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Glacial Gravel	'Clayey' sandy gravel Gravel: fine and coarse, angular, subangular, subrounded and well-rounded flint. Gravel content decreases with depth Sand: medium with fine and coarse, brown	10.2	10.7
London Clay	Clay, stiff, brown	0.1+	10.8

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
10	55	35	0.5–1.5	10	4	23	20	34	9	0
			1.5–2.5	17	8	25	5	19	26	0
			2.5–3.5	11	9	22	8	24	26	0
			3.5–4.5	5	4	21	11	33	26	0
			4.5–5.5	8	9	33	11	26	13	0
			5.5–6.5	18	59	5	0	12	6	0
			6.5–7.5	10	6	55	13	11	5	0
			7.5–8.5	6	6	61	8	10	9	0
			8.5–9.5	5	5	80	2	5	3	0
			9.5–10.5	6	9	51	7	18	9	0
			10.5–10.7	no information available				22	13	
			Mean	10	12	37	6			0

TL 30 NE 12 3546 0677 Broxbourne Bury, Hoddesdon **Block B**

Surface level (+61.3 m) +201 ft
Water struck at (+52.8 m)
October 1972

Overburden 0.5 m
Mineral 12.4 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Glacial Gravel	Gravel Gravel: fine and coarse, mainly subangular to subrounded flint, gravel content increases with depth Sand: medium with coarse and fine, brown, very clayey in upper 3.0 m	12.4	12.9
London Clay	Clay, stiff, brown	0.2+	13.1

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
5	47	48	0.5–1.5	13	9	34	8	22	14	0
			1.5–2.5	7	4	25	8	24	32	0
			2.5–3.5	14	12	34	8	17	15	0
			3.5–4.5	5	7	60	6	12	10	0
			4.5–5.5	5	5	56	11	13	10	0
			5.5–6.5	4	4	40	13	26	9	4
			6.5–7.5	5	6	22	9	26	32	0
			7.5–8.5	7	7	24	8	23	31	0
			8.5–9.5	2	2	20	11	33	32	0
			9.5–10.5	1	3	33	22	26	15	0
			10.5–11.5	1	0	19	10	33	37	0
			11.5–12.5	2	1	12	16	39	30	0
			12.5–12.9	0	1	9	16	43	31	0
			Mean	5	5	31	11	25	23	0

TL 30 NE 13 3518 0519 N.E. of Spring Wood, Cheshunt **Block E**

Surface level (+41.1 m) +135 ft
Water not struck
April 1972

Waste 2.1 m
Bedrock 6.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
? Taplow Gravel	Clay, soft to 1.2 m then stiff, brown and grey with orange streaks from 1.2 m, silty from 1.2 m	1.8	2.1
London Clay	Clay, stiff, chocolate brown to 3.0 m, then becoming brown–grey, and dark grey and blue from 7.9 m; sandy horizons from 3.0 m to 7.9 m then silty	6.1+	8.2

TL 30 NE 14 3611 0875 High Leigh, Hoddesdon **Block B**

Surface level (+61.0 m) +200 ft
Water not struck
August 1972

Overburden 0.8 m
Mineral 4.6 m
Waste 0.9 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Glacial Gravel	'Very clayey' sandy gravel Gravel: fine and coarse with cobbles in lower 1.0 m. Subangular, subrounded and well rounded flint, very gravelly in lower 2.0 m Sand: medium with coarse and fine, brown, very sandy in upper 2.0 m Fines: band of soft, sandy, brown clay from 2.8 m to 3.4 m	4.6	5.4
	Sandy pebbly clay	0.9	6.3
London Clay	Clay, stiff, brown to 7.4 m then grey	1.0+	7.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand		Gravel			
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
22	46	32	0.8–1.8	11	9	61	5	10	4	0
			1.8–2.8	18	5	46	12	9	10	0
			2.8–3.4	clay seam*						
			3.4–4.4	1	5	15	11	32	36	0
			4.4–5.4	11	3	30	8	18	25	5
			Mean	22	5	33	8	15	16	1

* Assumed to comprise 100% fines.

TL 30 NE 15 3616 0570 Wormley, Hoddesdon **Block E**

Surface level (+33.8 m) +111 ft
Water struck at (+29.8 m)
April 1972

Overburden 3.4 m
Mineral 2.0 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Brickearth	Clay, silty, brown, soft, friable	3.2	3.4
Taplow Gravel	Gravel Gravel: fine and coarse, angular, subangular, subrounded and well-rounded flint with quartz Sand: coarse and medium with fine, brown	2.0	5.4
London Clay	Clay, silty, brown and soft to 6.0 m then, blue–grey and stiff	1.5+	6.9

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
1	21	78	3.4–4.4	no information available						
			4.4–5.4	1	2	9	10	40	38	0
			Mean	1	2	9	10	40	38	0

TL 30 SW 20 3039 0090 Cattlegate Farm, Enfield (L.B.) **Block D**

Surface level (+82.6 m) +271 ft
Water not struck
August 1972

Overburden 2.6 m
Mineral 1.5 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Pebble Gravel	Pebbly clay, brown and earthy to 0.5 m, then grey–brown with well-rounded black flints	2.3	2.6
	Gravel Gravel: fine and coarse, subrounded and well-rounded black flints Sand: medium with coarse and fine, brown, clayey	1.5	4.1
London Clay	Clay, blue–grey mottled, stiff	0.3+	4.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
9	26	65	2.6–3.6	8	6	14	7	28	37	0
			3.6–4.1	10	3	11	9	42	25	0
			Mean	9	5	13	8	32	33	0

TL 30 SW 21 3157 0460 Burleigh Farm, Cheshunt **Block C**

Surface level (+108.8 m) +357 ft
Water from (+99.0 m) to (+98.0 m) and from (+97.0 m) to (+96.0 m)
May 1972

Waste 12.8 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.3	0.3
Boulder Clay	Clay, grey from 2.1 m to 6.9 m and from 11.3 m to 11.8 m, chalky to 6.9 m and from 11.3 m to 11.8 m. Clayey sand with flints from 9.8 m to 11.3 m and from 11.8 m	12.5	12.8
London Clay	Stiff clay, brown to 13.6 m, then grey–blue	1.2+	14.0

TL 30 SW 22 3176 0298 South of Poplars Farm, Cheshunt **Block D**

Surface level (+96.0 m) +315 ft
Water not struck
July 1972

Waste 4.4 m
Bedrock 15.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, soft, brown becoming grey–brown, sandy	3.9	4.4
London Clay	Clay, stiff and brown to 5.6 m, then grey, soft	15.6+	20.0

TL 30 SW 23 3286 0456 Appleby Street, Cheshunt **Block D**

Surface level (+100.9 m) +331 ft
Water not struck
July 1972

Waste 8.7 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, soft, brown becoming grey–brown and grey from 2.0 m, chalky from 1.2 m	4.5	4.8
Pebble Gravel	Clay sandy with well-rounded flints, brown–grey	2.3	7.1
	Gravel Gravel: fine and coarse, angular to rounded flint Sand: medium, coarse, and fine, white	1.6	8.7
London Clay	Clay, stiff, brown	0.5+	9.2

TL 30 SW 24 3217 0254 Poyndon Pits, Cheshunt **Block D**

Surface level (+93.3 m) +306 ft
Water not struck
July 1972

Waste 3.3 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Pebble Gravel	Clay, brown and grey, sand content increases with depth, with well-rounded flint gravel	2.8	2.9
	Clay, bright blue, with sand and gravel	0.4	3.3
London Clay	Clay, stiff, brown becoming brown–grey at 4.3 m	1.3+	4.6

TL 30 SW 25 3249 0146 East of Burnt Farm, Cheshunt **Block D**

Surface level (+84.4 m) +277 ft
Water not struck
July 1972

Waste 11.5 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, brown becoming grey, chalky from 3.0 m	11.4	11.5
London Clay	Clay, brown, silty, stiff	0.9+	12.4

TL 30 SW 26 3236 0049 North of Sloeman's Farm, Cheshunt **Block D**

Surface level (+72.5 m) +238 ft
Water not struck
July 1972

Waste 7.4 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, soft, chalky, grey from 5.0 m to 6.3 m, otherwise brown	7.2	7.4
	Sand and gravel, medium sand with fine and coarse, well-rounded and subrounded flint gravel	0.7	8.1
London Clay	Clay, stiff, brown to 8.5 m, then grey	1.1+	9.2

TL 30 SW 27 3365 0430 Appleby Street, Cheshunt **Block D**

Surface level (+83.8 m) +275 ft
Water not struck
May 1972

Waste 2.3 m
Bedrock 7.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.5	0.5
Boulder Clay	Clay, soft, brown becoming brown–grey	1.8	2.3
London Clay	Clay, stiff, brown with blue streaks to 3.9 m, then brown becoming greyer at 4.2 m	7.1+	9.4

TL 30 SW 28 3355 0269 Caldecot House, Cheshunt **Block E**

Surface level (+67.7 m) +222 ft
Water not struck
May 1972

Overburden 0.3 m
Mineral 1.0 m
Bedrock 7.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Pebble Gravel	'Clayey' gravel Gravel: fine and coarse, well-rounded flints Sand: medium and coarse with fine, brown becoming white Fines: brown clay	1.0	1.3
London Clay	Clay, soft to 1.9 m, then stiff, brown to 1.6 m, then with blue streaks to 1.9 m, brown to 5.7 m, then dark grey	7.7+	9.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
14	38	48	0.3–1.3	14	8	17	13	26	22	0

TL 30 SW 29 3375 0140 West of Burygreen Plantation, Cheshunt **Block E**

Surface level (+61.0 m) +200 ft
Water not struck
July 1972

Waste 4.4 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, silty, with flint and chalk, to 3.0 m, then grey–brown mottled to 3.4 m	3.2	3.4
Glacial Gravel	Gravel, fine and coarse, with fine and medium brown sand	1.0	4.4
London Clay	Clay, stiff, brown	0.6+	5.0

TL 30 SW 30 3326 0090 Oldpark Farm, Cheshunt **Block E**

Surface level (+69.2 m) +227 ft
Water not struck
July 1972

Overburden 2.6 m
Mineral 5.1 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.2	0.2
Head	Clay, sandy with angular flints	2.4	2.6
Pebble Gravel	'Clayey' gravel Gravel: fine with coarse, mainly subrounded and well-rounded flint Sand: medium with coarse and fine, brown Fines: grey clay seam from 5.4 m to 5.7 m	5.1	7.7
London Clay	Clay, stiff, brown to 8.1 m, then grey	0.7+	8.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
13	42	45	2.6–3.6	9	7	19	14	35	16	0
			3.6–4.6	7	10	20	12	32	19	0
			4.6–5.4	8	9	22	14	30	17	0
			5.4–5.7	clay seam*						
			5.7–6.7	6	10	25	11	36	12	0
			6.7–7.7	10	11	30	9	27	13	0
			Mean	13	9	22	11	30	15	0

* Assumed to comprise 100% fines.

TL 30 SW 31 3445 0448 Cheshunt Park, Cheshunt **Block D**

Surface level (+71.6 m) +235 ft
Water not struck
April 1972

Waste 1.9 m
Bedrock 6.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Head	Clay, sandy to 0.4 m, brown to 0.4 m, then red–brown	1.7	1.9
London Clay	Clay, silty, stiff, chocolate brown to 4.9 m, then brown with blue–grey streaks to 7.8 m, blue–grey from 7.8 m	6.2+	8.1

TL 30 SW 32 3448 0264 Cheshunt Great House, Cheshunt **Block E**

Surface level (+36.6) +120 ft
Water not struck
August 1972

Waste 2.1 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
? Head	Clay, brown and friable to 0.5 m, then grey–brown mottled	1.8	2.1
London Clay	Clay, stiff, brown to 2.8 m, then grey	1.4+	3.5

TL 30 SW 33 3482 0055 Theobalds Park Farm, Cheshunt **Block E**

Surface level (+28.3 m) +93 ft
Water not struck
August 1972

Overburden 2.2 m
Mineral 2.7 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Brickearth	Clay, soft, brown, friable	1.1	1.5
Flood Plain Gravel	Clay with sand and gravel	0.7	2.2
	Gravel Gravel: fine, with coarse, angular to subrounded, with occasional rounded, flint Sand: medium and coarse with some fine, brown	2.7	4.9
London Clay	Clay, stiff, brown to 5.6 m, then grey and silty	0.8+	5.7

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
6	37	57	2.2–3.2	6	4	15	13	48	14	0
			3.2–4.2	7	5	23	16	31	18	0
			4.2–4.9	4	4	22	10	35	25	0
			Mean	6	4	20	13	39	18	0

TL 30 SE 47 3552 0420 N.W. of Brookfield Farm, Cheshunt **Block E**

Surface level (+33.5 m) +110 ft
Water not struck
August 1972

Waste 2.6 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Taplow Gravel	Clay, soft, grey–brown mottled to 1.4 m, then brown and sandy with angular flints	1.5	2.0
	Gravel, fine and coarse, flint, with medium and coarse brown sand	0.6	2.6
London Clay	Clay, stiff, brown	1.4+	4.0

TQ 29 NW 51 2038 9971 Crossoaks Farm, Shenley **Block D**

Surface level (+125.5 m) +412 ft
Water not struck
September 1972

Overburden 1.0 m
Mineral 2.0 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Head	Orange–brown clay with sand and gravel	0.5	1.0
Pebble Gravel	'Clayey' Gravel Gravel: fine and coarse, subangular, subrounded and rounded flint and quartz Sand: medium and coarse with some fine, sharp quartz with flint Fines: silty, micaceous, grey	2.0	3.0
London Clay	Clay, brown becoming dull grey, stiff	0.5+	3.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
15	26	59	1.0–2.0	8	5	11	13	33	30	0
			2.0–3.0	22	4	13	7	28	26	0
			Mean	15	4	12	10	31	28	0

TQ 29 NW 52 2079 9868 Buckettsland Farm, Shenley **Block D**

Surface level (+129.5 m) +425 ft
Water not struck
September 1972

Overburden 1.0 m
Mineral 2.0 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	1.0	1.0
Pebble Gravel	Gravel Gravel: fine and coarse, subrounded and rounded flint and quartz Sand: medium and coarse with some fine	2.0	3.0
London Clay	Clay, dull brown, stiff	0.4+	3.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
8	36	56	1.0–3.0	8	4	21	11	32	24	0

TQ 29 NW 54 2482 9959 Wrotham Park, South Mimms **Block D**

Surface level (+127.7 m) +419 ft
Water not struck
September 1972

Overburden 1.7 m
Mineral 1.0 m
Waste 0.6 m
Bedrock 0.5 m

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	1.7	1.7
Pebble Gravel	Gravel Gravel: coarse and fine, subangular, subrounded and rounded flint and quartz Sand: medium and coarse with some fine quartz with flint	1.0	2.7
	Pebbly clay	0.6	3.3
London Clay	Clay, dull brown becoming dark brown, stiff	0.5+	3.8

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
1	15	84	1.7–2.7	1	2	6	7	39	45	0

TQ 29 NE 1 2552 9934 Ganwick Corner, South Mimms **Block D**

Surface level (+127.7 m) +419 ft
Water not struck
May 1972

Waste 1.4 m
Bedrock 2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Pebble Gravel	Clay, silty, dark brown and black	0.2	0.6
	'Clayey' sand: orange–brown with some flint and quartz pebbles near base	0.8	1.4
London Clay	Clay, stiff, orange–brown, becoming dark brown then grey	2.0+	3.4

TQ 29 NE 2 2506 9863 Great North Road, Wrotham Park **Block D**

Surface level (+128.6 m) +422 ft
Water struck at (+127.1 m)
September 1972

Overburden 0.6 m
Mineral 2.0 m
Waste 1.6 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Head	Clay, sandy, orange–brown and grey with some flint and quartz pebbles	0.3	0.6
Pebble Gravel	Gravel Gravel: fine and coarse, subrounded and rounded with some subangular, flint and quartz Sand: medium and coarse with traces of fine, quartz with flint, pale brown	2.0	2.6
	Clay, sandy with gravel	1.6	4.2
London Clay	Clay, blue–grey	0.1+	4.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
4	41	55	0.6–1.6	6	3	26	17	25	23	0
			1.6–2.6	2	1	12	23	34	28	0
			Mean	4	2	19	20	30	25	0

TQ 29 NE 3 2781 9966 Plumridge Hill, Enfield Chase **Block D**

Surface level (+106.7 m) +350 ft
Water not struck
May 1972

Overburden 1.1 m
Mineral 2.5 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Pebble Gravel	Clay, silty, orange–brown and grey clay with some medium and coarse sand and fine gravel	0.8	1.1
	'Clayey' sandy gravel Gravel: fine and coarse, mainly subrounded and rounded flint and quartz Sand: medium with coarse and some fine Clay: orange–brown and grey	2.5	3.6
London Clay	Clay, stiff, orange–brown becoming dark brown, then grey	0.9+	4.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
12	59	29	1.1–2.1	12	8	52	14	8	6	0
			2.1–3.1	13	9	26	11	19	22	0
			3.1–3.6	10	8	25	21	27	9	0
			Mean	12	9	36	14	16	13	0

TQ 29 NE 4 2836 9962 North Lodge Farm, Enfield Chase **Block D**

Surface level (+96.6 m) +317 ft
Water not struck
July 1972

Waste 0.8 m
Bedrock 1.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Pebble Gravel	'Clayey' sand and gravel: fine and coarse flint and quartz gravel with medium and coarse sand and soft orange–brown clay	0.2	0.8
London Clay	Clay, stiff, brown becoming blue–grey	1.7+	2.5

TQ 29 NE 6 2974 9905 Bay Farm, Enfield Chase **Block D**

Surface level (+73.2 m) +240 ft
Water not struck
July 1972

Overburden 0.2 m
Mineral 1.0 m
Bedrock 1.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Pebble Gravel	'Clayey' sandy gravel Gravel: fine and coarse, mainly subrounded and rounded flint and quartz Sand: medium and fine with coarse, orange–brown, with some grey–brown silty clay	1.0	1.2
London Clay	Clay, stiff, brown mottled blue	1.8+	3.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
10	48	42	0.2–1.2	10	16	24	8	23	19	0

TQ 39 NW 7 3189 9890 Hill Lodge, Enfield (L.B.) **Block E**

Surface level (+56.1 m) +184 ft
Water not struck
August 1972

Waste 1.1 m
Bedrock 2.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.2
? Head	Clay, soft, brown, with well-rounded and subrounded flint pebbles	0.9	1.1
London Clay	Clay, brown	2.4+	3.5

TQ 39 NW 8 3355 9862 Forty Hall, Enfield (L.B.) **Block E**

Surface level (+50.0 m) +164 ft
Water not struck
August 1972

Overburden 1.0 m
Mineral 3.0 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Head	Clay, brown, with flints	0.9	1.0
Boyn Hill Terrace	Gravel Gravel: fine and coarse, subangular and subrounded with occasional well-rounded flint Sand: medium and fine with coarse, brown Fines: decreases with depth	3.0	4.0
London Clay	Clay, soft, brown and sandy to 4.9 m, then stiff, grey	1.4+	5.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}$–$\frac{1}{4}$	$+\frac{1}{4}$–1	+1–4	+4–16	+16–64	+64
8	41	51	1.0–2.0	12	5	18	10	25	30	0
			2.0–3.0	10	8	20	7	30	25	0
			3.0–4.0	3	24	25	5	19	24	0
			Mean	8	13	21	7	25	26	0

APPENDIX G

WORKING PITS

In September 1975 two sand and gravel pits, both working Glacial Gravel, were known to be in operation in the district: Bunker's Hill [300 096] and Broxbourne Bury [355 074].

APPENDIX H

CONVERSION TABLE, METRES TO FEET (to nearest 0.5 ft)

m	ft	m	ft	m	ft	m	ft	m	ft
0.1	0.5	6.1	20	12.1	39.5	18.1	59.5	24.1	79
0.2	0.5	6.2	20.5	12.2	40	18.2	59.5	24.2	79.5
0.3	1	6.3	20.5	12.3	40.5	18.3	60	24.3	79.5
0.4	1.5	6.4	21	12.4	40.5	18.4	60.5	24.4	80
0.5	1.5	6.5	21.5	12.5	41	18.5	60.5	24.5	80.5
0.6	2	6.6	21.5	12.6	41.5	18.6	61	24.6	80.5
0.7	2.5	6.7	22	12.7	41.5	18.7	61.5	24.7	81
0.8	2.5	6.8	22.5	12.8	42	18.8	61.5	24.8	81.5
0.9	3	6.9	22.5	12.9	42.5	18.9	62	24.9	81.5
1.0	3.5	7.0	23	13.0	42.5	19.0	62.5	25.0	82
1.1	3.5	7.1	23.5	13.1	43	19.1	62.5	25.1	82.5
1.2	4	7.2	23.5	13.2	43.5	19.2	63	25.2	82.5
1.3	4.5	7.3	24	13.3	43.5	19.3	63.5	25.3	83
1.4	4.5	7.4	24.5	13.4	44	19.4	63.5	25.4	83.5
1.5	5	7.5	24.5	13.5	44.5	19.5	64	25.5	83.5
1.6	5	7.6	25	13.6	44.5	19.6	64.5	25.6	84
1.7	5.5	7.7	25.5	13.7	45	19.7	64.5	25.7	84.5
1.8	6	7.8	25.5	13.8	45.5	19.8	65	25.8	84.5
1.9	6	7.9	26	13.9	45.5	19.9	65.5	25.9	85
2.0	6.5	8.0	26	14.0	46	20.0	65.5	26.0	85.5
2.1	7	8.1	26.5	14.1	46.5	20.1	66	26.1	85.5
2.2	7	8.2	27	14.2	46.5	20.2	66.5	26.2	86
2.3	7.5	8.3	27	14.3	47	20.3	66.5	26.3	86.5
2.4	8	8.4	27.5	14.4	47	20.4	67	26.4	86.5
2.5	8	8.5	28	14.5	47.5	20.5	67.5	26.5	87
2.6	8.5	8.6	28	14.6	48	20.6	67.5	26.6	87.5
2.7	9	8.7	28.5	14.7	48	20.7	68	26.7	87.5
2.8	9	8.8	29	14.8	48.5	20.8	68	26.8	88
2.9	9.5	8.9	29	14.9	49	20.9	68.5	26.9	88.5
3.0	10	9.0	29.5	15.0	49	21.0	69	27.0	88.5
3.1	10	9.1	30	15.1	49.5	21.1	69	27.1	89
3.2	10.5	9.2	30	15.2	50	21.2	69.5	27.2	89
3.3	11	9.3	30.5	15.3	50	21.3	70	27.3	89.5
3.4	11	9.4	31	15.4	50.5	21.4	70	27.4	90
3.5	11.5	9.5	31	15.5	51	21.5	70.5	27.5	90
3.6	12	9.6	31.5	15.6	51	21.6	71	27.6	90.5
3.7	12	9.7	32	15.7	51.5	21.7	71	27.7	91
3.8	12.5	9.8	32	15.8	52	21.8	71.5	27.8	91
3.9	13	9.9	32.5	15.9	52	21.9	72	27.9	91.5
4.0	13	10.0	33	16.0	52.5	22.0	72	28.0	92
4.1	13.5	10.1	33	16.1	53	22.1	72.5	28.1	92
4.2	14	10.2	33.5	16.2	53	22.2	73	28.2	92.5
4.3	14	10.3	34	16.3	53.5	22.3	73	28.3	93
4.4	14.5	10.4	34	16.4	54	22.4	73.5	28.4	93
4.5	15	10.5	34.5	16.5	54	22.5	74	28.5	93.5
4.6	15	10.6	35	16.6	54.5	22.6	74	28.6	94
4.7	15.5	10.7	35	16.7	55	22.7	74.5	28.7	94
4.8	15.5	10.8	35.5	16.8	55	22.8	75	28.8	94.5
4.9	16	10.9	36	16.9	55.5	22.9	75	28.9	95
5.0	16.5	11.0	36	17.0	56	23.0	75.5	29.0	95
5.1	17	11.1	36.5	17.1	56	23.1	76	29.1	95.5
5.2	17	11.2	36.5	17.2	56.5	23.2	76	29.2	96
5.3	17.5	11.3	37	17.3	57	23.3	76.5	29.3	96
5.4	17.5	11.4	37.5	17.4	57	23.4	77	29.4	96.5
5.5	18	11.5	37.5	17.5	57.5	23.5	77	29.5	97
5.6	18.5	11.6	38	17.6	57.5	23.6	77.5	29.6	97
5.7	18.5	11.7	38.5	17.7	58	23.7	78	29.7	97.5
5.8	19	11.8	38.5	17.8	58.5	23.8	78	29.8	98
5.9	19.5	11.9	39	17.9	58.5	23.9	78.5	29.9	98
6.0	19.5	12.0	39.5	18.0	59	24.0	78.5	30.0	98.5

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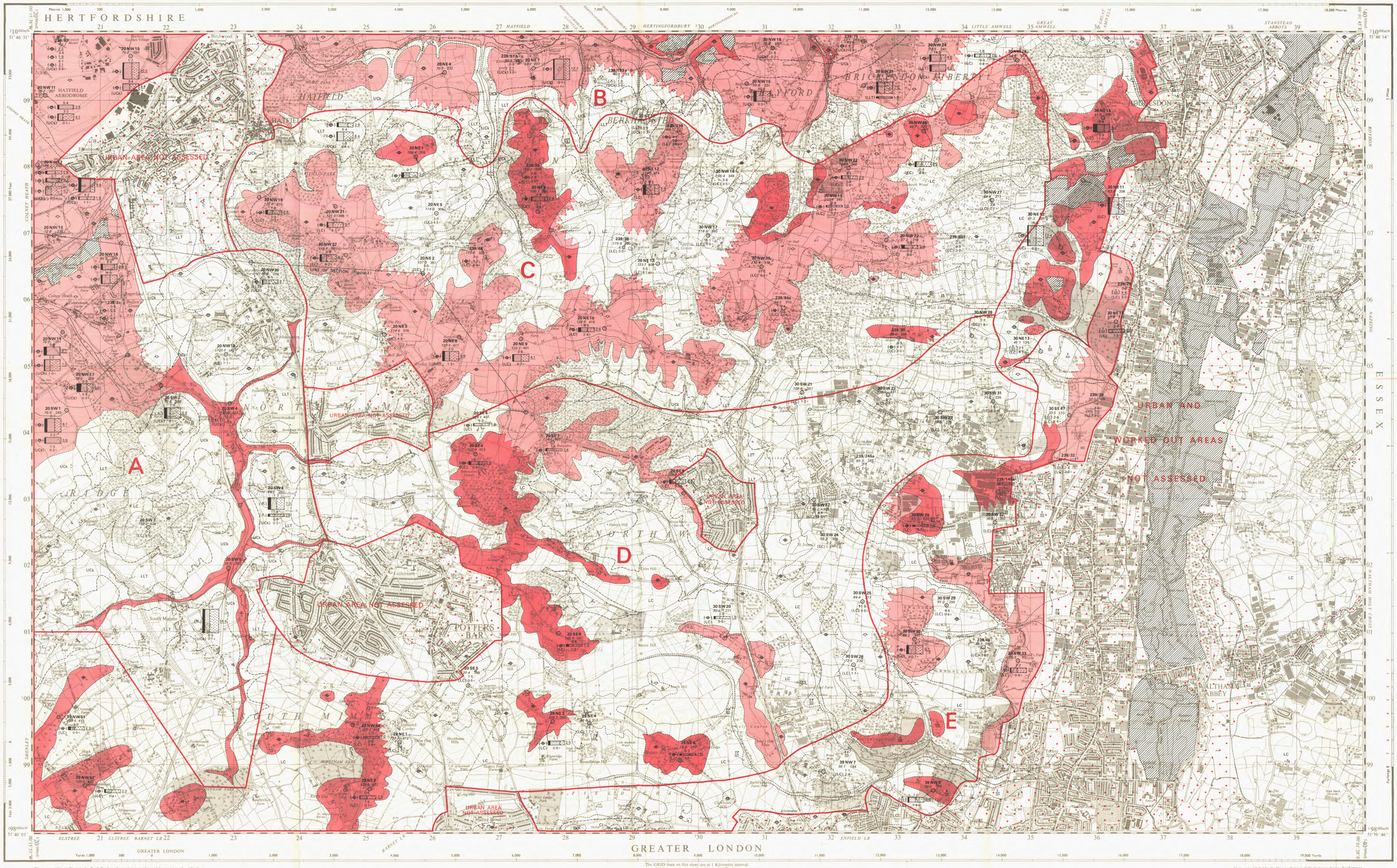
INSTITUTE OF GEOLOGICAL SCIENCES
INDUSTRIAL MINERALS ASSESSMENT UNIT

THE SAND AND GRAVEL RESOURCES OF SHEETS TL 20,30 & Parts of TQ 29,39 (HATFIELD & CHESHUNT, HERTS)

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

ORDNANCE SURVEY
SHEETS TL 20,30 & PARTS OF TQ 29,39
PROVISIONAL EDITION



EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

- Alluvium -clayey silt and sand. A-45
- Valley Gravel -silty flint gravel. VG-1
- Brickearth -sandy silty loam. (T where Taplow) B-12
- Undivided and Flood-Plain Gravel (F.P.) -fine and coarse flint gravels. UF-1
- ? Arctic Bed -stiff blue black and yellow clay. AB-1
- Taplow Gravel -fine and coarse flint gravels. TG-1
- Boyn Hill Gravel -flint gravels BG-1
- Glacial Gravel -flint gravel with medium sand. GG-1
- Boulder Clay -stiff dark grey clay with pebbles. BC-24
- Pebble Gravel -rounded flint gravel with clean white sand. PG-3

RECENT AND PLEISTOCENE

SOLID

- Cl — Claygate Beds -alternations of sand and clay.
- LC — London Clay -grey and brown stiff clay.
- LLT — Lower London Tertiaries -grey and brown clay and fine sand.
- UCk — Upper Chalk -soft, white chalk with flints.

EOCENE / PALAEOCENE / CRETACEOUS

Worked out areas of sand and gravel. WO-9

BOUNDARY LINES

- Geological Boundary, Drift.
- Geological Boundary, Solid.
- Inferred boundary between recognised categories of deposits.
- Resource Block boundary.

Broken line denotes uncertainty.

BOREHOLE DATA

SITE LOCATIONS

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

I.M.A.U. BOREHOLES

Borehole Registration Number — Borehole Site — Waste — Geological Classification (UCk)

Surface level in metres and feet above O.D. (Newlyn)
Overburden
Mineral (Sand and Gravel)
Bedrock

Grading Diagram
Thicknesses in metres

Notes
(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 at the bottom of boreholes are thicknesses recorded in feet.
(iv) The Geological Classification is given only for mineral and bedrock

Borehole Registration Number

Each I.M.A.U. borehole is identified by a Registration Number, e.g. NW16. The letters refer to the quarter sheet and the final figures to the I.G.S. serial number for that quarter. The unique designation for borehole NW16 is TL 20 NW 16.

Grading Diagrams

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

Sand (0.063–4mm) / Fines (<0.063mm) / Gravel (>4mm)

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 of gravel may be omitted or exaggerated.

OTHER BOREHOLES

The layout of information is the same as for I.M.A.U. boreholes, although data available may not be as comprehensive. They are registered in the same series.

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

Where appropriate on other sheets a category; 'Discontinuous spreads of mineral beneath overburden' is recognised.

RESOURCE BLOCKS

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

A horizontal section showing the general relations of the drift deposits along the line shown, constitutes Fig 3 of the Report.

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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Geological Lines from six-inch surveys by J. A. Howe in 1902 and by H. G. Dines, R. W. Pocock, T. Robertson and R. L. Sherlock in 1912-1922
R. G. Carruthers, G. Barrow and H. Dewey, District Geologists
Included in One-Inch Geological Sheets 239, 240, 256 and 257.

Sand and Gravel Survey by S. Mathin and D. R. Parker in 1972.
R. G. Thurrell, Head, Industrial Minerals Assessment Unit.

1:25 000 Sand and Gravel Resource Sheet published 1981.
G. M. Brown, D.Sc., F.R.S., Director, Institute of Geological Sciences.
(100.8)

The GRID lines on this sheet are at 1 Kilometre interval.
Heights are in feet above Mean Sea Level at Newlyn

1 square inch on this map represents 99.69 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.

Compiled from 6" sheets last fully revised 1910-1940
Aerodromes revised 1961
Other partial systematic revision 1937-1955 has been incorporated.
Major roads and Greater London boundaries revised 1966,1971

TL11	TL21	TL31	TL41
TL10	239 TL20	TL30	240 TL40
TQ19	TQ29	TQ39	TQ49