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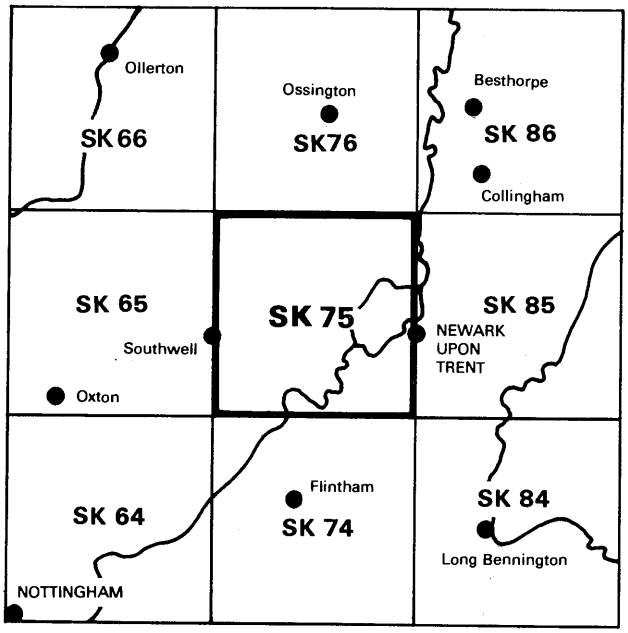

The sand and gravel resources of the country west of Newark upon Trent, Nottinghamshire

Description of 1:25 000 resource sheet SK 75

D. Price and P. J. Rogers

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PREFACE

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

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

This report describes the resources of sand and gravel of 51 km^2 of country west of Newark upon Trent, Nottinghamshire, shown on the accompanying 1:25 000 resource map SK 75. The survey, which was controlled from a Sub-unit then based in Leeds (Officer-in-Charge, J. H. Hull) was conducted by Mr D. Price assisted by Mr J. R. Gozzard and Mr J. H. Lovell who supervised the drilling and sampling programme. Dr D. G. Farmer of the Institute's Computer Unit designed computer programs for the automated production of results, deposit classification and graphic displays. The work is based on six-inch scale geological surveys carried out between 1903 and 1909, and published on one-inch geological sheets 113 (Ollerton) and 126 (Nottingham).

Mr J. W. Gardner, CBE (Land Agent) was responsible for negotiating access to land for drilling. The ready co-operation of land owners, tenants and Messrs. Hoveringham Gravels Ltd. is gratefully acknowledged.

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The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 50 boreholes drilled for the Industrial Minerals Assessment Unit, form the basis of the assessment of sand and gravel resources in the area west of Newark upon Trent, Nottinghamshire.

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 four resource blocks, containing between 10.3 and 15.2 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.

SOMMAIRE

Les sources des renseignements qui constituent la base de l'évaluation des ressources en sable et en gravier dans la région à l'ouest de Newark upon Trent, Nottinghamshire, comprennent les cartes géologiques de l'Institute of Geological Sciences, des données obtenues de trous de sonde déjà en existence et 50 trous de sonde forés pour l'Industrial Minerals Assessment Unit.

Tous les dépôts dans la région qui pourraient être exploités pour le sable et le gravier ont été étudiés et on s'est servi d'une méthode statistique simple pour en évaluer le volume. Les évaluations de volume ont été tenues d'être à 95 pour cent exactes.

La carte 1:25 000 est divisée en 4 blocs de ressources avec d'entre 10.3 et 15.2 km^2 de sable et de gravier. Pour chaque bloc on décrit la géologie des dépôts et on donne l'étendue du terrain minéralisé, l'épaisseur moyenne de recouvrement et de minéral et les triages moyens. Des données détaillées des trous de sonde sont aussi présentées. La géologie, la situation des trous de sonde et les profils des blocs de ressources sont montrées sur la carte.

ZUSAMMENFASSUNG

Die geologischen Karten vom Institute of Geological Sciences, vorher-existierende Information, und 50 für die Industrial Minerals Assessment Unit gebohrten Bohrlöcher, bilden den Grund der Einschätzung von Sand- und Schottermittel in Gebiet Westlich von Newark upon Trent, Nottinghamshire.

Alle Ablagerungen im Gebiet, die möglich bearbeitbar für Sand und Schotter sind, wurden untersucht, und eine einfache statistische Methode wurde benutzt, um den Volumen zu schätzen. Man gibt die Zuverlässigkeit der Volumenschätzungen mit symmetrischen 95 Prozent Vertrauenswerten.

Man teilt die 1:25 000 Karte in 4 Mittelsblöcke, die zwischen 10.3 und 15.2 km^2 von Sand und Schotter umfassen. Für jeden Block beschreibt man die Geologie der Ablagerungen, und das mineralhaltige Gebiet, die mittleren Dicken von Überlastung und Mineral und die mittleren Klassifizierungen werden erklärt. Ausführliche Bohrlöcherdaten werden auch gegeben. Die Geologie die Lage der Bohrlöcher und die Skizzen der Mittelsblöcke werden auf der Begleitkarte gezeigt.

The first twelve reports on the assessment of British sand and gravel resources appeared in the Report Series of the Institute of Geological Sciences as a subseries. Report No. 13 onwards appear in the Mineral Assessment Report Series of the Institute. Details of published reports appear at the end of this report.

Bibliographical reference

PRICE, D. and ROGERS, P. J. 1978. The sand and gravel resources of the country west of Newark upon Trent, Nottinghamshire. Description of 1:25 000 resource sheet SK 75. Miner. Assess. Rep. Inst. Geol. Sci., No. 31

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Description of 1:25 000 resource sheet SK 75

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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 geological evidence. The sites available for inspection, measurement, and sampling are too widely spaced to permit the mineral bodies to be outlined completely or the grade established throughout" (Bureau of Mines and Geological Survey, 1948, p. 15).

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

The following arbitrary physical criteria have been adopted:

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

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

For the particular needs of assessing sand and gravel resources, a grain-size classification based on the geometric scale 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 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.

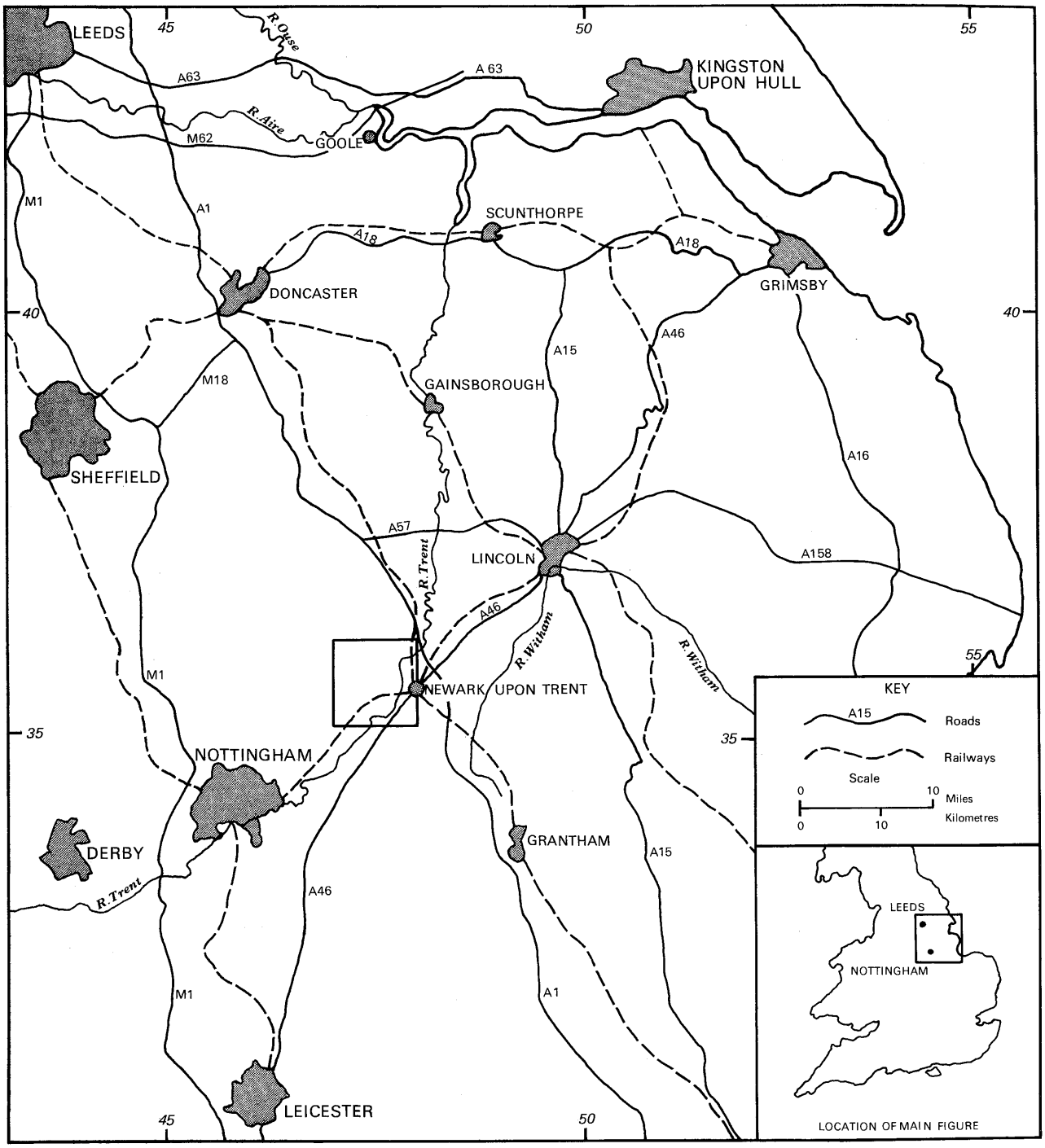


Fig. 1. Map showing the location of sheet SK 75

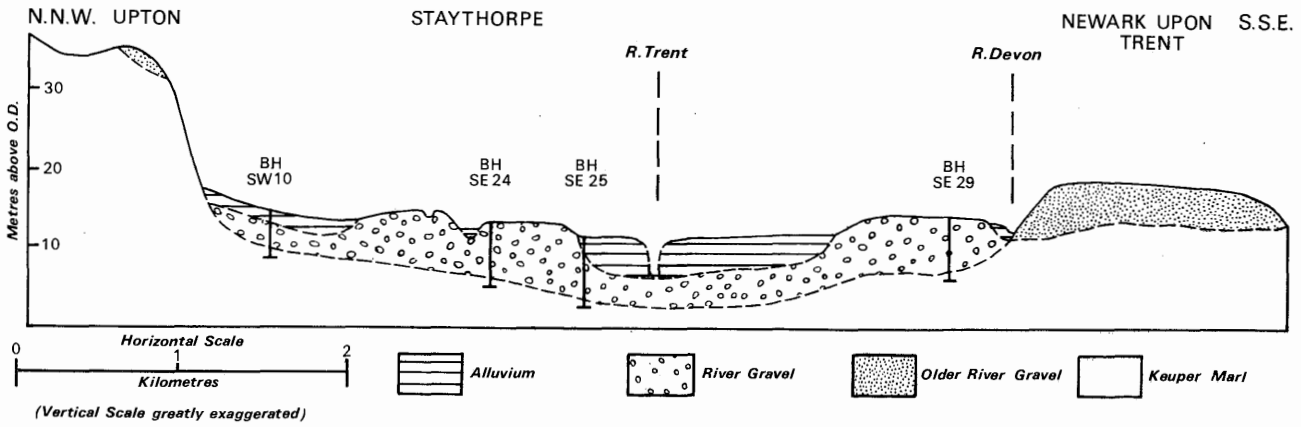


Fig. 2. Generalised section across the Trent Valley between Upton and the southern outskirts of Newark upon Trent

DESCRIPTION OF THE DISTRICT SHOWN ON SHEET SK 75

GENERAL

Lying to the west of Newark upon Trent, the district straddles the broad floodplain of the north-eastward flowing River Trent. The river is joined near Fiskerton by the River Greet and at Newark by the River Devon; the lower ground is also drained by a number of man-made dykes. North-west of the floodplain gently undulating, mainly drift-free, ground rises to a height of 71 m above OD near Muskham Wood [741 577]; south-east of the river the land generally lies below the 15 m contour.

The historic town of Newark upon Trent, which lies on the eastern edge of the district, is a residential and commercial centre with some service and light industry and a sugar refinery. Sand and gravel is worked north of the town and supplies a ready-mixed concrete plant. There is an important power station at Staythorpe. Elsewhere the district remains predominantly agricultural.

The River Trent, together with artificial cuts at Newark and Nottingham, is an important commercial waterway connecting the Humber with towns in the Midlands; boats up to 43 m long and 5.6 m beam can reach Nottingham, 24 km upstream from Newark. The A1 trunk road and the main rail link between London and Yorkshire and the north-east cross the district.

GEOLOGY

The geological sequence represented is described briefly below; further details may be found in the Ollerton and Newark memoirs (Edwards, 1967; Lamplugh and others, 1908). The relationship between the drift deposits is shown in the generalised horizontal section, Fig. 2.

SOLID

Keuper Waterstones and Keuper Marl

The oldest strata cropping out in the district are the Keuper Waterstones, seen around Southwell. They consist of red-brown and grey-green mudstones and flaggy sandstones.

Keuper Marl underlies the remainder of the district but is largely concealed by superficial deposits in the south-east. It consists mainly of red-brown and grey-green mudstones with thin beds of dolomitic sandstone known as skerries; gypsiferous beds occur near the top and have been commercially exploited in the south-east of the district.

DRIFT

Older River Gravel

The greater part of Newark upon Trent stands on a platform of Older River Gravel which lies at a height of about 18 m above OD and approximately 7 m above the level of the Trent floodplain. Borehole records indicate the presence of sand and gravel up to at least 7.2 m thick. It has long been recognised that these deposits were probably laid down when the River Trent flowed through the Lincoln Gap towards the Fens (Jukes-Brown, 1883, pp. 607-8), and subsequently they have been correlated with the Ipswichian Beeston Terrace of the Middle Trent (Straw, 1963, fig. 2).

West of the Trent, deposits mapped as Older River Gravel are found at a higher elevation, about 20 to 30 m above OD, near Southwell and Upton; they consist of pebbly sandy silt with pockets of sand and clayey gravel.

River Gravel

Gravels and sandy gravels, together with subordinate pebbly sands and sands lie in the bottom of the Trent Valley. They are partly concealed by younger alluvium but commonly protrude some 2 to 3 m above the level of the floodplain in the form of long banks and islands. They reach an elevation of 15.5 m OD in the south, near Fiskerton cum Morton and Rolleston, where they attain the maximum proved thickness of 8.5 m. Straw (1963, fig. 2 and p. 176) considered these sands and gravels to be equivalent to the Floodplain Terrace deposits of higher reaches of the Trent which, he argued, were deposited during an episode of the Devensian (last) glaciation when drainage to the Humber was impeded by ice.

Alluvium

Silts and clays occupy much of the floor of the Trent Valley, usually resting on River Gravel deposits. Exceptionally they total 4.2 m or more, but are commonly less than 2 m thick. Thin peat

Table 1. Pebble count analyses of random samples

Block	Borehole No.	Depth	Percentage by weight (and number)							
			Quartz	Quartzite	Flint and Chert	Sandstone	Mudstone and Siltstone	Limestone	Igneous Rock	Others
A	NE 78	1.2 to 4.0	27(36)	58(29)	9(18)	5(10)	1(7)	–	trace	–
	NE 81	0.3 to 5.7	27(30)	60(32)	3(15)	9(11)	1(5)	–	–	trace (4)
	NE 83	3.8 to 4.8	28(34)	46(24)	10(19)	15(15)	1(4)	–	–	1(4)
	NE 85	0.8 to 6.5	25(32)	60(39)	7(19)	8(7)	trace (1)	–	trace	trace (2)
	NE 87	0.9 to 8.0	18(33)	59(25)	8(18)	13(14)	1(5)	1(3)	trace	trace (2)
B	SE 24	4.5 to 5.5	17(22)	71(51)	6(15)	2(3)	1(4)	2(3)	1(1)	trace (1)
	SW 14	1.5 to 7.1	25(37)	59(25)	5(14)	5(10)	1(5)	1(5)	–	4(4)
C	SW 21	1.8 to 2.8	29(41)	57(34)	4(9)	9(10)	1(4)	–	–	trace (2)
D	SE 15	2.0 to 7.0	23(25)	63(52)	11(17)	3(4)	trace (1)	trace (1)	trace	trace
	SE 16	4.9 to 5.9	19(38)	67(24)	7(19)	6(13)	1(4)	–	–	trace (2)
	SE 17	1.8 to 2.8	24(32)	47(27)	15(18)	10(13)	1(4)	trace	3(5)	trace (1)
	SE 30	3.0 to 4.0	20(26)	69(53)	8(14)	2(5)	trace (1)	–	1(1)	trace
	SE 35	0.5 to 3.7	26(30)	42(24)	16(19)	11(15)	2(5)	trace (1)	2(2)	1(4)

is found locally within the alluvium, and near Morton a borehole (SW 17) proved 2.9 m of peat below 0.5 m of soil within an area mapped as alluvium.

More restricted developments of similar alluvium are found in the Trent's tributary valleys.

COMPOSITION OF THE SAND AND GRAVEL

Older River Gravel

Small patches of this deposit near Southwell and Upton are either too thin or too dirty to be potentially workable. The broad spread at Newark upon Trent is largely sterilised by urban development but a small area outside the town has been investigated by a single borehole (SE 35) which found gravel and sandy gravel with a mean grading of fines 7 per cent, sand 43 per cent and gravel 50 per cent.

The gravel fraction, 60 per cent of which passes the 16 mm sieve, consists mainly of quartzite and quartz, with smaller but conspicuous amounts of chert, flint and sandstone; other constituents account for only 5 per cent of the fraction (see Table 1). The sand is medium grained and consists of quartz together with, in subordinate amount, other lithologies which are also present in the gravel fraction.

River Gravel

The uppermost parts of the River Gravel are generally characterised by a high fines content and thus range in composition from 'very clayey' sand to 'clayey' gravel (see Appendix C). Although in places up to 4.2 m thick, these clayey deposits are generally less than 1 m and have a mean thickness of only 0.6 m. Their mean grading is fines 19 per cent, sand 60 per cent and gravel 21 per cent. In contrast, the remainder of the River Gravel is characterised by a low fines content and high percentages of gravel, the mean grading being fines 1 per cent, sand 41 per cent and gravel 58 per cent. Proved thicknesses of these cleaner deposits range from 1.6 m to 8.0 m with a mean of 4.6 m. The mineral as a whole has a mean grading of fines 3 per cent, sand 44 per cent and gravel 53 per cent and a mean thickness of about 5.2 m.

The gravel fraction is predominantly fine, but coarse pebbles are common and locally dominant; cobbles were encountered in only ten of the IMAU boreholes and nowhere account for more than 8 per cent of the mineral. The pebbles are mainly of quartz and quartzite, with subordinate amounts of flint, chert and sandstone; mudstone, limestone and igneous rocks may also be present but rarely account for more than 1 per cent of the fraction (see Table 1). However, borehole SE 36 proved exceptional in containing high proportions of limestone, calcareous siltstone, Gryphaea fragments and ironstone.

The sand is mainly medium grained and consists of quartz together with, especially in the coarse parts, fragments of the rocks found in the gravel 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 geological data in black and the mineral resource information in shades of red.

Geological data

The geological boundary lines and symbols are taken from the geological maps of the area, which was surveyed in the years 1903 to 1909 at the scale of 1:10 560. Borehole data, which include the stratigraphic relations, thicknesses and mean particle-size distribution of the sand and gravel samples collected during the assessment survey, are also shown.

The geological boundaries are the best interpretation of the information available at the time of survey. However, it is inevitable, particularly with deposits such as those included in the area of sheet SK 75, that local discrepancies will be revealed by some boreholes (as for example, at borehole SW 17). Where necessary, these are taken into account in the assessment of resources.

Mineral resource information

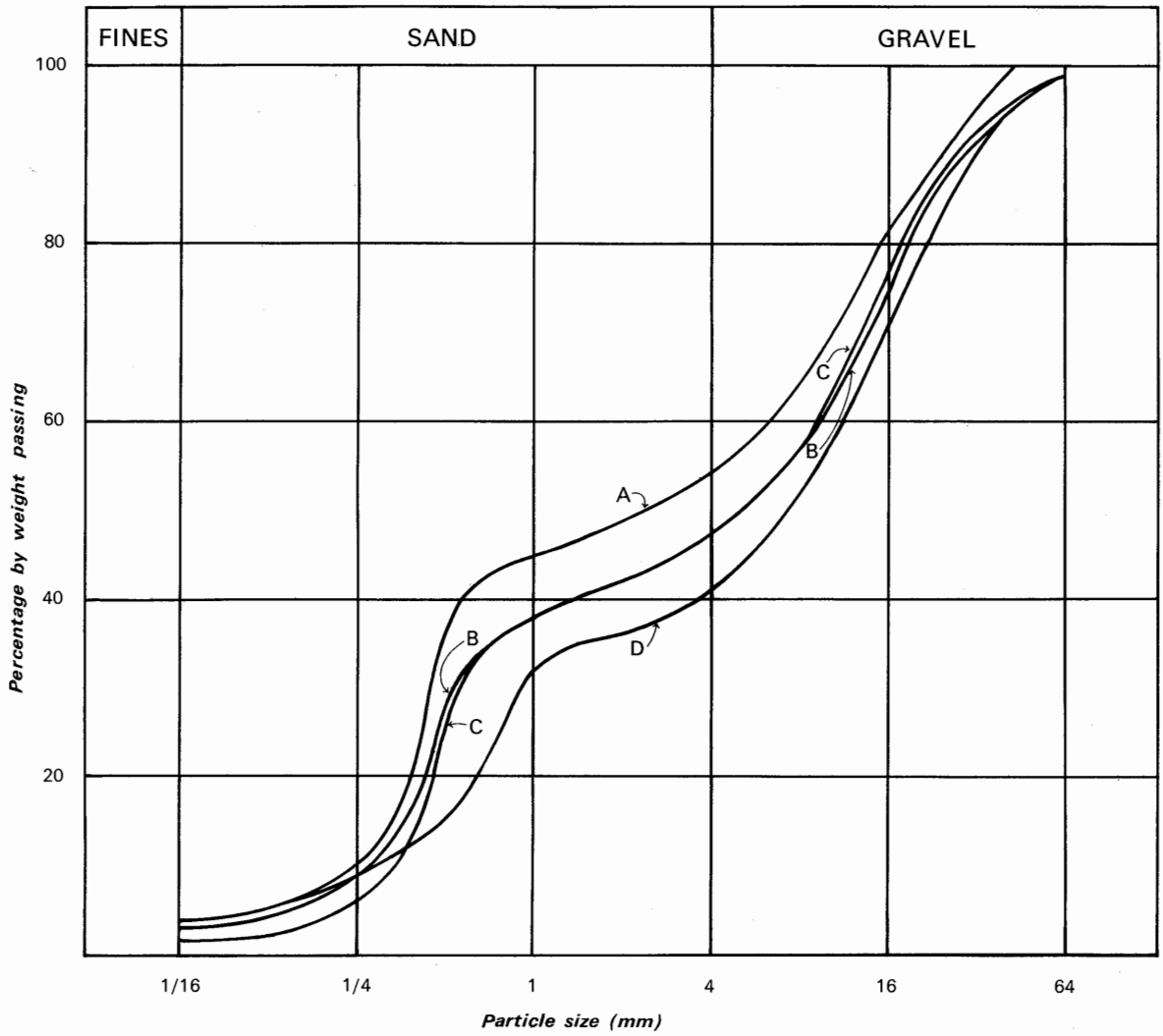
The mineral-bearing ground is subdivided into resource blocks (see Appendix A). Within a resource block the mineral is subdivided into areas where it is 'exposed' and areas where it is present beneath overburden. The mineral is identified as 'exposed' where the overburden, commonly consisting only of soil and subsoil, averages less than 1.0 m in thickness. Beneath overburden the mineral may be continuous (or almost continuous) or discontinuous. The recognition of these categories is dependent upon the importance attached to the proportion of boreholes which did not find potentially workable sand and gravel and the distribution of barren boreholes within a block. The mineral is described as 'almost continuous' if it is present in 75 per cent or more of the boreholes in a resource block. The 'discontinuous' category has not been recognised on the present sheet.

Areas where bedrock crops out and where the available evidence suggests that sand and gravel is not potentially workable or is absent, are uncoloured on the Map; where appropriate the reason is given (e.g. at Southwell). In such areas it has been assumed that mineral is absent except in infrequent and relatively minor patches which can neither be outlined nor assessed quantitatively in the context of this survey. Areas of unassessed sand and gravel, for example, built-up areas, are indicated by a red stipple.

The area of the exposed sand and gravel is measured from the mapped geological boundary lines. The whole of this area is considered as mineral, although it may include small areas where sand and gravel is not present or is not potentially workable. Inferred boundaries have been inserted where sand and gravel beneath cover is interpreted to be not potentially workable or absent. Such boundaries (for which a distinctive symbol is used) are drawn primarily for the pur-

Table 2. The sand and gravel resources of sheet SK 75

Resource Block	Area (km^2)		Mean thickness (m)		Volume of mineral			Mean grading percentage		
	Block	Mineral	Overburden	Mineral	million m^3	Limits at the 95% probability level		Fines -1/16 mm	Sand -4 + 1/16 mm	Gravel +4 mm
						± %	million m^3			
A	10.8	10.3	0.7	5.6	58	14	8	4	50	46
B	10.7	10.7	1.4	5.4	58	21	12	3	44	53
C	11.2	11.2	1.3	5.2	58	30	17	2	45	53
D	18.2	15.2	1.0	4.4	67	20	13	4	37	59
A to D	50.9	47.4	1.1	5.1	242	10	32	3	43	54



Resource Block	Percentage by weight passing					
	1/16 mm	$\frac{1}{4}$ mm	1 mm	4 mm	16 mm	64 mm
A	4	10	45	54	81	100
B	3	9	38	47	75	99
C	2	6	38	47	76	99
D	4	9	32	41	71	99

Fig. 3. Mean particle size distribution for the mineral in the resource blocks (see also figs. 4 to 7)

Table 3. Block A: data from assessment boreholes

Borehole No.	Recorded thickness		Mean grading percentage					
	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine Sand $-\frac{1}{4}$ + 1/16 mm	Medium Sand -1 + $\frac{1}{4}$ mm	Coarse Sand -4 + 1 mm	Fine Gravel -16 + 4 mm	Coarse Gravel +16 mm
NE 76	3.8	0.4	3	6	44	8	23	16
NE 77	6.3	0.4	4	6	30	9	28	23
NE 78	2.8	1.2	3	4	33	7	25	28
NE 79	5.4	0.4	4	7	29	9	29	22
NE 80	6.1	0.3	3	8	35	11	28	15
NE 81	5.4	0.3	2	5	31	8	31	23
NE 82	6.1	0.3	2	6	38	11	32	11
NE 83	6.0	0.8	6	9	37	8	23	17
NE 84	7.0	0.3	11	5	33	8	25	18
NE 85	5.7	0.8	1	5	26	10	31	27
NE 87	7.1	0.9	1	8	46	8	20	17

Table 4. Block B: data from assessment boreholes

Borehole No.	Recorded thickness		Mean grading percentage					
	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine Sand $-\frac{1}{4}$ +1/16 mm	Medium Sand -1 + $\frac{1}{4}$ mm	Coarse Sand -4 + 1 mm	Fine Gravel -16 + 4 mm	Coarse Gravel +16 mm
NE 88	6.5	1.7	3	4	34	9	31	19
SE 18	7.6	0.4	1	7	34	9	28	21*
SE 19	7.9	–	2	8	33	8	27	22*
SE 22	2.6	2.0	9	8	22	7	26	28
SE 23	6.0	0.2	6	9	33	9	26	17
SE 24	5.5	0.5	6	7	24	7	25	21*
SE 25	3.4	3.2	trace	2	42	11	19	26
SW 10	3.3	1.5	8	4	19	7	31	31
SW 11	3.7	2.3	trace	2	14	7	34	43*
SW 14	5.6	1.5	1	4	26	9	34	26

* Including some cobbles

pose of volume estimation. The symbol is intended to convey an approximate location within a likely zone of occurrence rather than to represent the breadth of the zone, its size being limited only by cartographic considerations. For the purpose of measuring areas the centre-line of the symbol is used.

RESULTS

The statistical results are summarised in Table 2. Fuller grading particulars are shown in Figs. 3 to 7 and Tables 3 to 6. Up to 11 data points have been used in plotting the cumulative grading curves.

Accuracy of results

For the four resource blocks, the accuracy of the results at the symmetrical 95 per cent probability level varies between 14 per cent and 30 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 roughly the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say, 200 acres) 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 (242 million m^3) can be estimated to limits of $\pm$ 10 per cent at the 95 per cent probability level, by a calculation based on the data from all the sample points in the four resource blocks.

However, it must again 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 RESOURCE BLOCKS

River Gravel is by far the major source of potentially workable sand and gravel. The lateral variation within this deposit is not marked but the distribution of overburden is somewhat irregular. For assessment purposes, therefore, the mineral is subdivided on a geographical rather than geological basis. Blocks A, B and C consist of the River Gravel north-west of the River Trent and block D includes this deposit south-east of the river, together with a little Older River Gravel.

The Older River Gravel at Upton is largely built over and, although borehole SW 9 proved 1 m of sand beneath soil and silt, hand augering indicates that elsewhere the deposit is commonly less than 1 m thick. South-east of Southwell, borehole SW 12 shows the Older River Gravel to consist of sandy silt and this is confirmed by natural sections. Consequently these deposits are deemed not to be potentially workable and are not included in a resource block. The Older River Gravel at Newark upon Trent is largely sterilised by urban development and only a small part of it has been assessed.

Block A

This block occupies an area of almost 11 km^2 between North and South Muskham and Kelham, where River Gravel is for the most part at the surface.

Thickness and grading data for the 11 IMAU boreholes are summarised in Table 3 and Figure 4. These data are supplemented by thickness figures from a number of other borehole records, some of which are held in confidence by the Institute. The mean proved thickness of mineral in the block is 5.6 m and its mean grading is fines 4 per cent, sand 50 per cent, gravel 46 per cent. Five of the IMAU boreholes found one mineral deposit consisting of gravel or sandy gravel with a mean fines content of less than 3 per cent, and the remainder proved 'clayey' to 'very clayey' pebbly sand and gravel from 0.7 to 4.2 m thick, overlying gravel or sandy gravel.

Overburden consists mainly of thin sandy soil, but IMAU holes have proved up to 1.2 m of clayey and sandy silt where the mineral is shown beneath overburden on the resource map. The mean overburden thickness for the block is 0.7 m.

Sand and gravel has been removed from an area of about 0.4 km^2 in the south-eastern part of the block and extraction continues. The estimated volume remaining is 58 million m^3 $\pm$ 14 per cent.

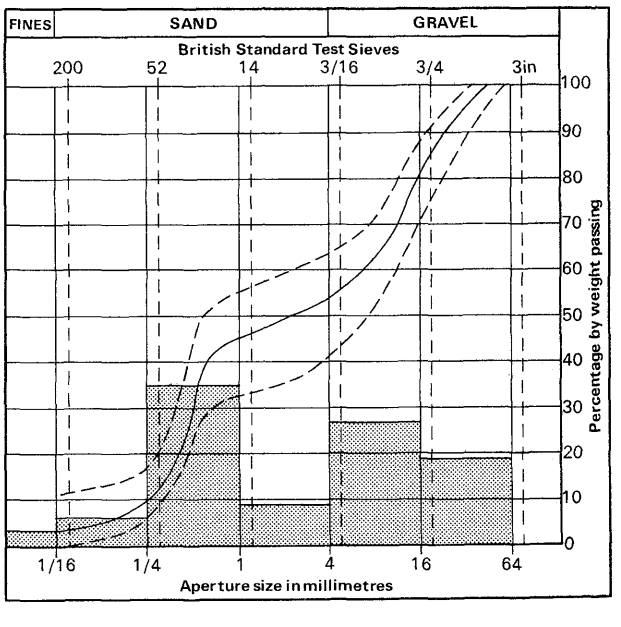


Fig. 4. Grading characteristics of the mineral in block A. The continuous line is the cumulative frequency curve of the mean grading of the block as a whole; the broken lines denote the envelope within which the mean grading curves for individual boreholes fall. The mean grading of the block is also shown as a histogram.

Table 5. Block C: data from assessment boreholes

Borehole No.	Recorded thickness		Mean grading percentage					
	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine Sand $-\frac{1}{4}+1/16$ mm	Medium Sand $-1+\frac{1}{4}$ mm	Coarse Sand -4 +1 mm	Fine Gravel -16 + 4 mm	Coarse Gravel +16 mm
SE 26	5.2	1.2	1	3	36	10	32	18
SE 27	3.6	1.5	7	6	38	7	23	19
SW 13	3.1	3.0	trace	5	34	6	32	23
SW 15	6.8	1.1	2	4	30	8	25	31*
SW 16	6.1	0.7	1	7	42	10	28	12
SW 17	Absent							
SW 18	8.5	0.5	1	5	24	10	26	34*
SW 19	5.3	0.6	1	5	33	9	32	20
SW 20	6.5	0.3	2	8	32	9	24	25*
SW 21	6.1	0.8	2	3	18	8	34	35
SW 22	5.2	1.0	trace	2	35	10	33	20

* Including small percentage of cobbles

Table 6. Block D: data from assessment boreholes

Borehole No.	Recorded thickness		Mean grading percentage					
	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine Sand $-\frac{1}{4}+1/16$ mm	Medium Sand $-1+\frac{1}{4}$ mm	Coarse Sand -4 + 1 mm	Fine Gravel -16 + 4 mm	Coarse Gravel +16 mm
NE 86	5.1	1.8	2	4	26	7	30	31*
NE 89	6.5	0.5	2	5	31	9	29	24
SE 15	6.2	2.0	1	2	18	11	37	31
SE 16	7.8	0.9	3	3	31	8	33	22
SE 17	4.3	1.1	3	3	15	7	29	43*
SE 20	4.5	0.5	4	5	27	10	29	25
SE 21	4.6	0.5	2	1	19	10	35	33
SE 28	4.2	3.7	trace	3	16	12	34	35
SE 29	4.9	0.2	7	8	21	9	26	29
SE 30	5.0	0.3	3	4	26	10	23	34*
SE 31	3.6	0.3	4	6	17	9	33	31
SE 32	4.5	0.4	4	3	14	7	35	37
SE 33	3.1	0.3	9	6	21	9	28	27
SE 34	1.8	0.3	29	31	32	2	5	1
SE 35	3.2	0.5	7	11	22	9	31	20
SE 36	1.2	2.9	10	13	27	18	27	5

* Including some cobbles

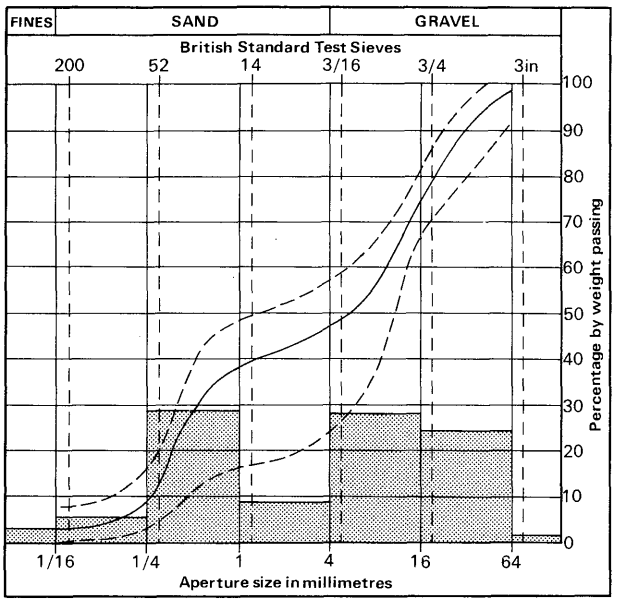


Fig. 5. Grading characteristics of the mineral in block B (for explanation see Fig. 4.)

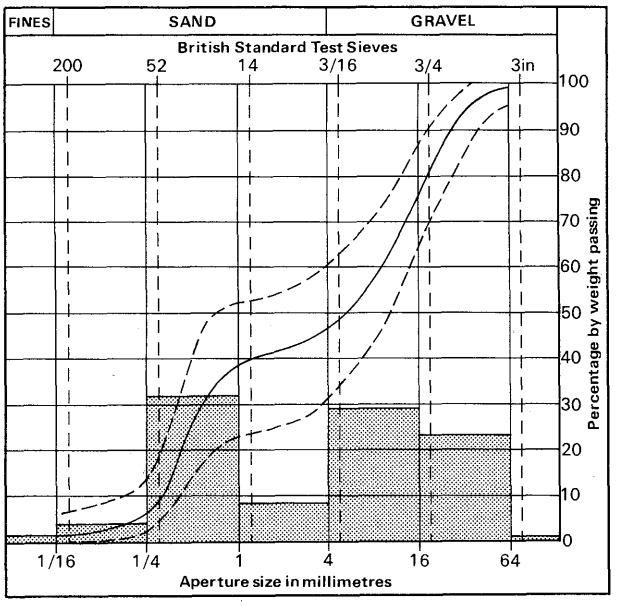


Fig. 6. Grading characteristics of the mineral in block C (for explanation see Fig. 4.)

Block B

The results of 10 IMAU boreholes, summarised in Table 4 and Fig. 5, are supplemented by thickness data from site investigation boreholes drilled at or near Staythorpe Power Station. Thicknesses of mineral proved range from 2.3 to 7.9 m, the thicker parts being found where the mineral is exposed. The mean thickness of the mineral is 5.4 m and its mean grading is fines 3 per cent, sand 44 per cent and gravel 53 per cent. Six IMAU boreholes proved from 0.8 to 1.9 m of 'clayey' or 'very clayey' pebbly sand or sandy gravel resting on 1.6 to 6.0 m of gravel; in a seventh hole 1.2 m of sand overlay 2.2 m of gravel; the remaining holes proved only gravel. Estimated mineral volume is 58 million $m^3 \pm 21$ per cent.

A little less than half the area of mineral is 'exposed', that is, overburden is generally less than 1 m thick. It consists only of thin sandy soil. The remainder lies beneath alluvial clays and silts with a mean thickness of 2.2 m but ranging upwards to at least 4.1 m (site investigation borehole SE 14/6). The mean thickness of overburden for the block as a whole is 1.4 m.

Block C

The whole of this block is shown on the resource map as mineral bearing, although the pebbly sand found in borehole SW 17 is too thin to be potentially workable. Nevertheless, the reading from this borehole has been included in the calculations and the mean thickness of the mineral in the block is therefore 5.2 m. Most boreholes proved only gravel but SW 16 found sandy gravel and SE 27 'very clayey' sand overlying gravel. The mean grading of the block is fines 2 per cent, sand 45 per cent and gravel 53 per cent. The estimate of mineral volume is 58 million $m^3 \pm 30$ per cent.

Where overburden is indicated on the resource map it consists of clay, silt and peat up to at least 3.0 m thick. Elsewhere it is limited to thin sandy soil, except at borehole SW 15 where 1.1 m of soil and silt were found. The mean thickness for the block is 1.3 m.

Data from the assessment boreholes are summarised in Table 5 and Fig. 6.

Block D

The mineral in this block consists mainly of River Gravel together with some Older River Gravel. In borehole SE 35 the latter is 3.2 m thick, although site investigation boreholes to the north, in the unassessed urban area, found thicknesses of 5.6 to 7.2 m; at the IMAU borehole the mineral has a mean grading of 7 per cent fines, 42 per cent sand and 51 per cent gravel.

The remaining IMAU boreholes proved River Gravel with a mean thickness of 4.5 m and a mean

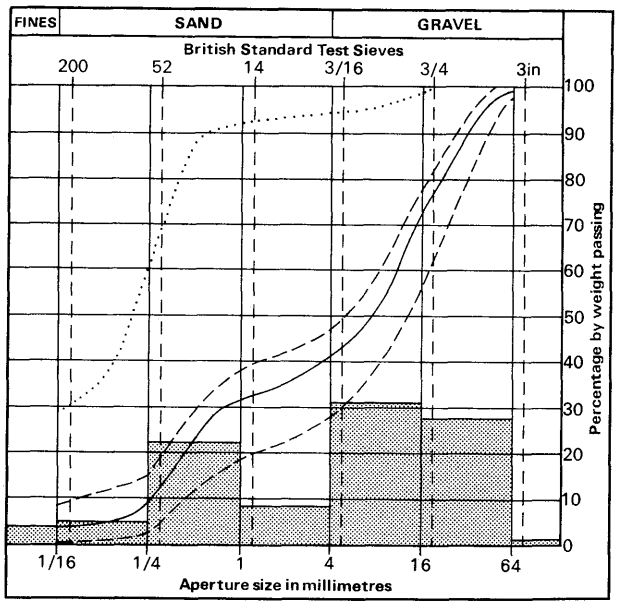


Fig. 7. Grading characteristics of the mineral in block D. For explanation see Fig. 4, but note that the grading envelope excludes borehole SE 34, the mean grading of which is shown by the dotted line

grading of 4 per cent fines, 36 per cent sand and 60 per cent gravel. Borehole SE 34 proved only clayey sand and borehole SE 36 found 'clayey' sandy gravel with about 30 per cent of calcareous material and 11 per cent ironstone in the gravel fraction. The remaining holes proved gravel overlain in places by up to 1 m of 'clayey' or 'very clayey' sands and gravels.

Where mineral is shown on the resource map as 'exposed' there is only a thin cover of sandy soil. Elsewhere it is overlain by alluvial clays and silts up to at least 3.7 m thick, with a mean proved thickness of 1.5 m. For the block as a whole the mean thickness of overburden is 1.0 m.

Sand and gravel has been worked in the north of the block and on a smaller scale north of Farndon. The estimate of volume remaining is 67 million m^3 $\pm$ 20 per cent. The data from IMAU boreholes are summarised in Table 6 and Fig. 7.

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 laboratories of the Institute's Geochemical Division.

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

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

4. The above relationship may be transposed such that

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

From this it can be seen that as $S_A^2 / S_{\bar{l}_m}^2$ tends to 0, S_V tends to $S_{\bar{l}_m}$.
If, therefore, the standard deviation for area is small with respect to that for mean thickness, the standard deviation for volume approximates to that for mean thickness.

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

$$\frac{\sum (l_{m_1} + l_{m_2} \ldots l_{m_n})}{n}$$

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

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

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

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

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

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

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

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

9. In calculating confidence limits for volume, L_V, the following inequality corresponding to equation [3] is applied: $L_{\bar{l}_m} \leqslant L_V \leqslant 1.05\, L_{\bar{l}_m}$

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

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

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

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

per cent.

11. The application of this procedure to a fictitious area is illustrated in Figs. 8 and 9.

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 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 Fig. 10). The procedure is as follows:

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

For example, a deposit grading 11 per cent gravel, 70 per cent sand and 19 per cent fines is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Note 10, p. 19).

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 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 7), , 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 (−¼ +1/16 mm), medium (−1 +¼ mm) and coarse (−4 +1 mm). The boundary at 16 mm distinguishes a range of finer gravel (−16 +4 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 1/16 mm, ¼ 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 types, 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 7. Classification of gravel, sand and fines

Size limits	Grain size description	Qualification	Primary classification
64 mm	Cobble		Gravel
16 mm	Pebble	Coarse	
		Fine	
4 mm	Sand	Coarse	Sand
1 mm		Medium	
¼ mm		Fine	
1/16 mm	Fines (silt and clay)		Fines

Block Calculation — 1:25 000 Block — Fictitious

Area

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

Volume

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

Mean Thickness

Overburden:	2.5 m
Mineral:	6.5 m

Confidence limits of the estimate of mineral volume at the 95 per cent probability level: ± 20 per cent
That is, the volume of mineral (with 95 per cent probability) 54 ± 11 million m^3

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

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	IMAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	Hydrogeological Dept 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	Σw = 8	Σwl_o = 20.2		Σwl_m = 52.0		
Means		$\bar{l}_o$ = 2.5		$\bar{l}_m$ = 6.5		

Calculation of confidence limits

l_m	$(l_m - \bar{l}_m)$	$(l_m - \bar{l}_m)^2$
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

$\Sigma(l_m - \bar{l}_m)^2 = 15.82$

$n = 8$

$t = 2.365$

L_V is calculated as

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

$$= 1.05 \times \frac{2.365}{6.5} \sqrt{\frac{15.82}{8 \times 7}} \times 100$$

$$= 20.3$$

$\simeq$ 20 per cent

Fig. 8. Example of resource block assessment: calculations and results

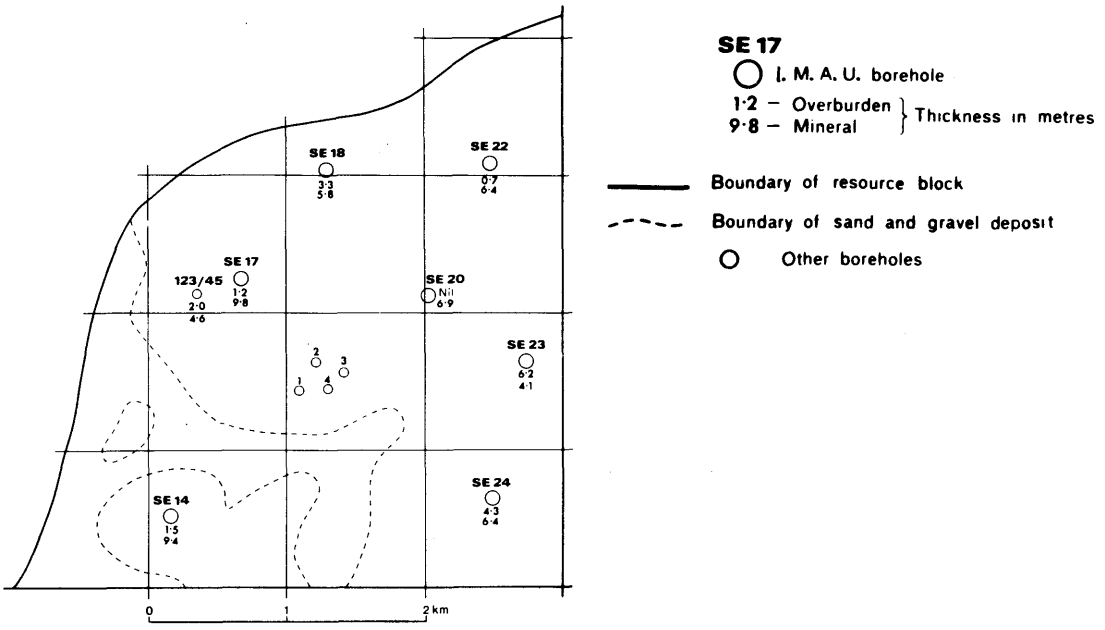
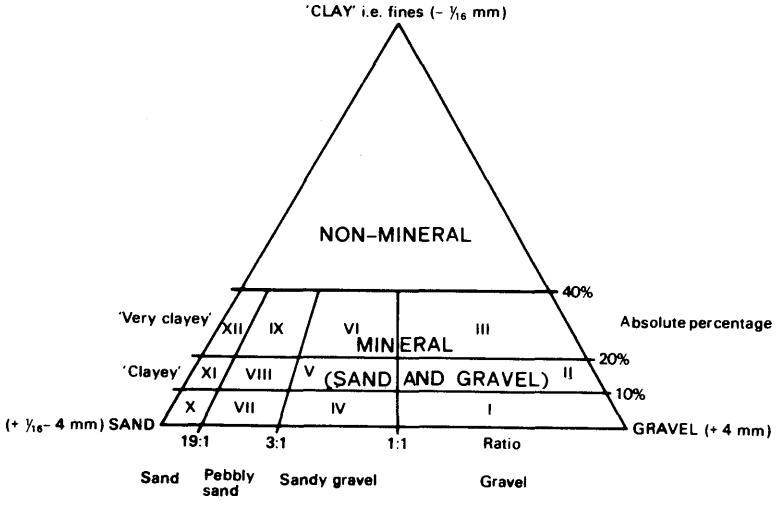


Fig. 9. Example of resource block assessment: map of fictitious block



I	Gravel	IV	Sandy gravel	VII	Pebbly sand	X	Sand
II	'Clayey' gravel	V	'Clayey' sandy gravel	VIII	'Clayey' pebbly sand	XI	'Clayey' sand
III	'Very clayey' gravel	VI	'Very clayey' sandy gravel	IX	'Very clayey' pebbly sand	XII	'Very clayey' sand

Fig. 10. Diagram to show the descriptive categories used in the classification of sand and gravel.

APPENDIX D: EXPLANATION OF THE BOREHOLE RECORDS

ANNOTATED EXAMPLE

SK 75 SE 25 [1] 7607 5314 [2] South-east of Staythorpe [3] Block B

Surface level +10.7 m [4]
Water level +10.7 m [5]
Shell and auger, 200 mm [6]
April 1972

Overburden [7] 3.2 m
Mineral 3.4 m
Bedrock 1.4 m+ [8]

LOG

Geological Classification		Lithology	Thickness m	Depth m
Alluvium [9]		Clay, peaty below 1.8 m	3.2	3.2
River Gravel	A.	Sand [10]: medium quartz and lithic grains; few pebbles	1.2	4.4
	B.	Gravel Gravel: coarse, subrounded to well rounded quartz, quartzite and sandstone, and angular to subrounded chert Sand: medium, quartz and lithic grains	2.2	6.6
Keuper Marl		Mudstone, red	1.4+	8.0

GRADING

		Mean for Deposit [14] %	mm	%	Bulk Samples [11] Depth below surface (m)	Percentage [12] Fines	Sand	Gravel
A.	Gravel	1	+16	0	3.2 - 4.2	1	98	1
			-16 + 4	1	4.2 - 4.4	1	98	1
	Sand	98	-4 + 1	21				
			-1 + ¼	76				
			-¼ + 1/16	1				
	Fines	1	-1/16	1				
B.	Gravel	69	+16	40	4.4 - 5.4	trace	35	65
			-16 + 4	29	5.4 - 6.4	trace	27	73
					6.4 - 6.6	[trace	31	69] [13]
	Sand	31	-4 + 1	6				
			-1 + ¼	22				
			-¼ + 1/16	3				
	Fines	trace	-1/16	trace				

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

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

1) The number of the 1:25 000 sheet on which the borehole lies, for example SK 75.
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 SE 25.

Thus the full Registration Number is SK 75 SE 25. Usually this is abbreviated to SE 25 in the text.

2. The National Grid Reference.
All National Grid references in this publication lie within the 100 km square SK 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 above Ordnance Datum.

5. Groundwater conditions.
Four 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 encountered but its level not recorded; or that water was not encountered; or that no note of groundwater conditions was made.

6. Type of drill and date of drilling.
The type of machine, the diameter of the casing used, and the month and year of completion of the borehole 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. Geological Classification.
The geological classification is given wherever possible.

10. Lithological Description.
When sand and gravel is recorded a general description based on the mean grading characteristics (for details see Appendix C) is followed by more detailed particulars of the gravel and/or sand fractions. The description of other rocks is based on visual examination, in the field.

11. Sampling.
A continuous series of bulk samples is taken throughout the thickness of sand and gravel. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel or at every 3 ft or 1 m of depth.

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

13. If, exceptionally, grading results are not available, an attempt is made to give grading information by comparing the grading and field descriptions of adjacent samples with the samples in question. Such estimates are shown in brackets.

14. 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 4. Unless otherwise stated all the material passes the 64 mm sieve.

Fully representative sampling of sand and gravel is difficult to achieve particularly where groundwater levels are high. Comparison between boreholes and adjacent exposures suggests that in borehole samples the proportion of sand may be higher and the proportions of fines and coarse gravel (+16 mm) may be lower.

APPENDIX E: LIST OF BOREHOLES USED IN THE ASSESSMENT OF RESOURCES

1. Industrial Minerals Assessment Unit Boreholes

Borehole No. by sheet quadrant	Grid Reference	Page No.	Borehole No. by sheet quadrant	Grid Reference	Page No.
SK 75 NE			SK 75 SW		
76	7807 5972	21	20	7229 5030	44
77	7917 5962	22	21	7467 5098	45
78	7751 5855	23	22	7401 5048	46
79	7830 5850	24			
80	7950 5871	25	SK 75 SE		
81	7904 5790	26	15	7952 5458	47
82	7806 5765	27	16	7853 5463	48
83	7751 5720	28	17	7768 5476	49
84	7803 5663	29	18	7619 5468	50
85	7985 5681	30	19	7538 5473	51
86	7778 5587	31	20	7871 5361	52
87	7695 5593	32	21	7781 5394	53
88	7612 5547	33	22	7690 5383	54
89	7890 5518	34	23	7520 5325	55
			24	7564 5354	56
SK 75 SW			25	7607 5314	57
9	7289 5423	35	26	7552 5176	58
10	7442 5413	36	27	7541 5052	59
11	7300 5353	37	28	7738 5310	60
12	7143 5355	37	29	7820 5254	61
13	7334 5264	38	30	7646 5169	62
14	7451 5265	39	31	7732 5172	63
15	7454 5164	40	32	7653 5086	64
16	7325 5180	41	33	7744 5083	65
17	7223 5156	41	34	7837 5083	66
18	7382 5126	42	35	7874 5190	67
19	7254 5099	43	36	7915 5072	68

2. Other boreholes.

SK 75 NE 71D
SK 75 SE 14/4B, 5, 5B, 7, 11, 12, 13, 15, A and D, and several other boreholes, the records of which are held on a 'commercial-in-confidence' basis.

APPENDIX F: INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLE RECORDS

SK 75 NE 76 7807 5972 North-east of Bathley Block A

Surface level +13.1 m
Water level +10.1 m
Shell and auger, 200 mm
April 1972

Overburden 0.4 m
Mineral 3.8 m
Bedrock 1.8 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil, sandy and gravelly	0.4	0.4
River Gravel	A. 'Clayey' pebbly sand Sand: medium, well rounded to sub-rounded quartz and rock fragments Gravel: fine, rounded quartz, chert and sandstone with some igneous rock and angular green sandstone	1.0	1.4
	B. Sandy gravel Sand and gravel: as above	2.8	4.2
Keuper Marl	Mudstone and clay, red and green	1.8+	6.0

GRADING

Mean for Deposit

	%	mm	%
A and B			
Gravel	39	+16	16
		-16 + 4	23
Sand	58	-4 + 1	8
		-1 + $\frac{1}{4}$	44
		-$\frac{1}{4}$ + 1/16	6
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	11	75	13
1.4 - 2.4	1	50	49
2.4 - 3.4	trace	51	49
3.4 - 4.2	1	56	43

SK 75 NE 77 7917 5962 North Muskam Block A

Surface level +10.7 m
Water level not recorded
Shell and auger, 150 mm
September 1972

Overburden 0.4 m
Mineral 6.3 m
Bedrock 1.3 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravel	A. 'Clayey' pebbly sand Sand: medium, rounded to subangular quartz with rock fragments Gravel: fine, subrounded to well rounded quartz and quartzite with some angular subrounded chert	1.0	1.4
	B. Gravel, sandy at top Gravel: fine to coarse, as above Sand: as above	5.3	6.7
Keuper Marl	Mudstone, red	1.3+	8.0

GRADING

Mean for Deposit

	%	mm	%
A and B.			
Gravel	51	+16	23
		-16 + 4	28
Sand	45	-4 + 1	9
		-1 + $\frac{1}{4}$	30
		-$\frac{1}{4}$ + 1/16	6
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
A.			
0.4 - 1.4	15	71	14
B.			
1.4 - 2.4	5	52	43
2.4 - 3.4	1	48	51
3.4 - 4.4	1	37	62
4.4 - 5.4	4	35	61
5.4 - 6.4	trace	30	70
6.4 - 6.7	1	39	60

SK 75 NE 78 7751 5855 South of Bathley Block A

Surface level +11.9 m
Water level not recorded
Shell and auger, 200 mm
May 1972

Overburden 1.2 m
Mineral 2.8 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Silt, clayey and sandy; peaty at 1 m	1.2	1.2
River Gravel	Gravel, sandy at top; some dark silt at 0.5 m Gravel: fine to coarse, sandstone, quartz and chert with igneous rock and siltstone Sand: medium, well rounded to subrounded quartz and rock fragments	2.8	4.0
Keuper Marl	Mudstone and clay, red	1.0+	5.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	53	+16	28
		-16 + 4	25
Sand	44	-4 + 1	7
		-1 + $\frac{1}{4}$	33
		-$\frac{1}{4}$ + 1/16	4
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.2 - 2.2	5	59	36
2.2 - 3.2	3	38	59
3.2 - 4.0	1	33	66

SK 75 NE 79 7830 5850 Oak Farm Block A

Surface level +11.9 m
Water level not recorded
Shell and auger, 150 mm
September 1972

Overburden 0.4 m
Mineral 5.4 m
Bedrock 1.2 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravel	Gravel, 'clayey' and sandy in top 0.7 m Gravel: mainly fine, subrounded to well rounded, quartz and quartzite with some sandstone and angular to subrounded chert Sand: medium, quartz with lithic grains	5.4	5.8
Keuper Marl	Mudstone, red	1.2+	7.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	51	+16	22
		-16 + 4	29
Sand	45	-4 + 1	9
		-1 + $\frac{1}{4}$	29
		-$\frac{1}{4}$ + 1/16	7
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.1	20	50	30
1.1 - 2.1	6	69	25
2.1 - 3.1	trace	39	61
3.1 - 4.1	trace	44	56
4.1 - 5.1	trace	33	67
5.1 - 5.8	trace	38	62

SK 75 NE 80 7950 5871 North Muskham Block A

Surface level +10.1 m
Water level +8.1 m
Shell and auger, 200 mm
May 1972

Overburden 0.3 m
Mineral 6.1 m
Bedrock 1.6 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	A. Very 'clayey' pebbly sand Sand: medium, quartz with lithic grains Gravel: fine, rounded quartz and quartzite with angular to subrounded chert	0.7	1.0
	B. Sandy gravel and gravel Gravel and Sand: as above	5.4	6.4
Keuper Marl	Mudstone, grey	1.6+	8.0

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	14	+16	trace
		-16 + 4	14
Sand	63	-4 + 1	8
		-1 + ¼	40
		-¼ + 1/16	15
Fines	23	-1/16	23
B.			
Gravel	47	+16	17
		-16 + 4	30
Sand	53	-4 + 1	11
		-1 + ¼	34
		-¼ + 1/16	8
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage fines	Sand	Gravel
0.3 - 1.0	23	63	14
1.0 - 2.0	1	71	28
2.0 - 3.0	1	48	51
3.0 - 4.0	1	76	23
4.0 - 5.0	trace	46	54
5.0 - 6.0	trace	28	72
6.0 - 6.4	trace	41	59

SK 75 NE 81 7904 5790 North of South Muskham Block A

Surface level +11.0 m
Water level not recorded
Shell and auger, 200 mm
May 1972

Overburden 0.3 m
Mineral 5.4 m
Bedrock 1.3 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.5
River Gravel	Gravel, sandy at base Gravel: mainly fine, rounded quartzite, quartz and chert with some siltstone and igneous rock Sand: medium, quartz and lithic grains	5.4	5.7
Keuper Marl	Mudstone, red and green	1.3+	7.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	54	+16	23
		-16 + 4	31
Sand	44	-4 + 1	8
		-1 + $\frac{1}{4}$	31
		-$\frac{1}{4}$ + 1/16	5
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	4	47	49
1.3 - 2.3	3	45	52
2.3 - 3.3	trace	41	59
3.3 - 4.3	1	36	63
4.3 - 5.3	trace	37	63
5.3 - 5.7	1	81	18

SK 75 NE 82 7806 5765 North of Little Carlton Block A

Surface level +12.2 m
Water level not recorded
Shell and auger, 200 mm
April 1972

Overburden 0.3 m
Mineral 6.1 m
Bedrock 1.1 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	Gravel, sandy in lower part Gravel: fine, well rounded quartz, quartzite and chert with sandstone and some igneous rock Sand: medium, quartz with lithic grains	6.1	6.4
Keuper Marl	Mudstone, red, hard	1.1+	7.5

GRADING

Mean for Deposit			
	%	mm	%
Gravel	43	+16	11
		-16 + 4	32
Sand	55	-4 + 1	11
		-1 + $\frac{1}{4}$	38
		-$\frac{1}{4}$ + 1/16	6
Fines	2	-1/16	2

Bulk Samples			
Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	3	44	53
1.3 - 2.3	1	44	55
2.3 - 3.3	1	43	56
3.3 - 4.3	6	58	36
4.3 - 5.3	trace	79	21
5.3 - 6.4	1	59	40

SK 75 NE 83 7751 5720 Little Carlton Block A

Surface level +12.2 m
Water level +10.7 m
Shell and auger, 200 mm
April 1972

Overburden 0.8 m
Mineral 6.0 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
River Gravel	A. Sandy clay with pockets of sand and some chert and sandstone pebbles	1.0	1.8
	B. 'Clayey' sandy gravel Gravel: fine, well rounded quartz, sandstone and chert with some igneous rock and siltstone Sand: medium, quartz and lithic grains	1.0	2.8
	C. Gravel Gravel: fine to coarse, rounded quartz, quartzite and chert with sandstone and some igneous rock and siltstone Sand: as above	4.0	6.8
Keuper Marl	Mudstone and clay, red and green	1.0+	7.8

GRADING

Mean for Deposit

	%	mm	%
A and B.			
Gravel	18	+16	6
		-16 + 4	12
Sand	64	-4 + 1	4
		-1 + $\frac{1}{4}$	38
		-$\frac{1}{4}$ + 1/16	22
Fines	18	-1/16	18
C.			
Gravel	50	+16	23
		-16 + 4	28
Sand	50	-4 + 1	10
		-1 + $\frac{1}{4}$	37
		-$\frac{1}{4}$ + 1/16	3
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
A. 0.8 - 1.8	24	65	11
B. 1.8 - 2.8	11	64	25
C. 2.8 - 3.8	trace	61	39
3.8 - 4.8	trace	51	49
4.8 - 5.8	trace	41	59
5.8 - 6.8	trace	45	55

SK 75 NE 84 7803 5663 South-west of South Muskham Block A

Surface level +13.4 m
Water level +10.4 m
Shell and auger, 150 mm
September 1972

Overburden 0.3 m
Mineral 7.0 m
Bedrock 1.7 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	A. 'Clayey' to very 'clayey' sandy gravel Gravel: mainly fine, subrounded to well rounded quartz and quartzite with angular chert Sand: medium, quartz with lithic grains	4.2	4.5
	B. Gravel Gravel: mainly coarse, rounded quartz and quartzite with sandstone and angular to subrounded chert Sand: as above	2.8	7.3
Keuper Marl	Mudstone, red and grey	1.7+	9.0

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	35	+16	12
		-16 + 4	23
Sand	47	-4 + 1	7
		-1 + ¼	32
		-¼ + 1/16	8
Fines	18	-1/16	18
B.			
Gravel	56	+16	28
		-16 + 4	28
Sand	43	-4 + 1	8
		-1 + ¼	33
		-¼ + 1/16	2
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 0.8	11	55	34
0.8 - 1.8	22	46	32
1.8 - 2.8	26	59	15
2.8 - 3.3	1	64	35
3.3 - 3.5	25	36	39
3.5 - 4.5	19	24	57
4.5 - 5.5	1	35	64
5.5 - 6.5	1	53	46
6.5 - 7.3	trace	42	58

SK 75 NE 85 7985 5681 Slake Lane Block A

Surface level +9.5 m
Water level +6.0 m
Shell and auger, 200 mm
April 1972

Overburden 0.8 m
Mineral 5.7 m
Bedrock 1.1 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Silt, brown	0.8	0.8
River Gravel	Gravel Gravel: fine to coarse, well rounded sandstone and quartz with chert and some siltstone and igneous rock Sand: mainly medium, quartz and lithic grains	5.7	6.5
Keuper Marl	Mudstone and clay, red	1.1+	7.6

GRADING

Mean for Deposit

	%	mm	%
Gravel	58	+16	27
		-16 + 4	31
Sand	41	-4 + 1	10
		-1 + $\frac{1}{4}$	26
		-$\frac{1}{4}$ + 1/16	5
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.8 - 1.8	1	22	77
1.8 - 2.8	trace	32	68
2.8 - 3.8	1	55	44
3.8 - 4.8	trace	47	53
4.8 - 5.8	trace	49	51
5.8 - 6.5	2	45	53

SK 75 NE 86 | 7778 5587 | East of Kelham | Block D

Surface level +9.8 m
Water level +6.8 m
Shell and auger, 200 mm
April 1972

Overburden 1.8 m
Mineral 5.1 m
Bedrock 0.9 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Silt, sandy, brown	1.8	1.8
River Gravel	Gravel Gravel: fine to coarse, rounded sandstone, quartzite, quartz and chert with some siltstone and igneous rock Sand: medium, quartz with lithic grains	5.1	6.9
Keuper Marl	Mudstone and clay, red and green, with gypsum	0.9+	7.8

GRADING

Mean for Deposit

	%	mm	%
Gravel	61	+64	2
		-64 + 16	29
		-16 + 4	30
Sand	37	-4 + 1	7
		-1 + $\frac{1}{4}$	26
		-$\frac{1}{4}$ + 1/16	4
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.8 - 2.8	1	35	64
2.8 - 3.8	1	38	61
3.8 - 4.8	trace	33	67
4.8 - 5.8	trace	38	62*
5.8 - 6.9	5	42	53

* includes 11% cobble gravel

SK 75 NE 87 7695 5593 Kelham Block A

Surface level +12.2 m
Water level +11.7 m
Shell and auger, 200 mm
April 1972

Overburden 0.9 m
Mineral 7.1 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on reddish brown clay	0.9	0.9
River Gravel	Sandy gravel with much sand at base Gravel: fine to coarse, sandstone, quartz and quartzite with some chert, igneous rock and, below 2.9 m, coal Sand: medium, quartz and lithic grains including, below 2.9 m, coal	7.1	8.0
Keuper Marl	Mudstone and clay, red and green	1.0+	9.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	37	+16	17
		-16 + 4	20
Sand	62	-4 + 1	8
		-1 + $\frac{1}{4}$	46
		-$\frac{1}{4}$ + 1/16	8
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.9 - 1.9	5	60	35
1.9 - 2.9	trace	69	31
2.9 - 3.9	trace	53	47
3.9 - 4.9	trace	67	33
4.9 - 5.9	trace	48	52
5.9 - 6.9	trace	54	46
6.9 - 8.0	3	81	16

SK 75 NE 88 7612 5547 North of Averham Block B

Surface level +13.1 m
Water level +11.3 m
Shell and auger, 200 mm
April 1972

Overburden 1.7 m
Mineral 6.5 m
Bedrock 1.3 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on slightly gravelly sandy silt	1.7	1.7
River Gravel	Gravel,'clayey' and sandy in top 1.2 m Gravel: fine, subrounded to well rounded quartz and quartzite with chert Sand: medium, quartz with lithic grains	6.5	8.2
Keuper Marl	Mudstone, red	1.3+	9.5

GRADING

Mean for Deposit

	%	mm	%
Gravel	50	+16	19
		-16 + 4	31
Sand	47	-4 + 1	9
		-1 + $\frac{1}{4}$	34
		-$\frac{1}{4}$ + 1/16	4
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.7 - 2.7	16	52	32
2.7 - 2.9	16	48	36
2.9 - 3.9	trace	35	65
3.9 - 4.9	trace	54	46
4.9 - 5.9	trace	35	65
5.9 - 6.9	trace	55	45
6.9 - 7.9	trace	50	50
7.9 - 8.2	trace	47	53

SK 75 NE 89 7890 5518 North-west of Newark Block D

Surface level +10.7 m
Water level +7.0 m
Shell and auger, 200 mm
April 1972

Overburden 0.5 m
Mineral 6.5 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
River Gravel	A. 'Clayey' sand: medium, quartz with some lithic grains; few pebbles	0.5	1.0
	B. Gravel Gravel: mainly fine, well rounded sandstone, quartz and chert with some siltstone and igneous rock Sand: medium, quartz with lithic grains	6.0	7.0
Keuper Marl	Mudstone, red, hard	1.0+	8.0

GRADING

Mean for Deposit

	%	mm	%
A and B.			
Gravel	53	+16	24
		-16 + 4	29
Sand	45	-4 + 1	9
		-1 + $\frac{1}{4}$	31
		-$\frac{1}{4}$ + 1/16	5
Fines	2	-1/16	2

Bulk Samples

	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	0.5 - 1.0	15	82	3
B.	1.0 - 2.0	trace	28	72
	2.0 - 3.0	6	55	39
	3.0 - 4.0	3	48	49
	4.0 - 5.0	trace	40	60
	5.0 - 6.0	trace	44	56
	6.0 - 7.0	trace	36	64

SK 75 SW 9 7289 5423 Upton House

Surface level +21.6 m
Water level not recorded
Shell and auger, 200mm
April 1972

Overburden 2.2 m
Mineral 1.0 m
Waste 4.2 m
Bedrock 1.6 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Older River Gravel	Silt, sandy, with few pebbles	2.0	2.2
	Sand: medium, quartz and lithic grains; few pebbles	1.0	3.2
	Silt, pale brown and grey	3.8	7.0
	'Clayey' pebbly sand	0.4	7.4
Keuper Marl	Mudstone, red	1.6+	9.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	99	-4 + 1	5
		-1 + ¼	57
		-¼ + 1/16	37
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.2 - 3.2	trace	99	1

SK 75 SW 10 7442 5413 South-east of Upton Block B

Surface level +14.3 m
Water level +14.3 m
Shell and auger, 200 mm
April 1972

Overburden 1.5 m
Mineral 3.3 m
Bedrock 1.2 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Clay, pale brown	1.5	1.5
River Gravel	A. Very 'clayey' sandy gravel Gravel: fine, subrounded to well rounded quartz and quartzite and angular to sub-rounded chert Sand: medium, quartz and lithic grains Fines: pale grey and brown silt	0.8	2.3
	B. Gravel Gravel: fine to coarse, as above Sand: as above	2.5	4.8
Keuper Marl	Mudstone, red	1.2+	6.0

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	26	+16	5
		-16 + 4	21
Sand	40	-4 + 1	6
		-1 + ¼	24
		-¼ + 1/16	10
Fines	34	-1/16	34
B.			
Gravel	73	+16	39
		-16 + 4	34
Sand	27	-4 + 1	8
		-1 + ¼	17
		-¼ + 1/16	2
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.5 - 2.3	34	40	26
2.3 - 3.3	trace	31	69
3.3 - 4.3	trace	25	75
4.3 - 4.8	trace	21	79

SK 75 SW 11 7300 5353 Upton Mill Block B

Surface level +17.7 m
Water level +15.5 m
Shell and auger, 200 mm
April 1972

Overburden 2.3 m
Mineral 3.7 m
Bedrock 1.5 m

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on clay and silt	2.3	2.3
River Gravel	Gravel Gravel: fine and coarse, subrounded to well rounded quartz and quartzite and angular to subrounded chert Sand: medium, quartz and lithic grains	3.7	6.0
Keuper Marl	Mudstone, red	1.5+	7.5

GRADING

Mean for Deposit

	%	mm	%
Gravel	77	+64	8
		-64 + 16	35
		-16 + 4	34
Sand	23	-4 + 1	7
		-1 + $\frac{1}{4}$	14
		-$\frac{1}{4}$ + 1/16	2
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.3 - 3.3	trace	19	81
3.3 - 4.3	trace	36	64
4.3 - 5.3	trace	15	85*
5.3 - 6.0	trace	20	80

* includes 28% cobbles

SK 75 SW 12 7143 5355 Dale Cottage

Surface level +25.6 m
Ground water not encountered
Shell and auger, 200 mm
April 1972

Waste 1.8 m
Bedrock 1.2 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Older River Gravel	Soil on sandy silt with a little gravel	1.8	1.8
Keuper Marl	Mudstone, red	1.2+	3.0

SK 75 SW 13 7334 5264 Rolleston Race Course Block C

Surface level +15.2 m
Water level not recorded
Shell and auger, 200 mm
May 1972

Overburden 3.0 m
Mineral 3.1 m
Bedrock 1.4 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Clay, pale brown	2.8	2.8
	Peat	0.2	3.0
River Gravel	Gravel, with much sand from 5 to 6 m Gravel: mainly fine, subrounded to well rounded quartz, quartzite and sandstone and angular to subrounded chert Sand: medium, quartz and lithic grains	3.1	6.1
Keuper Marl	Mudstone, red and grey	1.4+	7.5

GRADING

Mean for Deposit

	%	mm	%
Gravel	55	+16	23
		-16 + 4	32
Sand	45	-4 + 1	6
		-1 + $\frac{1}{4}$	34
		-$\frac{1}{4}$ + 1/16	5
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
3.0 - 4.0	trace	16	84
4.0 - 5.0	trace	45	55
5.0 - 6.0	trace	76	24
6.0 - 6.1	trace	39	61

SK 75 SW 14 7451 5265 Rolleston Block B

Surface level +15.5 m
Water level +13.4 m
Shell and auger, 200 mm
April 1972

Overburden 1.5 m
Mineral 5.6 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil and ?fill	1.5	1.5
River Gravel	Gravel Gravel: fine and coarse, well rounded sandstone, quartz and chert with some igneous rock and siltstone Sand: medium, quartz and lithic grains	5.6	7.1
Keuper Marl	Mudstone and clay, red	1.0+	8.1

GRADING

Mean for Deposit

	%	mm	%
Gravel	60	+16	26
		-16 + 4	34
Sand	39	-4 + 1	9
		-1 + ¼	26
		-¼ + 1/16	4
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.5 - 2.5	2	38	60
2.5 - 3.5	trace	47	53
3.5 - 4.5	trace	29	71
4.5 - 5.5	trace	37	63
5.5 - 6.5	trace	45	55
6.5 - 7.1	trace	37	63

SK 75 SW 15 | 7454 5164 | Fiskerton Mill | Block C

Surface level +13.4 m
Water level +10.9 m
Shell and auger, 200 mm
April 1972

Overburden 1.1 m
Mineral 6.8 m
Bedrock 1.1 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
River Gravel	Soil on silt	1.1	1.1
	Gravel, part sandy Gravel: fine and coarse, well rounded sandstone, quartz, quartzite and chert with some igneous rock, limestone and a little siltstone Sand: medium, quartz and lithic grains	6.8	7.9
Keuper Marl	Mudstone and clay, red and green	1.1+	9.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	56	+64	4
		-64 + 16	27
		-16 + 4	25
Sand	42	-4 + 1	8
		-1 + ¼	30
		-¼ + 1/16	4
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage fines	Sand	Gravel
1.1 - 2.1	9	51	40
2.1 - 3.1	trace	28	72
3.1 - 4.1	trace	51	49
4.1 - 5.1	trace	45	55
5.1 - 6.1	trace	36	64*
6.1 - 7.1	trace	45	55
7.1 - 7.9	1	43	56**

* Includes 14% cobbles

** Includes 18% cobbles

SK 75 SW 16 7325 5180 Station Road, Fiskerton Block C

Surface level +15.5 m
Water level +14.5 m
Shell and auger, 200 mm
May 1972

Overburden 0.7 m
Mineral 6.1 m
Bedrock 1.2 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
River Gravel	Sandy gravel Gravel: fine, well rounded sandstone, quartzite and quartz with chert and some igneous rock and siltstone Sand: medium, quartz and lithic grains	6.1	6.8
Keuper Marl	Mudstone, red	1.2+	8.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	40	+16	12
		-16 + 4	28
Sand	59	-4 + 1	10
		-1 + $\frac{1}{4}$	42
		-$\frac{1}{4}$ + 1/16	7
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.7 - 1.7	1	45	54
1.7 - 2.7	1	66	33
2.7 - 3.7	1	50	49
3.7 - 4.7	trace	56	44
4.7 - 5.7	trace	65	35
5.7 - 6.8	trace	72	28

SK 75 SW 17 7223 5156 The Poplars Block C

Surface level +18.0 m
Ground water not encountered
Shell and auger, 200 mm
April 1972

Waste 3.8 m
Bedrock 1.2 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
	Peat	2.9	3.4
River Gravel	Pebbly sand	0.4	3.8
Keuper Marl	Mudstone, red	1.2+	5.0

SK 75 SW 18 7382 5126 Fiskerton Manor Block C

Surface level +15.5 m
Water level not recorded
Shell and auger, 150 mm
September 1972

Overburden 0.5 m
Mineral 8.5 m
Bedrock 2.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
River Gravel	Gravel Gravel: fine and coarse with some cobbles near base, subrounded to well rounded quartz, quartzite and sandstone with sub-angular to rounded chert Sand: medium, quartz with lithic grains, including coal below 5 m	8.5	9.0
Keuper Marl	Mudstone, grey and red	2.0+	11.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	60	+64	1
		-64 + 16	33
		-16 + 4	26
Sand	39	-4 + 1	10
		-1 + $\frac{1}{4}$	24
		-$\frac{1}{4}$ + 1/16	5
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.5 - 1.0	9	36	55
1.0 - 2.0	trace	31	69
2.0 - 3.0	trace	48	52
3.0 - 4.0	trace	35	65
4.0 - 5.0	1	46	53
5.0 - 6.0	1	39	60
6.0 - 7.0	1	38	61
7.0 - 8.0	trace	46	54*
8.0 - 9.0	1	28	72

* Includes 6% cobbles

SK 75 SW 19 7254 5099 Morton Block C

Surface level +15.2 m
Water level +14.4 m
Shell and auger, 200 mm
May 1972

Overburden 0.6 m
Mineral 5.3 m
Bedrock 1.1 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
River Gravel	Gravel, part sandy Gravel: fine, well rounded quartz, quartzite and sandstone with chert and some igneous rock and siltstone Sand: medium, quartz with lithic grains	5.3	5.9
Keuper Marl	Mudstone, red and green	1.1+	7.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	52	+16	20
		-16 + 4	32
Sand	47	-4 + 1	9
		-1 + $\frac{1}{4}$	33
		-$\frac{1}{4}$ + 1/16	5
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.6 - 1.6	3	34	63
1.6 - 2.6	1	53	46
2.6 - 3.6	1	51	48
3.6 - 4.6	trace	46	54
4.6 - 5.9	trace	49	51

SK 75 SW 20 7229 5030 Fiskerton Grange Block C

Surface level +15.2 m
Water level not recorded
Shell and auger, 150 mm
September 1972

Overburden 0.3 m
Mineral 6.5 m
Bedrock 1.7 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	Sandy gravel and gravel Gravel: fine and coarse, with cobbles at base, subrounded to well rounded quartz and quartzite and angular to subrounded chert and sandstone Sand: medium, quartz and lithic grains	6.5	6.8
Keuper Marl	Mudstone, red and grey	1.7+	8.5

GRADING

Mean for Deposit

	%	mm	%
Gravel	49	+64	1
		-64 + 16	24
		-16 + 4	24
Sand	49	-4 + 1	9
		-1 + $\frac{1}{4}$	32
		-$\frac{1}{4}$ + 1/16	8
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 0.7	5	67	28
0.7 - 1.3	1	48	51
1.3 - 2.3	5	33	62
2.3 - 3.3	1	76	23
3.3 - 4.3	1	40	59
4.3 - 5.3	trace	60	40
5.3 - 6.3	trace	40	60
6.3 - 6.8	trace	36	64*

* Includes 12% cobbles

SK 75 SW 21 7467 5098 East of Fiskerton Block C

Surface level +13.1 m
Water level +10.6 m
Shell and auger, 200 mm
May 1972

Overburden 0.8 m
Mineral 6.1 m
Bedrock 1.1 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Silt, dark brown, micaceous	0.8	0.8
River Gravel	Gravel Gravel: fine and coarse, rounded sandstone, quartzite and quartz with chert and some igneous rock Sand: medium, quartz with lithic grains	6.1	6.9
Keuper Marl	Mudstone and clay, red and green	1.1+	8.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	69	+16	35
		-16 + 4	34
Sand	29	-4 + 1	8
		-1 + $\frac{1}{4}$	18
		-$\frac{1}{4}$ + 1/16	3
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.8 - 1.8	6	39	55
1.8 - 2.8	1	33	66
2.8 - 3.8	trace	21	79
3.8 - 4.8	1	20	79
4.8 - 5.8	1	22	77
5.8 - 6.9	4	39	57

SK 75 SW 22 7401 5048 South-east of Fiskerton Block C

Surface level +14.0 m
Water level +9.5 m
Shell and auger, 200 mm
May 1972

Overburden 1.0 m
Mineral 5.2 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil and silt	1.0	1.0
River Gravel	Gravel, partly sandy Gravel: mainly medium but coarse near base, well rounded quartz, quartzite, sandstone and chert with some igneous rock and siltstone Sand: medium, quartz and lithic grains	5.2	6.2
Keuper Marl	Mudstone and clay, red	1.0+	7.2

GRADING

Mean for Deposit

	%	mm	%
Gravel	53	+16	20
		-16 + 4	33
Sand	47	-4 + 1	10
		-1 + $\frac{1}{4}$	35
		-$\frac{1}{4}$ + 1/16	2
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.0 - 2.0	trace	38	62
2.0 - 3.0	trace	64	36
3.0 - 4.0	trace	55	45
4.0 - 5.0	trace	37	63
5.0 - 6.2	trace	43	57

SK 75 SE 15 | 7952 5458 | Newark | Block D

Surface level +10.1 m
Water level +8.6 m
Shell and auger, 200 mm
April 1972

Overburden 2.0 m
Mineral 6.2 m
Bedrock 1.3 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on clayey micaceous silt	2.0	2.0
River Gravel	Gravel Gravel: fine to coarse, well rounded sandstone and quartz with chert and some igneous rock, siltstone and coal Sand: mainly medium, quartz with lithic grains	6.2	8.2
Keuper Marl	Mudstone, reddish brown and grey	1.3+	9.5

GRADING

Mean for Deposit

	%	mm	%
Gravel	68	+16	31
		-16 + 4	37
Sand	31	-4 + 1	11
		-1 + $\frac{1}{4}$	18
		-$\frac{1}{4}$ + 1/16	2
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.0 - 3.0	3	41	56
3.0 - 4.0	trace	34	66
4.0 - 5.0	1	25	74
5.0 - 6.0	1	47	52
6.0 - 7.0	trace	22	78
7.0 - 8.2	trace	17	83

SK 75 SE 16 7853 5463 North-west of Newark Block D

Surface level +9.8 m
Water level +7.0 m
Shell and auger, 200 mm
May 1972

Overburden 0.9 m
Mineral 7.8 m
Bedrock 1.3 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on brown silt	0.9	0.9
River Gravel	A. 'Clayey' pebbly sand Sand: medium, quartz with lithic grains Gravel: fine, sandstone and quartz	1.0	1.9
	B. Gravel Gravel: mainly medium, rounded sandstone, quartzite and quartz with chert, siltstone and igneous rock: cobbles of angular green sandstone below 5.9 m Sand: as above	6.8	8.7
Keuper Marl	Mudstone and clay, red and green, with gypsum	1.3+	10.0

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	11	+16	2
		-16 + 4	9
Sand	70	-4 + 1	2
		-1 + $\frac{1}{4}$	56
		-$\frac{1}{4}$ + 1/16	12
Fines	19	-1/16	19
B.			
Gravel	62	+16	25
		-16 + 4	37
Sand	38	-4 + 1	9
		-1 + $\frac{1}{4}$	27
		-$\frac{1}{4}$ + 1/16	2
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.9 - 1.9	19	70	11
1.9 - 2.9	trace	34	66
2.9 - 3.9	trace	37	63
3.9 - 4.9	trace	34	66
4.9 - 5.9	trace	39	61
5.9 - 6.9	trace	40	60
6.9 - 7.9	trace	43	57
7.9 - 8.7	trace	37	63

SK 75 SE 17 7768 5476 South of Kelham Block D

Surface level +10.1 m
Water level +7.4 m
Shell and auger, 200 mm
April 1972

Overburden 1.1 m
Mineral 4.3 m
Bedrock 1.6 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on brown silt	1.1	1.1
River Gravel	Gravel, 'clayey' and sandy in top 0.7 m Gravel: mainly coarse, subrounded to well rounded quartz and quartzite with angular to subrounded chert Sand: medium, quartz with lithic grains	4.3	5.4
Keuper Marl	Mudstone, red	1.6+	7.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	72	+64	8
		-64 + 16	35
		-16 + 4	29
Sand	25	-4 + 1	7
		-1 + $\frac{1}{4}$	15
		-$\frac{1}{4}$ + 1/16	3
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.1 - 1.8	17	53	30
1.8 - 2.8	trace	21	79
2.8 - 3.8	trace	14	86*
3.8 - 4.8	trace	23	77
4.8 - 5.4	trace	20	80

* includes 34% cobbles

SK 75 SE 18 7619 5468 Averham Block B

Surface level +13.4 m
Water level +11.7 m
Shell and auger, 150 mm
September 1972

Overburden 0.4 m
Mineral 7.6 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravel	Sandy gravel and gravel Gravel: fine and coarse, subrounded to well rounded quartz and quartzite with sandstone, angular to subrounded chert and some mudstone Sand: medium, quartz and lithic grains	7.6	8.0
Keuper Marl	Mudstone, red	1.0+	9.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	49	+64	1
		-64 + 16	20
		-16 + 4	28
Sand	50	-4 + 1	9
		-1 + $\frac{1}{4}$	34
		-$\frac{1}{4}$ + 1/16	7
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 0.7	1	49	50
0.7 - 1.7	2	83	15
1.7 - 2.7	3	62	35
2.7 - 3.7	1	52	47
3.7 - 4.7	1	43	56
4.7 - 5.7	trace	43	57
5.7 - 6.7	trace	29	71*
6.7 - 7.7	trace	41	59
7.7 - 8.0	1	42	57

* includes 6% cobbles

SK 75 SE 19 | 7538 5473 | West of Averham | Block B

Surface level +13.7 m
Water level +12.0 m
Shell and auger, 150 mm
September 1972

Mineral 7.9 m
Bedrock 1.6 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
River Gravel	A. Pebbly sand and sandy gravel, partly 'clayey' Gravel: fine rounded quartz and quartzite Sand: medium, quartz with lithic grains	1.9	1.9
	B. Gravel Gravel: mainly coarse, subrounded to well rounded quartz and quartzite with sub-angular to subrounded chert Sand: as above	6.0	7.9
Keuper Marl	Mudstone, red	1.6+	9.5

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	22	+16	2
		-16 + 4	20
Sand	69	-4 + 1	8
		-1 + ¼	44
		-¼ + 1/16	17
Fines	9	-1/16	9
B.			
Gravel	58	+64	1
		-64 + 16	27
		-16 + 4	30
Sand	42	-4 + 1	8
		-1 + ¼	29
		-¼ + 1/16	5
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.0 - 0.6	12	72	16
0.6 - 0.9	3	65	32
0.9 - 1.9	8	69	23
1.9 - 2.9	trace	45	55
2.9 - 3.9	trace	36	64
3.9 - 4.9	trace	52	48*
4.9 - 5.9	1	55	44
5.9 - 6.9	trace	46	54
6.9 - 7.9	trace	20	80

* includes 8% cobbles

SK 75 SE 20 7871 5361 West of Newark Block D

Surface level +11.6 m
Water level not recorded
Shell and auger, 200 mm
April 1972

Overburden 0.5 m
Mineral 4.5 m
Bedrock 1.5 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Sandy loam	0.5	0.5
River Gravel	A. Very 'clayey' pebbly sand Sand and Gravel: as below	0.6	1.1
	B. Gravel Gravel: mainly fine, subrounded to well rounded quartz and quartzite and angular to subrounded chert Sand: medium, quartz and lithic grains	3.9	5.0
Keuper Marl	Mudstone, red	1.5+	6.5

GRADING

Mean for Deposit			
	%	mm	%
A.			
Gravel	5	+16	1
		-16 + 4	4
Sand	64	-4 + 1	4
		-1 + ¼	44
		-¼ + 1/16	16
Fines	31	-1/16	31
B.			
Gravel	61	+16	28
		-16 + 4	33
Sand	39	-4 + 1	10
		-1 + ¼	25
		-¼ + 1/16	4
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.5 - 0.9	33	62	5
0.9 - 1.1	26	68	6
1.1 - 2.1	trace	38	62
2.1 - 3.1	trace	29	71
3.1 - 4.1	trace	43	57
4.1 - 5.0	trace	47	53

SK 75 SE 21 7781 5394 Old Trent Dyke Block D

Surface level +10.4 m
Water level +8.5 m
Shell and auger, 200 mm
April 1972

Overburden 0.5 m
Mineral 4.6 m
Bedrock 1.4 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Sandy loam	0.5	0.5
River Gravel	Gravel, 'clayey' at top Gravel: fine to coarse, subangular to well rounded quartz, quartzite and sandstone with angular to subrounded chert Sand: medium, quartz and lithic grains	4.6	5.1
Keuper Marl	Mudstone, red	1.4+	6.5

GRADING

Mean for Grading

	%	mm	%
Gravel	68	+16	33
		-16 + 4	35
Sand	30	-4 + 1	10
		-1 + $\frac{1}{4}$	19
		-$\frac{1}{4}$ + 1/16	1
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.5 - 1.1	16	31	53
1.1 - 2.1	trace	17	83
2.1 - 3.1	1	24	75
3.1 - 4.1	trace	34	66
4.1 - 5.1	trace	42	58

SK 75 SE 22 7690 5383 Staythorpe Power Station Block B

Surface level +11.3 m
Water level +9.3 m
Shell and auger, 200 mm
April 1972

Overburden 2.0 m
Mineral 2.6 m
Bedrock 0.9 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on brown and grey silt	2.0	2.0
River Gravel	A. 'Very clayey' sandy gravel Gravel: fine, well rounded quartzite and sandstone and subrounded chert Sand: medium, quartz and lithic grains	1.0	3.0
	B. Gravel Gravel: coarse, well rounded quartzite and sandstone with chert and some igneous rock Sand: as above	1.6	4.6
Keuper Marl	Mudstone, red and green, and hard green sandstone	0.9+	5.5

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	29	+16	8
		-16 + 4	21
Sand	48	-4 + 1	2
		-1 + ¼	28
		-¼ + 1/16	18
Fines	23	-1/16	23
B.			
Gravel	70	+16	40
		-16 + 4	30
Sand	30	-4 + 1	10
		-1 + ¼	19
		-¼ + 1/16	1
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.0 - 3.0	23	48	29
3.0 - 4.0	trace	25	75
4.0 - 4.6	trace	39	61

SW 75 SE 23 7520 5325 Staythorpe Crossing Block B

Surface level +13.4 m
Water level not recorded
Shell and auger, 150 mm
September 1972

Overburden 0.2 m
Mineral 6.0 m
Bedrock 1.3 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
River Gravel	A. 'Very clayey' sandy gravel Gravel: fine, subrounded to well rounded quartz and quartzite with some chert and sandstone Sand: fine to medium, quartz with lithic grains Fines: pale brown silt	1.7	1.9
	B. Gravel and sandy gravel Gravel: mainly fine, subrounded to well rounded quartz and quartzite with some chert Sand: medium, quartz and lithic grains	4.3	6.2
Keuper Marl	Mudstone, red	1.3+	7.5

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	20	+16	7
		−16 + 4	13
Sand	58	-4 + 1	4
		-1 + ¼	31
		-¼ + 1/16	23
Fines	22	-1/16	22
B.			
Gravel	52	+16	21
		-16 + 4	31
Sand	48	-4 + 1	11
		-1 + ¼	33
		-¼ + 1/16	4
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 0.9	37	52	11
0.9 - 1.9	11	62	27
1.9 - 2.9	trace	39	61
2.9 - 3.9	trace	53	47
3.9 - 4.9	trace	49	51
4.9 - 5.9	trace	52	48
5.9 - 6.2	trace	52	48

SK 75 SE 24 7564 5354 South-east of Staythorpe Block B

Surface level +11.6 m
Water level not recorded
Shell and auger, 200 mm
April 1972

Overburden 0.5 m
Mineral 5.5 m
Bedrock 1.5 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
River Gravel	A. 'Very clayey' pebbly sand Sand: medium, quartz and lithic grains Fines: brown and grey silt in'nodules' and as matrix	1.0	1.5
	B. Gravel Gravel: fine and coarse, subangular to well rounded quartz, quartzite, sandstone and chert Sand: medium, quartz and lithic grains	4.5	6.0
Keuper Marl	Mudstone, red	1.5+	7.5

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	11	+16	3
		-16 + 4	8
Sand	59	-4 + 1	4
		-1 + ¼	31
		-¼ + 1/16	24
Fines	30	-1/16	30
B.			
Gravel	66	+64	7
		-64 + 16	31
		-16 + 4	28
Sand	34	-4 + 1	8
		-1 + ¼	23
		-¼ + 1/16	3
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.5 - 1.5	30	59	11
1.5 - 2.5	trace	35	65
2.5 - 3.5	trace	35	65
3.5 - 4.5	trace	16	84*
4.5 - 5.5	trace	41	59**
5.5 - 6.0	1	56	43

* includes 12% cobbles
**includes 18% cobbles

SK 75 SE 25 7607 5314 South-east of Staythorpe Block B

Surface level +10.7 m
Water level +10.7 m
Shell and auger, 200 mm
April 1972

Overburden 3.2 m
Mineral 3.4 m
Bedrock 1.4 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Clay, peaty below 1.8 m	3.2	3.2
River Gravel	A. Sand: medium, quartz and lithic grains; few pebbles	1.2	4.4
	B. Gravel Gravel: coarse, subrounded to well rounded quartz, quartzite and sandstone and angular to subrounded chert Sand: medium, quartz and lithic grains	2.2	6.6
Keuper Marl	Mudstone, red	1.4+	8.0

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	1	+16	0
		-16 + 4	1
Sand	98	-4 + 1	21
		-1 + ¼	76
		-¼ + 1/16	1
Fines	1	-1/16	1
B.			
Gravel	69	+16	40
		-16 + 4	29
Sand	31	-4 + 1	6
		-1 + ¼	22
		-¼ + 1/16	3
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
3.2 - 4.2	1	98	1
4.2 - 4.4	1	98	1
4.4 - 5.4	trace	35	65
5.4 - 6.4	trace	27	73
6.4 - 6.6	trace	31	69

SK 75 SE 26 7552 5176 South of Rolleston Field Block C

Surface level +12.2 m
Water level +9.7 m
Shell and auger, 200 mm
April 1972

Overburden 1.2 m
Mineral 5.2 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on silt	1.2	1.2
River Gravel	Gravel, mainly sandy Gravel: fine, well rounded sandstone, quartzite and quartz with chert and some igneous rock and siltstone Sand: medium, quartz with lithic grains	5.2	6.4
Keuper Marl	Mudstone, red, and green sandstone	1.0+	7.4

GRADING

Mean for Deposit

	%	mm	%
Gravel	50	+16	18
		-16 + 4	32
Sand	49	-4 + 1	10
		-1 + $\frac{1}{4}$	36
		-$\frac{1}{4}$ + 1/16	3
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.2 - 2.2	4	39	57
2.2 - 3.2	2	52	46
3.2 - 4.2	trace	63	37
4.2 - 5.2	trace	70	30
5.2 - 6.4	trace	27	73

SK 75 SE 27 7541 5052 Gawburn Holt **Block C**

Surface level +12.2 m
Water level +9.9 m
Shell and auger, 200 mm
May 1972

Overburden 1.5 m
Mineral 3.6 m
Bedrock 1.0 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Silt, brown	1.5	1.5
River Gravel	A. Very 'clayey' sand: medium quartz with lithic grains; brown silt	1.0	2.5
	B. Gravel, sandy near base Gravel: mainly fine, well rounded quartzite, sandstone and quartz with chert and some igneous rock and siltstone Sand: medium, quartz and lithic grains	2.6	5.1
Keuper Marl	Mudstone and clay, red	1.0+	6.1

GRADING

Mean for Deposit				Bulk Samples			
	%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.							
Gravel	trace	+16	0	1.5 - 2.5	25	75	trace
		-16 + 4	trace				
Sand	75	-4 + 1	1				
		-1 + $\frac{1}{4}$	58				
		-$\frac{1}{4}$ + 1/16	17				
Fines	25	-1/16	25				
B.							
Gravel	59	+16	27	2.5 - 3.5	trace	30	70
		-16 + 4	32	3.5 - 4.5	1	41	58
				4.5 - 5.1	trace	58	42
Sand	41	-4 + 1	9				
		-1 + $\frac{1}{4}$	30				
		-$\frac{1}{4}$ + 1/16	2				
Fines	trace	-1/16	trace				

SK 75 SE 28 7738 5310 North-west of Farndon Field Block D

Surface level +11.3 m
Water level +11.3 m
Shell and auger, 150 mm
September 1972

Overburden 3.7 m
Mineral 4.2 m
Bedrock 1.6 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Soil on grey and brown clay	3.7	3.7
River Gravel	Gravel Gravel: mainly fine, subrounded to well rounded quartz and quartzite with some sandstone and angular to subrounded chert Sand: medium, quartz and lithic grains	4.2	7.9
Keuper Marl	Mudstone, red	1.6+	9.5

GRADING

Mean for Deposit

	%	mm	%
Gravel	69	+16	35
		-16 + 4	34
Sand	31	-4 + 1	12
		-1 + ¼	16
		-¼ + 1/16	3
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
3.7 - 4.7	trace	21	79
4.7 - 5.7	1	34	65
5.7 - 6.7	trace	36	64
6.7 - 7.9	trace	31	69

SK 75 SE 29 7820 5254 Farndon Field Block D

Surface level +11.6 m
Water level not recorded
Shell and auger, 150 mm
September 1972

Overburden 0.2 m
Mineral 4.9 m
Bedrock 1.4 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
River Gravel	A. Very 'clayey' pebbly sand Sand: medium, quartz and lithic grains Gravel: fine, well rounded quartz and quartzite Fines: pale brown silt	0.9	1.1
	B. Gravel, sandy at top Gravel: mainly coarse, well rounded quartz, quartzite and chert Sand: medium, quartz and lithic grains	4.0	5.1
Keuper Marl	Mudstone, red and grey	1.4+	6.5

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	15	+16	7
		-16 + 4	8
Sand	59	-4 + 1	4
		-1 + $\frac{1}{4}$	36
		-$\frac{1}{4}$ + 1/16	19
Fines	26	-1/16	26
B.			
Gravel	64	+16	34
		-16 + 4	30
Sand	33	-4 + 1	10
		-1 + $\frac{1}{4}$	18
		-$\frac{1}{4}$ + 1/16	5
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 1.1	26	59	15
1.1 - 2.1	8	47	45
2.1 - 3.1	1	27	72
3.1 - 4.1	trace	25	75
4.1 - 5.1	trace	31	69

SK 75 SE 30 | 7646 5169 | West of Farndon | Block D

Surface level +12.2 m
Water level +10.2 m
Shell and auger, 200 mm
April 1972

Overburden 0.3 m
Mineral 5.0 m
Bedrock 1.2 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	A. 'Very clayey' sand: medium, quartz with lithic grains; some pebbles in lower part	0.7	1.0
	B. Gravel, sandy at top Gravel: fine to coarse with cobbles at base, subrounded to well rounded quartz and quartzite and angular to subrounded chert Sand: medium, quartz with lithic grains	4.3	5.3
Keuper Marl	Mudstone, red	1.2+	6.5

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	2	+16	0
		-16 + 4	2
Sand	75	-4 + 1	12
		-1 + ¼	52
		-¼ + 1/16	11
Fines	23	-1/16	23
B.			
Gravel	66	+64	3
		-64 + 16	36
		-16 + 4	27
Sand	34	-4 + 1	10
		-1 + ¼	22
		-¼ + 1/16	2
Fines	trace	-1/16	trace

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 0.7	40	60	trace
0.7 - 1.0	1	94	5
1.0 - 2.0	1	57	42
2.0 - 3.0	trace	16	84
3.0 - 4.0	trace	30	70
4.0 - 5.0	trace	34	66
5.0 - 5.3	trace	31	69*

* Includes 40% cobbles

SK 75 SE 31 7732 5172 Farndon Block D

Surface level +12.8 m
Water level not recorded
Shell and auger, 150 mm
September 1972

Overburden 0.3 m
Mineral 3.6 m
Bedrock 2.1 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	Gravel, with lenses of silt from 2.3 to 3.3 m Gravel: mainly fine but coarse at base, subangular to well rounded quartz, quartzite, sandstone and chert Sand: medium, quartz and lithic grains	3.6	3.9
Keuper Marl	Mudstone, red, silty and soft in top 1 m	2.1+	6.0

GRADING

Mean for Deposit

	%	mm	%
Gravel	64	+16	31
		-16 + 4	33
Sand	32	-4 + 1	9
		-1 + $\frac{1}{4}$	17
		-$\frac{1}{4}$ + 1/16	6
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	8	32	60
1.3 - 2.3	trace	34	66
2.3 - 3.3	6	24	70
3.3 - 3.9	trace	40	60

SK 75 SE 32 7653 5086 Willow Holt Block D

Surface level +13.1 m
Water level not recorded
Shell and auger, 200 mm
April 1972

Overburden 0.4 m
Mineral 4.5 m
Bedrock 1.6 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravel	A. 'Very clayey' sandy gravel Gravel: fine, subangular to well rounded quartz, quartzite and chert Sand: medium, quartz and lithic grains Fines: pale grey and brown silt	0.6	1.0
	B. Gravel Gravel: fine in upper part, coarse below, subangular to well rounded quartz and quartzite with angular to subrounded chert Sand: as above	3.9	4.9
Keuper Marl	Mudstone, grey, red and brown	1.6+	6.5

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	26	+16	4
		-16 + 4	22
Sand	51	-4 + 1	8
		-1 + ¼	26
		-¼ + 1/16	17
Fines	23	-1/16	23
B.			
Gravel	79	+16	42
		-16 + 4	37
Sand	20	-4 + 1	7
		-1 + ¼	12
		-¼ + 1/16	1
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.0	23	51	26
1.0 - 2.0	trace	24	76
2.0 - 3.0	1	27	72
3.0 - 4.0	1	15	84
4.0 - 4.9	trace	15	85

SK 75 SE 33 7744 5083 South of Farndon Cottage Block D

Surface level +12.5 m
Water level +10.9 m
Shell and auger, 200 mm
April 1972

Overburden 0.3 m
Mineral 3.1 m
Bedrock 1.6 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	A. 'Very clayey' pebbly sand Sand: medium, quartz with lithic grains Gravel: fine, subrounded to well rounded quartz and quartzite and angular to subangular chert Fines: pale grey and brown silt	0.6	0.9
	B. Gravel, 'clayey' near top Gravel: mainly coarse, as above Sand: as above	2.5	3.4
Keuper Marl	Mudstone, red	1.6+	5.0

GRADING

Mean for Deposit

	%	mm	%
A.			
Gravel	16	+16	2
		-16 + 4	14
Sand	54	-4 + 1	8
		-1 + ¼	27
		-¼ + 1/16	19
Fines	30	-1/16	30
B.			
Gravel	64	+16	33
		-16 + 4	31
Sand	31	-4 + 1	9
		-1 + ¼	20
		-¼ + 1/16	2
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 0.9	30	54	16
0.9 - 1.9	10	24	66
1.9 - 2.9	trace	36	64
2.9 - 3.4	1	37	62

SK 75 SE 34 7837 5083 Howton Block D

Surface level +13.1 m
Groundwater not encountered
Shell and auger, 150 mm
September 1972

Overburden 0.3 m
Mineral 1.8 m
Bedrock 1.4 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel	'Very clayey' sand, pebbly in upper part Sand: medium, quartz with lithic grains Gravel: fine, quartz, quartzite and chert	1.8	2.1
Keuper Marl	Mudstone, red	1.4+	3.5

GRADING

Mean for Deposit

	%	mm	%
Gravel	6	+16	1
		-16 + 4	5
Sand	65	-4 + 1	2
		-1 + $\frac{1}{4}$	32
		-$\frac{1}{4}$ + 1/16	31
Fines	29	-1/16	29

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	30	61	9
1.3 - 2.1	27	72	1

SK 75 SE 35 7874 5190 Top Farm Block D

Surface level c+16.8 m
Water not encountered
Minuteman 100 mm auger
January 1976

Overburden 0.5 m
Mineral 3.2 m
Bedrock 0.5 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
	Soil, dark sandy	0.5	0.5
Older River Gravel	Gravel and sandy gravel Gravel: fine to coarse, rounded quartzite and quartz with subangular flint and chert and rounded sandstone and traces of siltstone, ironstone and igneous rock Sand: medium, quartz with lithic grains	3.2	3.7
Keuper Marl	Mudstone and clay, reddish brown	0.5+	4.2

GRADING

Mean for Deposit

	%	mm	%
Gravel	50	+16	20
		-16 + 4	30
Sand	43	-4 + 1	9
		-1 + $\frac{1}{4}$	22
		-$\frac{1}{4}$ + 1/16	12
Fines	7	-1/16	7

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.5 - 1.0	12	59	29
1.0 - 1.9	6	39	55
1.9 - 2.8	8	47	45
2.8 - 3.7	5	32	63

SK 75 SE 36 7915 5072 Elm Cottage, Hawton Block D

Surface level c+12.2 m
Water not encountered
Minuteman 100 mm auger
January 1976

Overburden 2.9 m
Mineral 1.2 m
Bedrock 0.8 m+

LOG

Geological Classification	Lithology	Thickness m	Depth m
Alluvium	Sandy soil on brown sandy clay	2.9	2.9
River Gravel	'Clayey' sandy gravel Gravel: fine, angular to rounded limestone, fossil fragments and calcareous siltstone with subangular to rounded siltstone, flint, chert and sandstone, rounded ironstone and some quartzite and quartz Sand: medium, quartz with lithic grains	1.2	4.1
Keuper Marl	Mudstone and clay, reddish brown	0.8+	4.9

GRADING

Mean for Deposit

	%	mm	%
Gravel	32	+16	4
		-16 + 4	28
Sand	58	-4 + 1	18
		-1 + $\frac{1}{4}$	27
		-$\frac{1}{4}$ + 1/16	13
Fines	10	-1/16	10

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.9 - 3.2	12	54	34
3.2 - 3.7	7	60	33
3.7 - 4.1	12	60	28

APPENDIX G: LIST OF WORKINGS

Location	Grid Reference	Deposit worked
Active (Febuary 1976)		
South Muskham	800 565	River Gravel
Abandoned (backfilled or flooded)		
South Muskham	794 565	River Gravel
"	785 563	River Gravel
"	794 559	River Gravel
Farndon	772 525	River Gravel

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

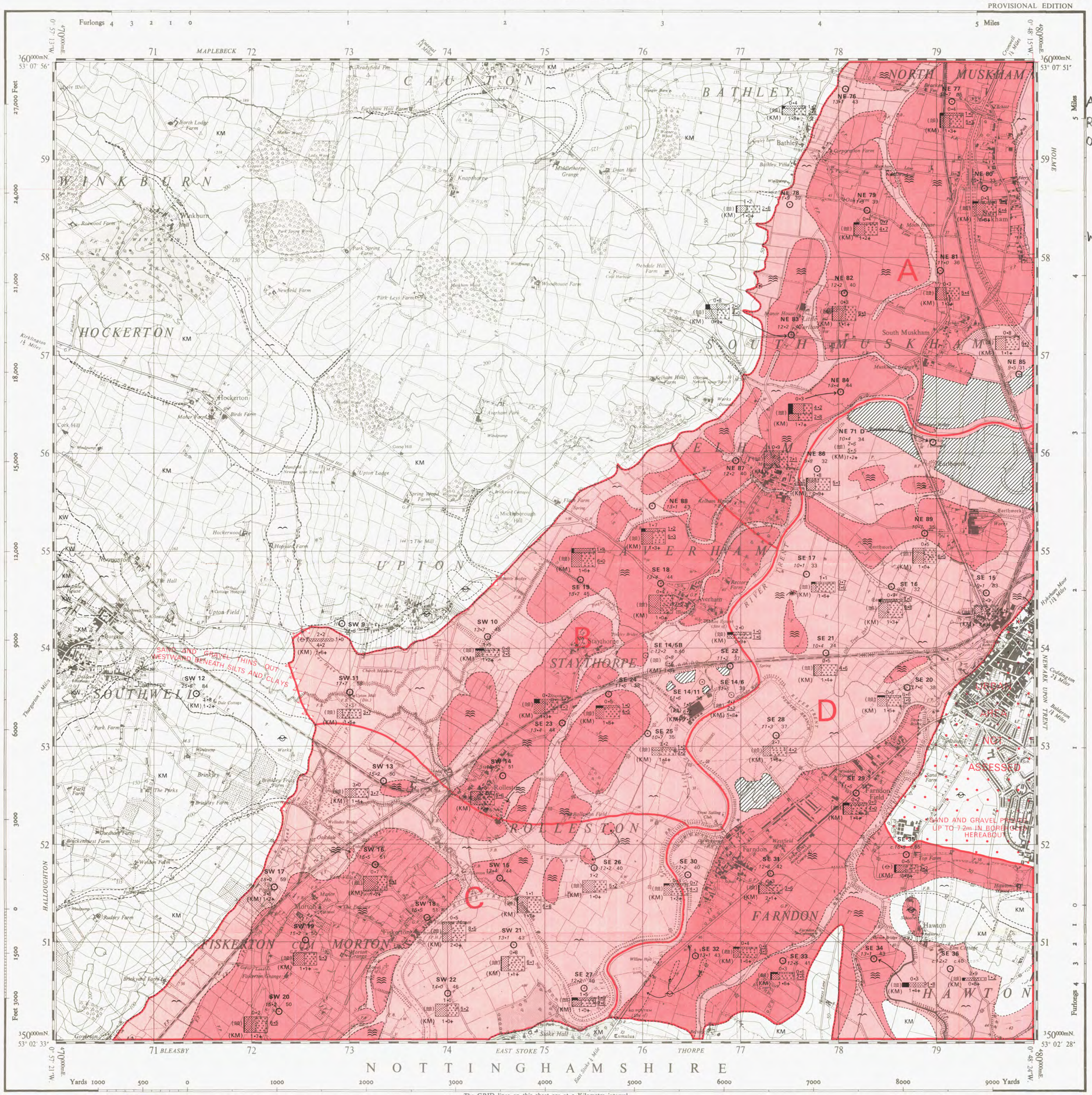
THE SAND & GRAVEL RESOURCES OF SHEET SK 75(WEST OF NEWARK UPON TRENT, NOTTS)

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

ORDNANCE SURVEY
SHEET SK 75
PROVISIONAL EDITION

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

31



EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

A-21 — **Alluvium**— clays and silts. (RECENT AND PLEISTOCENE)

RG-2 — **River Gravel**— sandy gravels and gravels overlain in places by sands. (RECENT AND PLEISTOCENE)

OR-5 — **Older River Gravel**— sands, gravels and pebbly silts. (RECENT AND PLEISTOCENE)

SOLID

KM — **Keuper Marl**— mudstones with thin sandstones (skerries) and gypsum bands. (TRIASSIC)

KW — **Keuper Waterstones**— mudstones and sandstones. (TRIASSIC)

WO-4 — **Worked-out Ground (sand and gravel)**

BOUNDARY LINES

Geological boundary, Drift.

Geological boundary, Solid.

Inferred boundary between recognized categories of deposits.

Resource Block boundary.

Broken lines denote uncertainty.

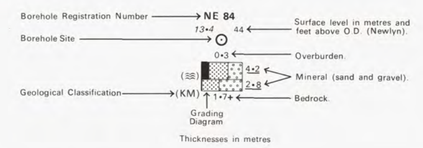
BOREHOLE DATA

SITE LOCATIONS

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

Other Boreholes

I.M.A.U. BOREHOLES



Note:

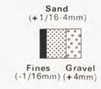
(i) Figures underlined denote thicknesses used in the assessment of resources.
(ii) The + sign indicates that the base of the deposit was not reached.
(iii) The figures in *italics* are conversions to metres of measurements recorded in feet.
(iv) The Geological Classification is given only for mineral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

Borehole Registration Number

Each I.M.A.U. borehole is identified by a Registration Number, e.g. NE 84. The letters refer to the quarter sheet and the figures to the I.G.S. serial number for that quarter. The unique designation for borehole NE 84 is SK 75 NE 84.

Grading Diagrams

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



The height of the diagram is proportional to the mineral thickness

The width 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 recognized.

RESOURCE BLOCKS

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

Detailed records may be consulted on application to the Director at the appropriate offices of the Institute of Geological Sciences.

Made and printed for the Institute of Geological Sciences by the Director General of the Ordnance Survey, Southampton.

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

Geological lines from the six-inch survey by B.Smith, R.L.Sherlock, B.S.N.Wilkinson and G.W.Lamplugh in 1903-07. C.Fox-Strangways and G.W.Lamplugh, District Geologists. Included in One-Inch Geological Sheets 113 and 126.

Sand and Gravel Survey by D.Price, J.R.Gozzard and J.H.Lovell in 1972. R.G.Thurrell, Head, Industrial Minerals Assessment Unit.

Sand and Gravel Resources Sheet published 1978.
Austin W. Woodland C.B.E. *Director, Institute of Geological Sciences incorporating the Geological Survey of Great Britain, the Musuem of Practical Geology and Overseas Geological Surveys.*
1050/78

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

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

Compiled from 6" sheets last fully revised 1915.
Other partial systematic revision 1938-50 has been incorporated.
Major roads revised 1967.

SK66	SK76	SK86
	113	114
SK65	SK75	SK85
SK64	SK74	SK84
	126	127

Diagram showing the relation of the National Grid 1:25 000 sheets with the New Series One-Inch Geological sheets 113, 114, 126, and 127