Mineral Assessment Report 22

The sand and gravel resources of the country north-west of Scunthorpe, Humberside
Description of 1:25 000 resource sheet SE 81

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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 cooperation of the Sand and Gravel Association of Great Britain.

This Report describes the resources of sand and gravel of 70 km^2 of country north-west of Scunthorpe, shown on the accompanying 1:25 000 resource sheet SE 81. The survey was conducted by Mr J.W.C. James under the supervision of Mr D. Price, assisted in the drilling and sampling programme by Messrs I. Jackson, J.H. Lovell and J.R. Gozzard. The work, which was controlled from the sub-unit in Leeds (J.H. Hull, Officer-in-Charge) is based on six-inch scale geological surveys carried out in 1939-1941, 1964-1965 and 1972-1973 and published in part on New Series one-inch Goole (79) and Doncaster (88) geological sheets.

Mr J.W. Gardner, CBE (Land Agent) has been responsible for negotiating access to land for drilling. The ready cooperation of land owners and tenants in this work is gratefully acknowledged.

A.W. Woodland
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The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 63 boreholes drilled for the Mineral Assessment Unit form the basis of the assessment of sand and gravel resources of the country north-west of Scunthorpe, Humberside.

All the floodplain 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 six resource blocks containing between 7.1 and 13.5 km² of potentially workable sand and gravel. For the blocks assessed statistically the geology of the deposits is described and the mineral-bearing area, the mean thickness of overburden and mineral, and the mean grading of the mineral are stated. Detailed borehole data are 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 les bases de l'évaluation des ressources en sable et en gravier dans la région de Scunthorpe, Humberside, comprennent les cartes géologiques de l'Institute of Geological Sciences, des données obtenues des trous de sonde déjà en existence, et de 63 trous de sonde forés pour le Mineral Assessment Unit.

Dans la région tous les dépôts de plaine d'inondation 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 sont tenues d'être symétriquement à 95 pour cent exactes.

La carte 1:25 000 est divisée en six blocs de ressource avec d'entre 7.1 à 13.5 km² de sable et de gravier. Pour les blocs évalués statistiquement on décrit la géologie des dépôts et on donne l'étendue du terrain minéralisé, l'épaisseur moyenne de recouvrement et de minéral, et le triage moyen de minéral. On présente des données détaillées des trous de sonde. La situation des trous de sonde, la géologie et les profils des blocs de ressource sont montrés sur la carte.

Zusammenfassung

Die geologischen Karten vom Institute of Geological Sciences, vorherexistierende Information über Bohrlöcher, und 63 für die Mineral Assessment Unit gebohrten Bohrlöcher, bilden den Grund für die Einschätzung der Sand- und Schottermittel im Scunthorpe Gebiet, Humberside.

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

Man teilt die 1:25 000 Karte in 6 Mittelsblöcke, die zwischen 7.1 und 13.5 km² von Sand und Schotter umfassen. Man beschreibt die Geologie der Ablagerungen für die statistisch bewerteten Blöcke. Das mineralhaltige Gebiet, die mittlere Dicke von Überlastung und Mineral, und die mittlere Klassifizierung von Mineral werden bestimmt Ausführliche Bohrlöcherdaten werden auch gegeben. Die Geologie, die Lage der Bohrlöcher und die Skizzen der Blöcke werden auf der Begleitkarte gezeigt.

The sand and gravel resources of the country north-west of Scunthorpe, Humberside

Description of 1:25 000 resource sheet SE 81

J. W. C. James

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 B.S. 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.

If a deposit of sand and gravel broadly meets these criteria, it 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, 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 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.
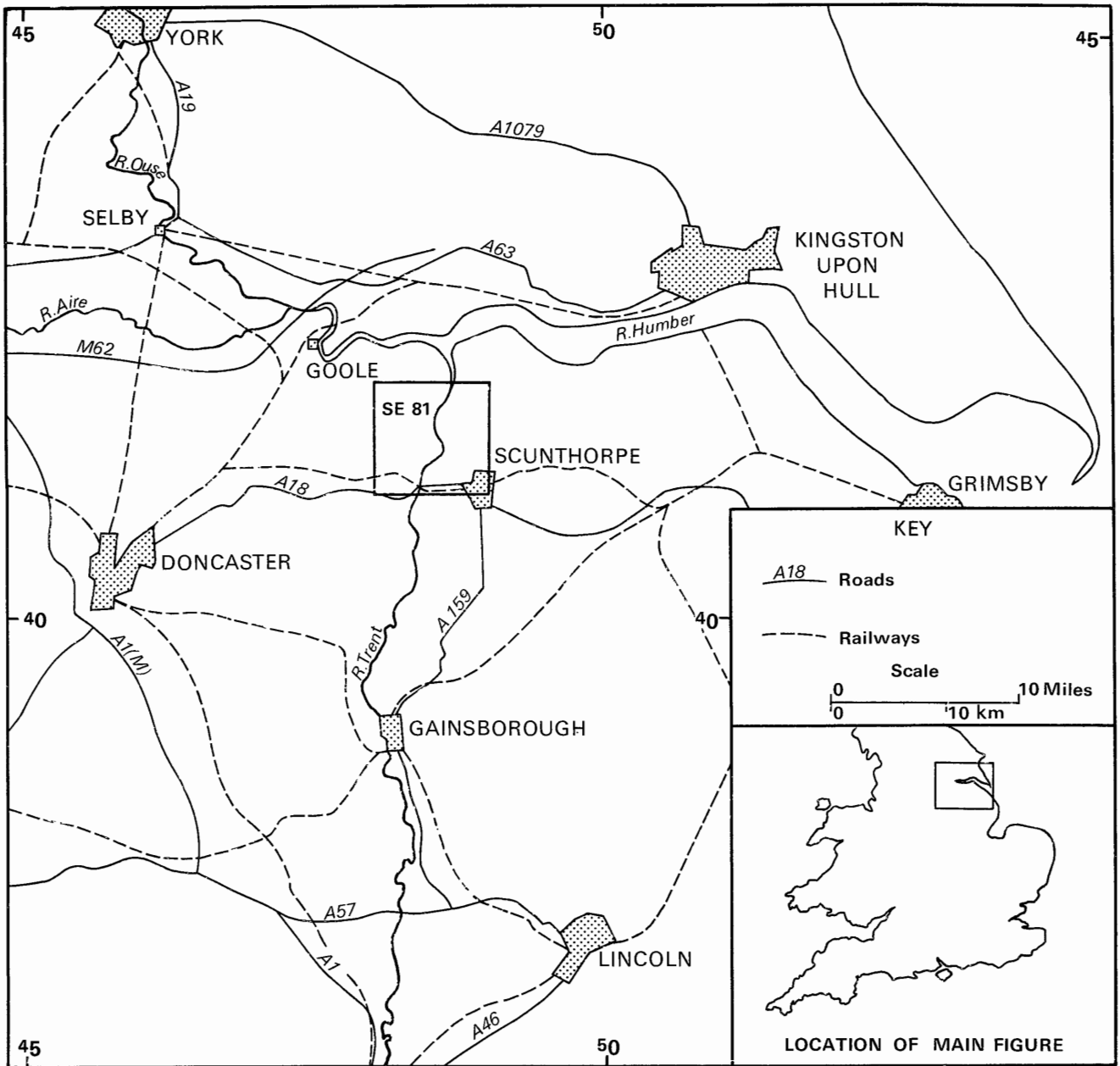
Fig. 1. Sketch map to show location of Sheet SE 81

Table 1. Stratigraphy.

DRIFT

Recent and Pleistocene   Alluvium
                                    Peat
                                    Blown Sand, older
                                    Head
                                    Sand of the 25-ft Drift of the Vale of York
                                    Silt and clay of the 25-ft Drift of the Vale of York
                                    Older Littoral Sand and Gravel
                                    Older River Sand and Gravel
                                    Glacial Sand and Gravel

SOLID

Jurassic   Lower Lias, including Frodingham Ironstone

Triassic   Rhaetic
                                    Keuper Marl

Description of 1:25 000 resource sheet SE 81

GENERAL

The floodplain of the River Trent occupies the western two-thirds of the district and is intensively farmed. Its eastern boundary is a prominent north-south scarp, which rises steeply to a height of over 200 ft (61.0 m) above OD north of Flixborough and more gently to over 150 ft (45.7 m) above OD near Scunthorpe. From the crest of the scarp the land surface slopes gently eastwards.

The Trent is navigable for sea-going ships to Gunness; there is a power station at Keadby and a large chemical works at Flixborough Stather [861 147][1]. Scunthorpe in the south-east (Fig. 1) is one of the main iron and steel making centres in Britain with two large steelworks, one of which, Normanby Park [888 138], lies within the sheet area.

GEOLOGY

The deposits of the area are classified as shown in Table 1, where they are listed as far as possible in order of increasing age. Their inter-relationships are illustrated by a schematic cross section (Fig. 2); the line of section is drawn on the accompanying map.

SOLID

Solid rocks are exposed only on the escarpment and dip slope near Scunthorpe and north of Flixborough; elsewhere they are

[1]National Grid References in this publication all lie within 100 km square SE (44).

concealed beneath drift.

Keuper Marl

Immediately underlying the drift deposits in the western two-thirds of the area, and of the order of 275 m (900 ft) thick, the Keuper Marl is composed of reddish brown and grey-green mudstone with gypsum bands and thin beds of dolomitic sandstone (skerries).

Rhaetic

Conformably overlying the Keuper Marl, the Rhaetic outcrops along the base of the Jurassic scarp where it attains a thickness of about 50 ft (15.0 m). It comprises reddish brown and pale grey mudstones (Cotham Beds) resting on dark grey shales (Westbury Beds, formerly called the Rhaetavicula [Pteria] contorta shales).

Lower Lias

The Lower Lias conformably overlies the Rhaetic and forms the prominent north-south scarp and the dip slope to the east. The lower 200 ft (61.0 m) of the formation comprises grey calcareous mudstone with thin shelly argillaceous limestones. The overlying Frodingham Ironstone, a ferruginous oolitic limestone, is soft and weathered at outcrop so that its oolitic structure is obscured. The bed is lenticular and varies in thickness from 12 ft (3.7 m) to 32 ft (9.8 m). It has been worked extensively for use in local steelworks.

The Lower Lias has a regional eastward dip of between 1° and 2°. A deflection of the outcrop east of Flixborough is due to a monoclinal structure containing a number of faults,

N20°W

S20°E | W10°N

E10°S

+20

Haldenby

Amcotts

R.Trent

Scunthorpe

NW 5

+10

NW 11

NW 16

NW 27

SW 21

SE 25

SE 26

SE 1

O.D.

-10

BEDROCK

BEDROCK

BEDROCK

-20

Metres

0   1   2   kilometres

Horizontal Scale
Vertical exaggeration ×50

Alluvium: clay, silt, sand and peat

Blown Sand

Silt and Clay of the 25 ft Drift

Alluvium: sand with some gravel

Sand of the 25 ft Drift

Older River Sand and Gravel

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Fig. 2. Schematic cross-section across the district

Table 2. Quaternary events and related deposits in the area of sheet SE 81. (The sequence of events is based on the works of Gaunt and his collaborators modified in detail as a result of present work.)

STAGE	SEQUENCE OF EVENTS	DEPOSITS
Flandrian (Postglacial)	Fluvial deposition phase: slow and intermittent rise in sea level to that of present day	Alluvium
	Fluvial incision phase: fall in base level to at least 19.9 m below OD with consequent erosion of earlier drifts	
Devensian (Glacial)	Aeolian phase	Blown Sand, older
	Fluvial deposition phase: draining of Lake Humber with base level remaining slightly below that of emergent lake floor; initiation of 'proto-Humber' rivers	Sand of 25-ft Drift
	Lacustrine phase	Silt and Clay of 25-ft Drift
	Glacial phase: ice dammed the Humber Estuary causing the formation of Lake Humber	Older Littoral Sand and Gravel
	Fluvial incision phase: fall in sea level to at least 19 m below OD and erosion of earlier drifts	
Ipswichian (Interglacial)	Fluvial deposition phase: rise in sea level from at least 18.5m below OD to 1 or 2 m above OD	Older River Sand and Gravel
Wolstonian (Glacial)		Glacial Sand and Gravel

the most important of which downthrows to the south (Whitehead and others, 1952, pp. 68-76).

DRIFT

The Quaternary of Britain is subdivided on the basis for climatic change into a number of stages (Mitchell and others, 1973). The deposits of the district are assigned to the youngest four stages (Table 2).

Glacial Sand and Gravel

Two small patches of clayey gravel which occur near the edge of the Jurassic scarp, just north of Flixborough at an elevation of 125 to 175 ft (38 to 53 m) above OD, have been assigned a glacial origin on the basis of their erratic content (G. D. Gaunt, 1975, oral communication).

Older River Sand and Gravel

This deposit which overlies Keuper Marl consists predominantly of well sorted sand, 'clayey' in part (see Appendix C), and is distinguished from younger alluvial sand by a general absence of organic matter. Where present the deposit is usually from 5 to 7 m (16.5 to 23 ft) thick but it is known to range in thickness from 2 m (6.5 ft) to more than 12 m (39.5 ft). The major variations in thickness (Fig. 3) are due in part to irregularity of the Keuper Marl surface (Fig. 4) and in part to selective erosion of the deposit in late Devensian to early Flandrian times. Prior to this erosion the Older River Sand and Gravel filled channels running east to west beneath Haldenby and north to south approximately along the line of the River Trent; it also spread beyond these channels to cover the
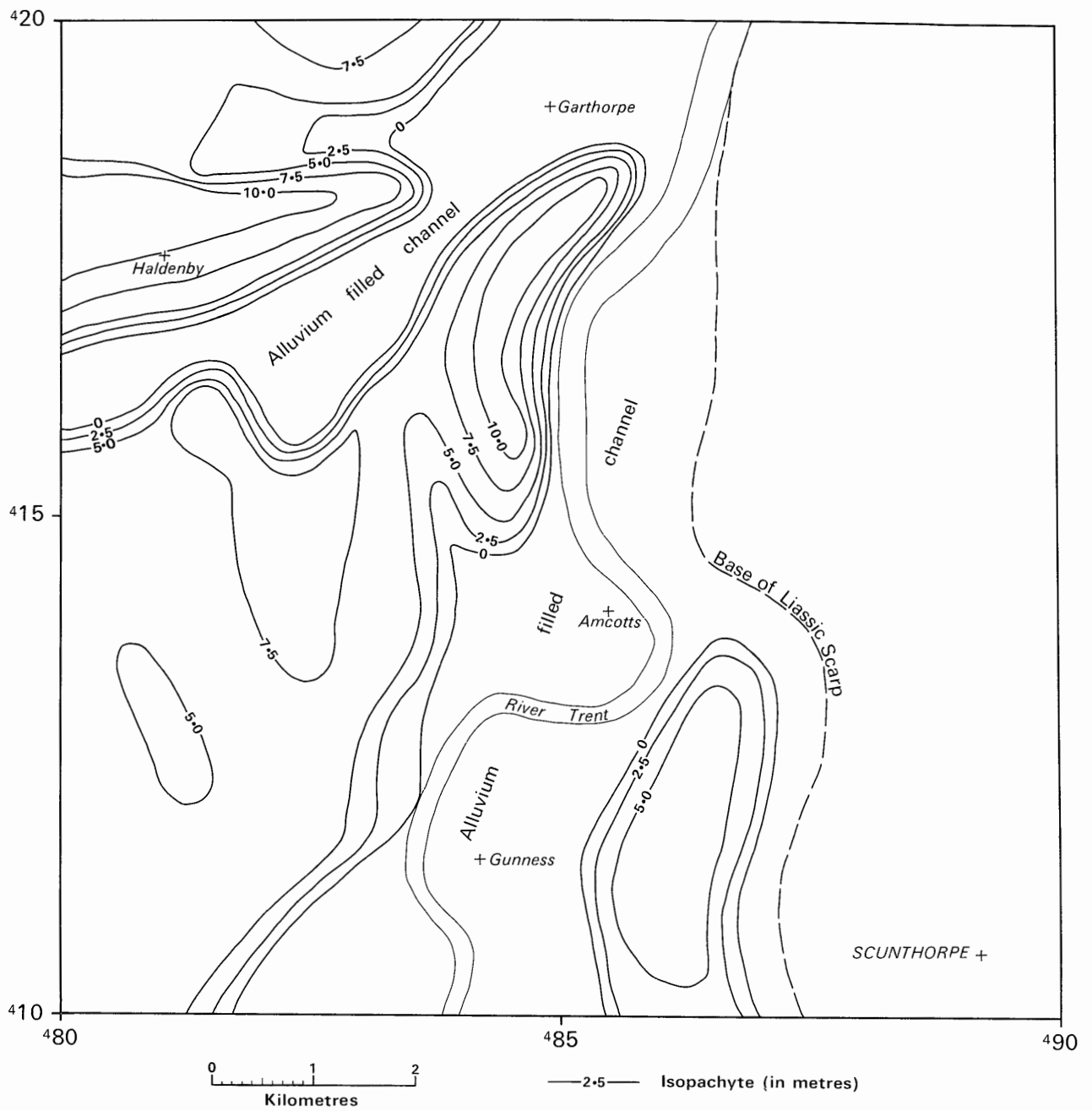
Fig. 3. Isopachytes of the Older River Sand and Gravel

whole area west of the Jurassic scarp. Pebble-grade material is restricted to the lower parts of the deposits within these channels; nowhere is it found on the 'interfluves'.

The channel beneath Haldenby is probably early Ipswichian in age and was cut to a depth of at least 18.5 m (60.5 ft) below OD during a period of incision related to a fall in sea level. Evidence for contemporaneous incision in adjacent parts of the Trent Valley has been largely obliterated by later events, but in the Goole-Snaith area to the west, downcutting reached at least 13 m (42.6 ft) below OD (Gaunt and others, 1974, p. 20). Towards the end of the Ipswichian, mean sea level rose again, possibly to 1 to 2 m above OD (Gaunt and others, 1974, p. 21) and form and general stratigraphic relationships suggest that the Older River Sand and Gravel may have been laid down in an estuarine environment during the resulting transgression.

During the early to middle Devensian, a fall in base level to at least 19 m (62.5 ft) below OD led to another period of incision in the Vale of York-Humber region (Gaunt, 1974, p.195) but evidence of any related incision in the area under consideration is sparse because of later, Flandrian, erosion. However the anomalously thick silt and clay of the 25-ft Drift (6.4 m (21.Q ft)) proved in a borehole at Heldenby Hall [8315 1842] may indicate local early Devensian erosion of the Older River Sand and Gravel.

Older Littoral Sand and Gravel
During the Devensian glaciation, advance of ice into the Vale of York and Humber Estuary resulted in the formation of an ice-dammed lake, called Lake Humber. It is thought that initially the lake level stood at 33 m (108 ft) above OD and during a relatively short time Older Littoral Sand and Gravel deposits formed along its margins (Edwards, 1936, p. 104; Gaunt and others, 1972, pp. 4-5). Remnants of these deposits occur as two small patches [868 146] on the Jurassic scarp west of Flixborough, at 8 to 23 m (25 to 75 ft) above OD.

Silt and Clay of the 25-ft Drift of the Vale of York
The level of Lake Humber subsequently dropped to 10 to 14 m (33.0 to 46.0 ft) above OD (Gaunt, 1974, p.195). The whole of the present district west of the Jurassic scarp remained submerged and during a relatively long cold period the Silt and Clay of the 25-ft Drift was deposited. The sediments consist of red-brown and grey-brown silts or clays with micaceous silty laminations, containing fine sand and small coal fragments. In places a 'clayey' sand parting 1 to 2 m (3.3 to 6.6 ft) thick is present. The deposit ranges in thickness from 1 to 6.4 m (3.5 to 21.0 ft) but averages 2 to 4 m (6.5 to 13 ft). Its upper surface falls from 2 to 4 m (6.5 to 13 ft) below OD.

The Silt and Clay of the 25-ft Drift provides a significant marker in the drift succession of this area, its presence or absence enabling the extent and direction of the subsequent early Flandrian incision by the rivers Don and Trent to be determined.

Sand of the 25-ft Drift of the Vale of York
This deposit, which rests directly on Silt and Clay of the 25-ft Drift, comprises reddish brown 'clayey' sand, generally 1 to 3 m (3.3 to 10.0 ft) thick but exceptionally reaching 5 m (16.5 ft). The only exposure is at Sand Hill [807 1841].

The Sand was deposited during the late Devensian when a amelioration of climate led to recession of the ice front and the final disappearance of Lake Humber. Base level during this period fell initially to just below that of the emergent silt and clay plain, and the Sand of the 25-ft Drift is thought to represent 'fossil' levees of rivers crossing the plain; the deposit at Sand Hill has been interpreted as such a levee (Gaunt and others, 1971, p. 281). There is however a possibility that the extensive subsurface developments of the Sand were laid down in the shrinking lake prior to levee formation.

Head
Small patches of solifluxed silty clay containing angular fragments of Lower Lias limestone are found along the escarpment north of Flixborough. The deposits are generally, but not invariably, older than neighbouring blown sand.

Blown Sand
Although there may be small deposits of recent blown sand in the district, deposits shown on the map date from the latter part of the last glacial episode (Devensian) and are classified as 'Blown Sand, older' on Geological Survey maps. They form a thick deposit against the base of the Jurassic scarp and cover a large area of the dip slope to the east; there are other small occurrences on the floodplain. Where Blown Sand rests directly on Sand of the 25-ft Drift, it is difficult to distinguish between them because in boreholes much of the Blown Sand is redistributed Sand of the 25-ft Drift. Similar difficulty exists where Blown Sand is thought to rest directly on Older River Sand and Gravel in the thick (> 10.0 m (32.8 ft)) sequences at the base of the Jurassic scarp.

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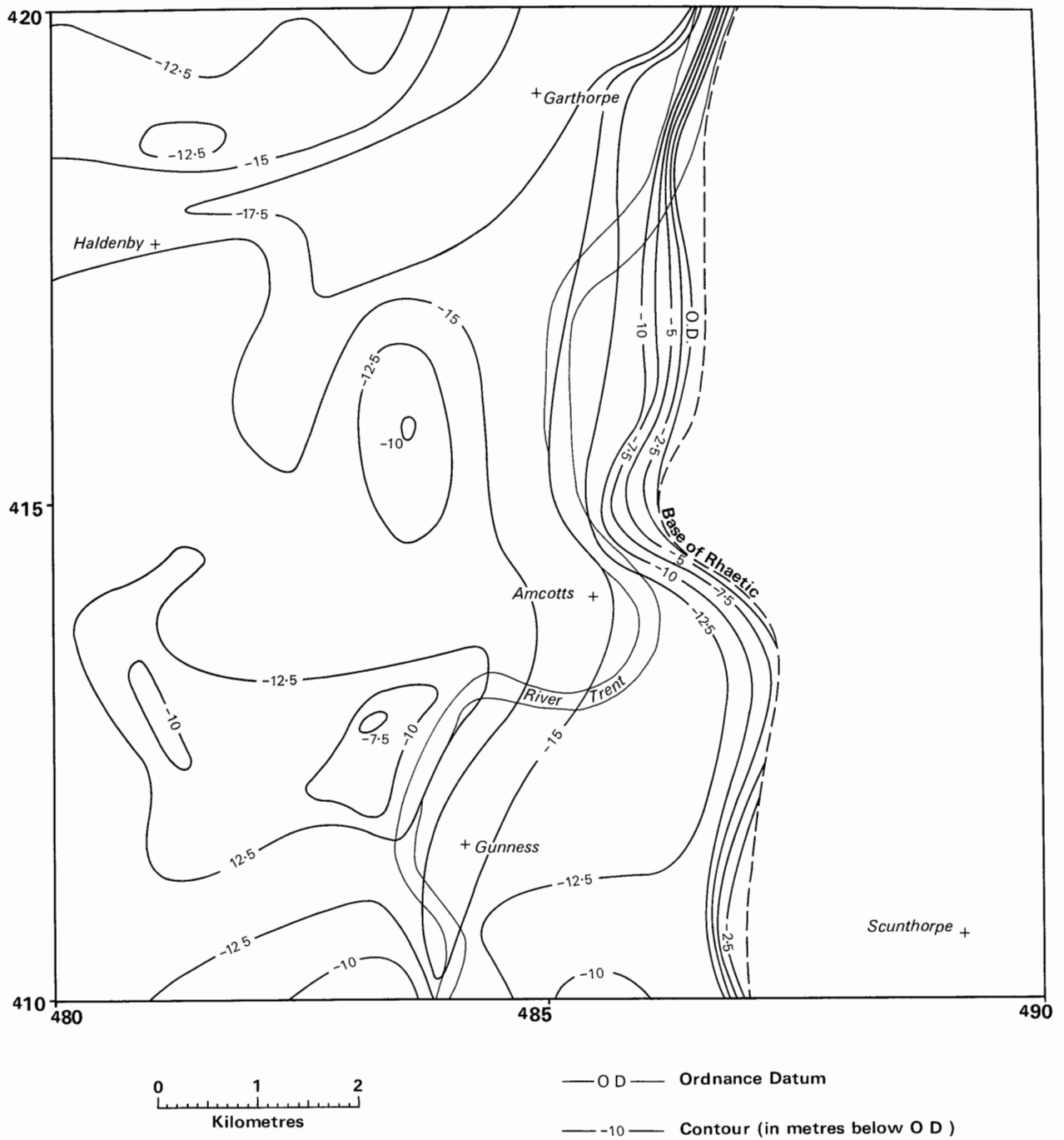
Fig. 4. Contour map showing the form of the Keuper Marl surface

Alluvium

Alluvium covers almost all the Trent floodplain and has two distinct facies: one comprises gravel and sand, infilling two deep channels cut down to bedrock by the rivers Don and Trent and the other consists of overlying deposits of silt, peat and clay which reach a maximum thickness of 16.0 m (52.5 ft) and extend over the sand of the 25-ft Drift on the flanks of the channels (Fig. 2).

Within the channels, sandy gravel up to 4.4 m (14.4 ft) thick is found locally at the base of the deposit; it is overlain by sand and 'clayey' sand up to 12.1 m (39.5 ft) thick, which is in turn succeeded by silt, peat and clay up to 16.0 m (52.5 ft) thick. The maximum proven thickness of alluvium is 22.9 m (75 ft).

The alluvial sands and sandy gravels are readily distinguished from the underlying Older River Sand and Gravel, by the appreciable amount of grey silt and organic debris they contain. Organic matter apart, the similarity in mineralogy of the deposits suggests that there has been little or no change of provenance since the deposition of the Older River Sand and Gravel. Indeed, the alluvial sands probably contain appreciable amounts of reworked material from the upper reaches of the Don and Trent.

The formation of these alluvially filled channels requires incision postdating the 25-ft Drift. Evidence from the Vale of York shows that such deep and comparatively rapid incision occurred in late Devensian to early Flandrian times and was allied to a sea level as low as 16.5 m (54 ft) below OD (Gaunt and Tooley, 1974, p. 25). Within this district, the downcutting reached at least 19.9 m (65.5 ft) below OD and was followed by gradual alluviation up to the present surface level of the floodplain.

COMPOSITION OF THE SAND AND GRAVEL

Within the area, potentially workable sand and gravel exist in the Older River Sand and Gravel, Sand of the 25-ft Drift of the Vale of York, Blown Sand and Alluvium. Deposits of Glacial Sand and Gravel, Older Littoral Sand and Gravel and Blown Sand on and to the east of the Jurassic scarp have not been assessed; of these only Blown Sand is widespread and much of it is sterilised by industrial development. Evidence from ironstone workings suggests that it thins to less than 1.8 m (6 ft) north of Flixborough.

Older River Sand and Gravel

This deposit consists predominantly of sand and 'clayey' sand (for definition of terms see Appendix C) but locally pebbly sand and sandy gravel are present at the base. The mean grading of the deposit is fines 7 per cent, sand 91 per cent and gravel 2 per cent. The sand fraction is predominantly fine grained and comprises subrounded to well rounded quartz with some coal, mudstone and chert. The gravel is fine and coarse and consists of subrounded to well rounded pebbles of quartzite with sporadic subangular chert and rare quartz.

Sand of the 25-ft Drift of the Vale of York

The mineral of this deposit has a mean grading of fines 14 per cent, sand 86 per cent and a trace of gravel. It ranges in composition from sand to 'very clayey' sand but is predominantly 'clayey' sand. The sand consists of fine to medium grained, rounded to well rounded quartz with some coal and mudstone.

Blown Sand

The Blown Sand assessed consists of fine, subrounded to well rounded quartz sand, 'clayey' in part. Its mean grading is fines 7 per cent, sand 93 per cent and a trace of gravel.

Alluvium

The mineral of this deposit has a mean grading of fines 7 per cent, sand 87 per cent and gravel 6 per cent. Generally the deposit is classified as sand, but locally it is 'clayey' or 'very clayey'; pebbly sand or sandy gravel occurs in places at the base of the deposit. The sand fraction is fine to medium grained and consits of subrounded to well rounded quartz with some coal and traces of chert. The gravel fraction is generally fine grained; it consists of subrounded to well rounded quartzite and quartz pebbles with chert and rare limestone.

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, symbols, etc., shown are taken from the geological map of this area, which was surveyed recently at the scale of 1:10 560. This information
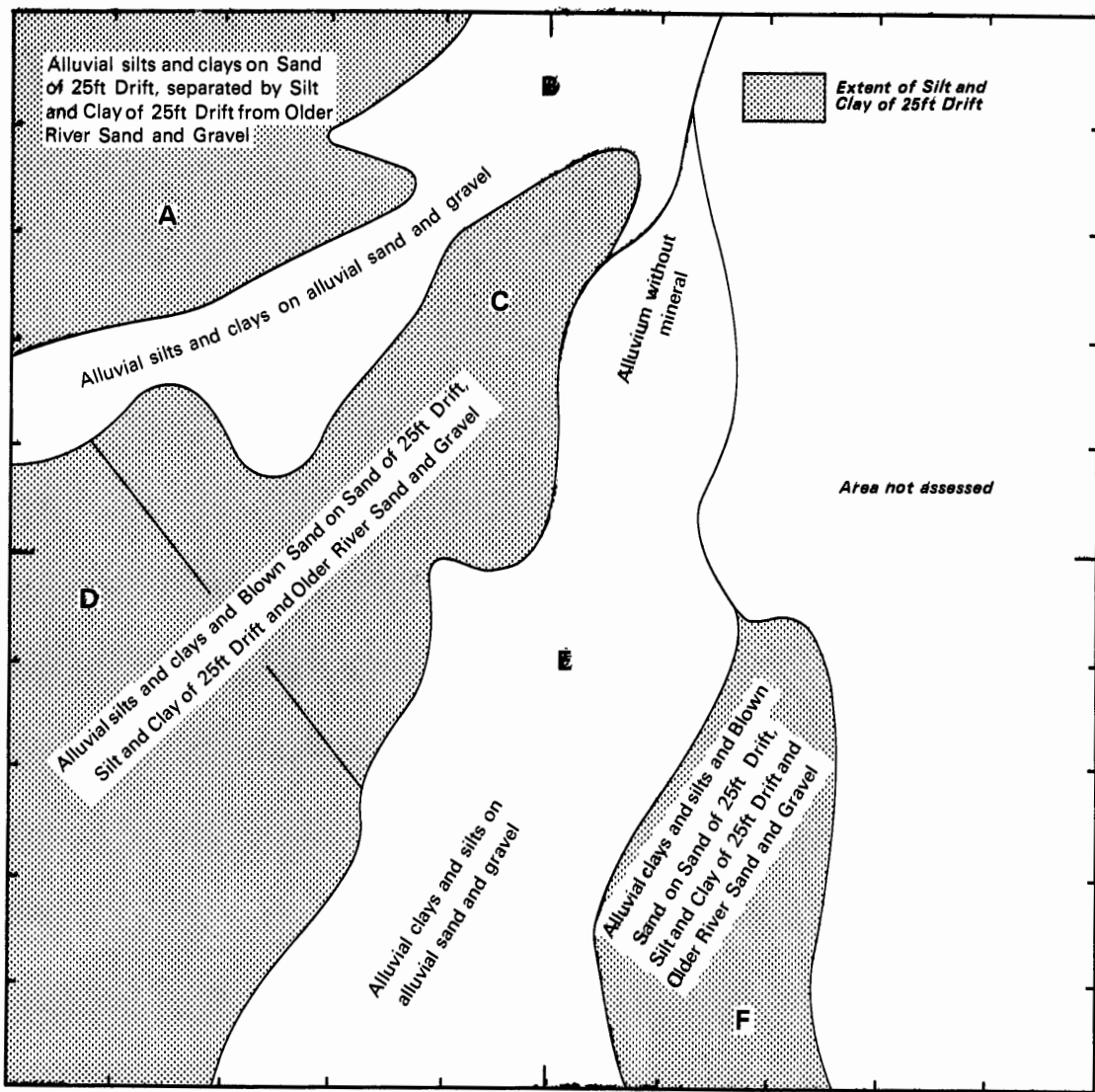
Fig. 6. The relationship of the resource block boundaries to the drift geology

Table 3. The sand and gravel resources of sheet SE 81.

BLOCK	Area		Mean thickness						Volume of Mineral				Mean grading percentages		
	Block	Mineral	Overburden		Mineral		Waste				Limits at the 95% confidence level		Fines	Sand	Gravel
									million			±		+1/16	
	km²	km²	m	ft	m	ft	m	ft	m³	yd³	+% -	million m³	-1/16 mm	-4 mm	+4 mm
A	9.3	9.3	3.1	10.0	10.1	33.0	3.0	10.0	94	123	22	21	8	90	2
B	9.3	9.3	8.2	27.0	10.2	33.5	0.4	1.5	95	124	34	32	12	82	6
C	11.3	11.3	4.0	13.0	9.6	31.5	2.8	9.0	108	141	17	18	9	90	1
D	13.5	13.5	1.9	6.0	9.6	31.5	2.5	8.0	130	170	15	20	8	91	1
E	19.5	12.8	8.0	26.0	7.5	24.5	-	-	96	126	21	20	4	92	4
F	7.1	7.1	1.1	3.5	8.6	28.0	1.3	4.5	61	80	22	13	6	91	3
A to F	70.0	63.3	4.2	14.0	9.2	30.0	1.8	6.0	584	764	8	47			

NOTES ON RESOURCE BLOCKS

Within the area covered by sheet SE 81 only the sand and gravel of the lower ground has been assessed. Patches of Glacial Sand and Gravel, Older Littoral Sand and Gravel and Blown Sand on the higher ground in the east (generally above the 25-ft contour) have not been investigated; they are for the most part sterilised by industrial development, small in area or thin. Except for blocks C and D which are geologically similar and have been separated arbitrarily, the boundaries between resource blocks are based on the inferred subsurface extent of the silt and clay of the 25-ft Drift of the Vale of York (Fig. 6).

Block A

Potentially workable sand and gravel deposits comprise the Older River Sand and Gravel and the Sand of the 25-ft Drift. The former was proved in all the assessment boreholes and ranged in thickness from 4.9 m (16.0 ft) to more than 12.0 m (39.5 ft). The latter, which is separated from the former by Silt and Clay of the 25-ft Drift, 1.2 to 6.4 m (4.0 to 21.0 ft) thick, is restricted in extent but locally is at least 3.9 m (13.0 ft) thick.

Proved combined thicknesses of mineral range from 6.9 m (22.5 ft) at borehole NW 4 to 14.8 m (48.5 ft) in borehole NW 9, but borehole NW 11 failed to reach the base of the Older River Sand and Gravel after penetrating 14.4 m (47.0 ft) of mineral. The thicker deposits occupy a west to east channel cut in bedrock beneath Haldenby.

Both the Older River Sand and Gravel and the Sand of the 25-ft Drift are generally pebble free, but in three boreholes in the southern part of the block pebbly sand or sandy gravel up to 2.9 m (9.5 ft) thick was found at the base of the former deposit. Throughout the block the fines content ranges up to 39 per cent but the mean value is 8 per cent. Mean proportions of sand and gravel are 90 per cent and 2 per cent respectively. The estimated volume of mineral present is 94 million m³ ± 21 million m³.

At Sand Hill [807 184] the mineral is at the surface but elsewhere it is overlain by clay, silt and peat varying in thickness from 1.0 m (3.5 ft) to 7.6 m (25.0 ft), with a mean thickness of 3.1 m (10.0 ft).

Block B

The mineral of this block consists almost entirely of the arenaceous facies of the Alluvium which fills a channel cut to bedrock through the older drift deposits. At the block margins this Alluvium may overlap on to Older River

Sand and Gravel.

The mean thickness of mineral is 10.2 m (33.5 ft), but proved thicknesses vary from 4.8 m (15.5 ft) to 20.1 m (66.0 ft). The composition of the mineral generally ranges from sand to 'very clayey' sand but sandy gravel up to 4.4 m (14.5 ft) thick is found locally (boreholes NW 8, 13 and 17) at the base of the deposit. The 'very clayey' sand deposits in boreholes NW 16 and 21 contain rare thin peat bands, and in borehole NW 21 a 3.0 m (10.0 ft) silt parting encloses pockets of peat.

The mean grading for the block is fines 12 per cent, sand 82 per cent and gravel 6 per cent and the estimated volume of mineral is 95 million $m^3 \pm 32$ million m^3.

The mineral lies entirely beneath overburden which varies in thickness from 2.7 m (9.0 ft) to 11.7 m (38.5 ft), with a mean of 8.2 m (27.0 ft).

Block C
This block, together with block D, occupies the interfluve between the two alluvium-filled channels outlined by blocks B and E. Potentially workable deposits of sand and gravel are confined, as in block A, to the Older River Sand and Gravel and the Sand of the 25-ft Drift. The former has been proved throughout the block, thicknesses ranging from 3.2 m (10.5 ft) to 11.1 m (36.5 ft), giving a mean of 8.1 m (26.5 ft). Sand of the 25-ft Drift was not found in borehole NW 23, and in boreholes NW 26 and 27 the ratio of overburden to sands exceeds 3:1 so that the deposit cannot be regarded as mineral. Elsewhere up to 2.5 m (8.0 ft) of Sand of 25-ft Drift has been proved, the mean for the block being 1.6 m (5.0 ft). Everywhere a waste parting of Silt and Clay of the 25-ft Drift separates the two mineral deposits; its thickness ranges from 1.7 m (5.5 ft) to 5.0 m (16.5 ft), with a mean of 3.3 m (11.0 ft).

The Sand of the 25-ft Drift almost everywhere consists of 'clayey' or 'very clayey' sand. The composition of the Older River Sand and Gravel ranges from sand to 'very clayey' sand. The highest fines contents are commonly found adjacent to the waste parting and it is possible that some of the samples are contaminated. In two boreholes (NE 11 and NW 28) close to the eastern margin of the block, pebbly sand was found at the base of the Older River Sand and Gravel.

Proved total thicknesses of mineral generally lie between 7.5 m (24.5 ft) and 13.4 m (44.0 ft) but borehole NW 27 proved only 3.2 m (10.5 ft);

the mean for the block is 9.6 m (31.5 ft). The mean grading of the mineral is fines 9 per cent, sand 90 per cent and gravel 1 per cent. The mean thickness of waste is 2.8 m (9.0 ft). Overburden is ubiquitous, varying in thickness from 1.8 m (6.0 ft) to 8.8 m (29.0 ft) and with a mean of 4.0 m (13.0 ft). The estimated volume of mineral is 108 million $m^3 \pm 18$ million m^3.

Block D
The geology of this block is similar to that of block C, but in addition to Older River Sand and Gravel and Sand of the 25-ft Drift, Blown Sand outcrops locally. The last is probably redistributed Sand of the 25-ft Drift and because the two cannot be distinguished from one another in boreholes they are considered together for assessment purposes.

The Older River Sand and Gravel is found throughout the block and varies in thickness from 3.5 m (11.5 ft) to 9.4 m (31.0 ft); it consists mainly of sand, in places 'clayey', but 2.5 m (8.0 ft) of pebbly sand was found at its base in borehole SW 28. At borehole SW 17, Sand of the 25-ft Drift is less than 1 m (3.5 ft) thick and therefore cannot be considered as mineral, but elsewhere the deposit, including associated Blown Sand, has been shown to vary in thickness between 1 m (3.5 ft) and 5.0 m (16.5 ft). The Silt and Clay of the 25-ft Drift which separates the Older River Sand and Gravel from the sand of the 25-ft Drift generally ranges in thickness from 0.8 m (2.5 ft) to 5.4 m (17.5 ft) but was absent from borehole SW 29. The composition of the Sand of the 25 ft Drift and Blown Sand varies from sand to 'very clayey' sand.

Total thicknesses of mineral proved generally fall between 8.1 m (26.5 ft) and 14.7 m (48.0 ft) but borehole SW 17 found only 4.6 m (15.0 ft); the mean for the block is 9.6 m (31.5 ft). The mean grading is fines 8 per cent, sand 91 per cent and gravel 1 per cent. The estimated volume of mineral is 130 million $m^3 \pm 20$ million m^3. The mean thickness of waste for the block is 2.5 m (8.0 ft). Except where Blown Sand is found at surface, the mineral is covered by overburden up to at least 7.0 m (23.0 ft) thick; its mean thickness is 1.9 m (6.0 ft).

Block E
As in block B, the mineral is almost entirely Alluvium which occupies a channel cut to bedrock through older drift deposits. Boreholes SW 25, SW 32 and SW 33 show that at depth on the western margin of the block

sand of the Alluvium overlaps Older River Sand and Gravel.

The overburden in this block is consistently thick. Three boreholes in the northern part (NE 12 to 14) and two boreholes in the south (SW 31 and 34) proved that the ratio of thickness of overburden to sand and gravel is greater than 3:1. Areas around these holes have been delineated as generally barren; they may be more or less extensive than shown on the resource map. Elsewhere overburden thicknesses from 3.9 m (13.0 ft) to 11.0 m (36.0 ft) have been proved, giving a mean of 8.0 m (26.0 ft).

The mineral is generally sand which is occasionally 'clayey'; however, four boreholes found pebbly sand or sandy gravel up to 4.0 m (13.0 ft) thick at the base and in another two holes, SW 32 and SW 33, pebbly sand was found at the top. The mean grading for the block is fines 4 per cent, sand 92 per cent and gravel 4 per cent. Thicknesses of mineral proved range from 4.8 m (15.5 ft) to 12.1 m (39.5 ft) and the mean for the block is 7.5 m (24.5 ft), giving an estimated mineral volume of 96 million m^3 ± 20 million m^3.

Block F

The potentially workable sand and gravel of this block comprises Blown Sand, Sand of the 25-ft Drift and Older River Sand and Gravel, but the deposits are commonly so similar in composition that it is difficult to distinguish between them.

In boreholes SE 24 and SE 18 Blown Sand is thought to rest directly on sand of the 25-ft Drift,

although the boundary between the two deposits is inexact. The whole of the sand proved by six boreholes sited on the Blown Sand outcrop has been so classified, but it is possible that Sand of 25-ft Drift and Older River Sand and Gravel are also represented in the lower part. Proved thicknesses of mineral within the Blown Sand outcrop vary from 5.2 m (17.0 ft) to 14.5 m (47.5 ft) and these are also the maximum and minimum for the block.

To the west, Sand of 25-ft Drift is found beneath Alluvium; it varies in thickness from 3.2 m (10.5 ft) to 6.1 m (20.0 ft) but in boreholes SE 26 and SE 27 the deposit includes a waste parting up to 1.5 m (5.0 ft) thick.

Older River Sand and Gravel is found at depth throughout most of the block and thicknesses up to 6.8 m (22.5 ft) have been proved. It is generally separated from the overlying sands by a waste parting Silt and Clay of the 25-ft Drift) from 0.9 m (3.0 ft) to 3.0 m (10.0 ft) thick. The deposit is usually a sand but pebbly sand was found at its base in three boreholes.

The mean thickness of mineral in the block is 8.6 m (28.0 ft), giving an estimated volume of 61 million m^3 ± 13 million m^3. The mean grading of the mineral is fines 6 per cent, sand 91 per cent and gravel 3 per cent.

Overburden is generally restricted to the western two-thirds of the block; it has a maximum proved thickness of 2.8 m (9.0 ft), the mean thickness being 1.1 m (3.5 ft).

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Appendix A: Field and Laboratory Procedures

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

The mineral shown on each 1:25 000 sheet is divided into resource blocks. The arbitrary size selected, 10 km^2, is a compromise to meet the aims of the survey by providing sufficient sample points in each block. As far as possible the block boundaries are determined by geological boundaries so that, for example, glacial and river terrace gravels are separated. Otherwise division is by arbitrary lines, which may bear no relationship to the geology. The blocks are drawn provisionally before drilling begins.

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

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

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

A continuous series of bulk samples is taken throughout the sand and gravel. Ideally samples are composed exclusively of the whole of the material encountered in the borehole between stated depths. However, care is taken to discard, as far as possible, material which has caved or has been pumped from the bottom of the hole. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel, or at every 1 m (3.3 ft) depth. The samples each weighing between 25 and 45 kg (55 and 100 lb), are despatched in heavy duty polythene bags to a laboratory for grading. The grading procedure is based on British Standard 1377 (1967). Random checks on the accuracy of the grading are made in the Institute's laboratories.

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

Detailed records may be consulted at the appropriate offices of the Institute, upon application to the Head, Mineral 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 para. 12 below).

2. The simple methods used in the calculations are consistent with the amount of data provided by the survey. Conventional symmetrical confidence limits are calculated for the 95 per cent probability level. That is there is a 5 per cent or one in twenty

chance of a result falling outside the stated limits.

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

$$S_V = \sqrt{S_A^2 + S_{\bar{l}_m}^2} \quad \ldots\ldots(1)$$

4. The above relationship may be transposed such that

$$S_V = S_{\bar{l}_m} \sqrt{1 + \frac{S_A^2}{S_{\bar{l}_m}^2}} \quad \ldots\ldots(2)$$

From this it can be seen that as $\dfrac{S_A^2}{S_{\bar{l}_m}^2}$ 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}, $\ldots\ldots l_{m_n}$, then the best estimate of mean thickness, $\bar{l}_m$ =

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

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

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

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

6. The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the

limits of a deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness.

The relationship

$$\frac{S_A}{S_{\bar{l}_m}} \leqslant 1/3 \text{ is assumed in all cases}$$

It follows from equation (2) that

$$S_{\bar{l}_m} \leqslant S_V \leqslant 1.05 \ S_{\bar{l}_m} \quad \ldots\ldots(3)$$

7. The limits on the estimate of mean thickness of mineral, $L_{\bar{l}_m}$, may be expressed in absolute units

$$\pm \frac{t}{\sqrt{n}} \times S_{\bar{l}_m}$$

or as a percentage

$$\pm \frac{t}{\sqrt{n}} \times S_{\bar{l}_m} \times \frac{100}{\bar{l}_m} \quad \text{per cent}$$

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	∞	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 Ed. 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

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

and when n is greater than 20, as

$$\frac{1.05 \times 1.96}{\bar{l}_m} \times \sqrt{\frac{\sum(l_m - \bar{l}_m)^2}{n(n-1)}} \times 100 \text{ per cent}$$

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

INFERRED ASSESSMENT

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

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

14. No assessment is attempted for an isolated area of mineral less than 0.25 km^2.

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

Appendix C: Classification and Description of Sand and Gravel

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

The terminology commonly used by geologists when describing sedimentary rocks (Wentworth, 1922) is not entirely satisfactory for this purpose. For example, Wentworth proposed that a deposit should be described as a 'gravelly sand' when it contains more sand than gravel and there is at least 10 per cent of gravel, provided that there is less than 10 per cent of material finer than sand (less than 1/16 mm) and coarser than pebbles (more than 64 mm 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. 9). The procedure is as follows:

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

For example, a deposit grading 11 per cent gravel, 70 per cent sand and 19 per cent fines is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Note 11, p. 23).

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 4), which is used in this Report.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the qualitative assessments of the resource blocks. Three sizes of sand are recognised, fine ($-\frac{1}{4}$ +1/16 mm), medium (-1 +$\frac{1}{4}$ 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, and the results reported usually as semi-logarithmic cumulative curves (see, for example, British Standard 1377: 1967). The grading is tabulated on the borehole record sheets (Appendix F), the intercepts corresponding with the sample geometric scale 1/16 mm, $\frac{1}{4}$ mm 1 mm, 4 mm, 16 mm and so on as required. The sample grading results are available for reference at the appropriate office of the Institute.

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

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

The terms used in the field to describe the degree of rounding of particles, which is concerned with the sharpness of the edges and corners of a clastic fragment and not the shape (after Pettijohn, 1957), are as follows.

Angular: showing little or no evidence of wear; sharp edges and corners.
Subangular: showing definite effects of wear. Fragments still have their original form but edges and corners begin to be rounded off.
Subrounded: showing considerable wear. The edges and corners are rounded off to smooth curves. Original grain shape is still distinct.
Rounded: original faces almost completely destroyed, but some comparatively flat surfaces may still remain. All original edges and corners have been smoothed off to rather broad curves. Original shape is still apparent.
Well rounded: no original faces, edges or corners left. The entire surface consists of broad curves; flat areas are absent. The original shape is suggested by the present form of the grain.

Table 4. Classification of gravel, sand and fines

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

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Block Calculation   1:25 000 } Fictitious
                       Block }

Area
Block: 11.08 km²
Mineral: 8.32 km²

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: $\pm$ 20 per cent
That is, the volume of mineral (with 95 per cent probability) 54 $\pm$ 11 million m^3

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

Sample point	Weighting w	Overburden l_o	wl_o	Mineral l_m	wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	MAU boreholes
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	$\frac{1}{2}$	1.2 }	1.6	9.8 }	7.2	Hydrogeological Dept record
123/45	$\frac{1}{2}$	2.0 }		4.6 }		
1	$\frac{1}{4}$	2.7 }		7.3 }		
2	$\frac{1}{4}$	4.5 }	2.5	3.2 }	5.8	Close group of four boreholes (commercial)
3	$\frac{1}{4}$	0.4 }		6.8 }		
4	$\frac{1}{4}$	2.8 }		5.9 }		
Totals	$\Sigma w = 8$	$\Sigma wl_o = 20.1$		$\Sigma wl_m = 52.0$		
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

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

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

$$= 20.3$$

$$\approx 20 \text{ per cent}$$

Fig. 7. Example of resource block assessment: statement and calculation
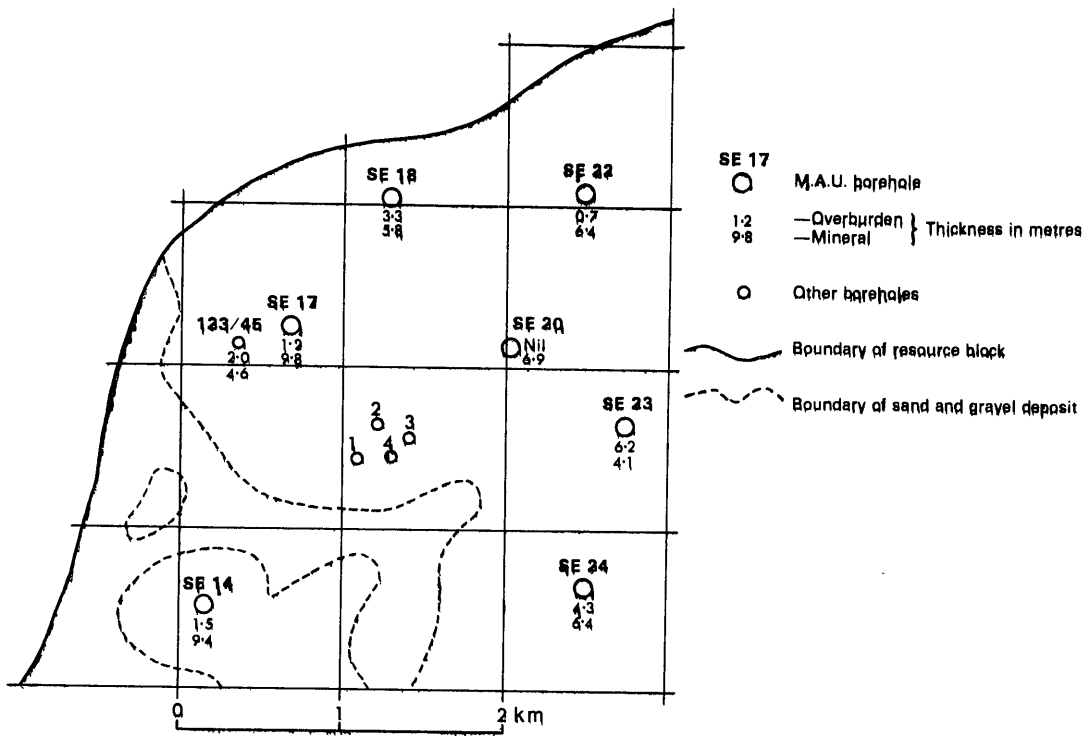
Fig. 8, Example of resource block assessment: map of fictitious block

I	Gravel	VII	Pebbly sand
II	'Clayey' gravel	VIII	'Clayey' pebbly sand
III	'Very clayey' gravel	IX	'Very clayey' pebbly sand
IV	Sandy gravel	X	Sand
V	'Clayey' sandy gravel	XI	'Clayey' sand
VI	'Very clayey' sandy gravel	XII	'Very clayey' sand
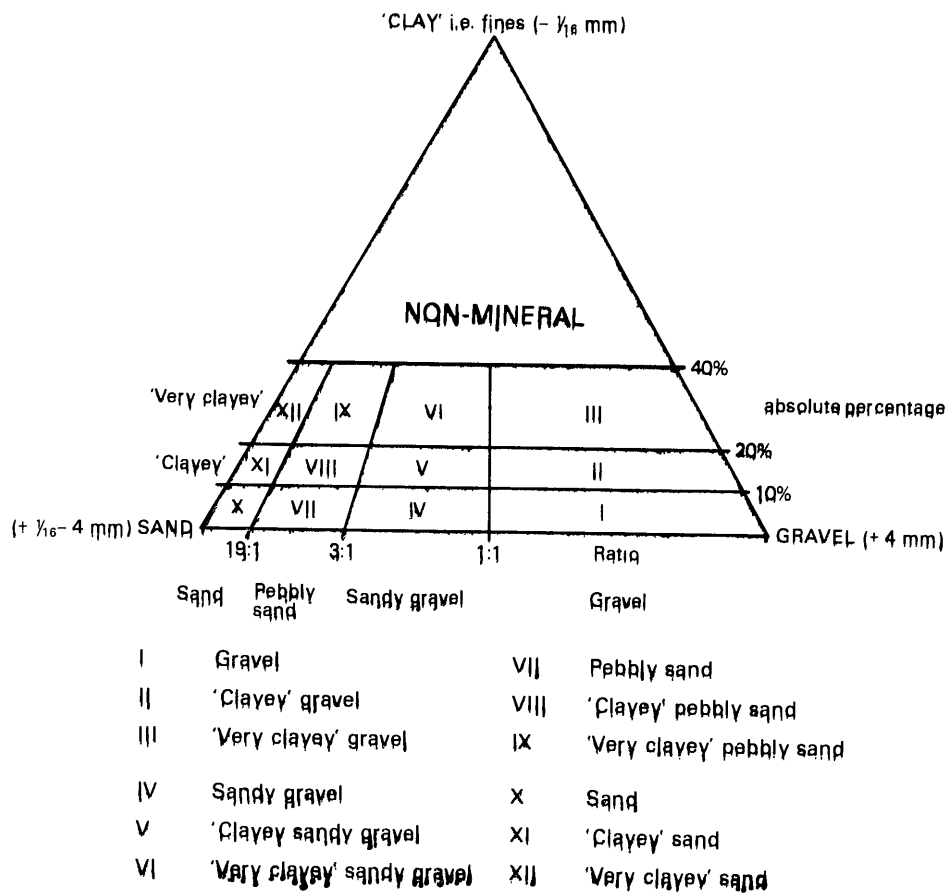
Fig. 9. Diagram showing the descriptive categories used in the classification of sand and gravel

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Appendix D: Explanation of the Borehole Records

ANNOTATED EXAMPLE

SE 81 NW 7[1]   8330 1943[2]   Pasture Lane, Fockerby   Block A[3]

Surface level (+ 1. 8 m) + 6 ft[4]
Water level + 0. 9 m (+ 3 ft)[5]
October 1973[6]

Overburden[7] 3. 6 m (12. 0 ft)
Mineral 2. 2 m (7. 0 ft)
Waste 1. 2 m (4. 0 ft)
Mineral 7. 2 m (23. 5 ft)
Bedrock 1. 0 m + (3. 5 ft +)[9]

		Thickness		Depth[8]	
		m	(ft)	m	(ft)
	Soil	0. 7	(2. 5)	0. 7	(2. 5)
Alluvium[10]	Silt and Peat[11]	2. 9	(9. 5)	3. 6	(12. 0)
25-ft Drift	(a) 'Clayey' sand, grey green: fine to medium, rounded to well rounded quartz with few coal fragments	2. 2	(7. 0)	5. 8	(19. 0)
	Clay, reddish brown, laminated	1. 2	(4. 0)	7. 0	(23. 0)
Older River Sand and Gravel	(b) Sand: fine, subrounded to rounded quartz with coal, rare chert and mudstone fragments.	7. 2	(23. 5)	14. 2	(46. 5)
Keuper Marl	Mudstone, reddish brown to green	1. 0 + (3. 5+)		15. 2	(50. 0)

		%	mm		%	Depth below[12] surface (m)	Percentage[13] Fines	Sand	Gravel
(a) [14]	Gravel	0	+ 16	:	0	3.6 - 4.6	12	88	0
			- 16 + 4	:	0	4.6 - 5.8	11	89	0
	Sand	89	- 4 + 1	:	0				
			- 1 + $\frac{1}{4}$	:	45				
			- $\frac{1}{4}$ + 1/16	:	44				
	Fines	11	- 1/16	:	11				
(b)	Gravel		+ 16	:	0	7.0 - 8.0	5	95	0
			- 16 + 4	:	0	8.0 - 9.0	1	99	0
						9.0 - 10.0	3	97	0
	Sand	98	- 4 + 1	:	1	10.0 - 11.0	1	99	0
			- 1 + $\frac{1}{4}$	:	20	11.0 - 12.0	1	99	0
			- $\frac{1}{4}$ + 1/1€	:	77	12.0 - 13.0	2	98	0
						13.0 - 14.2	3	97	0
	Fines	2	- 1/16	:	2				

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

1. Borehole Registration Number.
    Each Mineral Assessment Unit (MAU) 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 SE 81.
    2) The quarter of the 1:25 000 sheet on which the borehole lies and its number in a series for that quarter, for example SE 15.
    Thus the full Registration Number is SE 81 SE 15. Usually this is abbreviated to SE 15 in the text.

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

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

4. Surface Level
    The surface level at the borehole site is given in metres and feet above Ordnance Datum. All measurements were made in feet; approximate conversions to metres are given in brackets.

5. Groundwater Conditions
    If groundwater was present the level at which it was encountered is normally given relative to Ordnance Datum.

6. Type of Drill and Date of Drilling
    Unless otherwise stated all the boreholes were drilled by a shell and auger rig using six inch casing. 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. Thickness and Depth
    All measurements were made in metres; conversions from metres to feet (shown in brackets) have been rounded off to the nearest 0.5 ft. Where figures have been rounded in this way there may be a discrepancy between the sum of the thicknesses and the recorded depths.

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

10. Geological Classification
    The geological classification (p. 3) is given whenever possible.

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

12. 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.

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

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.

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

MINERAL ASSESSMENT UNIT BOREHOLES

Borehole No. by sheet quadrant	Grid reference (all fall in 100 km square SK)		Page No.	Borehole No.	Grid reference		Page No.
SE 81 NW				SE 81 SW			
pp. 25-49				pp 55-77			
4	8066	1958	25	12	8019	1469	55
5	8157	1960	26	13	8151	1445	56
6	8264	1976	27	14	8210	1486	57
7	8330	1943	28	15	8330	1431	58
8	8472	1960	29	16	8464	1438	59
9	8082	1842	30	17	8069	1354	60
10	8186	1859	31	18	8136	1368	61
11	8254	1826	32	19	8253	1342	62
12	8315	1842	33	20	8331	1336	63
13	8441	1868	34	21	8416	1314	64
14	8032	1764	35	22	8079	1225	65
15	8155	1734	36	23	8136	1230	66
16	8266	1748	37	24	8274	1259	67
17	8345	1756	38	25	8331	1273	68
18	8471	1773	39	26	8445	1240	69
19	8025	1645	40	27	8091	1139	70
20	8135	1621	41	28	8170	1145	71
21	8248	1640	42	29	8245	1144	73
22	8345	1649	43	30	8304	1168	74
23	8451	1665	44	31	8438	1145	74
24	8060	1525	45	32	8206	1021	75
25	8171	1540	46	33	8276	1083	76
26	8248	1526	47	34	8432	1049	77
27	8370	1572	48	SE 81 SE			
28	8473	1577	49	pp. 78-88			
SE 81 NE				20	8560	1434	78
pp. 50-54				21	8626	1406	79
10	8591	1922	50	22	8585	1364	80
11	8546	1828	51	23	8636	1299	81
12	8607	1709	52	24	8707	1290	82
13	8587	1592	53	25	8517	1258	83
14	8617	1504	54	26	8645	1249	84
				27	8583	1147	85
				28	8631	1045	87
				29	8655	1060	88

OTHER BOREHOLES
NW 3, NE 4a, 4c, SW 2b, 2g, SE 1, 2, 3a, 6, 7, 16, 18.

Appendix F: Mineral Assessment Unit Borehole Records

SE 81 NW 4   8066 1968   Ouseflet Pasture   Block A

Surface level (+2.4 m) +8 ft
Water level 0 m (0 ft)
October 1978

Overburden 7.6 m (25.0 ft)
Mineral 6.9 m (22.5 ft)
Waste 0.8 m (2.5 ft)
Bedrock 0.8 m+ (2.6 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt and peat	3.8	(12.5)	4.2	(14.0)
25-ft Drift	Clay, reddish brown, silty at top	3.4	(11.0)	7.6	(25.0)
Older River Sand and Gravel	Sand, reddish brown, 'clayey' at top & base: fine, rounded to well rounded quartz with coal, chert and mudstone	6.9	(22.5)	14.5	(47.5)
	Sandy silt, reddish brown	0.8	(2.5)	15.3	(50.0)
Keuper Marl	Mudstone, reddish brown, gypsiferous	0.8+	(2.5+)	16.1	(53.0)

	%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	0	+16	0	7.6 - 8.6	17	83	0
		-16+4	0	8.6 - 9.6	14	86	0
				9.6 - 10.5	8	92	0
Sand	90	-4+1	0	10.5 - 11.5	5	95	0
		-1+¼	9	11.5 - 12.5	4	96	0
		-¼+1/16	81	12.5 - 13.5	4	96	0
				13.5 - 14.5	17	83	0
Fines	10	- 1/16	10				

Surface level (+2.4 m) +8 ft
Water level 0 m (0 ft)
October 1973

Overburden 2.1 m (7.0 ft)
Mineral 1.7 m (5.5 ft)
Waste 3.4 m (11.0 ft)
Mineral 5.5 m (18.0 ft)
Bedrock 0.7 m+ (2.5 ft+)

			Thickness m	(ft)	Depth m	(ft)
	Soil		0.4	(1.5)	0.4	(1.5)
Alluvium	Silt and peat		1.7	(5.5)	2.1	(7.0)
25-ft Drift	A.	Sand, olive grey, 'clayey' towards base: fine, subangular to rounded quartz with some coal and mudstone	1.7	(5.5)	3.8	(12.5)
		Clay, reddish brown	3.4	(11.0)	7.2	(23.5)
Older River Sand and Gravel	B.	Sand, 'very clayey' at top: fine, subrounded to rounded quartz with some chert and coal	5.5	(18.0)	12.7	(41.5)
Keuper Marl		Mudstone, reddish brown	0.7+	(2.3+)	13.4	(44.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	2.1 - 3.1	8	92	0
			-16+4	0	3.1 - 3.8	15	85	0
	Sand	89	- 4+1	1				
			- 1+¼	23				
			- ¼+1/16	65				
	Fines	11	- 1/16	11				
B.	Gravel	0	+ 16	0	7.2 - 8.2	21	79	0
			- 16+4	0	8.2 - 9.2	6	94	0
					9.2 - 10.2	4	96	0
	Sand	92	- 4+1	0	10.2 - 11.2	3	97	0
			- 1+¼	19	11.2 - 12.2	5	95	0
			- ¼+1/16	73	12.2 - 12.7	7	93	0
	Fines	8	- 1/16	8				

Surface level (+2.1 m) +7 ft
Water level +1.3 m (+4 ft)
October 1973

Overburden 7.4 m (24.5 ft)
Mineral 7.9 m (26.0 ft)
Bedrock 0.7 m+ (2.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt and peat	3.4	(11.0)	3.8	(12.5)
25-ft Drift	'Clayey' sand, olive grey, fine, rounded to well rounded quartz with few coal fragments	0.3	(1.0)	4.1	(13.5)
	Clay, micaceous, laminated	3.3	(11.0)	7.4	(24.5)
Older River Sand and Gravel	Sand, 'clayey' at top, fine, subrounded to well rounded quartz with fine to coarse coal and rare chert	7.9	(26.0)	15.3	(50.0)
Keuper Marl	Mudstone, reddish brown	0.7+	(2.5+)	16.0	(52.5)

	%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	0	+16	0	7.4 - 8.4	17	83	0
		-16+4	0	8.4 - 9.4	7	93	0
				9.4 - 10.4	6	94	0
Sand	95	- 4+1	trace	10.4 - 11.4	3	97	0
		- 1+$\frac{1}{4}$	19	11.4 - 12.4	3	97	0
		- $\frac{1}{4}$+1/16	76	12.4 - 13.4	3	97	0
				13.4 - 14.4	2	98	0
Fines	5	- 1/16	5	14.4 - 15.3	trace	99	trace

Surface level (+1.8 m) +6 ft
Water level +0.9 m (+3 ft)
October 1973

Overburden 3.6 m (12.0 ft)
Mineral 2.2 m (7.0 ft)
Waste 1.2 m (4.0 ft)
Mineral 7.2 m (23.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.7	(2.5)	0.7	(2.5)
Alluvium		Silt and peat	2.9	(9.5)	3.6	(12.0)
25-ft Drift	A.	'Clayey' sand, grey-green: fine to medium, rounded to well rounded quartz with few coal fragments	2.2	(7.0)	5.8	(19.0)
		Clay, reddish brown, laminated	1.2	(4.0)	7.0	(23.0)
Older River Sand and Gravel	B.	Sand: fine, subrounded to rounded quartz with coal, and rare chert and mudstone fragments	7.2	(23.5)	14.2	(46.5)
Keuper Marl		Mudstone, reddish brown to green	1.0+	(3.5+)	15.2	(50.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	3.6 - 4.6	12	88	0
			-16+4	0	4.6 - 5.8	11	89	0
	Sand	89	- 4+1	0				
			- 1+$\frac{1}{4}$	45				
			- $\frac{1}{4}$+1/16	44				
	Fines	11	-1/16	11				
B.	Gravel	0	+16	0	7.0 - 8.0	5	95	0
			-16+4	0	8.0 - 9.0	1	99	0
					9.0 - 10.0	3	97	0
	Sand	98	- 4+1	1	10.0 - 11.0	1	99	0
			- 1+$\frac{1}{4}$	20	11.0 - 12.0	1	99	0
			- $\frac{1}{4}$+1/16	77	12.0 - 13.0	2	98	0
					13.0 - 14.2	3	97	0
	Fines	2	-1/16	2				

SE 81 NW 8   8472 1960   Nessfield House, Fockerby   Block B

Surface level (+3.7 m) +12 ft   Overburden 5.6 m (18.5 ft)
Water level +2.0 m (+7 ft)   Mineral 15.1 m (49.5 ft)
October 1973   Bedrock 0.9 m+ (3.0 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt, brown, micaceous	5.2	(17.0)	5.6	(18.5)
	A. 'Clayey' sand, olive grey to black: fine, rounded to well rounded quartz with few coal fragments, rare chert.	6.0	(19.5)	11.6	(38.0)
	B. Sand: fine to medium, subrounded to rounded quartz with few coal fragments; large fragments of wood at 12 m	5.0	(16.0)	16.6	(54.5)
	C. Sandy gravel Sand: medium to coarse, sub-rounded quartz with mudstone and rare chert Gravel: fine to coarse, sub-angular to rounded quartzite with some mudstone and rare quartz	4.1	(13.5)	20.7	(68.0)
Keuper Marl	Mudstone, reddish brown	0.9+	(3.0+)	21.6	(71.0)

		%	mm	%	Depth below surface (m)	Percentage		
						Fines	Sand	Gravel
A.	Gravel	0	+16	0	5.6 - 6.6	17	83	0
			-16+4	0	6.6 - 7.6	12	88	0
					7.6 - 8.6	11	89	0
	Sand	84	- 4+1	trace	8.6 - 9.6	12	88	0
			- 1+$\frac{1}{4}$	16	9.6 - 10.6	6	94	0
			- $\frac{1}{4}$+1/16	68	10.6 - 11.6	18	82	0
	Fines	16	- 1/16	16				
B.	Gravel	trace	+16	0	11.6 - 12.6	3	97	0
			-16+4	trace	12.6 - 13.6	2	98	0
					13.6 - 14.6	3	97	0
	Sand	97	- 4+1	1	14.6 - 15.6	3	97	0
			- 1+$\frac{1}{4}$	41	15.6 - 16.6	2	97	1
			- $\frac{1}{4}$+1/16	55				
	Fines	3	-1/16	3				
C.	Gravel	25	+16	8	16.6 - 17.6	2	82	16
			+16+4	17	17.6 - 18.6	1	81	18
					18.6 - 19.6	1	68	31
	Sand	74	- 4+1	34	19.6 - 20.7	2	65	33
			- 1+$\frac{1}{4}$	33				
			- $\frac{1}{4}$+1/16	7				
	Fines	1	-1/16	1				

Surface level (+1.2 m) +4 ft
Water level -0.9 m -3 ft
March 1973

Overburden 0.4 m (1.5 ft)
Mineral 3.9 m (13.0 ft)
Waste 2.7 m (9.0 ft)
Mineral 10.9 m (36.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
25-ft Drift	A.	Sand, 'clayey' in part: medium, subrounded quartz with some coal	3.9	(13.0)	4.3	(14.0)
		Silty clay, red-brown to grey	2.7	(9.0)	7.0	(23.0)
Older River Sand and Gravel	B.	Sand, 'very clayey' at top, a little gravel at base: fine subrounded to well rounded quartz with some coal, siltstone and rock fragments	8.0	(26.0)	15.0	(49.0)
	C.	Sandy gravel Gravel: fine, well rounded sandstone with siltstone, quartz and coal Sand: fine to medium, subrounded to well rounded quartz with rock fragments	2.9	(9.5)	17.9	(58.5)
Keuper Marl		Mudstone, red, gypsiferous	1.0+	(3.5+)	18.9	(62.0)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	0	+16	0	0.4 - 1.4	6	94	0
			-16+4	0	1.4 - 2.4	11	89	0
					2.4 - 3.4	2	98	0
	Sand	94	- 4+1	2	3.4 - 4.3	5	95	0
			- 1+¼	52				
			- ¼+1/16	40				
	Fines	6	-1/16	6				
B.	Gravel	1	+16	0	7.0 - 8.0	32	68	0
			-16+4	1	8.0 - 9.0	11	89	0
					9.0 - 10.0	5	95	0
	Sand	91	- 4+1	3	10.0 - 11.0	4	96	0
			- 1+¼	14	11.0 - 12.0	3	97	0
			- ¼+1/16	74	12.0 - 13.0	7	93	0
					13.0 - 14.0	4	96	0
	Fines	8	-1/16	8	14.0 - 15.0	2	91	7
C.	Gravel	25	+16	8	15.0 - 16.0	2	63	35
			-16+4	17	16.0 - 17.0	3	68	29
					17.0 - 17.9	2	90	8
	Sand	73	- 4+1	21				
			- 1+¼	29				
			- ¼+1/16	23				
	Fines	2	-1/16	2				

SE 81 NW 10 8135 1859 Sand Hill, Eastoft Block A

Surface level (+0.9 m) +3 ft
Water level -0.6 m (-2 ft)
November 1973

Overburden 1.0 m (3.5 ft)
Mineral 3.5 m (11.5 ft)
Waste 3.0 m (10.0 ft)
Mineral 4.9 m (16.0 ft)
Bedrock 0.6 m+ (2.0 ft+)

| | | Thickness | | Depth | |
		m	(ft)	m	(ft)
Alluvium	Soil and silt	1.0	(3.5)	1.0	(3.5)
25-ft Drift	A. Sand: fine, subangular to well rounded quartz with rare coal fragments	3.5	(11.5)	4.5	(15.0)
	Silt, reddish brown, with micaceous laminations	3.0	(10.0)	7.5	(24.5)
Older River Sand and Gravel	B. 'Very clayey' sand, light brown: fine, subrounded to rounded quartz, rare coal fragments	4.9	(16.0)	12.4	(40.5)
Keuper Marl	Mudstone, grey-green	0.6+	(2.0+)	13.0	(42.5)

| | | % | mm | % | Depth below surface (m) | Percentage | | |
						Fines	Sand	Gravel
A.	Gravel	0	+16	0	1.0 - 2.0	6	94	0
			-16+4	0	2.0 - 3.0	6	94	0
					3.0 - 4.0	15	85	0
	Sand	92	- 4+1	trace	4.0 - 4.5	2	98	0
			- 1+$\frac{1}{4}$	19				
			- $\frac{1}{4}$+1/16	73				
	Fine	8	- 1/16	8				
B.	Gravel	0	+16	0	7.5 - 8.5	5	95	0
			-16+4	0	8.5 - 9.5	32	68	0
					9.5 - 10.5	39	61	0
	Sand	79	- 4+1	trace	10.5 - 12.4	14	86	0
			- 1+$\frac{1}{4}$	9				
			- $\frac{1}{4}$+1/16	70				
	Fines	21	-1/16	21				

SE 81 NW 11   8254 1826   Haldenby Grange, Luddington   Block A

Surface level (+3.4 m) +11 ft   Overburden 4.2 m (14.0 ft)
Water level +0.4 m (+1 ft)   Mineral 2.4 m (8.0 ft)
October 1973   Waste 1.9 m (6.0 ft)
                                                     Mineral 12.0 m+ (39.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.7	(2.5)	0.7	(2.5)
Alluvium		Silt and peat	3.5	(11.5)	4.2	(14.0)
25-ft Drift	A.	'Clayey' sand, olive green to grey, fine, subrounded to rounded quartz with few coal fragments	2.4	(8.0)	6.6	(21.5)
		Clay, reddish brown, laminated	1.9	(6.0)	8.5	(28.0)
Older River Sand and Gravel	B.	Sand,'very clayey' at top, pebbly at base, reddish brown Sand: fine, subrounded to rounded quartz with coal, some mudstone and rare chert Gravel: fine to coarse, subrounded to rounded quartzite with rare mudstone and quartz Hole abandoned due to rising sand	12.0+	(39.5+)	20.5	(67.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	4.2 - 5.2	15	85	0
			-16+4	0	5.2 - 6.6	20	80	0
	Sand	82	- 4+1	trace				
			- 1+$\frac{1}{4}$	24				
			- $\frac{1}{4}$+1/16	58				
	Fines	18	-1/16	18				
B.	Gravel	2	+16	1	8.5 - 9.5	22	78	0
			-16+4	1	9.5 - 10.5	20	80	0
					10.5 - 11.5	4	96	0
	Sand	92	- 4+1	3	11.5 - 12.5	5	95	0
			- 1+$\frac{1}{4}$	26	12.5 - 13.5	3	97	0
			- $\frac{1}{4}$+1/16	63	13.5 - 14.5	2	98	0
					14.5 - 15.5	2	98	0
	Fines	6	-1/16	6	15.5 - 16.5	3	97	0
					16.5 - 17.5	3	97	0
					17.5 - 18.5	2	98	0
					18.5 - 19.5	2	91	7
					19.5 - 20.5	1	85	14

Haldenby Hall, Luddington   Block A

Surface level (+2.1 m) +7 ft   Overburden 3.1 m (10.0 ft)
Water level -0.3 m (-1 ft)   Mineral 2.9 m (9.5 ft)
October 1973   Waste 6.4 m (21.0 ft)
                                                                Mineral 8.2 m (27.0 ft)
                                                                Bedrock 0.7 m+ (2.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.7	(2.5)	0.7	(2.5)
Alluvium		Silt and peat	2.4	(8.0)	3.1	(10.0
25-ft Drift	A.	Sand, 'clayey' at top, olive grey: fine, subrounded to rounded quartz with rare coal	2.9	(9.5)	6.0	(20.0
		Clay and silt, reddish brown, laminated	6.4	(21.0)	12.4	(40.5)
Older River Sand and Gravel	B.	Sand: fine, rounded quartz with some coal and rare mudstone and chert	6.0	(19.5)	18.4	(60.5)
	C.	Sandy gravel Sand: medium to coarse, subrounded quartz with coal and mudstone Gravel: fine to coarse, subrounded quartzite and rare quartz and mudstone	2.2	(7.0)	20.6	(67.5)
Keuper Marl		Mudstone, reddish brown	0.7+	(2.5+)	21.3	(70.0)

		%	mm	%	Depth below surface (m)	Percentage		
						Fines	Sand	Gravel
A.	Gravel	trace	+16	0	3.1 - 4.1	14	86	0
			-16+4	trace	4.1 - 5.1	6	94	trace
					5.1 - 6.0	7	93	trace
	Sand	91	-4+1	1				
			-1+$\frac{1}{4}$	16				
			-$\frac{1}{4}$+1/16	74				
	Fines	9	-1/16	9				
B.	Gravel	1	+16	0	12.4 - 13.4	4	96	0
			-16+4	1	13.4 - 14.4	6	94	0
					14.4 - 15.4	8	92	0
	Sand	95	- 4+1	2	15.4 - 16.4	1	99	0
			- 1+$\frac{1}{4}$	33	16.4 - 17.4	2	97	1
			- $\frac{1}{4}$+1/16	60	17.4 - 18.4	2	94	4
	Fines	4	- 1/16	4				
C.	Gravel	26	+16	12	18.4 - 19.4	3	74	23
			-16+4	14	19.4 - 20.6	1	71	28
	Sand	72	- 4+1	26				
			- 1+$\frac{1}{4}$	35				
			-$\frac{1}{4}$+1/16	11				
	Fines	2	-1/16	2				

Surface level (+3.0 m) +10 ft
Water level +0.9 m (+3 ft)
October 1973

Overburden 11.7 m (38.5 ft)
Mineral 11.2 m (36.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
Alluvium	Silt and peat	11.0	(36.0)	11.7	(38.5)
	A. Sand, 'clayey' at top, fine to medium, rounded to subrounded quartz with some coal and chert	7.0	(23.0)	18.7	(61.5)
	B. Sandy gravel Sand: medium, subrounded to rounded quartz with mudstone and rare chert Gravel: fine to coarse, subrounded to rounded quartzite with some mudstone, rare chert and quartz	4.2	(14.0)	22.9	(75.0)
Keuper Marl	Mudstone, green	0.7+	(2.5+)	23.6	(77.5)

		%	mm	%	Depth below surface (m)	Fines	Sand	Gravel
A.	Gravel	1	+16	0	11.7 - 12.7	16	84	0
			-16+4	1	12.7 - 13.7	3	97	trace
					13.7 - 14.7	4	95	1
	Sand	93	- 4+1	3	14.7 - 15.7	4	96	trace
			- 1+$\frac{1}{4}$	47	15.7 - 16.7	7	93	trace
			- $\frac{1}{4}$+1/16	43	16.7 - 17.7	3	95	2
					17.7 - 18.7	3	92	5
	Fines	6	-1/16	6				
B.	Gravel	25	+16	14	18.7 - 19.7	2	84	14
			-16+4	11	19.7 - 20.7	1	87	12
					20.7 - 21.7	2	64	34
	Sand	74	- 4+1	26	21.7 - 22.9	1	63	36
			- 1+$\frac{1}{4}$	38				
			- $\frac{1}{4}$+1/16	10				
	Fines	1	-1/16	1				

The "Percentage" heading spans the Fines, Sand, and Gravel columns.

SE 81 NW 14   8032 1764   Home Farm, Eastoft   Block A

Surface level (+1.5 m) +5 ft
Water level +0.7 m (+2 ft)
November 1973

Overburden 1.7 m (5.5 ft)
Mineral 1.8 m (6.0 ft)
Waste 4.7 m (15.5 ft)
Mineral 10.4 m (34.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.5	(1.5)	0.5	(1.5)
Alluvium		Silt and peat	1.2	(4.0)	1.7	(5.5)
25-ft Drift	A.	'Clayey' sand, grey-green: fine rounded quartz	1.8	(6.0)	3.5	(11.5)
		Silt, reddish brown, laminated	4.7	(15.5)	8.2	(27.0)
Older River Sand and Gravel	B.	Sand: fine, subrounded to well rounded quartz with some coal	8.0	(26.0)	16.2	(53.0)
	C.	Pebbly sand — Sand: medium, rounded quartz with coal and other lithic fragments — Gravel: fine, quartzite with sandstone, coal and quartz	2.4	(8.0)	18.6	(61.0)
Keuper Marl		Siltstone, light grey, laminated	0.8+	(2.5+)	19.4	(63.5)

		%	mm	%
A.	Gravel	0	+16	0
			-16+4	0
	Sand	86	- 4+1	trace
			- 1+¼	20
			- ¼+1/16	66
	Fines	14	-1/16	14
B.	Gravel	trace	+16	0
			-16+4	trace
	Sand	94	- 4+1	2
			- 1+¼	18
			- ¼+1/16	74
	Fines	6	-1/16	6
C.	Gravel	14	+16	3
			-16+4	11
	Sand	83	- 4+1	25
			- 1+¼	36
			- ¼+1/16	22
	Fines	3	-1/16	3

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.7 - 2.7	7	93	0
2.7 - 3.5	22	78	0
8.2 - 9.2	12	88	0
9.2 - 10.2	3	97	0
10.2 - 11.2	5	95	0
11.2 - 12.2	2	98	0
12.2 - 13.2	5	95	0
13.2 - 14.2	11	89	0
14.2 - 15.2	7	93	0
15.2 - 16.2	4	94	2
16.2 - 17.2	2	80	18
17.2 - 18.6	3	85	12

Surface level (+1.5 m) +5 ft
Water level 0 m (0 ft)
November 1973

Overburden 3.0 m (10.0 ft)
Mineral 1.5 m (5.0 ft)
Waste 3.5 m (11.5 ft)
Mineral 6.5 m (21.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	**0.7**	(2.5)	0.7	(2.5)
Alluvium	Silt and peat	2.3	(7.5)	3.0	(10.0)
25-ft Drift	A. 'Very clayey' sand, grey, fine, rounded quartz	1.5	(5.0)	4.5	(15.0)
	Silt, reddish brown, laminated and micaceous	3.5	(11.5)	8.0	(26.0)
Older River Sand and Gravel	B. 'Clayey' sand, reddish brown, fine, rounded quartz with some coal; rare pebbles	6.5	(21.5)	14.5	(47.5)
Keuper Marl	Siltstone, grey-green to red	1.0+	(3.0+)	15.5	(51.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	3.0 - 4.0	12	88	0
			-16+4	0	4.0 - 4.5	39	61	0
	Sand	79	-4+1	trace				
			-1+$\frac{1}{4}$	13				
			-$\frac{1}{4}$+1/16	66				
	Fines	21	-1/16	21				
B.	Gravel	0	+16	0	8.0 - 9.0	23	77	0
			-16+4	0	9.0 - 10.0	26	74	0
					10.0 - 11.0	7	93	trace
	Sand	88	-4+1	1	11.0 - 12.0	5	95	0
			-1+$\frac{1}{4}$	13	12.0 - 13.0	10	90	trace
			-$\frac{1}{4}$+1/16	74	13.0 - 14.0	1	99	0
					14.0 - 14.5	17	83	0
	Fines	12	-1/16	12				

Surface level (+4.0 m) +13 ft
Water level +0.3 m (+1 ft)
November 1973

Overburden 9.4 m (31.0 ft)
Mineral 8.6 m+ (28.0 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Alluvium	Silt, peaty in parts	8.8	(29.0)	9.4	(31.0)
	'Very clayey' sand, with thin peat at 14.8 m, grey to black, fine, rounded quartz with some mica and coal	8.6+	(28.0+)	18.0	(59.0)
	Hole abandoned due to rising sand				

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	trace	+16	0	9.4 - 10.4	26	74	0
		-16+4	trace	10.4 - 11.4	4	96	0
				11.4 - 12.4	7	93	trace
				12.4 - 13.4	17	83	trace
Sand	80	-4+1	1	13.4 - 14.4	20	80	trace
		$-1+\frac{1}{4}$	22	14.4 - 15.4	21	79	trace
		$-\frac{1}{4}+1/16$	57	15.4 - 16.4	29	71	trace
				16.4 - 17.4	34	66	trace
Fines	20	-1/16	20	17.4 - 18.0	26	74	trace

Surface level (+2.1 m) +7 ft
Water level +1.4 m (+5 ft)
November 1974

Overburden 8.8 m (29.0 ft)
Mineral 11.4 m (37.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
Alluvium	Silt and peat	8.1	(26.5)	8.8	(29.0)
	A. Sand, 'clayey' at top, grey, fine to medium, subrounded to rounded quartz, with some coal, rare chert and mudstone	7.0	(23.0)	15.8	(52.0)
	B. Sandy Gravel Sand: medium, subrounded to rounded quartz with some coal, mudstone and chert Gravel: fine to coarse, rounded quartzite with some mudstone and rare chert	4.4	(14.5)	20.2	(66.5)
Keuper Marl	Mudstone, reddish brown	0.7+	(2.5+)	20.9	(68.5)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	trace	+16	0	8.8 - 9.8	15	75	trace
			-16+4	trace	9.8 - 10.8	13	87	trace
					10.8 - 11.8	3	96	1
	Sand	94	-4+1	3	11.8 - 12.8	3	97	0
			$-1+\frac{1}{4}$	39	12.8 - 13.8	3	97	trace
			$-\frac{1}{4}+1/16$	52	13.8 - 14.8	3	96	1
					14.8 - 15.8	3	96	t
	Fines	6	-1/16	6				
B	Gravel	37	+16	23	15.8 - 16.8	3	79	18
			-16+4	14	16.8 - 17.8	2	61	37
					17.8 - 18.8	1	51	48
	Sand	61	-4+1	20	18.8 - 20.2	2	55	43
			$-1+\frac{1}{4}$	31				
			$-\frac{1}{4}+1/16$	10				
	Fines	2	-1/16	2				

Surface level (+2.1 m) +7 ft
Water level +0.9 m (+3 ft)
October 1973

Overburden 2.9 m (9.5 ft)
Mineral 2.5 m (8.0 ft)
Waste 2.8 m (9.0 ft)
Mineral 10.9 m (36.0 ft)
Bedrock 0.6 m+ (2.0 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
	Soil		0.5	(1.5)	0.5	(1.5)
Alluvium	Silt and peat		2.4	(8.0)	2.9	(9.5)
25-ft Drift	A.	'Clayey' sand, olive green, fine rounded quartz	2.5	(8.0)	5.4	(17.5)
		Clay, silty in part, reddish brown	2.8	(9.0)	8.2	(27.0)
Older River Sand and Gravel	B.	Sand, 'clayey' at top, pebbly near base, medium, subrouned to rounded quartz with some coal and chert, and rare mudstone and quartzite	10.9	(36.0)	19.1	(62.5)
Keuper Marl		Mudstone, green	0.6+	(2.0+)	19.7	(64.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	trace	+16	0	2.0 - 3.9	6	94	0
			-16+4	trace	3.9 - 4.9	23	76	1
					4.9 - 5.4	26	73	1
	Sand	83	-4+1	2				
			$-1+\frac{1}{4}$	27				
			$-\frac{1}{4}+1/16$	54				
	Fines	17	-1/16	17				
B.	Gravel	1	+16	0	8.2 - 9.2	16	84	0
			-16+4	1	9.2 - 10.2	14	86	trace
					10.2 - 11.2	4	96	trace
	Sand	94	-4+1	3	11.2 - 12.2	3	97	trace
			$-1+\frac{1}{4}$	53	12.2 - 13.2	4	96	trace
			$-\frac{1}{4}+1/16$	38	13.2 - 14.2	3	95	2
					14.2 - 15.2	2	98	trace
	Fines	5	-1/16	5	15.2 - 16.2	2	98	trace
					16.2 - 17.2	1	99	trace
					17.2 - 18.2	5	91	4
					18.2 - 19.1	0	94	6

Surface level (+1.8 m) +6 ft

Water level -0.1 m (0 ft)

March 1973

Overburden 9.8 m (32.0 ft)

Mineral 4.8 m (15.5 ft)

Bedrock 1.0 m+ (3.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	1.0	(3.5)	1.0	(3.5)
Alluvium	Clay, yellow brown	0.7	(2.5)	1.7	(5.5)
	Peaty silt, grey brown, laminated	8.1	(26.5)	9.8	(32.0)
	Sand, 'clayey' in part, fine, sub-rounded to well rounded quartz with few rock fragments	4.8	(15.5)	14.6	(48.0)
Keuper Marl	Mudstone, red, laminated	1.0+	(3.5+)	15.6	(51.0)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	0	+16	0	9.8 - 10.8	9	91	0
		-16+4	0	10.8 - 11.8	4	96	0
				11.8 - 12.8	8	92	0
Sand	92	-4+1	2	12.8 - 13.8	11	89	0
		$-1+\frac{1}{4}$	27	13.8 - 14.6	8	92	0
		$-\frac{1}{4}+1/16$	63				
Fines	8	-1/16	8				

Surface level (+2.7 m) +9 ft
Water level +0.7 m (+2 ft)
November 1973

Overburden 2.3 m (7.5 ft)
Mineral 2.2 m (7.0 ft)
Waste 4.0 m (13.0 ft)
Mineral 8.8 m (29.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.6	(2.0)	0.6	(2.0)
Alluvium		Silt with peat, sandy at base	1.7	(5.5)	2.3	(7.5)
25-ft Drift	A.	'Clayey' sand, grey, fine, rounded quartz, rare coal	2.2	(7.0)	4.5	(15.0)
		Silt, light brown, sandy, laminated	4.0	(13.0)	8.5	(28.0)
Older River Sand and Gravel	B.	Sand, 'clayey' at base, fine, sub-rounded to rounded quartz with few coal fragments	8.8	(29.0)	17.3	(57.0)
Keuper Marl		Siltstone, reddish brown	1.0+	(3.5+)	18.3	(60.0)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	0	+16	0	2.3 - 3.3	9	91	0
			-16+4	0	3.3 - 4.5	12	88	0
	Sand	88	- 4+1	trace				
			- 1+$\frac{1}{4}$	20				
			- $\frac{1}{4}$+1/16	68				
	Fines	12	- 1/16	12				
B.	Gravel	0	+16	0	8.5 - 9.5	3	97	0
			-16+4	0	9.5 - 10.5	4	96	0
					10.5 - 11.5	4	96	0
	Sand	94	- 4+1	trace	11.5 - 12.5	6	94	0
			- 1+$\frac{1}{4}$	12	12.5 - 13.5	4	96	0
			-$\frac{1}{4}$+1/16	82	13.5 - 14.5	8	92	0
					14.5 - 15.5	4	96	trace
	Fines	6	-1/16	6	15.5 - 16.5	7	93	0
					16.5 - 17.3	19	81	0

SE 81 NW 21   8248 1640   Haldenby Grange, Luddington   Block B

Surface level (+2.7 m) +9 ft   Overburden 5.1 m (16.5 ft)
Water level +1.3 m (+4 ft)   Mineral 6.0 m (19.5 ft)
November 1973   Waste 3.0 m (10.0 ft)
                                                               Mineral 3.9 m+ (13.0 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	1.1	(3.5)	1.1	(3.5)
Alluvium	Silt, reddish brown to grey, micaceous	4.0	(13.0)	5.1	(16.5)
	A. 'Very clayey' sand, with rare thin peat bands Fines: laminated silt Sand: fine, rounded quartz with traces of coal	6.0	(19.5)	11.1	(36.5)
	Silt, grey, with thin peat	3.0	(10.0)	14.1	(46.0)
	B. 'Very clayey' sand with rare thin peat bands Fines: laminated silt Sand: fine, rounded quartz with some mica and rare coal	3.9+	(13.0+)	18.0	(59.0)

Hole abandoned due to rising sand

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	0	+16	0	5.1 - 6.1	32	68	0
			-16+4	0	6.1 - 7.1	29	71	0
					7.1 - 8.1	6	94	0
			- 4+1	trace	8.1 - 9.1	32	68	0
	Sand	71	- 1+$\frac{1}{4}$	1	9.1 - 10.1	40	60	0
			- $\frac{1}{4}$+1/16	70	10.1 - 11.1	37	63	trace
	Fines	29	- 1/16	29				
B.	Gravel	0	+16	0	14.1 - 15.1	38	62	trace
			-16+4	0	15.1 - 16.1	27	73	0
					16.1 - 17.1	29	71	0
	Sand	69	- 4+1	trace	17.1 - 18.0	33	67	0
			- 1+$\frac{1}{4}$	1				
			- $\frac{1}{4}$+1/16	68				
	Fines	31	- 1/16	31				

Surface level (+2.4 m) +8 ft
Water level 0 m (0 ft)
November 1973

Overburden 3.1 m (10.0 ft)
Mineral 1.9 m (6.0 ft)
Waste 1.8 m (6.0 ft)
Mineral 6.9 m (22.5 ft)
Bedrock 0.8 m+ (2.5 ft+)

				Thickness		Depth	
				m	(ft)	m	(ft)
			Soil	0.7	(2.5)	0.7	(2.5)
Alluvium			Silt and peat	2.4	(8.0)	3.1	(10.0)
25-ft Drift		A.	'Clayey' sand, brown to grey: fine, rounded quartz with traces of coal	1.9	(6.0)	5.0	(16.5)
			Clay, reddish brown, laminated	1.8	(6.0)	6.8	(22.5)
Older River Sand and Gravel		B.	'Clayey' sand, brown, fine, rounded quartz with rare coal	3.0	(10.0)	9.8	(32.0)
		C.	Sand: medium, rounded to subrounded quartz with coal, some mudstone and rare chert	3.9	(13.0)	13.7	(45.0)
Keuper Marl			Mudstone, reddish brown	0.8+	(2.5+)	14.5	(47.5)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	0	+16	0	3.1 - 4.1	13	87	0
			-16+4	0	4.1 - 5.0	17	83	0
	Sand	85	- 4+1	trace				
			- 1+$\frac{1}{4}$	14				
			- $\frac{1}{4}$+1/16	71				
	Fines	15	-1/16	15				
B.	Gravel	0	+16	0	6.8 - 7.8	10	90	0
			-16+4	0	7.8 - 8.8	16	84	0
					8.8 - 9.8	13	87	0
	Sand	87	- 4+1	trace				
			- 1+$\frac{1}{4}$	14				
			- $\frac{1}{4}$+1/16	73				
	Fines	13	- 1/16	13				
C.	Gravel	1	+16	trace	9.8 - 10.8	1	99	0
			-16+4	trace	10.8 - 11.8	2	97	1
					11.8 - 12.8	1	97	2
	Sand	97	- 4+1	2	12.8 - 13.7	4	95	1
			- 1+$\frac{1}{4}$	53				
			- $\frac{1}{4}$+1/16	42				
	Fines	2	-1/16	2				

SE 81 NW 23   8451 1665   More Dyke, Luddington   Block C

Surface level (+3.0 m) +10 ft   Overburden 8.8 m (29.0 ft)
Water level +0.4 m (+1 ft)   Mineral 9.9 m (32.5 ft)
October 1973   Bedrock 0.7 m+ (2.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium on 25-ft Drift	Silt and clay, reddish brown	8.4	(27.5)	8.8	(29.0)
Older River Sand and Gravel	Sand, 'clayey' at top: fine, subrounded to rounded quartz with coal, some mudstone and chert fragments	9.9	(32.5)	18.7	(61.5)
Keuper Marl	Mudstone, reddish brown	0.7+	(2.5+)	19.4	(63.5)

	%	mm	%	Depth below surface (m)	Percentage		
					Fines	Sand	Gravel
Gravel	1	+16	0	8.8 - 9.8	12	88	0
		-16+4	1	9.8 - 10.8	13	87	0
				10.8 - 11.8	9	91	0
Sand	93	- 4+1	3	11.8 - 12.8	5	95	0
		- 1+$\frac{1}{4}$	31	12.8 - 13.8	9	91	0
		- $\frac{1}{4}$+1/16	59	13.8 - 14.8	8	91	1
				14.8 - 15.8	4	96	trace
Fines	6	-1/16	6	15.8 - 16.8	2	95	3
				16.8 - 17.8	2	96	2
				17.8 - 18.7	2	95	3

Surface level (+2.7 m) +9 ft
Water level -0.3 m (-1 ft)
November 1973

Overburden 0.7 m (2.5 ft)
Mineral 3.9 m (13.0 ft)
Waste 5.0 m (16.5 ft)
Mineral 6.2 m (20.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
Blown Sand on 25-ft Drift	A. 'Clayey' sand, ochreous to brown, fine, rounded to well rounded quartz	3.9	(13.0)	4.6	(15.0)
	Sandy silt, red-brown	5.0	(16.5)	9.6	(31.5)
Older River Sand and Gravel	B. Sand, 'clayey' at top and base, grey brown, fine, rounded to well rounded quartz with few coal fragments	6.2	(20.5)	15.8	(52.0)
Keuper Marl	Mudstone, red and green	0.7+	(2.5+)	16.5	(54.0)

		%	mm	%	Depth below surface (m)	Percentage		
						Fines	Sand	Gravel
A.	Gravel	0	+16	0	0.7 - 1.7	23	76	1
			-16+4	0	1.7 - 2.7	30	70	0
					2.7 - 3.7	11	89	0
	Sand	82	- 4+1	1	3.7 - 4.6	8	92	0
			- 1+$\frac{1}{4}$	16				
			- $\frac{1}{4}$+1/16	65				
	Fines	18	-1/16	18				
B.	Gravel	0	+16	0	9.6 - 10.6	10	90	0
			-16+4	0	10.6 - 11.6	3	97	0
					11.6 - 12.6	9	91	0
	Sand	92	- 4+1	0	12.6 - 13.6	9	91	0
			- 1+$\frac{1}{4}$	29	13.6 - 14.6	3	97	0
			- $\frac{1}{4}$+1/16	63	14.6 - 15.8	11	89	0
	Fines	8	-1/16	8				

Surface level (+2.7 m) +9 ft
Water level -0.3 m (- 1 ft)
November 1973

Overburden 2.4 m (8.0 ft)
Mineral 1.4 m (4.5 ft)
Waste 4.3 m (14.0 ft)
Mineral 7.5 m (24.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.8	(2.5)	0.8	(2.5)
Alluvium	Clay, blue-grey	0.6	(2.0)	1.4	(4.5)
	Peat, silty and fibrous	1.0	(3.5)	2.4	(8.0)
25-ft Drift	A. Very 'clayey' sand, light grey: fine quartz	1.4	(4.5)	3.8	(12.5)
	Silt, light brown, micaceous	4.3	(14.0)	8.1	(26.5)
Older River Sand and Gravel	B. Sand: fine, subrounded to rounded quartz with some coal and other rock fragments	7.5	(24.5)	15.6	(51.0)
Keuper Marl	Mudstone, red and green	1.0+	(3.5+)	16.6	(54.5)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	0	+16	0	2.4 - 3.4	22	78	0
			-16+4	0	3.4 - 3.8	18	82	0
	Sand	79	- 4+1	0				
			- 1+¼	5				
			- ¼+1/16	74				
	Fines	21	-1/16	21				
B.	Gravel	0	+16	0	8.1 - 9.1	3	97	0
			-16+4	0	9.1 - 10.1	3	97	0
					10.1 - 11.1	4	96	0
	Sand	96	- 4+1	0	11.1 - 12.1	6	94	0
			- 1+¼	33	12.1 - 13.1	4	96	0
			- ¼+1/16	63	13.1 - 14.1	7	93	0
					14.1 - 15.1	2	98	0
	Fines	4	- 1/16	4	15.1 - 15.6	3	97	0

SE 81 NW 26   8248 1526   High Bridge Farm, Luddington   Block C

Surface level (+2.4 m) +8 ft   Overburden 8.0 m (26.0 ft)
Water level -0.6 m (-2 ft)   Mineral 9.4 m (31.0 ft)
October 1973   Bedrock 0.8 m+ (2.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
Alluvium	Silt, light brown, micaceous and laminated	2.5	(8.0)	3.2	(10.5)
	Peat, dark brown, fibrous	0.8	(2.5)	4.0	(13.0)
25-ft Drift	Silty sand, light brown, fine, subangular to rounded quartz	1.0	(3.5)	5.0	(16.5)
	Sandy silt, light brown	3.0	(10.0)	8.0	(26.0)
Older River Sand and Gravel	'Clayey' sand, light brown, fine, subrounded to rounded quartz with few coal fragments	9.4	(31.0)	17.4	(57.0)
Keuper Marl	Mudstone, red and green, gypsiferous	0.8+	(2.5+)	18.2	(60.0)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	0	+16	0	8.0 - 9.0	26	74	0
		-16+4	0	9.0 - 10.0	10	90	0
				10.0 - 11.0	14	86	0
Sand	90	- 4+1	1	11.0 - 12.0	10	90	0
		- $1+\frac{1}{4}$	19	12.0 - 13.0	13	87	0
		- $\frac{1}{4}$+1/16	70	13.0 - 14.0	9	91	0
				14.0 - 15.0	5	95	0
Fines	10	-1/16	10	15.0 - 16.0	3	97	0
				16.0 - 17.0	3	97	0
				17.0 - 17.4	11	89	0

Surface level (+3.0 m) +10 ft
Water level -0.5 m (-2 ft)
October 1973

Overburden 9.4 m (31.0 ft)
Mineral 3.2 m (10.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Alluvium	Silt, light brown, micaceous	2.4	(8.0)	3.0	(10.0)
	Peat, dark brown, fibrous	1.4	(4.5)	4.4	(14.5)
25-ft Drift	'Clayey' sand, grey-green, fine, subrounded to rounded quartz	1.0	(3.5)	5.4	(17.5)
	Sandy silt, grey brown, laminated	4.0	(13.0)	9.4	(31.0)
Older River Sand and Gravel	'Clayey' sand, light brown, fine subangular to rounded quartz with few coal fragments	3.2	(10.5)	12.6	(41.5)
Keuper Marl	Mudstone, red and green, laminated	1.0+	(3.5+)	13.6	(44.5)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
	---	---	---	---	---	---	---
Gravel	0	+16	0	9.4 - 10.4	23	77	0
		-16+4	0	10.4 - 11.4	13	87	0
				11.4 - 12.6	11	89	0
Sand	85	- 4+1	0				
		- 1+$\frac{1}{4}$	26				
		- $\frac{1}{4}$+1/16	59				
Fines	15	-1/16	15				

SE 81 NW 28   8473 1577   Cotley Hall, Amcotts   Block C

Surface level (+2.4 m) +8 ft
Water level 0 m (0 ft)
November 1973

Overburden 3.4 m (11.0 ft)
Mineral 1.9 m (6.0 ft)
Waste 3.5 m (11.5 ft)
Mineral 10.1 m (33.0 ft)
Bedrock 0.6 m+ (2.0 ft+)

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.7	(2.5)	0.7	(2.5)
Alluvium		Silt, blue-grey	1.8	(6.0)	2.5	(8.0)
		Peat, brown, friable	0.9	(3.0)	3.4	(11.0)
25-ft Drift	A.	'Clayey' sand Fines: grey-green laminated silt Sand: fine, subrounded to rounded quartz, with few chert fragments	1.9	(6.0)	5.3	(17.5)
		Silt and clay, reddish brown, sandy laminations	3.5	(11.5)	8.8	(29.0)
Older River Sand and Gravel	B.	Sand, 'clayey' at top, reddish brown, fine, subrounded to rounded quartz with few coal and chert fragments	6.0	(19.5)	14.8	(48.5)
	C.	Pebbly sand Sand: fine to medium, subrounded to rounded quartz with few chert and mudstone fragments Gravel: fine, subangular chert and subrounded quartzite with some mudstone and rare quartz	4.1	(13.5)	18.9	(62.0)
Keuper Marl		Mudstone, green laminated	0.6+	(2.0+)	19.5	(64.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	3.4 - 4.4	15	85	0
			-16+4	0	4.4 - 5.3	16	84	0
	Sand	84	- 4+1	1				
			- 1+$\frac{1}{4}$	16				
			- $\frac{1}{4}$+1/16	67				
	Fines	16	-1/16	16				
B.	Gravel	1	+16	0	8.8 - 9.8	18	82	0
			-16+4	1	9.8 - 10.8	18	82	0
					10.8 - 11.8	6	94	0
	Sand	91	- 4+1	2	11.8 - 12.8	3	97	0
			- 1+$\frac{1}{4}$	37	12.8 - 13.8	2	96	2
			- $\frac{1}{4}$+1/16	52	13.8 - 14.8	2	95	3
	Fines	8	-1/16	8				

C.		%	mm	%		Fines	Sand	Gravel
	Gravel	20	+16	3	14.8 - 15.8	1	78	21
			-16+4	17	15.8 - 16.8	2	84	14
					16.8 - 17.8	2	72	26
	Sand	78	- 4+1	17	17.8 - 18.9	1	78	21
			- 1+$\frac{1}{4}$	49				
			- $\frac{1}{4}$+1/16	12				
	Fines	2	- 1/16	2				

SE 81 NE 10   8591 1922   Fockerby   Block B

Surface level (+3.7 m) +12 ft
Water level +1.4 m (+5 ft)
October 1973

Overburden 11.1 m (36.5 ft)
Mineral 5.2 m (17.0 ft)
Bedrock 0.6 m+ (2.0 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Alluvium	Silt and peat	10.6	(35.0)	11.1	(36.5)
	'Clayey' sand, grey, fine to medium, subrounded to rounded quartz with some coal and chert; rare gravel at top and base	5.2	(17.0)	16.3	(53.5)
Keuper Marl	Mudstone, reddish brown	0.6+	(2.0+)	16.9	(55.5)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	trace	+16	0	11.1 - 12.1	19	81	trace
		-16+4	trace	12.1 - 13.1	11	88	1
				13.1 - 14.1	10	90	0
Sand	83	- 4+1	3	14.1 - 15.1	23	77	0
		- 1+$\frac{1}{4}$	41	15.1 - 16.3	20	79	1
		- $\frac{1}{4}$+1/16	39				
Fines	17	-1/16	17				

Surface level (+3.4 m) +11 ft
Water level +1.3 m (+4 ft)
October 1973

Overburden 5.0 m (16.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 1.7 m (5.5 ft)
Mineral 11.1 m (36.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

				Thickness		Depth	
				m	(ft)	m	(ft)
		Soil		0.4	(1.5)	0.4	(1.5)
Alluvium		Clay, peat and silt		4.6	(15.0)	5.0	(16.5)
25-ft Drift	A.	'Clayey' sand, grey: fine, subrounded quartz with quartzite		2.0	(6.5)	7.0	(23.0)
		Clay, brown		1.7	(5.5)	8.7	(28.5)
Older River Sand and Gravel	B.	Very 'clayey' sand: fine, subangular to rounded quartz and quartzite with some chert and rock fragments		4.0	(13.0)	12.7	(41.5)
	C.	Sand: medium, quartz and quartzite with chert and coal		5.0	(16.5)	17.7	(58.0)
	D.	Pebbly sand Sand: medium, subrounded to rounded quartz with chert and coal Gravel: fine to coarse, subrounded to rounded quartzite and sub-angular chert with some mudstone		2.1	(7.0)	19.8	(65.0)
Keuper Marl		Mudstone, green, gypsiferous		0.7+	(2.5+)	20.5	(67.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	5.0 - 6.0	22	78	0
			-16+4	0	6.0 - 7.0	17	83	0
	Sand	81	- 4+1	trace				
			- 1+$\frac{1}{4}$	28				
			- $\frac{1}{4}$+1/16	53				
	Fines	19	-1/16	19				
B.	Gravel	trace	+16	0	8.7 - 9.7	33	67	0
			-16+4	trace	9.7 - 10.7	28	72	0
					10.7 - 11.7	21	79	trace
	Sand	75	- 4+1	1	11.7 - 12.7	16	83	1
			- 1+$\frac{1}{4}$	16				
			- $\frac{1}{4}$+1/16	58				
	Fines	25	- 1/16	25				

		%	mm	%	Depth below surface (m)	Fines	Sand	Gravel
C.	Gravel	trace	+16	0	12.7 - 13.7	8	92	trace
			-16+4	trace	13.7 - 14.7	9	91	0
					14.7 - 15.7	5	95	0
	Sand	94	- 4+1	1	15.7 - 16.7	5	95	trace
			- 1+$\frac{1}{4}$	58	16.7 - 17.7	2	98	0
			- $\frac{1}{4}$+1/16	35				
	Fines	6	- 1/16	6				
D.	Gravel	23	+16	9	17.7 - 18.7	1	81	17
			-16+4	14	18.7 - 19.8	1	71	28
	Sand	76	- 4+1	9				
			- 1+$\frac{1}{4}$	55				
			- $\frac{1}{4}$+1/16	12				
	Fines	1	- 1/16	1				

SE 81 NE 12   8607 1709   Burton Stather   Block E

Surface level (+3.4 m) +11 ft   Waste 13.5 m (44.5 ft)
Water level +0.4 m (+1 ft)   Bedrock 0.5 m+ (1.5 ft+)
September 1973

			Thickness		Depth	
			m	(ft)	m	(ft)
	Soil		0.5	(1.5)	0.5	(1.5)
Alluvium	Silt, peat and clay		10.9	(36.0)	11.4	(37.5)
	Sand: fine to medium, rounded to well rounded quartz with coal fragments		2.1	(7.0)	13.5	(44.5)
Keuper Marl	Mudstone, red brown		0.5+	(1.5+)	14.0	(46.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
	Gravel	1	+16	0	11.4 - 12.4	6	94	trace
			-16+4	1	12.4 - 13.5	4	95	1
	Sand	94	- 4+1	0				
			- 1+$\frac{1}{4}$	41				
			- $\frac{1}{4}$+1/16	53				
	Fines	5	-1/16	5				

SE 81 NE 13   8587 1592   Flixborough Grange   Block E

Surface level (+3.4 m) +11 ft   Waste 17.0 m (56.0 ft)
Water level +0.4 m (+1 ft)   Bedrock 1.5 m+ (5.0 ft+)
March 1973

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt and clay	15.6	(51.0)	16.0	(52.5)

	Sandy gravel
	    Sand: medium, rounded quartz
	    Gravel: fine, subangular to rounded
	        quartz and quartzite with angular
	        to rounded chert
		1.0	(3.5)	17.0	(56.0)

Keuper Marl	Mudstone, red, laminated	1.5+	(5.0+)	18.5	(60.5)

	%	mm	%	Depth below surface (m)	Percentage		
					Fines	Sand	Gravel
Gravel	43	+16 -16+4	4 39	16.0 - 17.0	1	56	43
Sand	56	- 4+1 - 1+$\frac{1}{4}$ - $\frac{1}{4}$+1/16	16 32 8				
Fines	1	- 1/16	1				

Surface level (+3.7 m) +12 ft
Water level +1.9 m (+6 ft)
September 1973

Waste 3.0 m (10.0 ft)
Bedrock 2.0 m+ (6.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Alluvium	Silt, clay and peat	1.9	(6.0)	2.5	(8.0)
	Sand : medium, rounded quartz	0.5	(1.5)	3.0	(10.0)
Keuper Marl	Mudstone and clay, blue-grey, laminated	2.0+	(6.5+)	5.0	(16.5)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand·	Gravel
Gravel	0	+16	0	2.5 - 3.0	7	93	0
		-16+4	0				
Sand	93	- 4+1	trace				
		- 1+$\frac{1}{4}$	59				
		- $\frac{1}{4}$+1/16	34				
Fines	7	-1/16	7				

Surface level (+3.7 m) +12 ft

Water level +1.7 m (+6 ft)

March 1973

Overburden 1.1 m (3.5 ft)

Mineral 5.0 m (16.5 ft)

Waste 5.4 m (17.5 ft)

Mineral 5.5 m (18.0 ft)

Bedrock 1.0 m+ (3.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
	Soil		1.1	(3.5)	1.1	(3.5)
Blown Sand	A.	Sand, 'clayey' at top, yellow brown: fine, subrounded quartz with lithic grains	5.0	(16.5)	6.1	(20.0)
25-ft Drift		Silty clay, brown, laminated in parts	5.4	(17.5)	11.5	(37.5)
Older River Sand and Gravel	B.	Sand: medium, subrounded to well rounded quartz with rock fragments including coal	5.5	(18.0)	17.0	(56.0)
Keuper Marl		Mudstone, red and green, gypsiferous	1.0+	(3.5+)	18.0	(59.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	1.1 - 2.1	16	84	0
			-16+4	0	2.1 - 3.1	16	84	0
					3.1 - 4.1	4	96	0
	Sand	91	- 4+1	0	4.1 - 5.1	4	96	0
			- 1+$\frac{1}{4}$	22	5.1 - 6.1	2	98	0
			- $\frac{1}{4}$+1/16	69				
	Fines	9	-1/16	9				
B.	Gravel	0	+16	0	11.5 - 12.5	2	98	0
			-16+4	0	12.5 - 13.5	2	98	0
					13.5 - 14.5	3	97	0
	Sand	98	- 4+1	4	14.5 - 15.5	2	98	0
			- 1+$\frac{1}{4}$	62	15.5 - 17.0	3	97	0
			- $\frac{1}{4}$+1/16	32				
	Fines	2	-1/16	2				

SE 81 SW 13　　　　8151 1445　　　　　　　　　　　　　Poplar Farm, Luddington　　　　　　　Block D

Surface level (+1.2 m) +4 ft
Water level 0 m (0 ft)
October 1973

Overburden 1.6 m (5.0 ft)
Mineral 1.4 m (4.5 ft)
Waste 1.5 m (5.0 ft)
Mineral 1.0 m (3.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 7.1 m (23.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
Alluvium		Silt and peat	1.2	(4.0)	1.6	(5.0)
25-ft Drift	A.	'Clayey' sand, grey-brown: fine, rounded to well rounded quartz with few rock fragments	1.4	(4.5)	3.0	(10.0)
		Silt, micaceous and laminated	1.5	(5.0)	4.5	(15.0)
	B.	'Clayey' sand, reddish brown: fine, rounded quartz with few rock fragments including coal	1.0	(3.5)	5.5	(18.0)
		Sandy silt	1.0	(3.5)	6.5	(21.5)
Older River Sand and Gravel	C.	Sand: fine, well rounded quartz with few coal and other rock fragments	7.1	(23.5)	13.6	(44.4)
Keuper Marl		Mudstone, reddish brown	1.0+	(3.5+)	14.6	(48.0)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	0	+16	0	1.6 – 2.6	15	85	0
			−16+4	0	2.6 – 3.0	10	90	0
	Sand	87	− 4+1	0				
			− 1+$\frac{1}{4}$	27				
			− $\frac{1}{4}$+1/16	60				
	Fines	13	− 1/16	13				
B.	Gravel	0	+16	0	4.5 – 5.5	19	81	0
			−16+4	0				
	Sand	81	− 4+1	0				
			− 1+$\frac{1}{4}$	3				
			− $\frac{1}{4}$+1/16	78				
	Fines	19	− 1/16	19				
C.	Gravel	0	+16	0	6.5 – 7.5	9	91	0
			−16+4	0	7.5 – 8.5	5	95	0
					8.5 – 9.5	4	96	0
	Sand	95	− 4+1	0	9.5 – 10.5	5	95	0
			− 1+$\frac{1}{4}$	25	10.5 – 11.5	4	96	0
			− $\frac{1}{4}$+1/16	70	11.5 – 12.5	5	95	0
					12.5 – 13.6	4	96	0
	Fines	5	− 1/16	5				

Surface level (+3.0 m) +10 ft
Water level 0 m (0 ft)
October 1973

Overburden 4.5 m (15.0 ft)
Mineral 1.6 m (5.0 ft)
Waste 2.0 m (6.5 ft)
Mineral 8.7 m (28.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.5	(1.5)	0.5	(1.5)
Alluvium		Silt and peat	4.0	(13.0)	4.5	(15.0)
25-ft Drift	A.	Sand, very 'clayey' towards base, light brown, fine, subangular to rounded quartz	1.6	(5.0)	6.1	(20.0)
		Silt, brown, micaceous	2.0	(6.5)	8.1	(26.5)
Older River Sand and Gravel	B.	Sand, very 'clayey' in upper part, reddish brown, fine, rounded quartz with few coarse limestone and coal fragments	8.7	(28.5)	16.8	(55.0)
Keuper Marl		Mudstone, gypsiferous	0.7+	(2.5+)	17.5	(57.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	4.5 - 5.5	5	95	0
			-16+4	0	5.5 - 6.1	37	63	0
	Sand	83	- 4+1	1				
			- 1+$\frac{1}{4}$	35				
			- $\frac{1}{4}$+1/16	47				
	Fines	17	-1/16	17				
B.	Gravel	0	+16	0	8.1 - 9.1	24	76	0
			-16+4	0	9.1 - 10.1	13	87	0
					10.1 - 11.1	13	87	0
					11.1 - 12.1	10	90	0
	Sand	91	- 4+1	1	12.1 - 13.1	5	95	0
			- 1+$\frac{1}{4}$	30	13.1 - 14.1	5	95	0
			- $\frac{1}{4}$+1/16	60	14.1 - 15.1	2	98	0
					15.1 - 16.1	2	98	0
	Fines	9	-1/16	9	16.1 - 16.8	4	96	0

SE 81 SW 15   8330 1431   Warplands Farm, Amcotts   Block C

Surface level (+0.9 m)   +3 ft   Overburden 2.5 m (8.0 ft)
Water level +0.4 m (+1 ft)   Mineral 1.0 m (3.5 ft)
October 1973   Waste 4.0 m (13.0 ft)
                                                        Mineral 6.5 m (21.5 ft)
                                                        Bedrock 0.8 m+ (2.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Alluvium	Silt and peat	1.9	(6.0)	2.5	(8.0)
25-ft Drift	A. 'Clayey' sand, grey-brown, fine, rounded to well rounded quartz with few rock fragments	1.0	(3.5)	3.5	(11.5)
	Sandy silt	4.0	(13.0)	7.5	(24.5)
Older River Sand and Gravel	B. Sand, 'clayey' near top, reddish brown, fine, rounded to well rounded quartz with few rock fragments	6.5	(21.5)	14.0	(46.0)
Keuper Marl	Mudstone, red and green, laminated	0.8+	(2.5+)	14.8	(48.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	2.5 - 3.5	17	83	0
			-16+4	0				
	Sand	83	- 4+1	1				
			- 1+$\frac{1}{4}$	21				
			- $\frac{1}{4}$+1/16	61				
	Fines	17	-1/16	17				
B.	Gravel	0	+16	0	7.5 - 8.5	5	95	0
			-16+4	0	8.5 - 9.5	12	88	0
					9.5 - 10.5	5	95	0
	Sand	95	- 4+1	1	10.5 - 11.5	4	96	0
			- 1+$\frac{1}{4}$	38	11.5 - 12.5	5	95	0
			- $\frac{1}{4}$+1/16	56	12.5 - 13.5	2	98	0
					13.5 - 14.0	2	98	0
	Fines	5	-1/16	5				

SE 81 SW 16   8464 1438   Amcotts Pasture   Block E

Surface level (+2.1 m) +7 ft   Overburden 9.6 m (31.5 ft)
Water level +1.2 m (+4 ft)   Mineral 7.4 m (24.5 ft)
October 1973   Bedrock 1.0 m+ (3.5 ft+)

			Thickness m	(ft)	Depth m	(ft)
		Soil	1.0	(3.5)	1.0	(3.5)
Alluvium		Silt and peat	8.6	(28.0)	9.6	(31.5)
	A.	Sand, pebbly near base Sand: medium, rounded to well rounded quartz with few coal fragments Gravel: fine, rounded quartzite, chert, mudstone and limestone	5.0	(16.5)	14.6	(48.0)
	B.	Sandy Gravel Sand: medium, rounded quartz with quartzite, limestone and other rock fragments Gravel: fine, subangular to rounded quartz, chert and flint with lime- stone and sandstone	2.4	(8.0)	17.0	(56.0)
Keuper Marl		Mudstone, reddish brown	1.0+	(3.5+)	18.0	(59.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	3	+16	0	9.6 - 10.6	3	97	0
			-16+4	3	10.6 - 11.6	3	97	0
					11.6 - 12.6	2	98	0
	Sand	95	- 4+1	5	12.6 - 13.6	1	93	6
			- 1+$\frac{1}{4}$	70	13.6 - 14.6	2	93	5
			- $\frac{1}{4}$+1/16	20				
	Fines	2	-1/16	2				
B.	Gravel	47	+16	17	14.6 - 15.6	1	62	37
			-16+4	30	15.6 - 16.6	1	37	62
	Sand	52	- 4+1	7	16.6 - 17.0	1	67	32
			- 1+$\frac{1}{4}$	35				
			- $\frac{1}{4}$+1/16	10				
	Fines	1	- 1/16	1				

Surface level (+1.5 m) +5 ft
Water level +2.0 m (+7 ft)
October 1973

Overburden 7.0 m (23.0 ft)
Mineral 4.6 m (15.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Alluvium	Silt and peat	1.7	(5.5)	2.2	(7.0)
25-ft Drift	'Clayey' sand with thin laminated clay bands Sand: fine, subangular to well rounded quartz	0.8	(2.5)	3.0	(10.0)
	Sandy silt	4.0	(13.0)	7.0	(23.0)
Older River Sand and Gravel	Sand: fine, rounded to well rounded quartz with few rock fragments	4.6	(15.0)	11.6	(38.0)
Keuper Marl	Mudstone, red, laminated	1.0+	(3.5+)	12.6	(41.5)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	0	+16	0	7.0 - 8.0	8	92	0
		-16+4	0	8.0 - 9.0	9	91	0
				9.0 - 10.0	7	93	0
Sand	93	- 4+1	1	10.0 - 11.0	4	96	0
		- 1+$\frac{1}{4}$	27	11.0 - 11.6	5	95	0
		- $\frac{1}{4}$+1/16	65				
Fines	7	- 1/16	7				

Poplar Farm, Amcotts   Block D

Surface level (+1.2 m) +4 ft
Water level -0.8 m (-3 ft)
October 1973

Overburden 2.5 m (8.0 ft)
Mineral 1.0 m (3.5 ft)
Waste 4.0 m (13.0 ft)
Mineral 7.1 m (23.5 ft)
Bedrock 0.6 m+ (2.0 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.5	(1.5)	0.5	(1.5)
Alluvium		Silt and peat	2.0	(6.5)	2.5	(8.0)
25-ft Drift	A.	Sand: fine, subangular to well rounded quartz with few rock fragments	1.0	(3.5)	3.5	(11.5)
		Sandy silt	4.0	(13.0)	7.5	(24.5)
Older River Sand and Gravel	B.	Sand: fine, rounded to well rounded quartz with few rock fragments; rare gravel	7.1	(23.5)	14.6	(48.0)
Keuper Marl		Mudstone, red, gypsiferous	0.6+	(2.0+)	15.2	(50.0)

		%	mm	%	Depth below surface (m)	Percentage		
						Fines	Sand	Gravel
A.	Gravel	0	+16	0	2.5 - 3.5	9	91	0
			-16+4	0				
	Sand	91	- 4+1	0				
			- 1+$\frac{1}{4}$	4				
			- $\frac{1}{4}$+1/16	87				
	Fines	9	- 1/16	9				
B.	Gravel	0	+16	0	7.5 - 8.5	4	96	0
			-16+4	0	8.5 - 9.5	3	97	0
					9.5 - 10.5	5	95	0
	Sand	95	- 4+1	1	10.5 - 11.5	6	94	0
			- 1+$\frac{1}{4}$	37	11.5 - 12.5	5	95	0
			- $\frac{1}{4}$+1/16	57	12.5 - 13.5	4	96	0
					13.5 - 14.0	7	92	1
	Fines	5	- 1/16	5	14.0 - 14.6	9	91	0

Surface level (+0.9 m) +3 ft

Water level 0 m (0 ft)

October 1973

Overburden 1.2 m (4.0 ft)

Mineral 3.0 m (10.0 ft)

Waste 1.8 m (6.0 ft)

Mineral 7.6 m (25.0 ft)

Bedrock 0.8 m+ (2.5 ft+)

				Thickness		Depth	
				m	(ft)	m	(ft)
		Soil		0.7	(2.5)	0.7	(2.5)
Alluvium		Peaty silt		0.5	(1.5)	1.2	(4.0)
25-ft Drift	A.	Sand, 'clayey' near base: fine, rounded to well rounded quartz with few coal fragments		3.0	(10.0)	4.2	(14.0)
		Sandy silt		1.8	(6.0)	6.0	(19.5)
Older River Sand and Gravel	B.	'Clayey' sand: fine, rounded to well rounded quartz with few coal fragments		4.0	(13.0)	10.0	(33.0)
	C.	Sand, 'clayey' at base: fine, rounded to well rounded quartz with few coal fragments		3.6	(12.0)	13.6	(44.5)
Keuper Marl		Mudstone, red, laminated, gypsiferous		0.8+	(2.5+)	14.4	(47.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	1.2 - 2.2	4	96	0
			-16+4	0	2.2 - 3.2	4	96	0
					3.2 - 4.2	10	90	0
	Sand	94	- 4+1	0				
			- 1+$\frac{1}{4}$	28				
			-$\frac{1}{4}$+1/16	66				
	Fines	6	-1/16	6				
B.	Gravel	0	+16	0	6.0 - 7.0	26	74	0
			-16+4	0	7.0 - 8.0	12	88	0
					8.0 - 9.0	7	93	0
	Sand	84	- 4+1	0	9.0 - 10.0	19	81	0
			- 1+$\frac{1}{4}$	20				
			- $\frac{1}{4}$+1/16	64				
	Fines	16	-1/16	16				

		%	mm	%	Depth	Fines	Sand	Gravel
C.	Gravel	0	+16	0	10.0 - 11.0	3	97	0
			-16+4	0	11.0 - 12.0	3	97	0
					12.0 - 13.0	3	97	trace
	Sand	96	- 4+1	1	13.0 - 13.6	12	88	0
			- 1+$\frac{1}{4}$	37				
			- $\frac{1}{4}$+1/16	58				
	Fines	4	-1/16	4				

SE 81 SW 20   8331 1336   Amcotts Grange, Amcotts   Block C

Surface level (+1.5 m) +5 ft
Water level   -0.5 m (-2 ft)
October 1973

Overburden 1.8 m (6.0 ft)
Mineral 1.0 m (3.5 ft)
Waste 5.0 m (16.5 ft)
Mineral 6.6 m (21.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
Alluvium		Silt and peat	1.4	(4.5)	1.8	(6.0)
25-ft Drift	A.	'Very clayey' sand, brown: fine, well rounded quartz	1.0	(3.5)	2.8	(9.0)
		Sandy silt	5.0	(16.5)	7.8	(25.5)
Older River Sand and Gravel	B.	Sand, 'very clayey' at base: fine, well rounded quartz with few coal fragments; rare gravel	6.6	(21.5)	14.4	(47.0)
Keuper Marl		Mudstone, red and green, laminated	1.0+	(3.5+)	15.4	(50.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	1.8 - 2.8	37	63	0
			-16+4	0				
	Sand	63	- 4+1	0				
			- 1+$\frac{1}{4}$	1				
			- $\frac{1}{4}$+1/16	62				
	Fines	37	-1/16	37				
B.	Gravel	trace	+16	0	7.8 - 8.8	3	97	0
			-16+4	trace	8.8 - 9.8	4	96	0
					9.8 - 10.8	4	96	0
	Sand	94	- 4+1	1	10.8 - 11.8	2	98	0
			- 1+$\frac{1}{4}$	33	11.8 - 12.8	9	91	0
			- $\frac{1}{4}$+1/16	60	12.8 - 13.8	3	97	0
					13.8 - 14.4	24	74	2
	Fines	6	-1/16	6				

Surface level (+3.4 m) +11 ft
Water level not recorded
October 1973

Overburden 6.7 m (22.0 ft)
Mineral 6.8 m (22.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Alluvium	Silt and peat, sandy at base	6.1	(20.0)	6.7	(22.0)
	Sand, 'clayey' at top, medium, subangular to rounded quartz with few coal fragments; rare quartz and quartzite pebbles	6.8	(22.5)	13.5	(44.5)
Keuper Marl	Mudstone, reddish brown	1.0+	(3.5+)	14.5	(47.5)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	trace	+16	0	6.7 - 7.7	10	90	0
		-16+4	trace	7.7 - 8.7	4	96	trace
				8.7 - 9.7	2	97	1
Sand	97	- 4+1	2	9.7 - 10.7	2	98	trace
		- 1+¼	60	10.7 - 11.7	2	97	1
		- ¼+1/16	35	11.7 - 12.7	1	99	trace
				12.7 - 13.5	1	99	trace
Fines	3	-1/16	3				

Surface level (+1.2 m) +4 ft
Water level -0.1 m (0 ft)
March 1973

Overburden 1.0 m (3.5 ft)
Mineral 5.0 m (16.5 ft)
Waste 1.8 m (6.0 ft)
Mineral 6.6 m (21.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	1.0	(3.5)	1.0	(3.5)
25-ft Drift	A.	'Very clayey' sand Fines: thin bands of reddish brown silt Sand: fine, subrounded quartz with few coal fragments	5.0	(16.5)	6.0	(19.5)
		Silty clay, red-brown to grey, laminated	1.8	(6.0)	7.8	(25.5)
Older River Sand and Gravel	B.	Sand: fine, well rounded quartz with few coal and other rock fragments; rare fine gravel	6.6	(21.5)	14.4	(47.0)
Keuper Marl		Mudstone, red, laminated	1.0+	(3.5+)	15.4	(50.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A	Gravel	0	+16	0	1.0 - 2.0	30	70	0
			-16+4	0	2.0 - 3.0	23	77	0
					3.0 - 4.0	7	93	0
	Sand	75	- 4+1	1	4.0 - 5.0	35	65	0
			- 1+$\frac{1}{4}$	3	5.0 - 6.0	31	69	0
			- $\frac{1}{4}$+1/16	71				
	Fines	25	-1/16	25				
B.	Gravel	trace	+16	0	7.8 - 8.8	5	95	0
			-16+4	trace	8.8 - 9.8	4	96	trace
					9.8 - 10.8	8	92	0
	Sand	96	- 4+1	1	10.8 - 11.8	2	97	1
			- 1+$\frac{1}{4}$	40	11.8 - 12.8	2	96	2
			- $\frac{1}{4}$+1/16	55	12.8 - 14.4	3	97	0
	Fines	4	- 1/16	4				

Surface level (+1.2 m) +4 ft
Water level -1.8 m (-6 ft)
October 1973

Overburden 1.5 m (5.0 ft)
Mineral 4.6 m (15.0 ft)
Waste 1.0 m (3.5 ft)
Mineral 3.5 m (11.5 ft)
Bedrock 0.8 m+ (2.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil and silt	1.5	(5.0)	1.5	(5.0)
25-ft Drift	A. Sand, 'clayey' at base Fines: thin bands of light brown, silt Sand: fine, rounded quartz with few coal fragments	4.6	(15.0)	6.1	(20.0)
	Sandy silt	1.0	(3.5)	7.1	(23.5)
Older River Sand and Gravel	B. Sand, 'clayey' at top, light brown, medium to fine, rounded quartz with few coal fragments	3.5	(11.5)	10.6	(35.0)
Keuper Marl	Siltstone, grey-green	0.8+	(2.5+)	11.4	(37.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	1.5 - 2.5	2	98	0
			-16+4	0	2.5 - 3.5	3	97	0
					3.5 - 4.5	8	92	0
	Sand	93	- 4+1	trace	4.5 - 5.5	10	90	0
			- 1+¼	14	5.5 - 6.1	14	86	0
			- ¼+1/16	79				
	Fines	7	-1/16	7				
B.	Gravel	trace	+16	0	7.1 - 8.1	19	81	0
			-16+4	trace	8.1 - 8.5	3	97	0
					8.5 - 9.5	6	94	trace
	Sand	91	- 4+1	1	9.5 - 10.6	3	96	1
			- 1+¼	44				
			- ¼+1/16	46				
	Fines	9	- 1/16	9				

Surface level (+2.1 m) +7 ft
Water level +0.1 m (0 ft)
October 1973

Overburden 2.0 m (6.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 4.0 m (13.0 ft)
Mineral 6.7 m (22.0 ft)
Bedrock 1.3 m+ (3.5 ft+)

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.6	(2.0)	0.6	(2.0)
Alluvium		Silt, with sand and peat	1.4	(4.5)	2.0	(6.5)
25-ft Drift	A.	Sand: fine, rounded to well rounded quartz	2.0	(6.5)	4.0	(13.0)
		Sandy silt	4.0	(13.0)	8.0	(26.0)
Older River Sand and Gravel	B.	Sand, 'clayey' in part: fine to medium, well rounded quartz with few coal and rock fragments	6.7	(22.0)	14.7	(48.0)
Keuper Marl		Mudstone, red and green, laminated	1.3+	(4.5+)	16.0	(52.5)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	trace	+16	0	2.0 - 3.0	4	95	1
			-16+4	trace	3.0 - 4.0	8	92	0
	Sand	94	- 4+1	1				
			- 1+$\frac{1}{4}$	33				
			- $\frac{1}{4}$+1/16	60				
	Fines	6	-1/16	6				
B.	Gravel	trace	+16	0	8.0 - 9.0	7	93	0
			-16+4	trace	9.0 - 10.0	12	88	0
					10.0 - 11.0	3	97	trace
	Sand	95	- 4+1	1	11.0 - 12.0	3	97	trace
			- 1+$\frac{1}{4}$	47	12.0 - 13.0	2	98	0
			- $\frac{1}{4}$+1/16	47	13.0 - 14.0	4	96	0
	Fines	5	-1/16	5	14.0 - 14.7	2	98	0

Surface level (+1.5 m) +5 ft

Water level -1.3 m (-4 ft)

October 1973

Overburden 3.9 m (13.0 ft)

Mineral 5.0 m (17.0 ft)

Bedrock 0.6 m+ (2.0 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.9	(3.0)	0.9	(3.0)
Alluvium	Silt and peat	3.0	(10.0)	3.9	(13.0)
Alluvium on Older River Sand and Gravel	Sand: fine to medium, rounded to well rounded quartz with few coal fragments	5.0	(16.5)	8.9	(29.0)
Keuper Marl	Mudstone, reddish brown	0.6+	(2.0+)	9.5	(31.0)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	0	+16	0	3.9 - 4.9	5	95	0
		-16+4	0	4.9 - 5.9	4	96	0
				5.9 - 6.9	4	96	0
Sand	96	- 4+1	0	6.9 - 7.9	5	95	0
		- 1+$\frac{1}{4}$	43	7.9 - 8.9	3	97	0
		- $\frac{1}{4}$+1/16	53				
Fines	4	- 1/16	4				

SE 81 SW 26   8445 1240   Neap House Road, Gunness   Block E

Surface level (+2.7 m) +9 ft   Overburden 9.9 m (32.5 ft)
Water level +0.7 m (+2 ft)   Mineral 8.3 m (27.0 ft)
September 1973   Bedrock 0.8 m+ (2.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
	Soil		0.5	(1.5)	0.5	(1.5)
Alluvium	Sandy silt with 0.5 m 'clayey' sand near base		9.4	(31.0)	9.9	(32.5)
	A.	Sand: medium, rounded to well rounded quartz with few rock fragments	5.0	(16.5)	14.9	(49.0)
	B.	Pebbly sand Sand: medium, rounded to well rounded quartz with few lithic grains Gravel: fine to coarse, well rounded limestone, quartzite and sandstone	3.3	(11.0)	18.2	(59.5)
Keuper Marl	Mudstone, reddish brown		0.8+	(2.5+)	19.0	(62.0)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	9.9 - 10.9	4	96	0
			-16+4	0	10.9 - 11.9	3	97	0
					11.9 - 12.9	3	97	0
	Sand	97	- 4+1	0	12.9 - 13.9	2	97	1
			- 1+$\frac{1}{4}$	70	13.9 - 14.9	2	98	0
			- $\frac{1}{4}$+1/16	27				
	Fines	3	-1/16	3				
B.	Gravel	23	+16	7	14.9 - 15.9	3	81	16
			-16+4	16	15.9 - 16.9	1	79	20
					16.9 - 18.2	1	67	32
	Sand	76	- 4+1	9				
			- 1+$\frac{1}{4}$	54				
			- $\frac{1}{4}$+1/16	13				
	Fines	1	-1/16	1				

Surface level (+1.5 m) +5 ft
Water level -0.4 m (-1 ft)
March 1973

Overburden 2.0 m (6.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 3.6 m (12.0 ft)
Mineral 7.5 m (24.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Made ground	0.5	(1.5)	0.5	(1.5)
Alluvium		Clayey silt, micaceous and laminated	1.5	(5.0)	2.0	(6.5)
25-ft Drift	A.	Sand: fine, rounded quartz with rare coal	1.0	(3.5)	3.0	(10.0)
		Silty clay, red brown, laminated	3.6	(12.0)	6.6	(21.5)
Older River Sand and Gravel	B.	Sand: fine, subrounded quartz with few coal and other rock fragments	7.5	(24.5)	14.1	(46.5)
Keuper Marl		Mudstone, red, gypsiferous	1.0+	(3.5+)	15.1	(49.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	2.0 - 3.0	8	92	0
			-16+4	0				
	Sand	92	- 4+1	1				
			- 1+$\frac{1}{4}$	9				
			- $\frac{1}{4}$+1/16	82				
	Fines	8	-1/16	8				
B.	Gravel	0	+16	0	6.6 - 7.6	5	95	0
			-16+4	0	7.6 - 8.6	6	94	0
					8.6 - 9.6	5	95	trace
	Sand	95	- 4+1	trace	9.6 - 10.6	5	95	0
			- 1+$\frac{1}{4}$	25	10.6 - 11.6	4	96	0
			- $\frac{1}{4}$+1/16	70	11.6 - 12.6	4	96	0
					12.6 - 13.6	6	94	0
	Fines	5	- 1/16	5	13.6 - 14.1	8	92	0

Surface level (+1.8 m) +6 ft
Water level -0.1 m (0 ft)
September 1973

Overburden 1.6 m (5.0 ft)
Mineral 2.4 m (8.0 ft)
Waste 0.9 m (3.0 ft)
Mineral 1.7 m (5.5 ft)
Waste 0.8 m (2.5 ft)
Mineral 6.5 m (21.5 ft)
Bedrock 0.8 m+ (2.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	1.1	(3.5)	1.1	(3.5)
Alluvium		Sandy silt	0.5	(1.5)	1.6	(5.0)
25-ft Drift	A.	Sand: fine, rounded to well rounded quartz with few sandstone, chert and coal fragments	2.4	(8.0)	4.0	(13.0)
		Clay, reddish brown	0.9	(3.0)	4.9	(16.0)
	B.	Sand, 'clayey' at base, reddish brown: fine, rounded to well rounded quartz with few mudstone, coal and chert fragments	1.7	(5.5)	6.6	(21.5)
		Clay, reddish brown	0.8	(2.5)	7.2	(23.5)
Older River Sand and Gravel	C.	Sand: medium, subrounded to rounded quartz with few chert, mudstone, sandstone and coal fragments	4.0	(13.0)	11.2	(36.5)
	D.	Pebbly sand	2.5	(8.0)	13.7	(45.0)
		Sand: medium, subrounded to rounded quartz with few chert, mudstone, sandstone and coal fragments Gravel: fine, subangular chert and mudstone with some rounded quartz, quartzite and sandstone				
Keuper Marl		Mudstone, green	0.8+	(2.5+)	14.5	(47.5)

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	1.6 - 2.6	5	95	0
			-16+4	0	2.6 - 4.0	4	96	0
	Sand	95	- 4+1	1				
			- 1+$\frac{1}{4}$	18				
			- $\frac{1}{4}$+1/16	76				
	Fines	5	-1/16	5				
B.	Gravel	0	+16	0	4.9 - 5.9	6	94	0
			-16+4	0	5.9 - 6.6	12	88	0
	Sand	91	- 4+1	0				
			- 1+$\frac{1}{4}$	3				
			- $\frac{1}{4}$+1/16	88				
	Fines	9	-1/16	9				

C.	Gravel	0	+16	0	7.2 - 8.2	8	92	0
			-16+4	0	8.2 - 9.2	4	96	0
					9.2 - 10.2	3	97	0
	Sand	95	- 4+1	1	10.2 - 11.2	3	95	1
			- 1+$\frac{1}{4}$	51				
			- $\frac{1}{4}$+1/16	43				
	Fines	5	-1/16	5				
D.	Gravel	19	+16	1	11.2 - 12.2	3	81	16
			-16+4	18	12.2 - 13.7	2	76	22
	Sand	79	- 4+1	20				
			- 1+$\frac{1}{4}$	42				
			- $\frac{1}{4}$+1/16	17				
	Fines	2	-1/16	2				

SE 81 SW 29   8245 1144   Keadby Junction   Block D

Surface level (+2.1 m) +7 ft
Water level +0.1 m (0 ft)
October 1973

Overburden 0.3 m (1.0 ft)
Mineral 14.7 m (48.0 ft)
Bedrock 0.5 m+ (1.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)

25-ft Drift on Older River Sand and Gravel	A. 'Clayey' to 'very clayey' sand
	   Fines: reddish brown, micaceous
	     in parts
	   Sand: fine, well rounded quartz with
	     few coal fragments
		9.2	(30.0)	9.5	(31.0)

	B. Sand, 'clayey' at base: fine to
	   medium, rounded quartz with
	   few coal fragments
		5.5	(18.0)	15.0	(49.0)

Keuper Marl	Mudstone, red, gypsiferous	0.5+	(1.5+)	15.5	(51.0)

		%	mm	%	Depth below surface (m)	Percentage		
						Fines	Sand	Gravel
A.	Gravel	0	+16	0	0.3 - 1.3	26	74	trace
			-16+4	0	1.3 - 2.3	17	83	trace
					2.3 - 3.3	4	96	0
	Sand	81	- 4+1	0	3.3 - 4.5	8	92	0
			- 1+$\frac{1}{4}$	15	4.5 - 5.5	39	61	0
			- $\frac{1}{4}$+1/16	66	5.5 - 6.5	19	81	0
					6.5 - 7.5	18	82	0
	Fines	19	-1/16	19	7.5 - 8.5	23	77	0
					8.5 - 9.5	20	80	0
B.	Gravel	0	+16	0	9.5 - 10.5	6	94	0
			-16+4	0	10.5 - 11.5	4	96	0
					11.5 - 12.5	3	97	0
	Sand	95	- 4+1	1	12.5 - 13.5	4	96	0
			- 1+$\frac{1}{4}$	42	13.5 - 14.5	4	96	0
			- $\frac{1}{4}$+1/16	52	14.5 - 15.0	13	86	1
	Fines	5	-1/16	5				

SE 81 SW 30   8304 1168   Keadby Power Station   Block E

Surface level   (+1.8 m) +6 ft   Overburden 8.0 m (26.0 ft)
Water level 0 m 0 ft   Mineral 6.8 m (22.5 ft)
October 1973   Bedrock 0.7 m+ (2.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Alluvium	Silt and peat	7.5	(24.5)	8.0	(26.0)
	Sand: fine to medium, rounded to well rounded quartz with few coal fragments	6.8	(22.5)	14.8	(48.5)
Keuper Marl	Mudstone, red and green	0.7+	(2.5+)	15.5	(51.0)

	%	mm	%	Depth below surface (m)	Percentage Fines	Percentage Sand	Percentage Gravel
Gravel	0	+16	0	8.0 - 9.0	6	94	0
		-16+4	0	9.0 - 10.0	5	95	0
				10.0 - 11.0	3	97	0
Sand	97	- 4+1	1	11.0 - 12.0	2	98	0
		- 1+$\frac{1}{4}$	49	12.0 - 13.0	2	98	0
		- $\frac{1}{4}$+1/16	47	13.0 - 14.0	3	97	0
				14.0 - 14.8	3	97	0
Fines	3	-1/16	3				

SE 81 SW 31   8438 1145   61 Station Road, Gunness   Block E

Surface level (+2.1 m) +7 ft   Waste 17.7 m (58.0 ft)
Water level -0.9 m (-3 ft)   Bedrock 1.3 m+ (4.0 ft+)
March 1973

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Alluvium	Silt and peat	3.7	(12.0)	4.0	(13.0)
	Clayey silt, grey, laminated	11.2	(36.5)	15.2	(50.0)
	Sandy gravel Sand: medium, subangular to rounded quartz and quartzite with other rock fragments Gravel: fine, subangular to rounded quartz and quartzite with chert	2.5	(8.0)	17.7	(58.0)
Keuper Marl	Mudstone: red, laminated	1.3+	(4.0+)	19.0	(62.5)

	%	mm	%
Gravel	36	+16	8
		-16+4	28
Sand	62	- 4+1	11
		- 1+$\frac{1}{4}$	44
		- $\frac{1}{4}$+1/16	7
Fines	2	-1/16	2

Depth below surface (m)	Fines	Percentage Sand	Gravel
15.2 - 16.2	1	52	47
16.2 - 17.2	2	66	32
17.2 - 17.7	2	77	21

SE 81 SW 32   8206 1021   Doncaster Road, Althorpe   Block E

Surface level (+0.3 m) +1 ft   Overburden 6.5 m (21.5 ft)
Water level -1.5 m (-5 ft)   Mineral 5.9 m (19.5 ft)
March 1973   Bedrock 1.0 m+ (3.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Alluvium	Peaty silt	5.9	(19.5)	6.5	(21.5)
Alluvium on Older River Sand and Gravel	Sand, clayey and pebbly at top Sand: medium, well rounded quartz with subrounded rock fragments Gravel: fine, quartz and sandstone with flint and limestone	5.9	(19.5)	12.4	(40.5)
Keuper Marl	Mudstone, red	1.0+	(3.5+)	13.4	(44.0)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	3	+16	0	6.5 - 7.5	14	75	11
		-16+4	3	7.5 - 8.5	3	96	1
				8.5 - 9.5	3	97	trace
Sand	93	- 4+1	4	9.5 - 10.5	2	98	trace
		- 1+$\frac{1}{4}$	55	10.5 - 11.5	1	97	2
		- $\frac{1}{4}$+1/16	34	11.5 - 12.4	1	97	2
Fines	4	- 1/16	4				

Surface level (+0.6 m) +2 ft
Water level -2.1 m (-7 ft)
March 1973

Overburden 8.3 m (27.0 ft)
Mineral 4.8 m (15.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

		Thickness m	(ft)	Depth m	(ft)
	Soil	1.5	(5.0)	1.5	(5.0)
Alluvium	Peaty silt	6.8	(22.5)	8.3	(27.0)
Alluvium on Older River Sand and Gravel	Sand, pebbly at top Sand: medium, well rounded quartz and subrounded rock fragments Gravel: fine, well rounded quartz and sandstone	4.8	(15.5)	13.1	(43.0)
Keuper Marl	Mudstone, red, laminated	1.0+	(3.5+)	14.1	(46.5)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	4	+16	0	8.3 - 9.3	7	82	11
		-16+4	4	9.3 - 10.3	5	89	6
				10.3 - 11.3	3	96	1
Sand	91	- 4+1	5	11.3 - 12.3	5	95	trace
		- $1\frac{1}{4}$	56	12.3 - 13.1	5	95	trace
		- $\frac{1}{4}$+1/16	30				
Fines	5	-1/16	5				

SE 81 SW 34   8432 1049   White House Farm, Burringham   Block E

Surface level (+2.4 m) +8 ft   Waste 15.0 m (49.0 ft)
Water level +0.9 m (+3 ft)   Bedrock 1.0 m+ (3.5 ft+)
September 1973

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Alluvium	Silty clay, brown, micaceous	1.6	(5.0)	2.1	(7.0)
	Silt and peat	10.9	(36.0)	13.0	(42.5)
	Sand: medium, rounded to well rounded quartz with some rock fragments; rare gravel at base	2.0	(6.5)	15.0	(49.0)
Keuper Marl	Mudstone, red	1.0+	(3.5+)	16.0	(52.5)

	%	mm	%		Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	1	+16	0		13.0 - 14.0	2	98	0
		-16+4	1		14.0 - 14.5	2	98	0
					14.5 - 15.0	1	97	2
Sand	97	- 4+1	2					
		- 1+$\frac{1}{4}$	79					
		- $\frac{1}{4}$+1/16	16					
Fines	2	-1/16	2					

Surface level (+3.7 m) +12 ft

Water level +3.5 m (+11 ft)

October 1973

Overburden 7.4 m (24.5 ft)

Mineral 12.1 m (39.5 ft)

Bedrock 1.0 m+ (3.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt, sandy towards base	7.0	(23.0)	7.4	(24.5)
	Sand, 'clayey' at top, with a little gravel in parts, dark grey Sand: fine to medium, subrounded to well rounded quartz with few coal and chert fragments Gravel: fine, quartzite and chert	12.1	(39.5)	19.5	(64.0)
Keuper Marl	Mudstone, red and green	1.0+	(3.5+)	20.5	(67.5)

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	1	+16	0	7.4 - 8.4	11	89	0
		-16+4	1	8.4 - 9.4	6	94	0
				9.4 - 10.4	5	95	0
Sand	94	- 4+1	1	10.4 - 11.4	5	95	0
		- 1+$\frac{1}{4}$	39	11.4 - 12.4	8	92	trace
		- $\frac{1}{4}$+1/16	54	12.4 - 13.4	8	92	trace
				13.4 - 14.2	5	95	trace
Fines	5	-1/16	5	14.2 - 15.2	2	94	4
				15.2 - 16.2	3	96	1
				16.2 - 17.2	5	95	0
				17.2 - 18.2	3	97	trace
				18.2 - 19.5	3	96	1

SE 81 SE 21   8626 1406   Flixborough Stather   Block E

Surface level (+3.0 m) +10 ft   Overburden 11.0 m (36.0 ft)
Water level 0 m 0 ft   Mineral 6.2 m (20.5 ft)
March 1973   Bedrock 1.8 m+ (6.0 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Alluvium	Silt with peat and clay	10.7	(35.0)	11.0	(36.0)
	Sand, with a little gravel in parts 　Sand: medium to fine, subrounded 　　to rounded quartz with few chert 　　fragments 　Gravel: subangular to rounded 　　quartzite and chert	6.2	(20.5)	17.2	(56.5)
Keuper Marl	Mudstone, red, laminated	1.8+	(6.0+)	19.0	(62.5)

	%	mm	%	Depth below surface (m)	Percentage		
					Fines	Sand	Gravel
Gravel	2	+16	0	11.0 - 12.0	3	97	0
		-16+4	2	12.0 - 13.0	3	97	0
				13.0 - 14.0	4	95	1
Sand	95	- 4+1	5	14.0 - 15.0	2	96	2
		- 1+$\frac{1}{4}$	48	15.0 - 16.0	2	91	7
		- $\frac{1}{4}$+1/16	42	16.0 - 17.2	3	95	2
Fines	3	-1/16	3				

SE 81 SE 22   8535 1364   Amcotts   Block E

Surface level (+4.9 m)+16 ft   Overburden 6.0 m (19.5 ft)
Water level +1.9 m (+6 ft)   Mineral 11.8 m+ (38.5 ft+)
October 1973

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.8	(2.5)	0.8	(2.5)
Alluvium	Silt, micaceous, laminated	5.2	(17.0)	6.0	(19.5)
	Sand, 'clayey' in parts, dark grey, fine, subrounded to well rounded quartz with few coal fragments; rare gravel	11.8+	(38.5+)	17.8	(58.5)

Hole abandoned due to rising sand

	%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	trace	+16	0	6.0 - 7.0	7	93	0
		-16+4	trace	7.0 - 8.0	8	92	0
				8.0 - 9.0	7	93	0
Sand	92	- 4+1	1	9.0 - 10.0	6	94	0
		- 1+$\frac{1}{4}$	12	10.0 - 11.0	6	94	0
		- $\frac{1}{4}$+1/16	79	11.0 - 12.0	5	95	0
				12.0 - 13.0	4	96	trace
Fines	8	-1/16	8	13.0 - 14.0	4	95	1
				14.0 - 14.8	19	81	0
				14.8 - 15.8	25	75	0
				15.8 - 16.8	4	96	0
				16.8 - 17.8	2	98	0

Surface level +2.1 m (+7 ft)
Water level +0.6 m (+2 ft)
March 1973

Overburden 2.5 m (8.0 ft)
Mineral 3.7 m (12.0 ft)
Waste 2.9 m (9.5 ft)
Mineral 6.4 m (21.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
Alluvium		Peat and clay	2.1	(7.0)	2.5	(8.0)
25-ft Drift	A.	Sand: fine to medium, rounded quartz with some quartzite and chert	3.7	(12.0)	6.2	(20.5)
		Silty clay	2.9	(9.5)	9.1	(30.0)
Older River Sand and Gravel	B.	Sand: fine, rounded quartz with some quartzite and chert	4.0	(13.0)	13.1	(43.0)
	C.	Pebbly sand, 'clayey' in part Sand: fine to coarse, rounded quartz with some quartzite and chert Gravel: subangular to well rounded quartz, quartzite and sandstone with chert	2.4	(8.0)	15.5	(51.0)
Keuper Marl		Mudstone, red and grey, laminated	1.5+	(5.0+)	17.0	(56.0)

		%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
A.	Gravel	0	+16	0	2.5 - 3.5	4	96	0
			-16+4	0	3.5 - 4.5	3	97	0
					4.5 - 5.5	4	96	0
	Sand	97	- 4+1	1	5.5 - 6.2	2	98	0
			- 1+$\frac{1}{4}$	40				
			- $\frac{1}{4}$+1/16	56				
	Fines	3	-1/16	3				
B.	Gravel	1	+16	0	9.1 - 10.1	5	95	trace
			-16+4	1	10.1 - 11.1	3	97	trace
					11.1 - 12.1	4	94	2
	Sand	95	- 4+1	1	12.1 - 13.1	4	95	1
			- 1+$\frac{1}{4}$	29				
			- $\frac{1}{4}$+1/16	65				
	Fines	4	-1/16	4				
C.	Gravel	19	+16	3	13.1 - 14.1	1	77	22
			-16+4	16	14.1 - 15.1	11	70	19
					15.1 - 15.5	2	86	12
	Sand	75	- 4+1	19				
			- 1+$\frac{1}{4}$	33				
			- $\frac{1}{4}$+1/16	23				
	Fines	6	- 1/16	6				

Surface level (+2.4 m) +8 ft
Water level +0.4 m (+1 ft)
March 1973

Overburden 0.7 m (2.5 ft)
Mineral 5.0 m (16.5 ft)
Waste 2.4 m (8.0 ft)
Mineral 2.0 m+ (6.5 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
Blown Sand on 25-ft Drift	A. Sand: fine to medium, subangular to well rounded quartz and quartzite with chert; rare gravel	5.0	(16.5)	5.7	(18.5)
	Silty clay	2.4	(8.0)	8.1	(26.5)
Older River Sand and Gravel	B. Sand, as above	2.0+	(6.5+)	10.1	(33.0)

Hole abandoned due to rising sand

		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	trace	+16	0	0.7 - 1.7	4	96	0
			-16+4	trace	1.7 - 2.7	3	97	0
					2.7 - 3.7	3	97	0
	Sand	97	- 4+1	1	3.7 - 4.7	3	97	0
			- 1+$\frac{1}{4}$	41	4.7 - 5.7	2	97	1
			- $\frac{1}{4}$+1/16	55				
	Fines	3	-1/16	3				
B.	Gravel	1	+16	0	8.1 - 9.1	4	95	1
			-16+4	1	9.1 - 10.1	4	95	1
	Sand	95	- 4+1	3				
			- 1+$\frac{1}{4}$	29				
			- $\frac{1}{4}$+1/16	63				
	Fines	4	-1/16	4				

Surface level (+2.7 m) +9 ft   Overburden 11.0 m (36.0 ft)
Water level +0.7 m (+2 ft)   Mineral 6.7 m (22.0 ft)
March 1973   Bedrock 1.8 m+ (6.0 ft+)

		Thickness		Depth	
		m	(ft)	m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Alluvium	Silty peat and clay	10.7	(35.0)	11.0	(36.0)
A.	Sand: medium, rounded quartz and quartzite with chert and other rock fragments	3.0	(10.0)	14.0	(46.0)
B.	Pebbly sand Sand: medium, rounded quartz and quartzite with chert Gravel: fine, subangular to rounded quartz, quartzite and sandstone with chert	3.7	(12.0)	17.7	(58.0)
Keuper Marl	Mudstone, red, laminated	1.8+	(6.0+)	19.5	(64.0)

		%	mm	%	Depth below surface (m)	Percentage		
						Fines	Sand	Gravel
A.	Gravel	1	+16	0	11.0 - 12.0	2	95	3
			-16+4	1	12.0 - 13.0	3	96	1
					13.0 - 14.0	3	97	trace
	Sand	96	- 4+1	3				
			- 1+$\frac{1}{4}$	67				
			- $\frac{1}{4}$+1/16	26				
	Fines	3	-1/16	3				
B.	Gravel	8	+16	4	14.0 - 15.0	2	91	7
			-16+4	4	15.0 - 16.0	2	86	12
					16.0 - 17.0	1	92	7
	Sand	90	- 4+1	8	17.0 - 17.7	2	92	6
			- 1+$\frac{1}{4}$	58				
			- $\frac{1}{4}$+1/16	24				
	Fines	2	-1/16	2				

Surface level (+1.5 m) +5 ft
Water level 0 m 0 ft
March 1973

Overburden 1.8 m (6.0 ft)
Mineral 3.2 m (10.5 ft)
Waste 1.5 m (5.0 ft)
Mineral 1.0 m (3.5 ft)
Waste 1.5 m (5.0 ft)
Mineral 6.2 m (20.5 ft)
Bedrock 1.3 m+ (4.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.8	(2.5)	0.8	(2.5)
		Peat	1.0	(3.5)	1.8	(6.0)
25-ft Drift	A.	Sand: fine to medium, subangular to rounded quartz and quartzite with chert and rock fragments	3.2	(10.5)	5.0	(16.5)
		Silty clay, greenish grey, laminated	1.5	(5.0)	6.5	(21.5)
	B.	'Very clayey' sand, green-grey: fine, subrounded to rounded quartz with quartzite and chert	1.0	(3.5)	7.5	(24.5)
		Silt	1.5	(5.0)	9.0	(29.5)
Older River Sand and Gravel	C.	Sand, pebbly in lower part Sand: medium to fine, subrounded to rounded quartz with rock fragments Gravel: fine, subrounded to rounded quartzite with some chert	6.2	(20.5)	15.2	(50.0)
Keuper Marl		Mudstone, red	1.3+	(4.5+)	16.5	(54.0)

		%	mm	%	Depth below surface (m)	Percentage Fines	Percentage Sand	Gravel
A.	Gravel	0	+16	0	1.8 - 2.8	7	93	0
			-16+4	0	2.8 - 3.8	2	98	0
					3.8 - 4.8	2	98	0
	Sand	96	- 4+1	1	4.8 - 5.0	2	98	0
			- 1+$\frac{1}{4}$	42				
			- $\frac{1}{4}$+1/16	53				
	Fines	4	-1/16	4				
B.	Gravel	0	+16	0	6.5 - 7.5	26	74	0
			-16+4	0				
	Sand	74	- 4+1	trace				
			- 1+$\frac{1}{4}$	5				
			- $\frac{1}{4}$+1/16	69				
	Fines	26	-1/16	26				

C	Gravel	6	+16	1	9.0 - 10.0	4	96	0
			-16+4	5	10.0 - 11.0	2	98	0
					11.0 - 12.0	2	88	10
	Sand	92	- 4+1	6	12.0 - 13.0	2	93	5
			- 1+¼	50	13.0 - 14.0	2	87	11
			- ¼+1/16	36	14.0 - 15.2	1	92	7
	Fines	2	-1/16	2				

SE 81 SE 27   8583 1147   Gunness Common   Block F

Surface level (+1.5 m) +5 ft
Water level +0.5 m (+2 ft)
September 1973

Overburden 2.8 m (9.0 ft)
Mineral 1.2 m (4.0 ft)
Waste 1.4 m (4.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 6.8 m (22.5 ft)
Bedrock 0.8 m+ (2.5 ft+)

				Thickness		Depth	
				m	(ft)	m	(ft)
		Soil		0.5	(1.5)	0.5	(1.5)
Alluvium		Silt and peat		2.3	(7.5)	2.8	(9.0)
25-ft Drift	A.	Sand: medium, rounded to well rounded quartz		1.2	(4.0)	4.0	(13.0)
		Clay, grey brown		1.4	(4.5)	5.4	(17.5)
	B.	'Very clayey' sand, grey-brown: fine, rounded quartz with few coal fragments		2.0	(6.5)	7.4	(24.5)
		Silt, sandy, grey-brown		1.0	(3.5)	8.4	(27.5)
Older River Sand and Gravel	C.	Sand, with a little gravel, very 'clayey' from 10.4 to 11.4 m Sand: medium, rounded quartz with coal fragments Gravel: fine, chert, limestone and mudstone		5.0	(16.5)	13.4	(44.0)
	D.	Pebbly sand Sand: medium, rounded quartz with coal and limestone Gravel: fine, well rounded chert, mudstone and quartz		1.8	(6.0)	15.2	(50.0)
Keuper Marl		Mudstone, red		0.8+	(2.5+)	16.0	(52.5)

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		%	mm	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
A.	Gravel	1	+16	0	2.8 – 4.0	2	97	1
			−16+4	1				
	Sand	97	− 4+1	1				
			− 1+$\frac{1}{4}$	58				
			− $\frac{1}{4}$+1/16	38				
	Fines	2	−1/16	2				
B.	Gravel	0	+16	0	5.4 – 6.4	39	61	0
			−16+4	0	6.4 – 7.4	21	79	trace
	Sand	70	− 4+1	1				
			− 1+$\frac{1}{4}$	22				
			− $\frac{1}{4}$+1/16	47				
	Fines	30	−1/16	30				
C.	Gravel	2	+16	0	8.4 – 9.4	6	92	2
			−16+4	2	9.4 – 10.4	3	91	6
					10.4 – 11.4	39	61	trace
	Sand	88	− 4+1	5	11.4 – 12.4	2	97	1
			− 1+$\frac{1}{4}$	51	12.4 – 13.4	2	95	3
			− $\frac{1}{4}$+1/16	32				
	Fines	10	−1/16	10				
D.	Gravel	22	+16	2	13.4 – 14.4	2	81	17
			−16+4	20	14.4 – 15.2	1	71	28
	Sand	77	− 4+1	12				
			− 1+$\frac{1}{4}$	43				
			− $\frac{1}{4}$+1/16	22				
	Fines	1	−1/16	1				

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Surface level (+1.8 m)+6 ft
Water level +0.3 m (+1 ft)
September 1973

Overburden 8.0 m (26.0 ft)
Mineral 8.0 m (26.0 ft)
Bedrock 0.5 m+ (1.5 ft+)

			Thickness		Depth	
			m	(ft)	m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
Alluvium		Silt and peat	7.6 ·	(25.0)	8.0	(26.0)
	A.	Sand: medium, rounded quartz with few black rock fragments	4.0	(13.0)	12.0	(39.5)
	B.	Sandy gravel Sand: medium, well rounded to rounded quartz with few rock fragments Gravel: fine, well rounded quartz and quartzite with chert, sandstone and mudstone	4.0	(13.0)	16.0	(52.5)
Keuper Marl		Mudstone, red	0.5+	(1.5+)	16.5	(54.0)

		%	mm	%	Depth below surface (m)	Percentage		
						Fines	Sand	Gravel
A.	Gravel	trace	+16	0	8.0 - 9.0	3	97	0
			-16+4	trace	9.0 - 10.0	4	96	trace
					10.0 - 11.0	3	97	0
	Sand	97	- 4+1	2	11.0 - 12.0	1	98	1
			- 1+$\frac{1}{4}$	70				
			- $\frac{1}{4}$+1/16	25				
	Fines	3	-1/16	3				
B.	Gravel	29	+16	6	12.0 - 13.0	1	88	11
			-16+4	23	13.0 - 14.0	2	74	24
					14.0 - 15.0	1	65	34
	Sand	70	- 4+1	17	15.0 - 16.0	trace	54	46
			- 1+$\frac{1}{4}$	45				
			- $\frac{1}{4}$+1/16	8				
	Fines	1	-1/16	1				

Surface level (+3.4 m) +11 ft
Water level +1.4 m (+5 ft)
March 1973

Overburden 0.6 m (2.0 ft)
Mineral 14.5 m (47.5 ft)
Bedrock 1.4 m+ (4.5 ft+)

	Thickness		Depth	
	m	(ft)	m	(ft)
Soil	0.6	(2.0)	0.6	(2.0)

Blown Sand on Older River Sand and Gravel	Sand, very 'clayey' from 10.6 to 11.6 m: fine, rounded to well rounded quartz and quartzite with chert and rock fragments	14.5	(47.5)	15.1	(49.5)
Keuper Marl	Mudstone, red, laminated	1.4+	(4.5+)	16.5	(54.0)

	%	mm	%	Depth below surface (m)	Percentage Fines	Percentage Sand	Percentage Gravel
Gravel	trace	+16	0	0.6 - 1.6	4	96	0
		-16+4	trace	1.6 - 2.6	3	97	0
				2.6 - 3.6	4	96	0
Sand	94	- 4+1	1	3.6 - 4.6	3	97	0
		- 1+$\frac{1}{4}$	34	4.6 - 5.6	3	97	0
		- $\frac{1}{4}$+1/16	59	5.6 - 6.6	3	97	trace
				6.6 - 7.6	3	97	0
Fines	6	-1/16	6	7.6 - 8.6	2	98	0
				8.6 - 9.6	3	97	0
				9.6 - 10.6	5	95	0
				10.6 - 11.6	23	77	trace
				11.6 - 12.6	9	91	trace
				12.6 - 13.6	6	94	0
				13.6 - 14.6	6	94	0
				14.6 - 15.1	6	94	0

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Appendix G: 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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No. 2   The sand and gravel resources of the country around Witham, Essex: Description of 1 : 25 000 resource sheet TL 81. By H. J. E. Haggard. Price £1.20.   Report No. 72/6

No. 3   The sand and gravel resources of the area south and west of Woodbridge, Suffolk: Description of 1 : 25 000 resource sheet TM 24. By R. Allender and S. E. Hollyer. Price £1.70.
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No. 4   The sand and gravel resources of the country around Maldon, Essex: Description of 1 : 25 000 resource sheet TL 80. By J. D. Ambrose. Price £1.20.   Report No. 73/1

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No. 7   The sand and gravel resources of the country around Layer Breton and Tolleshunt D'Arcy, Essex: Description of 1 : 25 000 resource sheet TL 91 and part of TL 90. By J. D. Ambrose. Price £1.30.   Report No. 73/8

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MINERAL ASSESSMENT REPORTS

No. 13   The sand and gravel resources of the country east of Chelmsford, Essex. Description of 1 : 25 000 resource sheet TL 70. By M. R. Clarke. Price £3.50.

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THE SAND & GRAVEL RESOURCES OF SHEET SE 81 (SCUNTHORPE, HUMBERSIDE)

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

ORDNANCE SURVEY
SHEET SE81
PROVISIONAL EDITION
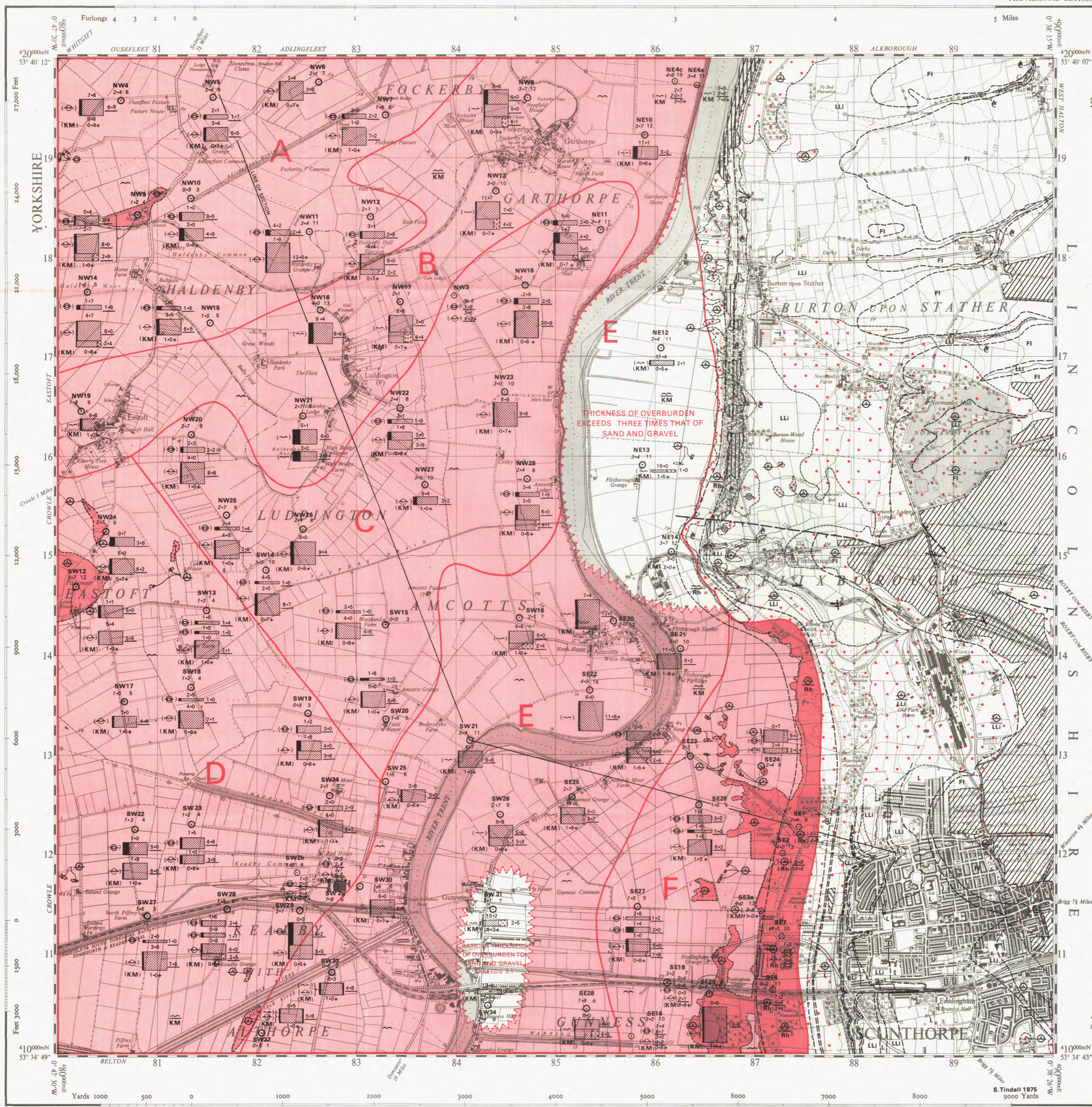
This map should be read in conjunction with the accompanying Report which contains details of the assessment of resources

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EXPLANATION OF SYMBOLS AND ABBREVIATIONS

Landslip

DRIFT

A-16	~	Alluvium- clays, silts, peat, silty sands and gravel.
P-1		Peat
BS-4		Blown Sand, older- fine. part 'clayey' sand.
SA-1		Sand of 25ft Drift of Vale of York- fine to medium sand with silt and clay.
SA-2		Silt and Clay of 25ft Drift of Vale of York (not present at surface)- laminated and micaceous silt and clay.
H-11		Head- soliflucted silty clay with Liassic limestone fragments.
OL-1		Older Littoral Sand and Gravel - sands with locally derived pebbles.
OR-6		Older River Sand and Gravel (not present at surface) -'clayey' sand with some gravel.
GS-16		Glacial Sand and Gravel -'clayey' sand with erratic pebbles.

RECENT AND PLEISTOCENE

SOLID

LLi		Lower Lias- grey mudstones with thin limestones.
Fi		Frodingham Ironstone- ferruginous oolitic limestone.
L		Limestone in Lower Lias -thin shelly argillaceous limestones.
Rh		Rhaetic- reddish brown and light grey mudstones on dark grey shales.
KM		Keuper Marl- reddish brown and grey-green mudstone with gypsum bands.

JURASSIC / TRIASSIC

MG-2 — Made Ground

Wo-7 — Worked out area of ironstone: largely back-filled.

Inclined strata, dip in degrees

BOUNDARY LINES

Geological boundary, Drift.
Geological boundary, Solid.
Fault at surface.
Inferred boundary between recognised categories of deposits.
Resource Block boundary.
Broken line denotes uncertainty.

BOREHOLE DATA
SITE LOCATIONS

⊙ Mineral Assessment Unit (M.A.U.) boreholes.
○ Other boreholes.

M.A.U. BOREHOLES

Borehole Registration Number → NW 5 ← Surface level in metres and feet above O.D. (Newlyn)
Borehole site
Wastes → Overburden
Geological classification → Mineral (sand and gravel)
Grading diagram → Bedrock
Thickness in metres

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

Borehole Registration Number
Each M.A.U. borehole is identified by a registration number e.g. NW5. 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 NW 5 is SE 81 NW 5.

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

Sand
(+1/16 -4mm)
The height of the diagram is proportional to the mineral thickness. The widths of the divisions show the proportions of Fines, Sand and Gravel.
Fines (−1/16mm)   Gravel (+4mm)

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

CATEGORIES OF DEPOSITS

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

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

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

A horizontal section showing the general relations of the drift and solid deposits along the line shown constitutes Fig.2 of the Report.

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

THICKNESS OF OVERBURDEN EXCEEDS THREE TIMES THAT OF SAND AND GRAVEL

S.Tindall 1975

Geological lines from six-inch surveys by V.Wilson in 1939-41, G.D.Gaunt in 1964-65, 1972-73, and R.J.Bull in 1972-73. T.H.Whitehead and D.R.A.Ponsford. District Geologists.

Sand and Gravel Survey by J.W.C.James, I.Jackson, J.H.Lovell and J.R.Gozzard in 1973, under the supervision of D.Price. R.G.Thurrell, Head, Mineral Assessment Unit.

1:25,000 Sand and Gravel Resource Sheet published 1976
Austin W. Woodland, C.B.E. Director, Institute of Geological Sciences incorporating the Geological Survey of Great Britain, the Museum of Practical Geology and Overseas Geological Surveys. 1330/76

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

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

1 square inch on this map represents 99.619 acres on the ground.

Compiled from 6" sheets last fully revised 1904-06. Other partial systematic revision 1938-51 has been incorporated.

Made and published by the Director General of the Ordnance Survey, Chessington, Surrey, 1955. Reprinted with corrections 1959.

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SE 72	SE 82	SE 92
	79	80
SE 71	SE 81	SE 91
SE 70	SE 80	SE 90
	88	89

Diagram showing the relation of the National Grid 1:25,000 sheets with the One-Inch Geological Sheets 79, 80, 88 and 89

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