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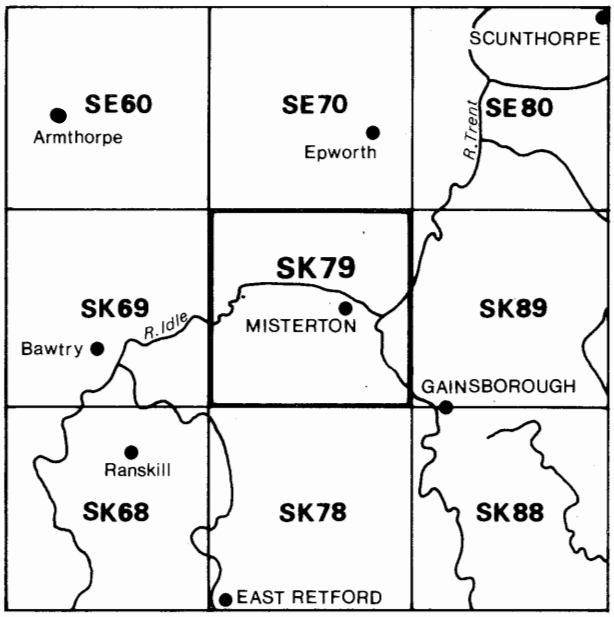

The sand and gravel resources of the country around Misterton, Nottinghamshire

Description of 1:25 000 resource sheet SK 79

D. Thomas and D. Price

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G. D. Gaunt

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The first twelve reports on the assessment of British sand and gravel resources appeared in the Report series of the Institute of Geological Sciences as a subseries. Report 13 and subsequent reports appear as Mineral Assessment Reports of the Institute.

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

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PREFACE

National resources of many industrial minerals may seem so large that stocktaking appears unnecessary, but the demand for minerals and for land for all purposes is intensifying and it has become increasingly clear in recent years that regional assessments of the reserves 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 (latterly the Industrial Minerals Assessment Unit) began systematic surveys in 1968. The work is now being financed by the Department of the Environment and is being undertaken with the cooperation of the Sand and Gravel Association of Great Britain.

This report describes the sand and gravel resources of an area around Misterton, Nottinghamshire, shown on the accompanying resource map. The survey was conducted by Mr D. Thomas, under the supervision of Mr D. Price. The work is based on six-inch geological surveys by G. D. Gaunt, G. H. Rhys and E. G. Smith in 1957–65. Dr Gaunt has contributed an account of the geology of the area.

Mr J. W. Gardner, CBE, was responsible for negotiating access to land for drilling. The ready cooperation of landowners and tenants in this work is gratefully acknowledged.

Austin W. Woodland
Director

31st May 1979

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MAP

The sand and gravel resources of sheet SK 79, Misterton, Nottinghamshire *in pocket*

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The sand and gravel resources of the country around Misterton, Nottinghamshire

Description of 1:25 000 resource sheet SK 79

D. THOMAS and D. PRICE

SUMMARY

The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 71 boreholes drilled for the Industrial Minerals Assessment Unit, form the basis of the assessment of sand and gravel resources in the area around Misterton, Nottinghamshire.

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

The 1:25 000 map is divided into 5 resource blocks, containing between 7.7 and 15.7 km^2 of sand and gravel. For each block the geology of the deposits is described and the mineral-bearing area, the mean thicknesses of overburden and mineral and the mean gradings are stated. Detailed borehole data are also given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying map.

Bibliographical reference

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INTRODUCTION

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, both the economic and the social factors used to decide whether a deposit may be workable in the future cannot be predicted; they are likely to change with time. Deposits not currently economically workable may be exploited as demand increases, as higher grade or alternative materials become scarce, or as improved processing techniques are applied to them. The improved knowledge of the main physical properties of the resource and their variability which this survey seeks to provide, will add significantly to the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971; Harris and others, 1974).

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

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

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

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

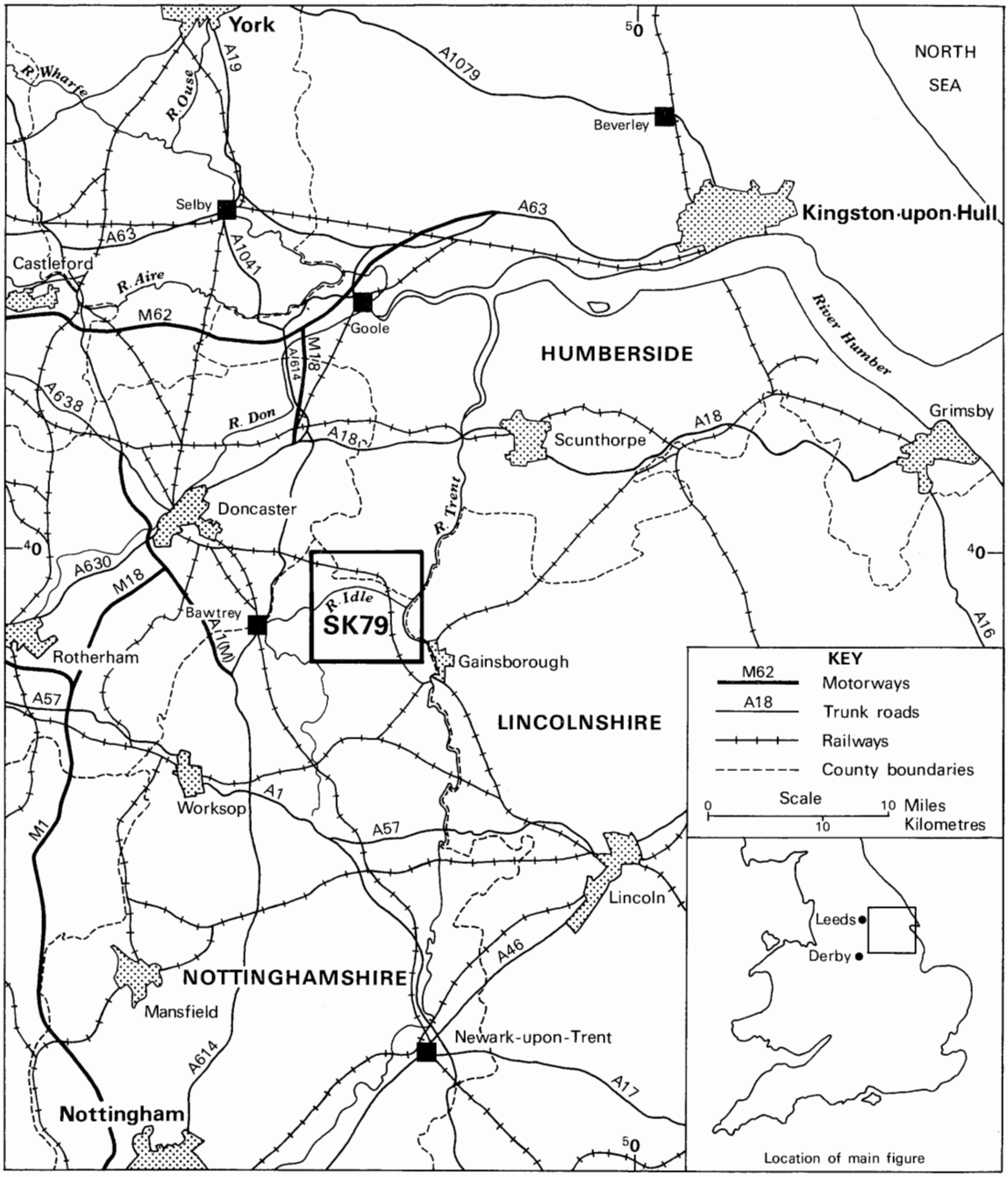


Figure 1 Sketch map showing the location of sheet SK 79

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

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

DESCRIPTION OF THE AREA

TOPOGRAPHY AND GENERAL

Between Doncaster and the River Trent there is an extensive tract of low ground, formerly marshy, from which there rises a line of low hills forming the Isle of Axholme. The district described lies on the southern margin of this tract and the major part of its area lies below 5 m (16 ft) above OD. At Haxey in the north, at the southern end of the Isle of Axholme, the ground rises to a little over 38 m (125 ft) above OD, and south of Misterton gently undulating higher ground spreads to occupy much of the southern margin of the district, reaching a height of a little over 75 m (246 ft) above OD at Gringley on the Hill. A network of drains carries water to the River Trent, directly or via the River Idle. The Idle, which once flowed northwards from Idle Stop

[721 966], was diverted eastwards to join the Trent at West Stockwith as part of the land reclamation scheme engineered by Cornelius Vermuyden in the 17th century. The rectangular outlines of some of the 'warp' fields produced by the 'Dutch' method of reclamation can be seen in the north of the district.

The district now provides highly productive agricultural land; lower fenland areas are devoted to root crops such as sugar beet and to high protein grass, and the higher ground to grain crops. There is little other industry except for light engineering at Misterton and sand and gravel extraction south of Haxey and near Misson [700 955].

The River Trent, supported by artificial cuts, is navigable downstream to the Humber and upstream to towns in the Midlands. A railway crossing the district connects Gainsborough with South Yorkshire.

GEOLOGY

The rocks and deposits of the area are listed in Table 1 and their relationships are illustrated in Figure 2. A detailed account of the geology of the southern part of the area is given by Smith and others (1973).

Table 1 Stratigraphy

DRIFT	
Quaternary	Peat
	Alluvium, including warp
	Blown Sand
	Terrace deposits
	25-Foot Drift of Vale of York
	Sand
	Silt and Clay
	Head
	Older River Sand and Gravel
	Glacial Sand and Gravel
	Boulder Clay
SOLID	
Triassic	Keuper Marl (Mercia Mudstone Group) including Clarborough Beds
	Bunter Sandstone (Sherwood Sandstone Group)

Bunter Sandstone (Sherwood Sandstone Group): The term 'Bunter Sandstone' is used here for the Permo-Triassic sandstones immediately underlying the Keuper Marl, which in the south are shown on one-inch geological Sheet 101 (East Retford) as Bunter Pebble Beds and Lower Mottled Sandstone. Bunter Sandstone, up to 300 m thick, occurs at the surface and beneath Quaternary deposits along the western margin of the area, and farther east is present beneath the Keuper Marl. The sandstone is generally red or brown, although at outcrop and close beneath the Keuper Marl it is locally grey. It is fine to coarse grained, commonly cross-bedded and in parts micaceous. Near the surface it may be unconsolidated and even at depth it can be friable. In the south some beds contain small rounded pebbles, mainly of quartzite, but pebbles are rare in the north. Thin lenses and small rolled fragments of red or greenish grey mudstone occur within the sandstone in places. Unconsolidated red, grey and yellow sandstone is exposed at the bottom of a gravel pit [701 954] north of the River Idle, and the canal cutting and old quarry at Drakeholes [706 904] expose up to 3.7 m of friable cross bedded red and yellow sandstone containing a few small pebbles and rolled mudstone fragments.

Keuper Marl (Mercia Mudstone Group) *including Clarborough Beds:* Other than along the western margin, the bedrock of the area consists of Keuper Marl, which is over 170 m thick in the east. The Keuper Marl is largely mudstone and silty mudstone, predominantly red but with green and grey beds and irregular patches. Thin beds of dolomitic siltstone and fine-grained sandstone, (skerries) form hard resistant features at outcrop. Gypsum is present in bands, nodules and cross-cutting veins.

The Clarborough Beds (Smith and Warrington, 1971) are up to 12 m thick and occur 90 to 120 m above the base. They contain a higher proportion of skerries and an abundance of gypsum, which is also present as impregnations in the mudstones. These characteristics give the Clarborough Beds their hard resistant nature, and the beds are responsible for the higher ground between Gringley on the Hill and Misterton, and farther north around Haxey. Keuper Marl crops out widely over the southern part of the area, but the only exposures of note are in old clay pits west of Walkeringham and north of Gringley on the Hill; a few small exposures of Clarborough Beds are also present near these villages (Smith and others, 1973, pp. 186–187).

Boulder Clay: Several small mounds of red sandy clay with pebbles rise through more recent deposits on the low ground north-west of Gringley on the Hill. Similar deposits are present on higher ground to the west and south of this village and as small patches farther north-east and east. Most of the pebbles in these clays are quartzites or skerry fragments.

Glacial Sand and Gravel: Sand and gravel capping the highest part of Gringley on the Hill, where in places it rests on Boulder Clay, and part of a similar deposit [714 900] near Taylor's Bridge are the only known sands and gravels of glacial origin in the area. An old sand pit [746 906] at Gringley on the Hill exposes 5.2 m of brown fine to medium grained sand with pebbles, and a borehole in the pit proved 12.2 m of the deposit (Smith and others, 1973, p. 224). The pebbles are principally of quartzite and sandstone, with a few of locally derived red silty mudstone.

Older River Sand and Gravel: Outcrops of Older River Sand and Gravel (shown as Older River Gravel on one-inch geological Doncaster Sheet 88) are confined to the western margin of the area. Farther west they form extensive spreads which were derived from the south via the River Idle and, in part at least, are of Ipswichian age (Gaunt and others, 1972). The pebbles are predominantly of quartzite and decrease in both size and abundance to the north and east. Sands and subsidiary gravels proved beneath younger deposits on the low ground to the west and north of Misterton and at depth in the Trent valley may also, in part at least, be of Ipswichian fluvial origin.

Head: Red pebbly clay, derived by solifluxion from Keuper Marl, covers a small area west of Walkeringham, and up to 0.9 m of the deposit is exposed in an old clay pit [7558 9232].

Silt and Clay of the 25-Foot Drift: The stiff brownish grey clay forming flat ground north of the River Idle and west of North Carr Farm is virtually devoid of pebbles except near its margins, and is laminated at depth. It is

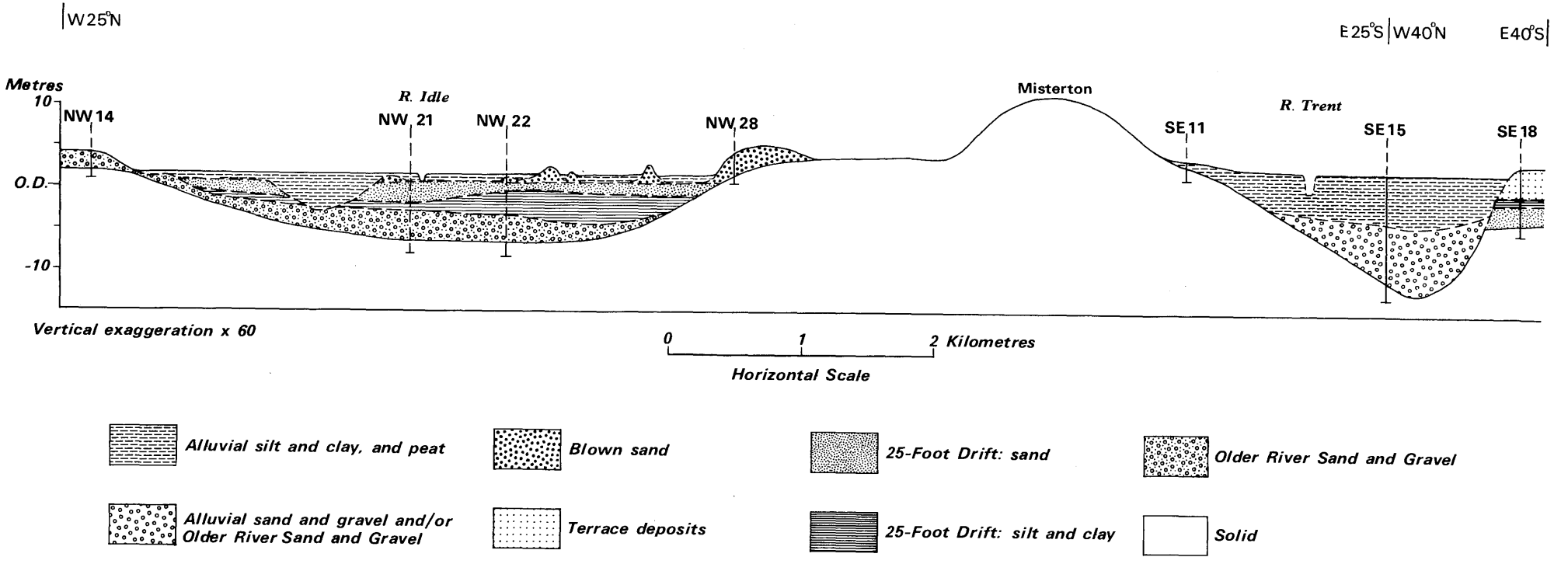


Figure 2 Generalised section showing relationships between drift deposits

interbedded with sand (see below), the whole sequence resting discordantly on the cryoturbated and ventifact-strewn top of the Older River Sand and Gravel (Gaunt and others, 1972). A similar clay outcrop flanks the Keuper Marl slope along the southern edge of Gringley Carr and, although shown as First Terrace on one-inch geological Sheet 101 (East Retford), can be regarded as part of the 25-Foot Drift (Smith and others, 1973, p. 216). These clays have been proved beneath adjacent younger deposits, and also occur at depth in places along the margins of the Trent Valley, being present, for example, beneath terrace deposits. The clays and interbedded sands are lacustrine, deposited in 'Lake Humber', which occupied much of the Vale of York when an ice and morainic dam blocked the Humber gap in Late Devensian times (Gaunt and others, 1971; Gaunt, 1974).

Sand of the 25-Foot Drift: The sand which underlies and is interbedded with the clay of the 25-Foot Drift is generally fine grained, thin bedded and devoid of pebbles except near the margins of the deposit. The only outcrop in the area is a small patch along the western margin, to the west of Newlands Farm [7048 9853].

Terrace deposits: The clayey terrace deposits flanking the southern edge of Gringley Carr are equivalent to part of the 25-Foot Drift (see above). The First Terrace of the Trent extends into the eastern part of the area, to the east of Walkerith. The deposit forming the terrace is medium-grained sand, laid down by the River Trent when it reverted to its northward course to the Humber immediately following the drainage of Lake Humber.

Blown Sand: Much of the higher ground in the north between Westwoodside and East Lound is mantled by blown sand, which extends up to about 23 m OD in places. The sand extends southwards across the low-lying ground south of Haxey and continues along the foot of the Keuper Marl slope north-west of Misterton. Farther west, small patches of blown sand protrude through the peat on the carr lands. Some of these outcrops are arcuate, convex to the east, and recognisably dunes. Others, such as those crossing Misterton Carr from west to east, are linear, and may originally have formed as levees of the River Idle shortly after the drainage of 'Lake Humber' (Gaunt and others, 1971), but have been subsequently modified by aeolian action. The blown sand is believed to be largely of very late Devensian and earliest Flandrian age, approximately contemporaneous with similar deposits to the north and east (Jones and Gaunt, 1976), but some remobilisation has occurred in historical times as a consequence of deforestation.

Alluvium, including warp: Clay, silt and, in places, basal sand are widely present beneath the peat which covers much of the low-lying carr land adjacent to the River Idle. They reach the surface only as small clayey patches marginal to the carr land, as clayey levees along the old course of the Idle north of Idle Stop and between the embankments of the artificial Bycarrs (or Bykers) Dyke into which Vermuyden diverted the river in 1636–37. Clay and, along the levee slopes, silt form the extensive flood plain of the Trent valley; they are underlain, at least in places, by alluvial sand and gravel. These alluvial deposits occupy wide deep channels incised into older deposits during a period of relatively low sea level in early Flandrian times (Gaunt and Tooley, 1974). In the Trent valley, for example, they are up to at least 14.5 m thick. Included with the alluvium is warp—silty clay and silt formed by artificially induced flooding. Most of the warp adjacent to the Trent dates from the nineteenth century, but in the north-west the warping was carried out in the early years of this century.

Peat: The carr lands adjacent to the River Idle are extensively covered by peat, the result of blanket-bog growth in later Flandrian times. The peat is generally thin, having been denuded by cutting, burning and wind erosion (the last resulting from artificial drainage) in historical times, but in places it occupies buried river channels and is up to 6 m thick. Thin peat is present beneath alluvium in places in the Trent valley.

COMPOSITION OF THE SAND AND GRAVEL

Potentially workable sand and gravel are found in the Older River Sand and Gravel, the 25-Foot Drift of the Vale of York, blown sand, terrace deposits and alluvium. The small area of Glacial Sand and Gravel at Gringley on the Hill, largely built over, has not been assessed and other small patches of Glacial Sand and Gravel near Wiseton, in the southwest, have been excluded by virtue of their limited extent. Bunter Sandstone found beneath drift along the western margin of the district is deemed to be outside the scope of the present work.

The petrological and mineralogical composition of the various sand and gravel deposits does not vary markedly. Where gravel is present the pebbles are predominantly of well-rounded white, grey and purple 'Bunter' quartzite; white quartz and tabular brown and grey sandstone are also common, but flint and chert are generally only found in subordinate amounts; traces of limestone, gypsum, siltstone and mudstone may also be present. The sand is mainly of quartz, together with representatives of the material found in the gravel fraction.

The variation between deposits is mainly in their grading, which is described briefly below.

Older River Sand and Gravel and Alluvium: Beneath the Trent floodplain south of Croft House [7984 9600] mineral-bearing Older River Sand and Gravel and alluvium cannot everywhere be distinguished one from the other and they are considered together here. The sands and gravels have a mean grading of 2 per cent fines, 63 per cent sand and 35 per cent gravel. In individual boreholes mean fines content ranges from 1 to 3 per cent and mean gravel content from 18 per cent to 65 per cent (see Figure 3). The sand is medium grained and the gravel fraction mainly fine.

Older River Sand and Gravel is widely distributed north-west of Croft House and in the western part of the district but varies markedly in thickness and grading (Figure 3). The mean fines content for individual boreholes ranges from 1 to 36 per cent, but is generally lower than 10 per cent; gravel may be absent or account, exceptionally, for up to 66 per cent of the mineral.

Alluvial mineral north of Croft House consists of sand, in places 'very clayey', with only small amounts of gravel; its mean grading is 7 per cent fines, 90 per cent sand and 3 per cent gravel.

Sand of the 25-Foot Drift of the Vale of York: These deposits consist of sands, in places 'clayey' or 'very clayey' with a mean gravel content not exceeding 2 per cent in any borehole. Their overall mean grading is fines 9 per cent, sand 91 per cent and gravel a trace. In slightly than fewer than half the boreholes proving this deposit, notably beneath the peat in the Idle valley, the sand

fraction is predominantly fine grained. Other holes found more poorly sorted fine to medium sands or, less commonly, better sorted medium sands.

Terrace deposits: The First Terrace of the Trent, occupying only a small part of this district east of Walkerith, has been proved by only one borehole which found it to consist of medium-grained sand, pebbly towards the base.

Blown Sand: This deposit consists of fine to medium sand with the mean fines content in individual boreholes ranging from 2 to 21 per cent but generally not exceeding 8 per cent. Its mean grading is 8 per cent fines and 92 per cent sand.

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 resources information in red.

Geological data: The geological boundary lines are based on six-inch geological surveys made in 1957–65 by members of the Institute's Yorkshire and East Midlands Unit, published on the one-inch scale on new series geological sheets 88 (Doncaster) and 101 (East Retford). Borehole data, which include the stratigraphic relations and mean particle size distributions of sand and gravel samples collected during the assessment survey, are also shown.

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

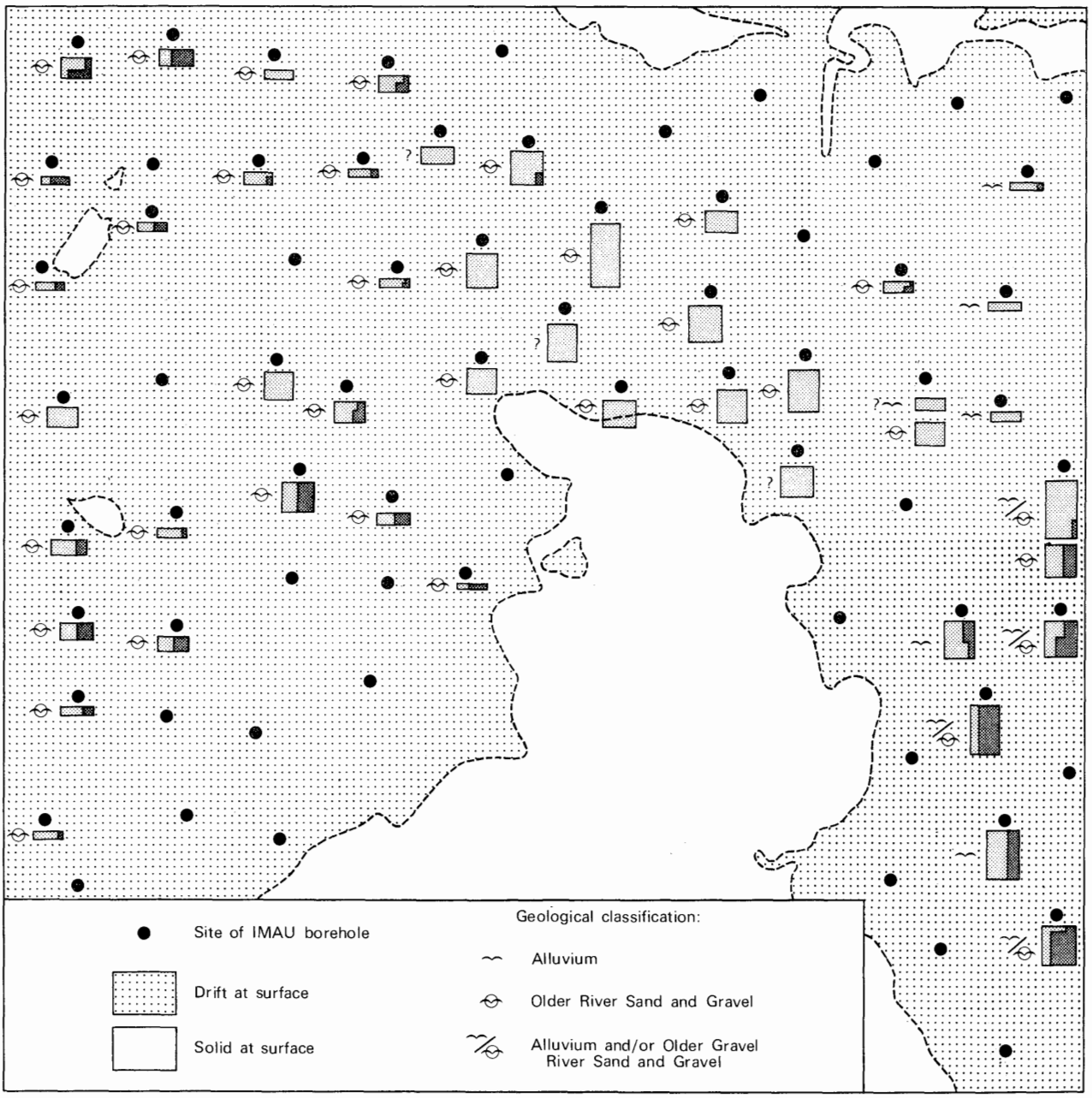


Figure 3 Distribution and variation in thickness and gravel content of the Older River Sand and Gravel and alluvial mineral

Table 2 Statistical assessment of the sand and gravel resources of sheet SK 79

Block	Area		Mean thickness			Volume of sand and gravel			Mean grading percentage		
	Block	Mineral	Over-burden	Mineral	Waste		Limits at the 95% confidence level		Fines $-\frac{1}{16}$ mm	Sand $+\frac{1}{16}$ -4 mm	Gravel $+4$ mm
	km²	km²	m	m	m	$m^3 \times 10^6$	±%	$\pm m^3 \times 10^6$			
A	14.4	13.9	2.3	2.9	0.3	40	34	14	10	68	22
B	15.8	15.7	2.5	3.8	0.9	60	39	23	9	88	3
C	14.4	12.4	0.5	5.4	0.1	67	49	33	4	94	2
D	9.4	9.1	0.8	5.3	0.1	48	33	16	7	91	2
E	7.7	7.7	6.5	7.3	0.1	56	41	23	3	63	34
Total	61.7	58.8	2.2	4.6	0.3	271	17	4			

Mineral resource information: The mineral-bearing ground is divided into resource blocks (see Appendix A). Within a resource block the mineral is subdivided into areas where it is 'exposed' and areas where it is present in continuous (or almost continuous) spreads beneath overburden. The mineral is identified as 'exposed' where overburden, commonly consisting only of soil and subsoil, averages less than one metre thick.

Areas where bedrock outcrops and where sand and gravel is interpreted to be not potentially workable are uncoloured on the map. In such areas it has been assumed that mineral is absent except, possibly, in infrequent and relatively minor patches which can neither be outlined nor assessed in the context of this survey. Areas of unassessed sand and gravel are indicated by a red stipple.

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

RESULTS

The statistical results of the survey are summarised in Table 2. Fuller grading particulars are given in Figure 4 and Tables 3 to 7.

Accuracy of results: For the five resource blocks the confidence limits at the 95 per cent probability level vary between 33 per cent and 49 per cent (that is, it is probable that nineteen times out of twenty the true volumes present lie within these limits). However, the true values are more likely to be nearer the figures estimated than the limits. Moreover, it is probable that in each block approximately the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say, 100 hectares) containing similar sand and gravel deposits if the results from the same number of sample points (as provided by, say, ten boreholes) were used in the calculation. Thus, if closer limits are needed for the quotation of reserves of part of a block, it can be expected that data from more than ten sample points will be required, even if the area is quite small. This point can be illustrated by considering the whole of the potentially workable sand and gravel on this sheet. The volume (271 million m^3) can be estimated to limits of ±17 per cent at the 95 per cent probability level, by a calculation based on the data from 61 sample points spread across the five resource blocks. However, it must be emphasised that the quoted volume of sand and gravel has no simple relationship with the amount that could be extracted in practice, as no allowance has been made in the calculations for any restraints (such as existing buildings and roads) on the use of the land for mineral working.

NOTES ON THE RESOURCE BLOCKS

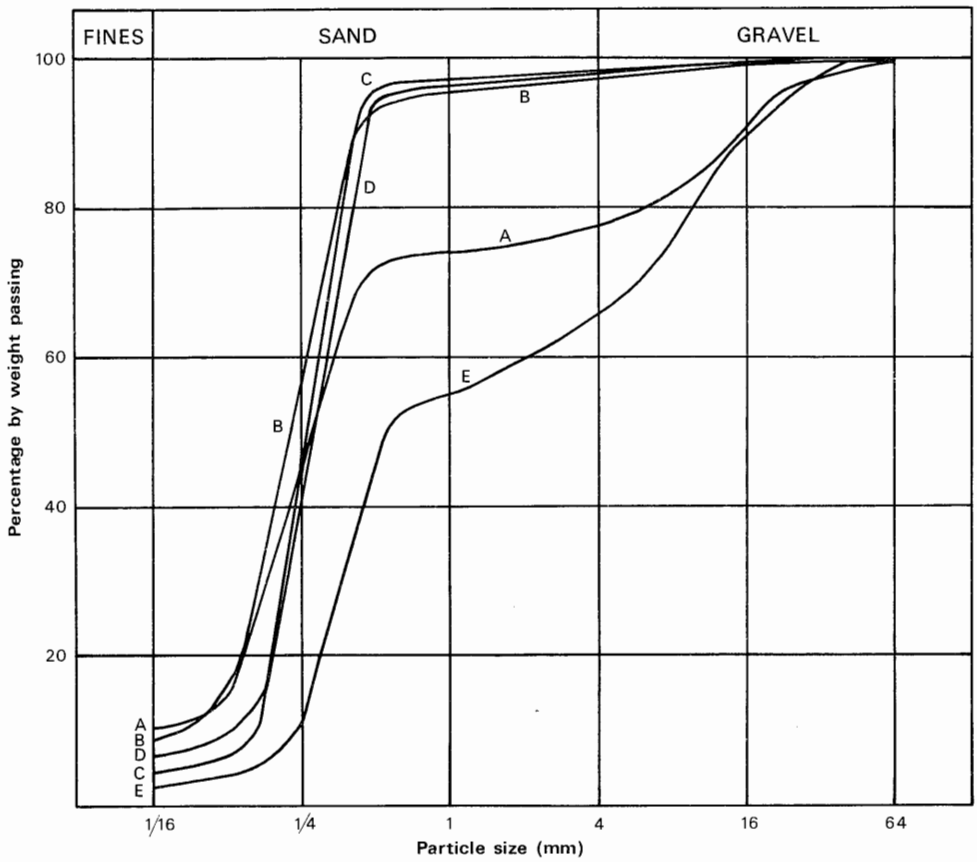
Blocks A and E encompass areas of mineral which are relatively gravelly, in contrast to the areas within blocks B, C and D where gravel is uncommon. Block E is further distinguished from adjacent block D by the thickness of overburden present over most of its area.

A number of boreholes north-west of Gringley on the Hill and in the western part of the Trent floodplain found sand and gravel to be absent or thin; consequently the areas around them are thought to be barren and are excluded from the resource blocks.

Block A (Table 3)

The mineral of this block consists of Older River Sand and Gravel, sand of the 25-Foot Drift, some blown sand and perhaps some unconsolidated Bunter Sandstone. As borehole NW 9 found no sand and gravel and the area of barren ground around it cannot be delineated, the nil reading has been taken into account in assessing the resources. Proved mineral thicknesses range upwards to 6.0 m. Gravelly deposits are locally overlain by sands (and may be separated from them by waste partings) and the mean gravel content of individual boreholes varies widely, from 1 to 60 per cent. As a result, estimated gravel contents range up to 32 000 tonnes/hectare (borehole NW 26) but are generally lower than 10 000 tonnes/hectare. (The estimated contents are calculated assuming densities of 1.46 tonnes/m^3 for gravel and 1.6 tonnes/m^3 for sand and fines).

Sand and gravel is largely concealed beneath alluvium and, excluding areas where mineral is shown on the resource map as exposed, proved thicknesses of overburden average 3.5 m. Partings of silt and clay were found within sand and gravel in a number of boreholes but the mean thickness of waste in the block is only 0.3 m.



Block	Percentage by weight					
	$-\frac{1}{16}$ mm	$+\frac{1}{16}-\frac{1}{4}$ mm	$+\frac{1}{4}-1$ mm	+1–4 mm	+4–16 mm	+16 mm
A	10	36	28	4	13	9
B	9	49	37	2	2	1
C	4	39	54	1	1	1
D	7	33	56	2	1	1
E	3	9	43	11	24	10

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

Table 3 Block A: data from assessment boreholes

Borehole	Recorded thickness			Mean grading percentage					
	Mineral m	Over-burden m	Waste, partings m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
NW 3	5.0	0.4	0.6	13	34	24	4	13	12
NW 4	4.9	0.5	1.0	5	27	31	4	13	20
NW 8	1.1	–		14	12	11	3	23	37
NW 9	absent								
NW 10	2.4	0.6		11	19	63	1	5	1
NW 14	0.9	1.4		21	16	22	5	25	11
NW 15	3.0	0.4	1.0	12	60	11	2	11	4
NW 19	3.1	4.4		21	47	30	1	1	
NW 24	6.0	–		14	44	33	2	4	3
NW 25	1.4	1.5		36	36	16	1	1	10
NW 26	4.5	4.5		2	22	20	9	34	13
NW 27	2.5	6.0	2.0	4	45	25	5	18	3
SW 6	4.0	3.4	0.3	5	40	28	5	12	10
SW 7	2.0	5.5		9	15	29	5	24	18
SW 11	3.0	5.3		6	40	38	5	7	4

Table 4 Block B: data from assessment boreholes

Borehole	Recorded thickness			Mean grading percentage					
	Mineral m	Overburden m	Waste, partings m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
NW 5	2.6	1.5	3.0	16	19	64	1	–	–
NW 6	5.8	4.9		5	26	52	6	9	2
NW 11	5.0	6.0		2	33	59	2	3	1
NW 12	5.1	4.5		1	30	67	1	1	–
NW 16	2.4	6.6		6	23	66	4	1	–
NW 17	8.5	2.0		3	35	58	2	1	1
NW 20	1.2	4.8		31	56	12	1	trace	–
NW 21	8.8	0.4	0.7	13	74	13	trace	trace	–
NW 22	7.5	0.2	3.3	3	66	23	2	4	2
NW 28	2.2	0.5		2	58	39	1	–	–
SW 8	2.0	0.5	3.0	23	66	10	1	–	–
SW 9	3.2	0.5	1.5	28	67	4	1	trace	–
SW 10	1.0	1.7		32	64	2	1	1	–
SW 12	0.9	4.0	1.8	16	57	12	4	3	11
SW 14	1.0	1.3		26	72	2	–	–	–
SW 15	4.0	0.4	0.3	15	65	17	1	trace	2

Block B (Table 4)
The mineral of this block consists of Older River Sand and Gravel and sand of the 25-Foot Drift. Proved thicknesses range up to 8.8 m but gravel content is generally less than 4 per cent, although boreholes NW 6, NW 22 and SW 12 yielded 11, 6 and 14 per cent gravel respectively. Exposed sand and gravel is found in small irregular patches but the mineral is more commonly found beneath peat and alluvial overburden with an average thickness of 3.1 m. Five boreholes proved thick waste partings and two others thin ones; the mean thickness of waste in the block is 0.9 m.

Block C (Table 5)
The mineral of this block comprises Older River Sand and Gravel (largely pebble-free), sand of the 25-Foot Drift and blown sand, together, possibly, with some alluvial sand. Although the whole area is shown on the map as mineral bearing, sand and gravel was not found in borehole NE 5. The thicknesses of mineral present are very variable (Table 5): the lower values are generally found in the north and east of the block and the higher in the south and west. Little gravel is present except near the bottom of boreholes NW 13 and NE 7 where 14 and 35 per cent respectively were proved beneath almost pebble-free sands.

Mineral is generally 'exposed', with overburden confined to a generally sandy soil. Waste was found in only two boreholes: NW 18, where 0.5 m of dark brown clay occurs within sands, and NE 9 which included 0.3 m of peat.

Table 5 Block C: data from assessment boreholes

Borehole	Recorded thickness		Mean grading percentage					
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
NW 7	5.0	0.5	8	31	59	1	1	–
NW 13	10.5	0.5	2	34	59	2	2	1
NW 18	11.5*	0.5	6	48	45	trace	1	–
NW 23	9.9	0.3	3	38	57	1	1	–
NE 3	3.0	0.5	7	47	46	trace	trace	–
NE 4	3.0	0.4	17	46	36	1	–	–
NE 5	absent							
NE 6	1.0	0.8	2	50	47	1	–	–
NE 7	10.2	0.3	2	40	53	1	2	2
NE 8	5.0	0.5	3	43	53	1	trace	–
NE 9	1.7†	0.4	14	55	27	3	1	–
NE 11	9.1	0.4	2	27	69	1	1	–
NE 13	0.9	1.5	12	48	39	1	–	–

* Excluding 0.5-m waste parting.
† Excluding 0.3-m waste parting.

Table 6 Block D: data from assessment boreholes

Borehole	Recorded thickness		Mean grading percentage					
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
NE 10	2.7	1.6	5	62	32	1	trace	–
NE 12	9.4	0.6	7	27	62	2	1	1
NE 14	7.7	0.3	10	33	54	1	1	1
NE 15	3.7*	1.5	12	51	36	1	trace	–
NE 16	5.0	0.1	3	42	52	1	1	1
NE 17	5.0	0.4	2	27	65	3	2	1
NE 18	6.4	1.3	5	18	71	2	2	2
NE 19	6.4	0.5	7	29	61	2	1	–
NE 20	1.8	1.1	3	25	69	2	1	–
NE 21	4.6	0.3	14	43	41	1	1	–

* Excluding 0.3-m and 0.5-m waste partings.

Block D (Table 6)
Mineral in this block consists of alluvium, blown sand, sand of the 25-Foot Drift and Older River Sand and Gravel. It varies in thickness from 1.8 m to 9.4 m, the lower values being found in the east of the block. Gravel content is generally less than 4 per cent, but exceptionally in borehole NE 14 the lowest 0.5 m of mineral contained 20 per cent.

The mineral is almost entirely covered by alluvial loam, clay or silt, but this cover is commonly thin and the mean proved thickness of overburden is only 0.8 m; consequently it is depicted as 'exposed' on the resource map.

Block E (Table 7)
The major part of the mineral in this block consists of alluvial sand and gravel and Older River Sand and Gravel beneath the Trent floodplain. These deposits range upwards in thickness to at least 13.9 m and the mean gravel content in individual boreholes lies between 18 and 65 per cent. The estimated contents of gravel ranges from 21 000 to 72 000 tonnes/hectare. The fines content is low. At borehole NE 23, mineral comprises 9.0 m of sand overlying 4.9 m of sandy gravel and pebbly sand; elsewhere the vertical variation is less marked. The deposits are concealed beneath alluvial clay and silt and peat which together are up to at least 11.3 m thick and average 7.5 m.

Also included in the block is a small area of terrace deposits underlain by 25-Foot Drift. Borehole SE 18 proved two deposits of clayey sand 2.7 m and 2.3 m thick separated by 1.0 m of clay and capped by sandy soil.

Table 7 Block E: data from assessment boreholes

Borehole	Recorded thickness		Mean grading percentage					
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm
NE 23	13.9	6.2	2	9	61	10	13	5
SE 12	6.0	7.3	2	5	59	11	20	3
SE 13	5.4	7.0	1	5	31	9	33	21
SE 15	7.4	6.0	1	2	21	11	42	23
SE 17	7.5	7.0	3	9	41	20	26	1
SE 18	5.0*	0.5	13	28	55	2	2	trace
SE 20	6.0	11.3	trace	7	19	9	41	24

* Excluding 1.0-m waste parting.

APPENDIX A

FIELD AND LABORATORY PROCEDURES

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

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

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

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

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

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

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

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

APPENDIX B

STATISTICAL PROCEDURE

Statistical assessment

1 A statistical assessment is made of an area of mineral greater than 2 km^2, if there is a minimum of five evenly spaced boreholes in the resource block (for smaller areas see paragraph 12 below).

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

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

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

4 The above relationship may be transposed such that

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

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

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

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

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

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

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

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

6 The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness. The relationship $S_A/S\bar{l}_m \leqslant \frac{1}{3}$ is assumed in all cases. It follows from equation [2] that

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

7 The limits on the estimate of mean thickness of mineral, $L_{\bar{l}_m}$, may be expressed in absolute units $\pm(t/\sqrt{n}) \times S_{\bar{l}_m}$ or as a percentage

$\pm(t/\sqrt{n}) \times S_{\bar{l}_m} \times (100/\bar{l}_m)$ per cent, where t is Student's t at the 95 per cent probability level for $(n-1)$ degrees of freedom, evaluated by reference to statistical tables. (In applying Student's t it is assumed that the measurements are distributed normally).

Block calculation 1:25 000 Block } Fictitious

Area
Block: 11.08 km²
Mineral 8.32 km²

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m³
Mineral: 54 million m³

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

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

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

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

$1.05\,(t/\bar{l}_m)\sqrt{[\Sigma(l_m-\bar{l}_m)^2/n(n-1)]}\times 100$
$=1.05\times(2.365/6.5)\sqrt{[15.82/(8\times 7)]}\times 100$
$=20.3$
$\simeq$20 per cent.

Figure 5 Example of resource block assessment: calculation and results

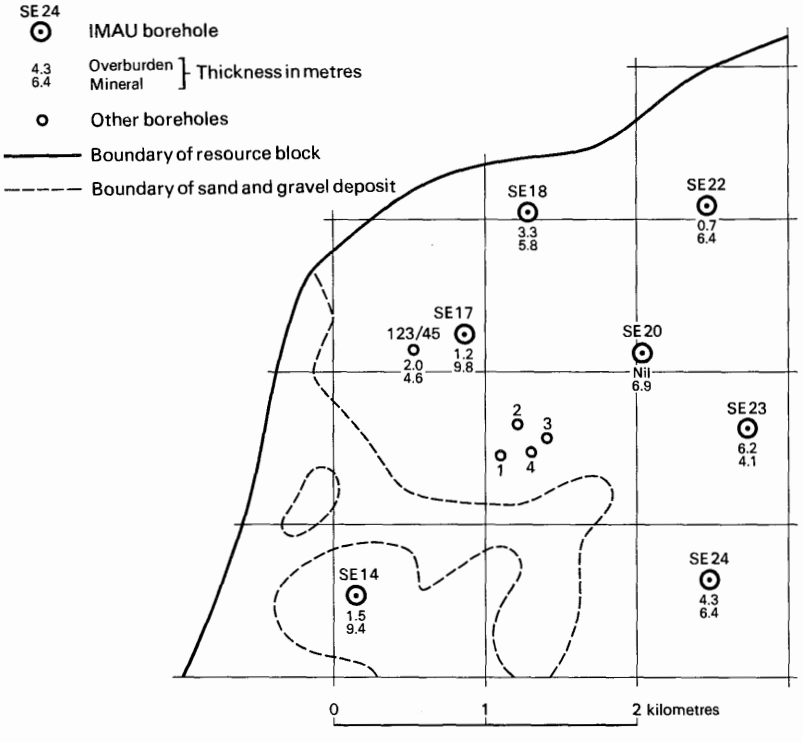


Figure 6 Example of resource block assessment: map of a fictitious block

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

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

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

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

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

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

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

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

per cent.

11 The application of this procedure to a fictitious area is illustrated in Figures 5 and 6.

Inferred assessment

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

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

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

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

APPENDIX C

CLASSIFICATION AND DESCRIPTION OF SAND AND GRAVEL

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

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

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

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

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

Thus it is possible to classify the mineral into one of twelve descriptive categories (see Figure 7). 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.

Many differing proposals exist for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the $\frac{1}{16}$ mm size, which approximates to the generally accepted boundary between silt and sand. These and other requirements are met by a system based on Udden's geometric scale and a simplified form of Wentworth's terminology (Table 8), which is used in this Report.

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

The size distribution of borehole samples is determined by sieve analysis, which is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standard 1377: 1967). In this report the grading is tabulated on the borehole record sheets (Appendix F), the intercepts corresponding with the simple geometric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm,

1 mm, 4 mm, 16 mm and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

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

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

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

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

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

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

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

Well-rounded: no original faces, edges or corners left. The entire surface consists of broad curves; flat areas are absent. The original shape is suggested by the present form of the grain.

Table 8 Classification of gravel, sand and fines

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

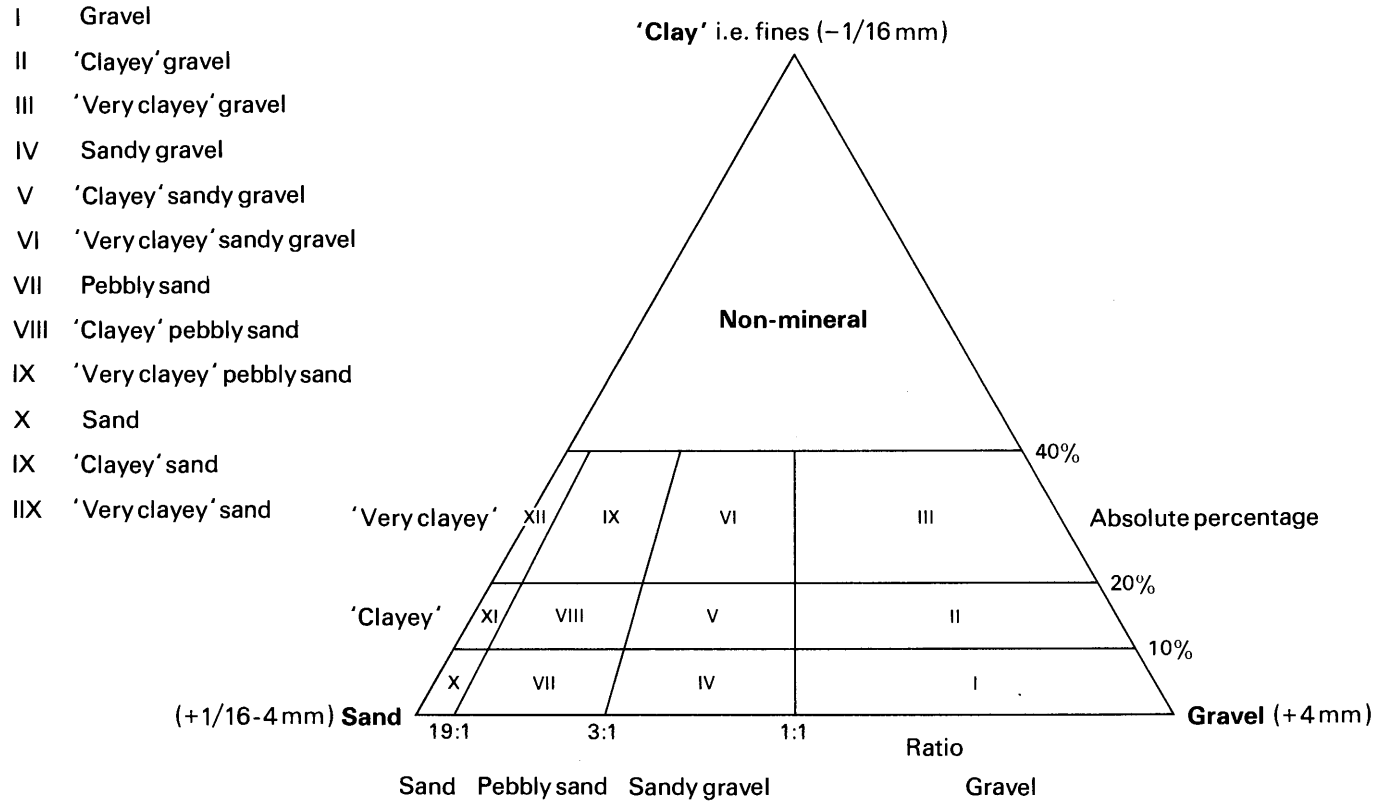


Figure 7 Diagram showing the descriptive categories used in the classification of sand and gravel

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated fictitious example

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

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

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

Log

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

Grading[10]

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	5	5	28	13	25	22	2	2.8–3.8	20	78	2
								3.8–4.8	2	32	66
	5	46			49			4.8–5.8	1	40	59
								5.8–6.8	0	45	55
								6.8–8.2	4	36	60
b	5	77	17	1				9.3–10.3	3	97	0
								10.3–10.7	9	91	0
	5	95									

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

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

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

Thus the full Registration Number is CK 66 NW 5. Usually this is abbreviated to NW 5 in the text of the report.

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

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

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

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

6 Type of drill and date of drilling
Unless otherwise stated the borehole was drilled by a shell and auger rig using 152-mm diameter casing. The month and year of completion of drilling are stated.

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

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

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

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

For each bulk sample the percentages of fines ($-\frac{1}{16}$ mm), sand ($+\frac{1}{16} - 4$ mm) and gravel (+ 4 mm) are stated. The mean grading of groups of samples making up an identified bed of mineral are also given in detail and in summary. Where more than one bed is recognised the mean grading for the whole of the mineral in the borehole may be given. Where necessary, in calculating mean gradings, data for individual samples are weighted by the thickness represented. If, exceptionally, grading results are not available for a sample, an attempt may be made to estimate the grading by comparing the grading and field descriptions of adjacent samples with the sample in question. Such estimates are shown in italics.

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

APPENDIX E

LIST OF BOREHOLES USED IN THE ASSESSMENT OF RESOURCES

All the boreholes were drilled for the Industrial Minerals Assessment Unit

Borehole number	Grid reference
SK 79 NW (pp.17–33)	
3	7063 9967
4	7154 9971
5	7246 9951
6	7350 9949
7	7457 9958
8	7040 9853
9	7133 9852
10	7227 9854
11	7328 9854
12	7398 9885
13	7485 9873
14	7021 9756
15	7138 9805
16	7266 9763
17	7360 9750
18	7441 9784
19	7046 9637
20	7139 9650
21	7248 9671
22	7314 9643
23	7436 9672
24	7051 9518
25	7153 9528
26	7272 9572
27	7353 9544
28	7465 9562
SK 79 NE (pp. 33–44)	
3	7613 9883
4	7700 9916
5	7880 9911
6	7982 9919
7	7555 9809
8	7662 9826
9	7805 9860
10	7949 9849
11	7518 9715
12	7654 9734
13	7742 9787
14	7832 9754
15	7930 9738
16	7571 9648
17	7672 9661
18	7740 9676
19	7851 9654
20	7924 9634
21	7734 9589
22	7837 9539
23	7984 9574
SK 79 SW (pp. 45–51)	
6	7066 9438
7	7154 9424
8	7263 9470
9	7354 9462
10	7426 9473
11	7064 9357
12	7146 9339
13	7227 9332
14	7338 9378
15	7036 9247
16	7165 9254
17	7250 9232
18	7067 9186
SK 79 SE (pp. 52–56)	
11	7776 9438
12	7887 9441
13	7985 9441
14	7843 9305
15	7912 9362
16	7821 9196
17	7927 9249
18	7987 9296
19	7868 9127
20	7978 9158
21	7929 9037

APPENDIX F

INDUSTRIAL MINERALS ASSESSMENT UNIT
BOREHOLE RECORDS

SK 79 NW 3 **7063 9967** **Bank End, Finningley** **Block A**

Surface level +1.2 m
Water level −0.8 m
October 1972

Overburden 0.4 m
Mineral 4.0 m
Waste 0.6 m
Mineral 1.0 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Sandy soil	0.4	0.4
25-Ft Drift	**a** Sand, fine to medium, quartz with some quartzite and, in lower part, traces of coal	2.0	2.4
Older River Sand and Gravel	**b** 'Very clayey' sandy gravel Gravel: fine to medium, rounded to well rounded grey sandstone and white quartzite Sand: brown, fine to medium, subangular to subrounded, quartz with some quartzite	2.0	4.4
	Peat, dark brown	0.6	5.0
	c Gravel Gravel: fine to cobble, subrounded to well rounded sandstone and quartzite with some darker rocks Sand: as above	1.0	6.0
Keuper Marl	Clay, reddish brown, on greenish mudstone	2.0+	8.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	10	61	27	1	1	trace		0.4–1.4	13	86	1
								1.4–2.4	7	91	2
	10	89			1						
b	23	24	28	3	12	10		2.4–3.4	21	52	27
								3.4–4.4	24	58	18
	23	55			22						
c	0	2	11	11	36	40		5.0–6.0	0	24	76
	0	24			76						

SK 79 NW 4 **7154 9971** **Bank House, Finningley** **Block A**

Surface level +1.2 m
Water level −1.3 m
October 1972

Overburden 0.5 m
Mineral 2.5 m
Waste 1.0 m
Mineral 2.4 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Blown Sand on 25-Ft Drift	Soil, very sandy	0.5	0.5
	a Sand, yellow brown, with brown clay balls near base: fine to medium, subangular to subrounded quartz with traces of dark accessory minerals	2.5	3.0
	Clay, stiff brown	1.0	4.0
Older River Sand and Gravel	**b** Gravel Gravel: medium to coarse with few cobbles, well rounded grey and brown sandstone, subrounded to well rounded white quartzite and traces of fine to coarse subangular to rounded black chert Sand: medium to coarse, subangular to rounded quartz and quartzite	2.4	6.4
Keuper Marl	Mudstone, green to brown, weathered	1.1+	7.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	7	48	44	1				0.5–1.5	5	95	0
								1.5–2.5	2	98	0
	7	93						2.5–3.0	21	79	0
b	3	6	18	7	27	38	1	4.0–5.0	6	35	59
								5.0–6.0	trace	29	71
	3	31			66			6.0–6.4	0	25	75

SK 79 NW 5 **7246 9951** **Levels Farm, Finningley** **Block B**

Surface level +0.7 m
Water level −1.8 m
October 1972

Overburden 1.5 m
Mineral 1.0 m
Waste 3.0 m
Mineral 1.6 m
Bedrock 1.4 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Peaty soil	0.5	0.5
Peat	Peat, brown	1.0	1.5
25-Ft Drift	**a** Sand, brown: medium, subangular to subrounded quartz with some quartzite	1.0	2.5
	Clay, buff, silty	0.5	3.0
	Sand, brown to buff: as above	0.5	3.5
	Clay, dark brown	2.0	5.5
Older River Sand and Gravel	**b** Sand, brown to buff: medium, subangular to subrounded quartz with some white quartzite and traces of dark minerals; clay balls in lower part	1.6	7.1
Keuper Marl	Mudstone, brown to green	1.4+	8.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$				
a+b	16	19	64	1	trace			**a** 1.5–2.5	14	86	0
	16	84			trace			**b** 5.5–6.5	3	96	1
								6.5–7.1	42	58	0

SK 79 NW 6 **7350 9949** **Leigh Farm, Haxey** **Block B**

Surface level +1.4 m
Water level −1.6 m
September 1972

Overburden 4.9 m
Mineral 5.8 m
Bedrock 0.8 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on peat	0.7	0.7
Alluvium	Clay, black, peaty, with 0.4 m of grey silty clay at base	4.2	4.9
25-Ft Drift	**a** Sand, 'clayey' at top, with traces of gravel: fine quartz with coal fragments below 6 m	3.1	8.0
Older River Sand and Gravel	**b** Pebbly sand and gravel with some clay balls near base Gravel: mainly fine, well rounded quartzite, subrounded tabular silty mudstone and, in lower part, well rounded sandstone; some coal Sand: fine to medium, quartz with quartzite, some coal and traces of mudstone	2.7	10.7
Keuper Marl	Mudstone, chocolate to green, weathered	0.8+	11.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$				
a	4	40	51	3	2			4.9–6.0	9	91	0
								6.0–7.0	2	94	4
	4	94			2			7.0–8.0	1	98	1
b	5	11	54	8	17	5		8.0–9.0	1	87	12
								9.0–10.0	1	69	30
	5	73			22			10.0–10.7	17	58	25

SK 79 NW 7 7457 9958 Westwoodside **Block C**

Surface level +2.4 m
Water level +0.4 m
October 1972

Overburden 0.5 m
Mineral 5.0 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, brown sandy	0.5	0.5
Blown Sand	**a** Sand, brown to buff: fine to medium, subangular to subrounded quartz with some fine to medium angular to subangular white quartzite	2.0	2.5
25-Ft Drift	**b** Sand, grey to buff, with rare pebbles; clay balls near base Gravel: fine sandstone, partly tabular, with quartz, and some cherty grey limestone Sand: as above	3.0	5.5
Keuper Marl	Mudstone, weathered, brown	1.0+	6.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$				
a+b	8	31	59	1	1			**a** 0.5–1.5	1	99	0
								1.5–2.5	4	96	0
	8	91			1						
								b 2.5–3.5	1	99	0
								3.5–4.5	0	99	1
								4.5–5.5	33	66	1

SK 79 NW 8 7040 9853 Newlands Farm, Finningley **Block A**

Surface level +3.0 m
Water not encountered
September 1972

Mineral 1.1 m
Bedrock 3.9 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Older River Sand and Gravel	Soil on 'clayey' gravel Gravel: fine to coarse, subrounded to rounded, quartzite with some sandstone and darker rocks Sand: fine to medium quartz Fines: reddish brown firm silty clay	1.1	1.1
Keuper Marl	Clay and mudstone, chocolate brown	3.9+	5.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$				
14	12	11	3	23	37		0–1.1	14	26	60
14	26			60						

SK 79 NW 9 **7133 9852** **Newlands, East Misson** **Block A**

Surface level +0.7 m
Water level −0.3 m
October 1972

Waste 0.4 m
Bedrock 3.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on dark brown peat	0.4	0.4
Keuper Marl	Clay, grey-green, passing down into mudstone	3.1+	3.5

SK 79 NW 10 **7227 9854** **Park Drain, Misson** **Block A**

Surface level +2.0 m
Water level −0.5 m
October 1972

Overburden 0.6 m
Mineral 2.4 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Sandy soil	0.6	0.6
Blown sand on Older River Sand and Gravel	'Clayey' sand on 'clayey' sandy gravel Gravel: fine to coarse subrounded quartz Sand: fine to medium, angular to subrounded quartz with some quartzite	2.4	3.0
Keuper Marl	Mudstone, red and green	2.0+	5.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
11	19	63	1	5	1		0.6–1.4	*10*	*90*	*0*
							1.4–2.4	10	90	0
11	83			6			2.4–3.0	13	65	22

SK 79 NW 11 **7328 9854** **Broomstone Lane, Westwoodside** **Block B**

Surface level +1.9 m
Water level −1.1 m
October 1972

Overburden 6.0 m
Mineral 5.0 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on black peat	6.0	6.0
25-Ft Drift	**a** Sand, grey, with slight trace of gravel: medium, subangular to subrounded quartz with coal traces	4.0	10.0
Older River Sand and Gravel	**b** Pebbly sand Gravel: mainly fine subrounded tubular dark grey sandstone and rounded quartzite with subrounded black chert Sand: fine to medium, as above	1.0	11.0
Keuper Marl	Mudstone, grey-green, weathered	2.0+	13.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	2	33	64	1				6.0–7.0	3	97	0
								7.0–8.0	3	97	0
	2	98						8.0–9.0	2	98	0
								9.0–10.0	1	99	0
b	2	34	41	6	11	6		10.0–11.0	2	81	17
	2	81			17						

SK 79 NW 12 **7398 9885** **Thinholme Burn, Westwoodside** **Block B**

Surface level +2.4 m
Water level −1.6 m
October 1972

Overburden 4.5 m
Mineral 5.1 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Topsoil, silty brown or grey silt	0.7	0.7
Peat	Peat, dark brown, woody, with silty bands	3.8	4.5
25-Ft Drift on Older River Sand and Gravel	Sand with traces of gravel Gravel: fine, subrounded quartzite, flint and, near base, green mudstone and sandstone Sand: medium, quartz with traces of fine coal	5.1	9.6
Keuper Marl	Mudstone, red and green	1.0+	10.6

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
1	30	67	1	1			4.5–5.5	1	99	0
							5.5–6.5	1	98	1
1	98			1			6.5–7.5	trace	100	0
							7.5–8.5	1	99	0
							8.5–9.6	1	98	1

SK 79 NW 13 7485 9873 Monkham Drain, Westwoodside **Block C**

Surface level +2.3 m
Water level −0.8 m
October 1972

Overburden 0.5 m
Mineral 10.5 m
Bedrock 0.8 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Sandy soil with peat debris	0.5	0.5
?Alluvium on Blown Sand	**a** Sand, dark brown to grey, with peat debris to 1.5 m and very few pebbles of quartzite	3.0	3.5
25-Ft Drift on Older River Sand and Gravel	Sand, reddish brown, with some pebbles Gravel: fine, rounded white quartzite with subrounded black chert, grey flint and subangular green mudstone Sand: fine to medium, subrounded quartz with some subangular quartzite and conspicuous coal	6.0	9.5
	b Pebbly sand: sand and gravel fractions as above	1.5	11.0
Keuper Marl	Mudstone, green, silty, bedded	0.8+	11.8

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	3	35	59	2	1			0.5–1.5	14	86	0
								1.5–2.5	2	98	0
	3	96			1			2.5–3.5	1	99	0
								3.5–4.5	2	98	0
								4.5–5.5	1	99	0
								5.5–6.5	1	96	3
								6.5–7.5	1	98	1
								7.5–8.5	1	98	1
								8.5–9.5	1	97	2
b	1	18	59	8	10	4		9.5–10.5	1	85	14
								10.5–11.0	1	85	14
	1	85			14						

SK 79 NW 14 7021 9756 Red House Farm, Misson **Block A**

Surface level +3.8 m
Water not encountered
October 1972

Overburden 1.4 m
Mineral 0.9 m
Bedrock 0.7 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Older River Sand and Gravel	Soil, sandy and gravelly	0.8	0.8
	Clay, brown, soft, with pebbles of quartzite and sandstone	0.6	1.4
	'Very clayey' sandy gravel Gravel: fine to coarse, subrounded to rounded, purple and white quartzite and brown sandstone Sand: fine to coarse, angular to subangular quartz	0.9	2.3
Keuper Marl	Mudstone, brownish grey to green variegated	0.7+	3.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
21	16	22	5	25	11		1.4–2.3	21	43	36
21	43			36						

SK 79 NW 15 7138 9805 South of Snow Sewer **Block A**

Surface level +0.9 m
Water level −2.5 m
October 1972

Overburden 0.4 m
Mineral 2.0 m
Waste 1.0 m
Mineral 1.0 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Peaty soil	0.4	0.4
25-Ft Drift	**a** Sand with some pebbles Gravel: fine to medium, rounded white quartzite Sand: fine, subangular to subrounded buff to brown quartz	2.0	2.4
	Clay, soft, purple brown	1.0	3.4
Older River Sand and Gravel	**b** 'Very clayey' gravel Gravel: fine to coarse, subrounded tabular grey, black and brown sandstone and rounded white quartzite Sand: as above Fines: brown and green clayey silt	1.0	4.4
Keuper Marl	Mudstone, soft, bright green	1.0+	5.4

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	7	79	13	0	1			0.4–1.4	1	98	1
								1.4–2.4	13	87	0
	7	92			1						
b	22	21	7	5	33	12		3.4–4.4	22	33	45
	22	33			45						

SK 79 NW 16 7266 9763 Fountain Farm, Gringley **Block B**

Surface level +1.8 m
Water level −1.2 m
October 1972

Overburden 6.6 m
Mineral 2.4 m
Bedrock 1.8 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Peaty soil on silty peaty clay	4.4	4.4
	Peat, black	2.2	6.6
25-Ft Drift	Sand, dark grey, with balls of reddish brown clayey silt: fine to medium, subangular to subrounded quartz	2.4	9.0
Keuper Marl	Mudstone, red and grey	1.8+	10.8

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
6	23	66	4	1			6.6–7.6	2	96	2
							7.6–9.0	10	90	0
6	93			1						

SK 79 NW 17 7360 9750 Sandhill Cottage, Westwoodside **Block B**

Surface level +2.3 m
Water level not recorded
October 1972

Overburden 2.0 m
Mineral 8.5 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Blown Sand	Brown soil on peaty sand	1.0	1.0
Peat	Peat, granular, sandy	1.0	2.0
25-Ft Drift	**a** Sand, grey and brown, with traces of gravel Gravel: fine, subrounded, white quartzite, grey-green silty mudstone and brown sandstone Sand: mainly medium, subangular to rounded quartz with some fine to coarse subangular white quartzite	7.0	9.0
Older River Sand and Gravel	**b** Pebbly sand and sandy gravel Gravel: fine to coarse with some cobbles; as above Sand: as above, with trace of dark rock fragments	1.5	10.5
Keuper Marl	Mudstone, brown	2.0+	12.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	3	32	64	1	trace			2.0–3.0	7	92	1
								3.0–4.0	2	98	0
	3	97			trace			4.0–5.0	1	98	1
								5.0–7.0	1	99	0
								7.0–8.0	3	97	0
								8.0–9.0	5	95	0
b	2	47	33	3	8	5	2	9.0–10.0	2	90	8
								10.0–10.5	2	70	28
	2	83			15						

SK 79 NW 18 **7441 9784** **Langholm Farm, Misterton** **Block C**

Surface level +3.1 m
Water level +0.1 m
October 1972

Overburden 0.5 m
Mineral 6.0 m
Waste 0.5 m
Mineral 5.5 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Light brown sandy soil	0.5	0.5
Blown Sand on 25-Ft Drift	**a** 'Clayey' sand, light brown with rare pebbles Gravel: fine, subrounded green mudstone and flint Sand: fine to medium, subangular to subrounded quartz with fine coal debris in lower part	6.0	6.5
	Clay, dark brown, soft	0.5	7.0
Older River Sand and Gravel	**b** Sand, buff to brown, with a few pebbles near base Gravel: fine to coarse, rounded tabular grey-green sandstone Sand: fine to medium, subangular to subrounded, quartz with some coal	5.5	12.5
Keuper Marl	Mudstone, green and brown, soft	1.1+	13.6

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	10	49	41	0	trace			0.5–1.5	2	98	0
								1.5–2.5	2	98	0
	10	90			trace			2.5–3.5	1	98	1
								3.5–4.5	22	78	0
								4.5–5.5	31	69	0
								5.5–6.5	1	99	0
b	1	47	49	1	1	1		7.0–8.0	2	98	0
								8.0–9.0	trace	100	0
	1	97			2			9.0–10.0	1	99	0
								10.0–11.0	1	96	3
								11.0–12.5	2	94	4

SK 79 NW 19 **7046 9637** **Pasture Lane West, Misson** **Block A**

Surface level +2.4 m
Water level +1.9 m
October 1972

Overburden 4.4 m
Mineral 3.1 m
Bedrock 1.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
25-Ft Drift on Older River Sand and Gravel	Soil on red, brown and grey clayey silt	4.4	4.4
	'Very clayey' sand with some gravel Gravel: fine well rounded sandstone quartz and igneous rocks Sand: fine to medium, subrounded, to well rounded quartz Fines: brown silt; thin clay band at 5.5 m	3.1	7.5
Bunter Sandstone	Sandstone; grey	1.5+	9.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
21	47	30	1	1			4.4–5.5	28	72	0
							5.5–6.5	19	77	4
21	78			1			6.5–7.5	14	86	0

SK 79 NW 20 **7139 9650** **Pasture Lane East, Misson** **Block B**

Surface level +1.6 m
Water level −0.9 m
October 1972

Overburden 4.8 m
Mineral 1.2 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Topsoil	0.8	0.8
25-Ft Drift	Sandy silt, grey and red, with scattered rootlets and ochreous patches; few well rounded pebbles	1.0	1.8
	Silt, grey-blue in upper part, red-brown below, laminated and micaceous; some sandy patches	3.0	4.8
	'Very clayey' sand: fine, well rounded quartz with grey brown silt	1.2	6.0
Keuper Marl	Mudstone, red and green grading from clay into mudstone	1.0+	7.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
31	56	12	1	trace			4.8–5.8	30	70	0
							5.8–6.0	37	62	1
31	69			trace						

SK 79 NW 21 **7248 9671** **South Carr Farm, Misterton** **Block B**

Surface level +3.4 m
Water level −2.4 m
October 1972

Overburden 0.4 m
Mineral 5.0 m
Waste 0.7 m
Mineral 3.8 m
Bedrock 1.4 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Sandy soil	0.4	0.4
Blown Sand	**a** Sand: quartz with some quartzite	2.0	2.4
25-Ft Drift	**b** 'Very clayey' sand, yellow brown with some thin brown clayey silt bands below 4.6 m: fine subrounded quartz	3.0	5.4
	Soft brown clay	0.7	6.1
Older River Sand and Gravel	**c** Sand: brown 'very clayey' at top, with some gravel near base Gravel: fine, angular to rounded white quartzite, with grey-green silty mudstone Sand: fine, rounded quartz with some quartzite, coal and other rock fragments	3.8	9.9
Keuper Marl	Mudstone, grey, red and brown, weathered in the upper part	1.4+	11.3

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64				
a	6	74	20					0.4–1.4	3	97	0
								1.4–2.4	9	91	0
	6	94									
b	21	74	5					2.4–3.4	21	79	0
								3.4–4.4	13	87	0
	21	79						4.4–5.4	30	70	0
c	10	73	15	1	1			6.1–7.1	29	71	0
								7.1–8.1	3	97	0
	10	89			1			8.1–9.1	3	97	0
								9.1–9.9	5	92	3

SK 79 NW 22 **7314 9643** **Misterton Carr Farm** **Block B**

Surface level +4.4 m
Water level −1.4 m
November 1972

Overburden 0.2 m
Mineral 4.5 m
Waste 3.3 m
Mineral 3.0 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, sandy	0.2	0.2
Blown Sand on 25-Ft Drift	**a** Sand, yellow brown: fine subangular to subrounded quartz with some quartzite	4.5	4.7
	Clay and silt, brown to dark brown, soft	3.3	8.0
Older River Sand and Gravel	**b** Sand on pebbly sand and sandy gravel Gravel: mainly fine, subangular to rounded, brown, grey and white sandstone with traces of white and grey quartzite, white quartz and fine subangular black chert and grey flint Sand: mainly fine, rounded, quartz with traces of white quartzite, coal debris, green silty mudstone and flint	3.0	11.0
Keuper Marl	Mudstone, grey-green	2.0+	13.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	3	71	26					0.2–1.2	4	96	0
								1.2–2.2	1	99	0
	3	97						2.2–3.2	3	97	0
								3.2–4.7	3	97	0
b	2	58	20	4	11	5		8.0–9.0	4	96	0
								9.0–10.0	2	82	16
	2	82			16			10.0–11.0	1	68	31

SK 79 NW 23 **7436 9672** **Cornley Farm** **Block C**

Surface level +2.4 m
Water level +0.4 m
October 1972

Overburden 0.3 m
Mineral 9.9 m
Bedrock 0.8 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Blown Sand on 25-Ft Drift	Sandy soil	0.3	0.3
	a Sand, brown with grey mottling in upper part: fine to medium, clear quartz with some white quartzite	6.0	6.3
Older River Sand and Gravel	**b** Sand with some pebbles Gravel: fine, angular to subangular tabular green silty mudstone with subrounded to rounded white quartzite and subrounded black chert; pebbles increasing in size with depth Sand: as above	3.9	10.2
Keuper Marl	Mudstone, green and brown, bedded	0.8+	11.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	3	45	51	1				0.3–1.3	8	92	0
								1.3–2.3	5	95	0
	3	97						2.3–3.3	1	99	0
								3.3–4.3	1	99	0
								4.3–5.3	2	98	0
								5.3–6.3	3	97	0
b	1	29	66	2	2			6.3–7.3	1	95	4
								7.3–8.3	2	96	2
	1	97			2			8.3–9.3	1	98	1
								9.3–10.2	2	96	2

SK 79 NW 24 **7051 9518** **Eastwood Lane** **Block A**

Surface level +6.3 m
Water level +4.3 m
October 1972

Mineral 6.0 m
Bedrock 4.7 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Older River Sand and Gravel	**a** 'Very clayey' sandy gravel Gravel: fine to coarse, well rounded, quartz and quartzite Sand: fine to medium, coarsening downwards, subrounded to well rounded quartz with rock fragments; some ochreous patches	2.0	2.0
?Bunter Sandstone	**b** Sand with scattered pebbles, 'clayey' in upper part Gravel: fine, well rounded white quartzite Sand: fine to medium, well rounded quartz	4.0	6.0
Bunter Sandstone	Sandstone and sand, grey-green	4.7+	10.7

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	22	23	30	5	12	8		0.0–1.0	20	54	26
								1.0–2.0	22	63	15
	22	58			20						
b	10	55	35	0				2.0–3.0	17	83	0
								3.0–4.0	15	85	0
	10	90						4.0–5.0	3	97	0
								5.0–6.0	3	97	0

SK 79 NW 25 **7153 9528** **Idle Pumping Station** **Block A**

Surface level +1.6 m
Water level −0.4 m
September 1972

Overburden 1.5 m
Mineral 1.4 m
Bedrock 1.3 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on peaty loam	0.5	0.5
Alluvium	Sandy clay, mottled grey-brown	1.0	1.5
Older River Sand and Gravel	'Very clayey' pebbly sand, light brown: fine to medium, subangular to rounded quartz with some white quartzite and traces of coal; some clay balls	1.4	2.9
Keuper Marl	Mudstone, brown with green mottling	1.3+	4.2

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
36	36	16	1	1	10		1.5–2.9	36	53	11
36	53			11						

SK 79 NW 26 **7272 9572** **Misterton Carr** **Block A**

Surface level +1.5 m
Water level OD
November 1972

Overburden 4.5 m
Mineral 4.5 m
Bedrock 2.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on black and grey clayey peat	4.5	4.5
Older River Sand and Gravel	Sandy gravel, contaminated with dark peat in the upper part Gravel: mainly fine, subrounded to rounded sandstone with subangular to well rounded, quartzite and subangular to rounded flint and chert Sand: fine to medium, subrounded to rounded, quartz with rock fragments	4.5	9.0
Keuper Marl	Mudstone, red-brown with green mottling	2.5+	11.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
2	22	20	9	34	13		4.5–5.5	1	45	54
							5.5–6.5	3	39	58
2	51			47			6.5–7.0	1	98	1
							7.0–8.0	1	36	63
							8.0–9.0	1	64	35

SK 79 NW 27 **7353 9544** **Misterton Carr Farm** **Block A**

Surface level +1.4 m
Water level −0.6 m
November 1972

Overburden 6.0 m
Mineral 1.0 m
Waste 2.0 m
Mineral 1.5 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on black peat	3.0	3.0
25-Ft Drift	Clay, brown	3.0	6.0
	a Sand, brown: fine, quartz with coal	1.0	7.0
	Clay, buff to reddish brown, soft	2.0	9.0
Older River Sand and Gravel	**b** Sandy gravel: fine pebbles of quartzite, sandstone, chert, flint and mudstone in fine to medium sand	1.5	10.5
Keuper Marl	Mudstone, brown and green with gypsum veins	2.0+	12.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	6	79	14	1				6.0–7.0	6	94	0
	6	94									
b	3	22	33	7	30	5		9.0–10.5	3	62	35
	3	62			35						

SK 79 NW 28 7465 9562 Cornley Road, Misterton **Block B**

Surface level +4.2 m
Water not encountered
October 1972

Overburden 0.5 m
Mineral 2.2 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Sandy soil	0.5	0.5
Blown Sand	Sand, yellow to brown: fine to medium, subangular to subrounded quartz with some medium to coarse, angular to subangular quartzite	2.2	2.7
Keuper Marl	Mudstone and clay, green and red-brown	1.0+	3.7

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
2	58	39	1				0.5–1.5	3	97	0
							1.5–2.7	2	98	0
2	98									

SK 79 NE 3 7613 9883 Westwood East **Block C**

Surface level +4.3 m
Water level +2.8 m
October 1972

Overburden 0.5 m
Mineral 3.0 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, brown, sandy	0.5	0.5
Blown Sand	Sand, mainly 'clayey', brown to dark grey: fine to medium, subangular to rounded quartz with some angular to subangular quartzite; disseminated organic debris, and fragments of green and brown mudstone in lower part	3.0	3.5
Keuper Marl	Mudstone, pale grey to green, with slightly silty bands	1.0+	4.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
7	47	46	0	trace			0.5–1.5	10	89	1
							1.5–2.5	1	99	0
7	93			trace			2.5–3.5	10	90	0

SK 79 NE 4 7700 9916 Lordfoss Lane, Haxey **Block C**

Surface level +5.1 m
Water level +3.6 m
October 1972

Overburden 0.4 m
Mineral 3.0 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, buff sandy	0.4	0.4
Blown Sand	'Clayey' sand, light brown to dark grey: fine to medium, subangular to subrounded quartz with a little subangular to rounded quartzite, and organic debris	3.0	3.4
Keuper Marl	Mudstone, brown, weathered at top	1.1+	4.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
17	46	36	1				0.4–1.4	11	89	0
							1.4–2.4	4	96	0
17	83						2.4–3.4	36	64	0

SK 79 NE 5 7880 9911 East Lound, Owston Ferry **Block C**

Surface level +2.6 m
Water level +1.1 m
September 1972

Waste 0.6 m
Bedrock 1.4 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Topsoil and loam	0.4	0.4
?25-Ft Drift	Sandy clay	0.2	0.6
Keuper Marl	Mudstone, red and grey, weathered at top	1.4+	2.0

SK 79 NE 6 7982 9919 Owston South **Block C**

Surface level +2.4 m
No water encountered
October 1972

Overburden 0.8 m
Mineral 1.0 m
Bedrock 0.2 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, dark, peaty and sandy	0.8	0.8
Blown Sand	Sand, dark, peaty: fine, rounded quartz	1.0	1.8
Keuper Marl	Mudstone, green and brown	0.2+	2.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
2	50	47	1				0.8–1.8	2	98	0
2	98									

SK 79 NE 7 7555 9809 Langholme House **Block C**

Surface level +3.0 m
Water level +1.0 m
October 1972

Overburden 0.3 m
Mineral 10.2 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Sandy soil	0.3	0.3
Blown Sand on Older River Sand and Gravel	**a** Sand, mottled brown and grey, with some gravel Gravel: fine, subrounded quartzite Sand: fine to medium, subangular to rounded quartz with some angular to subangular white quartzite, coal, peat and green mudstone, flint and chert	9.2	9.5
	b Sandy gravel Gravel: fine to cobble, subrounded quartzite and rounded brown sandstone Sand: as above	1.0	10.5
Keuper Marl	Mudstone, green, well bedded, weathered at top	1.0+	11.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$				
a	2	43	53	1	1			0.3–1.3	1	97	2
								1.3–2.5	5	94	1
	2	97			1			2.5–3.5	1	98	1
								3.5–4.5	8	92	0
								4.5–5.5	1	99	0
								5.5–6.5	3	97	0
								6.5–7.5	1	99	0
								7.5–8.5	1	98	1
								8.5–9.5	1	95	4
b	0	14	45	6	17	11	7	9.5–10.5	0	65	35
	0	65			35						

SK 79 NE 8 7662 9826 Craiselound West **Block C**

Surface level +3.1 m
Water level +1.1 m
October 1972

Overburden 0.5 m
Mineral 5.0 m
Bedrock 0.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, grey-brown, very sandy	0.5	0.5
Blown Sand on Older River Sand and Gravel	Sand, buff to dark grey, with few pebbles Gravel: fine, subrounded white quartzite, angular grey flint, rounded brown sandstone and flakes of mudstone and clay pellets Sand: medium,subangular to subrounded pale quartz	5.0	5.5
Keuper Marl	Mudstone, part silty, brown and green, with gypsum veinlets	0.5+	6.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
3	43	53	1	trace			0.5–1.5	7	93	0
							1.5–2.5	7	93	0
3	97			trace			2.5–3.5	1	99	0
							3.5–4.5	1	98	1
							4.5–5.5	1	98	1

SK 79 NE 9 7805 9860 East of Craiseland **Block C**

Surface level +2.6 m
Water level +0.6 m
September 1972

Overburden 0.4 m
Mineral 1.0 m
Waste 0.3 m
Mineral 0.7 m
Bedrock 1.6 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat on Blown Sand	Soil, peaty	0.4	0.4
	'Clayey' sand with 0.3 m peat at 1.7 m: mainly fine, subangular to rounded quartz with some quartzite and traces of green mudstone; some gravel near base	2.0	2.4
Keuper Marl	Mudstone, grey-green, soft	1.6+	4.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
14	55	27	3	1			0.4–1.4	13	87	0
							1.4–1.7	Peat		
14	85			1			1.7–2.4	15	83	2

SK 79 NE 10 7949 9849 Thornholme Farm **Block D**

Surface level +2.4 m
Water level +0.4 m
September 1972

Overburden 1.6 m
Mineral 2.7 m
Waste 0.4 m
Bedrock 1.8 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil on clayey loam with peat	1.6	1.6
	'Clayey' sand, brown: fine to medium, subangular to rounded quartz with a little quartzite and coal	1.0	2.6
	Sand: mainly fine, quartz with some quartzite and coal; scattered quartzite pebbles	1.7	4.3
25-Ft Drift	Clay, brown, soft	0.4	4.7
Keuper Marl	Mudstone, red to brown	1.8+	6.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
5	62	32	1	trace			1.6–2.6	10	89	1
							2.6–3.6	2	98	0
5	95			trace			3.6–4.3	2	98	0

SK 79 NE.11 7518 9715 Tindale Bank Road **Block C**

Surface level +2.1 m
Water level +1.1 m
October 1972

Overburden 0.4 m
Mineral 9.1 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Topsoil and made ground	0.4	0.4
Blown Sand and? 25-Ft Drift on Older River Sand and Gravel	Sand, brown to reddish brown, with some gravel Gravel: mainly fine, rounded brown sandstone and white quartzite with tabular subangular to subrounded green silty mudstone, and, in lower part, traces of angular flint Sand: mainly medium, angular to subrounded clear quartz with some angular to subangular white quartzite, coal and traces of green mudstone; disseminated peat in upper part	9.1	9.5
Keuper Marl	Mudstone, pale grey	1.0+	10.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
2	27	69	1	1			0.4–1.4	9	91	0
							1.4–2.4	1	97	2
2	97			1			2.4–3.4	1	98	1
							3.4–4.4	1	99	0
							4.4–5.4	2	98	0
							5.4–6.4	1	95	4
							6.4–7.4	1	99	0
							7.4–8.4	1	97	2
							8.4–9.5	2	95	3

SK 79 NE 12 7654 9734 Haxey Station **Block D**

Surface level +2.6 m
Water level +0.6 m
October 1972

Overburden 0.6 m
Mineral 9.4 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil: sandy loam	0.6	0.6
Alluvium on Blown Sand and ?25-Ft Drift	**a** Sand, mainly 'very clayey' Sand: fine to medium, subrounded, quartz with some quartzite and, below 3.6 m coal and mudstone	4.0	4.6
Older River Sand and Gravel	**b** Sand, brown, slightly pebbly in places Gravel: fine to coarse, subrounded to rounded, grey-green silty mudstone and white quartzite with some coal and chert Sand: as above	5.4	10.0
Keuper Marl	Mudstone, chocolate brown, with vein gypsum	1.0+	11.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	16	36	46	1	1			0.6–1.6	21	79	0
								1.6–2.6	4	95	1
	16	83			1			2.6–3.6	38	62	0
								3.6–4.6	1	97	2
b	1	20	73	3	1	2		4.6–5.6	1	94	5
								5.6–6.6	1	94	5
	1	96			3			6.6–7.6	trace	98	2
								7.6–8.6	trace	93	7
								8.6–10.0	1	97	2

SK 79 NE 13 7742 9787 Bridge Farm, Craiselound **Block C**

Surface level +2.4 m
Water level −0.1 m
September 1972

Overburden 1.5 m
Mineral 0.9 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil on brown sandy silt	1.5	1.5
Peat	Peat, dark brown	0.1	1.6
Blown Sand	'Clayey' sand, grey and brown mottled: fine to medium, rounded brown quartz with quartzite and some coal	0.9	2.5
Keuper Marl	Mudstone, hard, grey, with vein gypsum	1.0+	3.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
12	48	39	1				1.6–2.5	12	88	0
12	88									

SK 79 NE 14 **7832 9754** **Craiselound Road** **Block D**

Surface level +2.3 m
Water level +0.3 m
September 1972

Overburden 0.3 m
Mineral 7.7 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil: sandy loam	0.3	0.3
Alluvium on ?Blown Sand and 25-Ft Drift	**a** Sand, 'clayey' to 'very clayey' in upper part, with peaty layers near top; 0.2 m thick clay at 6.5 m: fine to medium, subangular to subrounded, quartz with quartzite and, below 2.3 m, some coal	7.2	7.5
Older River Sand and Gravel	**b** 'Clayey' pebbly sand Gravel: fine, subangular to rounded quartz and quartzite with traces of sandstone and mudstone Sand: as above	0.5	8.0
Keuper Marl	Mudstone, red and grey green	1.0+	9.0

Grading

	Mean for deposit* *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$				
a+b	10	33	54	1	1	1		**a** 0.3–1.3	26	73	1
								1.3–2.3	12	88	0
	10	88			2			2.3–3.3	1	99	0
								3.3–4.3	1	99	0
								4.3–5.3	1	99	0
								5.3–6.3	1	97	2
								6.3–6.5	Clay: not graded		
								6.5–7.5	2	97	1
								b 7.5–7.7	10	81	9
								7.7–8.0	24	49	27

* assuming ungraded clay comprises 100% fines.

SK 79 NE 15 **7930 9738** **Gypsy Lane, Owston Ferry** **Block D**

Surface level +2.2 m
Water level −0.8 m
September 1972

Overburden 1.5 m
Mineral 1.2 m
Waste 0.3 m
Mineral 0.9 m
Waste 0.5 m
Mineral 1.6 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil on brown sandy clay	1.0	1.0
	Peat, black, with reed remains	0.5	1.5
	a 'Very clayey' sand: mainly medium, subangular quartz with quartzite	1.2	2.7
25-Ft Drift	Clay, grey brown, with reed remains	0.3	3.0
	b Sand: fine, angular to subangular, quartz with quartzite	0.9	3.9
	Clay, reddish brown	0.5	4.4
	c Sand, 'clayey' towards base: fine, quartz with quartzite: some green mudstone pebbles in lower part	1.6	6.0
Keuper Marl	Mudstone, red-brown	1.0+	7.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	20	22	57	1				1.5–2.7	20	80	0
	20	80									
b	9	68	23	0				3.0–3.9	9	91	0
	9	91									
c	8	63	27	1	1			4.4–5.4	6	94	0
								5.4–6.0	13	85	2
	8	91			1						

SK 79 NE 16 7571 9648 Participants Bank **Block D**

Surface level +2.5 m
Water level +0.5 m
October 1972

Overburden 0.1 m
Mineral 5.0 m
Bedrock 1.2 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Top soil, grey, sandy	0.1	0.1
Alluvium on Older River Sand and Gravel	Sand, with some gravel Gravel: fine to coarse, rounded to well rounded quartzite, angular to subangular flint and subangular to subrounded green mudstone Sand: fine to medium, subangular to rounded quartz with some dark rock fragments	5.0	5.1
Keuper Marl	Mudstone, brown	1.2+	6.3

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
3	42	52	1	1	1		0.1–1.1	8	91	1
							1.1–2.1	1	98	1
3	95			2			2.1–3.1	1	97	2
							3.1–4.1	2	98	0
							4.1–5.1	1	95	4

SK 79 NE 17 7672 9661 North Carr Farm **Block D**

Surface level +2.4 m
Water level +1.4 m
September 1972

Overburden 0.4 m
Mineral 5.0 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium and	Soil on black sandy loam	0.4	0.4
?25-Ft Drift on Older River Sand and Gravel	Sand, with some pebbles Gravel: mainly fine, subangular to rounded white quartzite, and chert Sand: mainly medium, subrounded to well rounded, quartz with quartzite	5.0	5.4
Keuper Marl	Mudstone, red, with gypsum	1.1+	6.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
2	27	65	3	2	1		0.4–1.4	1	97	2
							1.4–2.4	2	96	2
2	95			3			2.4–3.4	3	94	3
							3.4–4.4	1	98	1
							4.4–5.4	1	92	7

SK 79 NE 18 7740 9676 Tyndale Bank Gatehouse **Block D**

Surface level +2.3 m
Water level +0.3 m
September 1972

Overburden 1.3 m
Mineral 6.4 m
Bedrock 0.8 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil on dark brown loam	0.3	0.3
	'Very clayey' sand, brown, with iron staining and some rootlets	0.5	0.8
?25-Ft Drift	Clay, pebbly	0.5	1.3
Older River Sand and Gravel	Sand, light brown, with some pebbles and with thin clay parting at 2.0 m Gravel: fine to coarse, green mudstone with well rounded white quartzite and subrounded black chert Sand: medium, subrounded quartz with some quartzite	6.4	7.7
Keuper Marl	Mudstone, green, hard	0.8+	8.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
5	18	71	2	2	2		1.3–2.3	18	79	3
							2.3–3.3	3	92	5
5	91			4			3.3–4.3	1	93	6
							4.3–5.3	1	94	5
							5.3–6.3	*1*	*96*	*3*
							6.3–7.3	1	98	1
							7.3–7.7	16	83	1

SK 79 NE 19 7851 9654 Low Farm, West Stockwith **Block D**

Surface level +2.6 m
Water level +0.6 m
September 1972

Overburden 0.5 m
Mineral 6.4 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium,? on 25-Ft Drift	Black soil	0.5	0.5
	'Clayey' sand, peat stained at the top, with few pebbles Gravel: fine, subrounded green silty mudstone with black chert Sand: medium, rounded quartz with fine coal fragments	2.0	2.5
Older River Sand and Gravel	Sand with some pebbles, 'very clayey' at base: as above	4.4	6.9
Keuper Marl	Mudstone, red and grey, with vein gypsum	1.1+	8.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
7	29	61	2	1			0.5–1.5	13	86	1
							1.5–2.5	16	84	0
7	92			1			2.5–3.5	1	97	2
							3.5–4.5	2	98	0
							4.5–5.5	1	98	1
							5.5–6.5	1	97	2
							6.5–6.9	28	70	2

SK 79 NE 20 7924 9634 Heckdyke Grange **Block D**

Surface level +2.2 m
Water level not recorded
September 1972

Overburden 1.1 m
Mineral 1.8 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil and loam	0.4	0.4
	Clay, brown, with peat	0.7	1.1
	Sand, grey to black, with peat staining: medium, subangular to subrounded quartz with quartzite	1.8	2.9
Keuper Marl	Mudstone, red and green mottled	1.1+	4.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
3	25	69	2	1			1.1–2.1	1	97	2
							2.1–2.9	6	94	0
3	96			1						

SK 79 NE 21 7734 9589 North Carr Crossing **Block D**

Surface level +2.4 m
Water level +1.1 m
September 1972

Overburden 0.3 m
Mineral 4.6 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Topsoil on dark brown loam	0.3	0.3
?25-Ft Drift	Sand, 'very clayey' in lower part, brown, with traces of gravel and, towards base, balls of clay up to 3 cm in diameter	4.6	4.9
	Gravel: fine, subangular green mudstone, brown sandstone and brown and yellow chert Sand: fine to medium, rounded grey quartz with coal flakes		
Keuper Marl	Mudstone, grey-green with sandstone band and vein gypsum	1.1+	6.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
14	43	41	1	1			0.3–1.3	8	91	1
							1.3–2.3	2	98	0
14	85			1			2.3–3.3	1	99	0
							3.3–4.3	39	61	0
							4.3–4.9	21	78	1

SK 79 NE 22 7837 9539 Mount Pleasant, West Stockwith

Surface level +2.6 m
Water level −0.4 m
September 1972

Waste 3.3 m
Bedrock 2.2 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Made ground	1.6	1.6
?25-Ft Drift	'Very clayey' pebbly sand	0.4	2.0
	Clay stiff brown (?varved)	1.0	3.0
	'Very clayey' sand	0.3	3.3
Keuper Marl	Mudstone, red and green	2.2+	5.5

SK 79 NE 23 7984 9574 Stockwith Ellers **Block E**

Surface level +3.6 m
Water level not recorded
November 1972

Overburden 6.2 m
Mineral 13.9 m
Bedrock 0.9 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil light brown	0.2	0.2
Alluvium	Clayey silt, light brown to grey	6.0	6.2
Alluvium and/or Older River Sand and Gravel	**a** Sand, pebbly towards base Gravel: fine, subrounded to rounded white quartzite, angular to subrounded, white and buff flint and subrounded to rounded black chert Sand: medium, subangular to rounded clear quartz, with angular to subangular white quartzite, some angular to subrounded flint and chert and traces of coal	9.0	15.2
Older River Sand and Gravel	**b** Sandy gravel Gravel: mainly fine, as above but with sandstone and tabular mudstone Sand: as above	4.9	20.1
Keuper Marl	Sandstone, greyish green, very hard	0.9+	21.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	2	12	73	8	5			6.2–7.2	6	93	1
								7.2–8.2	2	97	1
	2	93			5			8.2–9.2	4	93	3
								9.2–10.2	2	95	3
								10.2–11.2	2	96	2
								11.2–12.2	1	96	3
								12.2–13.2	1	86	13
								13.2–14.2	1	88	11
								14.2–15.2	1	95	4
b	1	4	40	14	28	13		15.2–16.2	1	76	23
								16.2–17.2	1	54	45
	1	58			41			17.2–18.2	1	44	55
								18.2–19.2	1	55	44
								19.2–20.1	1	60	39

SK 79 SW 6 **7066 9438** **Idle Bank** **Block A**

Surface level +2.5 m
Water level +0.5 m
September 1973

Overburden 3.4 m
Mineral 1.0 m
Waste 0.3 m
Mineral 3.0 m
Bedrock 3.3 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on brown peat	0.6	0.6
Alluvium	Silty clay, yellow, with scattered peaty fragments	0.6	1.2
25-Ft Drift	Clay, brown, soft	2.2	3.4
	a 'Clayey' sand: fine, subangular to rounded quartz with quartzite and traces of coal	1.0	4.4
	Clay, brown, soft	0.3	4.7
	b Sand: as above with few quartzite pebbles	0.7	5.4
Older River Sand and Gravel	**c** Sandy gravel, coarsening downwards Gravel: fine to coarse with some cobbles, rounded to well rounded white, grey and red quartzite with rounded brown and grey sandstone, rounded black chert and some igneous rocks Sand: medium subangular to rounded quartz with white quartzite, some rounded tabular green mudstone and coal	2.3	7.7
Bunter Sandstone	Sandstone and sand, grey, fine to medium; pebbles recovered from between 9.0 and 9.8 m may result from contamination from above	3.3+	11.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	16	64	20	trace				**a** 3.4–4.4	16	84	0
	16	84									
b+c	1	33	30	6	16	12	2	**b** 4.7–5.4	2	97	1
	1	69			30			**c** 5.4–6.4	trace	57	43
								6.4–6.7	1	54	45
								6.7–7.7	2	67	31

SK 79 SW 7 **7154 9424** **Cross Lane** **Block A**

Surface level +1.9 m
Water level +0.9 m
September 1972

Overburden 5.5 m
Mineral 2.0 m
Bedrock 1.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on brown peat	0.8	0.8
25-Ft Drift	Clay, part silty, brown, with some thin sand bands	4.7	5.5
Older River Sand and Gravel	'Clayey' sandy gravel and gravel Gravel: fine to coarse, subrounded to rounded white quartzite with tabular subrounded to rounded brown and green sandstone; green, clay balls in lower part Sand: fine to medium, rounded clear quartz	2.0	7.5
Keuper Marl	Mudstone, weathered, red, mottled	1.5+	9.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
11	13	29	5	24	18		5.5–6.5	14	56	30
							6.5–7.5	8	39	53
11	47			42						

SK 79 SW 8 **7263 9470** **Carr Farm** **Block B**

Surface level +1.3 m
Water level −0.7 m
October 1973

Overburden 0.5 m
Mineral 1.0 m
Waste 3.0 m
Mineral 1.0 m
Waste 1.0 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Peaty soil	0.5	0.5
25-Ft Drift	**a** 'Very clayey' sand with peat staining: fine, subangular to rounded clear quartz	1.0	1.5
	Clay, brown with grey staining	0.5	2.0
	'Very clayey' sand	0.5	2.5
	Clay, brown	2.0	4.5
	b 'Clayey' sand: fine, quartz with traces of green mudstone	1.0	5.5
?Keuper Marl	Clay, purple brown, firm	1.0	6.5
Keuper Marl	Mudstone, brown and green, weathered	2.0+	8.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	28	63	8	1				0.5–1.5	28	72	0
	28	72									
b	18	69	12	1				4.5–5.5	18	82	0
	18	82									

SK 79 SW 9 **7354 9462** **Cattle Road** **Block B**

Surface level +2.0 m
Water level −2.0 m
October 1972

Overburden 0.5 m
Mineral 2.5 m
Waste 1.5 m
Mineral 0.7 m
Bedrock 3.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Peaty soil	0.5	0.5
25-Ft Drift	**a** 'Very clayey' sand: fine, angular to subrounded brown quartz	2.5	3.0
	Clay, dark brown, soft	1.5	4.5
	b 'Very clayey' sand: medium, brown quartz with some quartzite	0.7	5.2
?Keuper Marl	Clay, dark brown, firm, unbedded	1.7	6.9
Keuper Marl	Mudstone, part silty, green and brown, with gypsum veins up to 3 cm thick	1.4+	8.3

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a+b	28	67	4	1	trace			**a** 0.5–1.0	31	68	1
								1.0–2.0	26	74	0
	28	72			trace			2.0–3.0	27	73	0
								b 4.5–5.2	31	69	trace

SK 79 SW 10 **7426 9473** **Cattle Farm** **Block B**

Surface level +2.4 m
Water level +0.4 m
October 1972

Overburden 1.7 m
Mineral 1.0 m
Waste 2.8 m
Bedrock 2.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil, peaty	0.5	0.5
25-Ft Drift	Clay, silty, brown and yellow	1.2	1.7
	'Very clayey' sand, buff: fine quartz	1.0	2.7
	Clay, silty, brown	2.3	5.0
Older River Sand and Gravel	'Clayey' gravel: quartzite, sandstone and other pebbles in silty and clayey sand matrix	0.5	5.5
Keuper Marl	Clay and mudstone, brown, with vein gypsum	2.0+	7.5

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
32	64	2	1	1			1.7–2.7	32	67	1
32	67			1						

SK 79 SW 11 **7064 9357** **Polly Bell Bank** **Block A**

Surface level +1.6 m
Water level +0.1 m
October 1972

Overburden 5.3 m
Mineral 3.0 m
Bedrock 2.2 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil, dark peaty	0.4	0.4
25-Ft Drift	Clay, brown, silty, with sand bands in middle part	4.9	5.3
Older River Sand and Gravel	**a** 'Clayey' sandy gravel Gravel: mainly fine with some coarse and cobble, subrounded to well rounded white and purple quartzite and brown sandstone with some black chert Sand: fine, subangular to subrounded clear quartz with some white quartzite	1.0	6.3
?Bunter Sandstone	**b** Sand, buff to brown: mainly medium quartz; few purple quartzite pebbles in the lower half	2.0	8.3
Bunter Sandstone	Sandstone and sand, pale grey	2.2+	10.5

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	15	46	1	8	19	4	7	5.3–6.3	15	55	30
	15	55			30						
b	2	36	57	3	1	1		6.3–7.3	1	96	3
								7.3–8.3	3	96	1
	2	96			2						

SK 79 SW 12 7146 9339 Carr Farm, Gringley **Block B**

Surface level +2.0 m
Water level +0.5 m
September 1972

Overburden 4.0 m
Mineral 0.5 m
Waste 1.8 m
Mineral 0.4 m
Bedrock 1.3 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat on Alluvium	Peaty soil on peaty silty clay	1.3	1.3
25-Ft Drift	Clay, stiff brown, silty in lower part	2.7	4.0
	'Clayey' sand, brown, fine to medium, with traces of coal	0.5	4.5
	Clay, stiff brown	1.8	6.3
?Older River Sand and Gravel	'Clayey' sandy gravel, with pebbles and cobbles of quartzite and sandstone, and traces of coal	0.4	6.7
Keuper Marl	Mudstone, green and chocolate brown	1.3+	8.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	16	76	8	trace				4.0–4.5	16	84	0
	16	84									
b	16	35	17	8	6	18		6.3–6.7	16	60	24
	16	60			24						

SK 79 SW 13 7227 9332 Oatland Farm West

Surface level +1.8 m
Water not encountered
September 1972

Waste 6.0 m
Bedrock 0.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Peaty soil	0.3	0.3
25-Ft Drift	Clay, silty, brownish grey, with bands of sand in upper part	1.2	1.5
	Clay, reddish brown	4.5	6.0
Keuper Marl	Mudstone, red and green	0.5+	6.5

SK 79 SW 14 7338 9378 Oatland Farm East **Block B**

Surface level +2.0 m
Water level −1.0 m
September 1972

Overburden 1.3 m
Mineral 1.0 m
Bedrock 1.7 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil on peat	0.5	0.5
25-Ft Drift	Very clayey silt, light brown	0.8	1.3
	'Very clayey' sand: fine, subangular to rounded, brown quartz with some coal fragments	1.0	2.3
Keuper Marl	Mudstone, red-brown and grey mottled	1.7+	4.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64				
	26	72	2	0				1.3–2.3	26	74	0
	26	74									

SK 79 SW 15 7036 9247 Tethering Lane Farm **Block B**

Surface level +1.6 m
Water level +0.1 m
October 1972

Overburden 0.4 m
Mineral 3.0 m
Waste 0.3 m
Mineral 1.0 m
Bedrock 1.3 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat on Alluvium	Soil, dark brown, peaty	0.4	0.4
	a Sand and 'very clayey' sand yellow to buff, peaty near top, with thin clay bands: fine, angular to subrounded quartz	3.0	3.4
25-Ft Drift	Clay, firm, brown	0.3	3.7
Older River Sand and Gravel	**b** Pebbly sand Gravel: mainly coarse with rare cobbles, subrounded purple brown quartzite and soft grey sandstone Sand: fine to medium, buff to grey quartz	1.0	4.7
Bunter Sandstone	Sandstone and sand, pale grey	1.3+	6.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64				
a	19	69	11	1				0.4–1.4	34	66	0
								1.4–2.4	3	97	0
	19	81						2.4–3.4	*20*	*80*	*0*
b	3	50	36	2	2	7		3.7–4.7	3	88	9
	3	88			9						

SK 79 SW 16 7165 9254 Ellicar Farm

Surface level +2.7 m
Water not encountered
September 1972

Waste 2.0 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, peaty	0.8	0.8
Peat and Alluvium	Clay, silt, very clayey sand and peat	1.2	2.0
Keuper Marl	Mudstone, red-brown	1.0+	3.0

SK 79 SW 17 7250 9232 Ings Road, Gringley on the Hill

Surface level +4.0 m
Water not encountered
October 1972

Waste 0.5 m
Bedrock 1.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Terrace deposits	Soil, brown, with cobbles and pebbles of purple quartzite and sandstone	0.5	0.5
Keuper Marl	Mudstone, reddish brown with green bands	1.5+	2.0

SK 79 SW 18 7067 9186 Black Bank

Surface level +2.3 m
No water encountered
October 1972

Waste 1.5 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Peat	Soil,brown,peaty	0.5	0.5
Boulder Clay	Clay, reddish brown, pebbly, with layers of grey sand	1.0	1.5
?Bunter Sandstone	Sandstone and sand, grey-green	1.0+	2.5

SK 79 SE 11 7776 9438 Misterton Station

Surface level +3.7 m
Water level +2.3 m
September 1972

Waste 0.7 m
Bedrock 1.8 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil, clayey loam and soft brown clay	0.7	0.7
Keuper Marl	Mudstone, red and grey, weathered at top	1.8+	2.5

SK 79 SE 12 7887 9441 East Stockwith **Block E**

Surface level +3.6 m
Water level not recorded
November 1972

Overburden 7.3 m
Mineral 6.0 m
Bedrock 1.7 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil	0.5	0.5
Alluvium	Clay, slightly sandy, light brown	2.5	3.0
	Clay, grey, with many twigs and carbonaceous material	2.0	5.0
	Clay, dark brown	2.3	7.3
	Sandy gravel on pebbly sand Gravel: fine, subrounded to well rounded quartz, quartzite and sandstone, angular to rounded chert and flint, and, below 8.3 m, many mussel and snail shells Sand: medium, angular to rounded, quartz with some lithic grains	6.0	13.3
Keuper Marl	Mudstone, red and greyish green	1.7+	15.0

Grading

Mean for deposit *percentages*

Fines	Sand			Gravel		
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64
2	5	59	11	20	3	
2	75			23		

Depth below surface (m)	Bulk samples *percentages* Fines	Sand	Gravel
7.3–8.3	3	59	38
8.3–9.3	1	71	28
9.3–10.3	3	67	30
10.3–11.3	1	83	16
11.3–12.3	1	86	13
12.3–13.3	1	84	15

SK 79 SE 13 7985 9441 Carr Lane, East Stockwith **Block E**

Surface level +1.7 m
Water level +0.7 m
November 1972

Overburden 7.0 m
Mineral 5.4 m
Bedrock 1.6 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Silt, light brown, with small white gastropod shells	0.9	0.9
	Peat, brown to black	1.8	2.7
	Clay, light grey and brown, with particles of peat	4.3	7.0
Alluvium and/or Older River Sand and Gravel	Sandy gravel on gravel Gravel: fine to coarse, subrounded to well rounded quartz and quartzite and angular to rounded chert and sandstone Sand: medium, angular to rounded quartz and quartzite	5.4	12.4
Keuper Marl	Mudstone, red	1.6+	14.0

Grading

Mean for deposit *percentages*

Fines	Sand			Gravel		
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64
1	5	31	9	33	21	
1	45			54		

Depth below surface (m)	Bulk samples *percentages* Fines	Sand	Gravel
7.0–8.0	1	73	26
8.0–9.0	1	61	38
9.0–10.0	1	57	42
10.0–11.0	1	10	89
11.0–12.0	1	29	70
12.0–12.4	1	39	60

SK 79 SE 14 7843 9305 Ferry Road, Walkeringham

Surface level +3.4 m
Water level +1.4 m
September 1972

Waste 8.0 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil	0.4	0.4
Alluvium	Brown and grey silty clay	2.1	2.5
Peat	Peat and clay with reed fragments	0.8	3.3
	Peat, dark brown	4.2	7.5
?Alluvium	Pebbly sand, grey, containing balls of weathered Keuper mudstone	0.5	8.0
Keuper Marl	Mudstone, red and grey, weathered	1.0+	9.0

SK 79 SE 15 7912 9362 Willow Bank Lane, Walkerith **Block E**

Surface level +2.1 m
Water level +0.2 m
November 1972

Overburden 6.0 m
Mineral 7.4 m
Bedrock 1.6 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil	0.3	0.3
Alluvium	Silt, reddish brown	0.7	1.0
	Silt, dark grey, peaty	2.2	3.2
Peat	Peat, woody, brown and black, silty near top	2.8	6.0
Alluvium and/or Older River Sand and Gravel	Gravel Gravel: fine to coarse, subangular to well rounded quartz and quartzite with angular to rounded chert and sandstone and some flint Sand: medium with coarse, angular to rounded quartz and quartzite	7.4	13.4
Keuper Marl	Mudstone, red	1.6+	15.0

Grading

Mean for deposit *percentages*

Fines	Sand			Gravel		
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64
1	2	21	11	42	23	
1	34			65		

Depth below surface (m)	Bulk samples *percentages* Fines	Sand	Gravel
6.0–7.0	1	42	57
7.0–8.0	1	20	79
8.0–9.0	1	29	70
9.0–10.0	1	37	62
10.0–11.0	1	42	57
11.0–12.0	1	35	64
12.0–13.0	1	27	72
13.0–13.4	2	40	58

SK 79 SE 16 7821 9196 Holmes Road, Walkeringham

Surface level +3.9 m
Water not encountered
October 1972

Waste 1.0 m
Bedrock 1.1 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil, brown, clayey, on yellow brown and grey clay	1.0	1.0
Keuper Marl	Mudstone, red-brown with green mottling	1.1+	2.1

SK 79 SE 17 7927 9249 Field Lane, Walkerith **Block E**

Surface level +2.7 m
Water level +0.7 m
November 1972

Overburden 7.0 m
Mineral 7.5 m
Bedrock 0.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil, brown, clayey	0.4	0.4
	Clay, silty, brown and grey with plant debris	3.0	3.4
	Silt, grey, with small white gastropod shells	3.6	7.0
	Sandy gravel, with scattered wood fragments Gravel: fine angular to subrounded black chert, white and grey flint, and subrounded white quartzite, with, below 8.0 m, large mussel shells Sand: fine to coarse, angular to rounded quartz, angular to subrounded black brown and white flint, angular to subangular white quartzite	7.5	14.5
Keuper Marl	Mudstone, silty, green with brown mottling	0.5+	15.0

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
3	9	41	20	26	1		7.0–8.0	1	63	36
							8.0–9.0	4	72	24
3	70			27			9.0–10.0	3	74	23
							10.0–11.0	trace	88	12
							11.0–12.0	trace	59	41
							12.0–13.0	1	67	32
							13.0–14.5	7	69	24

SK 79 SE 18 7987 9296 North Carr Farm **Block E**

Surface level +2.9 m
Water level not recorded
November 1972

Overburden 0.5 m
Mineral 2.7 m
Waste 1.0 m
Mineral 2.3 m
Bedrock 1.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil	0.5	0.5
Terrace deposits	**a** 'Clayey' sand, with clay balls: medium, subangular to well rounded quartz and quartzite	2.7	3.2
25-Ft Drift	Clay, brown	1.0	4.2
	b 'Clayey' sand, with clay balls: as above	2.3	6.5
Keuper Marl	Mudstone, red and grey	1.5+	8.0

Grading

	Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
	Fines	Sand			Gravel				Fines	Sand	Gravel
	$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
a	12	14	66	4	3	1		0.5–1.5	10	90	0
								1.5–2.5	10	89	1
	12	84			4			2.5–3.2	17	70	13
b	15	44	41					4.2–5.2	16	84	0
								5.2–6.2	13	87	0
	15	85						6.2–6.5	16	83	1

SK 79 SE 19 7868 9127 Beckingham

Surface level +4.0 m
Water not encountered
September 1972

Waste 0.8 m
Bedrock 1.2 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil and loam	0.4	0.4
Alluvium	Clay, reddish brown with few fine to coarse, well rounded quartzite pebbles	0.4	0.8
Keuper Marl	Mudstone, red and grey	1.2+	2.0

SK 79 SE 20 7978 9158 Point Farm, Beckhingham **Block E**

Surface level +4.3 m
Water level +1.8 m
October 1972

Overburden 11.3 m
Mineral 6.0 m
Bedrock 1.0 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
	Soil, brown, loamy	0.3	0.3
Alluvium	Clay, silty, brown and grey	2.0	2.3
	Clayey silt, grey to black with peat and wood fragments	7.0	9.3
	Peat, black: small white bivalve shells abundant in parts; clay bands towards base	2.0	11.3
Alluvium and/or Older River Sand and Gravel	Gravel Gravel: fine to coarse, subangular to well rounded quartzite and sandstone with chert, flint and some other dark rocks Sand: mainly medium subangular to subrounded, quartz with some quartzite	6.0	17.3
Keuper Marl	Mudstone, red-brown	1.0+	18.3

Grading

Mean for deposit *percentages*							Depth below surface (m)	Bulk samples *percentages*		
Fines	Sand			Gravel				Fines	Sand	Gravel
$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64				
trace	7	19	9	41	24		11.3–12.3	1	75	24
							12.3–13.3	trace	40	60
trace	35			65			13.3–14.3	trace	24	76
							14.3–15.3	1	23	76
							15.3–16.3	trace	21	79
							16.3–17.3	trace	24	76

SK 79 SE 21 7929 9037 Willow Works, Beckingham

Surface level +4.6 m
Water level +2.6 m
November 1972

Waste 4.0 m
Bedrock 1.5 m+

Log

Geological classification	*Lithology*	*Thickness* m	*Depth* m
Alluvium	Soil on brown and grey clay, slightly sandy in parts	2.0	2.0
?25-Ft Drift	Pebbly sand, brown	0.4	2.4
	Clay, brown	1.6	4.0
Keuper Marl	Mudstone, red with green mottling	1.5+	5.5

APPENDIX G

LIST OF WORKINGS

At the time of the survey the pits detailed below were operational. There are no other significant workings.

Location and Grid reference	*Deposits worked*
Misson 700 955	Older River Sand and Gravel
Langholme Farm 748 980	Blown Sand, 25-Foot Drift sand, ? and Older River Sand and Gravel

APPENDIX H

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

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

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Mineral Assessment Report 43

CORRECTIONS

Page 2, Figure 1: *For* Bawtrey *read* Bawtry

Page 6, Figure 3: *Add the following to the caption:*
A rectangular tablet beneath the borehole site indicates the presence of such mineral: the height of the tablet is proportional to the thickness (1 mm = 1 m) and the ratio of coarse stipple to fine stipple shows the ratio of gravel to sand and fines.

Page 11, paragraph 5: *The formula for the standard deviation for mean thickness should read:*

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

Page 14, Figure 7: *The column of roman numerals at the left should end:* IX, X, XI, XII

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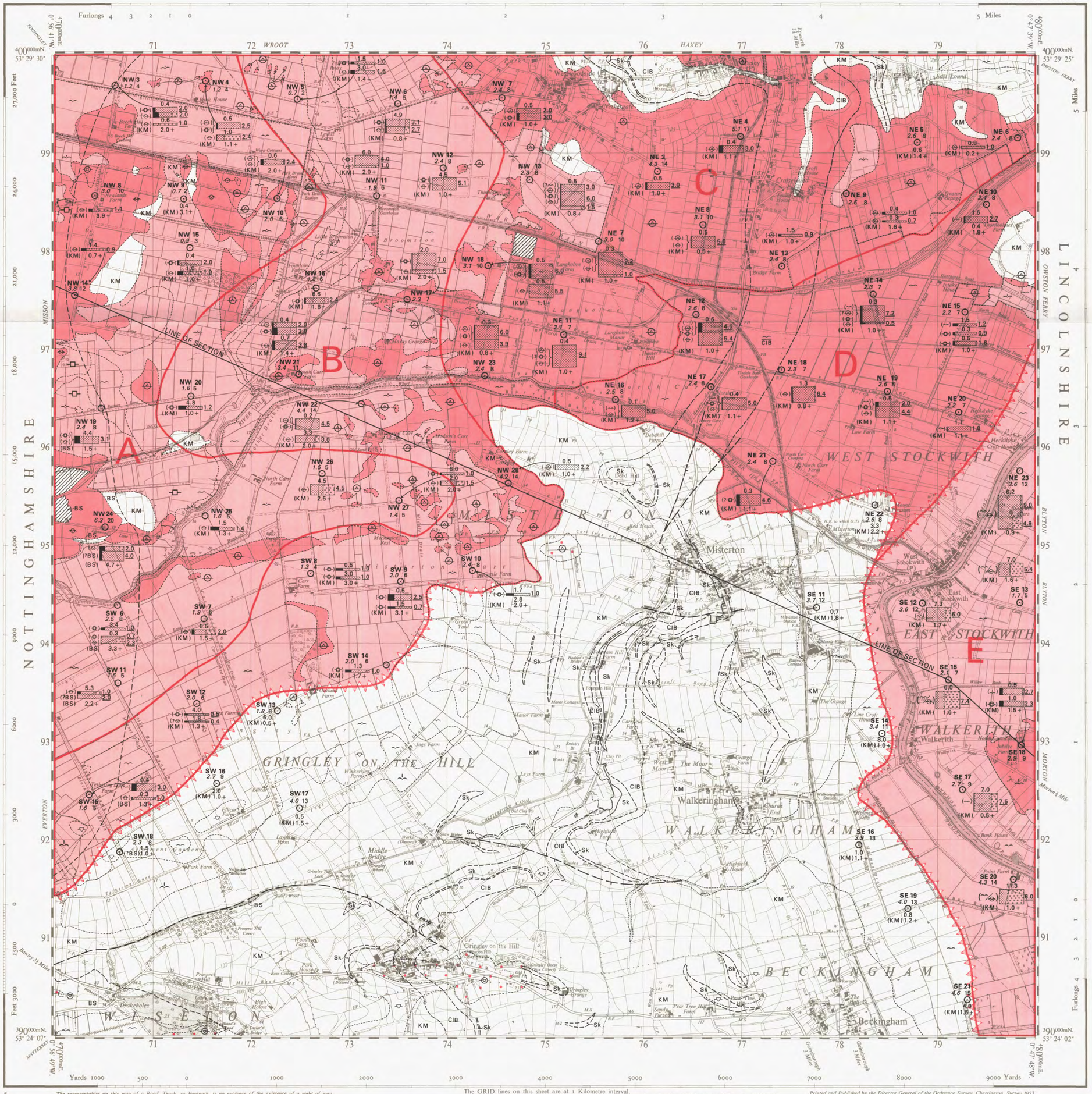
INSTITUTE OF GEOLOGICAL SCIENCES

INDUSTRIAL MINERALS ASSESSMENT UNIT

THE SAND & GRAVEL RESOURCES OF SHEET SK 79 (MISTERTON NOTTS.)

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

ORDNANCE SURVEY
SHEET SK 79
PROVISIONAL EDITION



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.
Contours values are in feet.
1 square inch on this map represents 99·639 acres on the ground.

Compiled from 6" sheets last fully revised 1918-40. Other partial systematic revision 1948-51 has been incorporated.

Printed and Published by the Director General of the Ordnance Survey, Chessington, Surrey, 1953.

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

Geological lines from six-inch surveys by G.D.Gaunt, G.H.Rhys and E.G.Smith in 1957-65. A.W.Woodland and D.R.A.Ponsford, District Geologists.

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

1:25000 Sand and Gravel Resource Sheet published 1979.
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.*

1100/79

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Diagram showing the relation of the National Grid 1:25,000 sheets with the New Series One-Inch Geological sheets 88, 89, 101 and 102.

THE SAND & GRAVEL RESOURCES OF SHEET SK 79 (MISTERTON, NOTTS.)

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

43

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

- **Alluvium and Warp** -clay and silt, in places overlying sand and gravel A-28
- **Peat** P-1
- **Blown Sand** -partly 'clayey', fine to medium sands BS-8
- **Terrace Deposits** -clay (Idle Valley) or medium sand, pebbly at base (Trent Valley) T-2
- **Sand of 25-Ft Drift of Vale of York** -partly 'clayey', fine and medium sands SA-5
- **Silt and Clay of 25-Ft Drift of Vale of York** -brownish grey clay, laminated at depth SI-3
- **Head** -red pebbly clay H-19
- **Older River Sand and Gravel** -medium sand and partly sandy gravels OR-12
- **Glacial Sand and Gravel** - fine to medium sand with pebbles GS-26
- **Boulder Clay** -red, sandy, pebbly clay BC-15

RECENT AND PLEISTOCENE

SOLID

- KM,CIB — **Keuper Marl (Mercia Mudstone Group) including Clarborough Beds** -red-brown and grey-green mudstone, partly silty
- Sk — **Skerry band in Keuper Marl** -dolomitic siltstone and fine sandstone
- BS — **Bunter Sandstone** (Sherwood Sandstone Group)-red and brown, fine to coarse sandstone with some pebbles in south

TRIASSIC

Areas worked for sand and gravel WO-13

BOUNDARY LINES

- Geological boundary, Drift.
- Geological boundary, Solid.
- Fault, crossmark indicates downthrow side
- Inferred boundary between recognised categories of deposits.
- Resource Block boundary.

Broken line denotes uncertainty.

BOREHOLE DATA

SITE LOCATIONS

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

I.M.A.U. BOREHOLES

Surface level in metres and feet above O.D. (Newlyn) — SW 6 / 2.5 8 — Borehole Registration Number; Borehole Site; Overburden 3.4 / 1.0; Waste 0.3; Geological Classification 0.7 / 2.3 (Mineral (sand and gravel)); (BS) 3.3+ (Bedrock)

Grading Diagram
Thicknesses in metres

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

Borehole Registration Number

Each I.M.A.U. borehole is identified by a Registration Number, e.g. SW6 The letters refer to the quarter sheet and the figures to the I.G.S. serial numbers for that quarter. The unique designation for borehole SW6 is SK 79 SW 6

Grading Diagrams

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

Sand (+1/16-4mm) — Fines (-1/16mm) — Gravel (+4mm)

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

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

CATEGORIES OF DEPOSITS

- **Exposed mineral, assessed.** CAT-E2
- **Continuous or almost continuous spreads of mineral beneath overburden.** CAT-C2
- **Sand and gravel either not potentially workable (see Report) or absent.** CAT-A2
- **Sand and gravel not assessed.** CAT-N1

RESOURCE BLOCKS

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

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

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

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