NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF GEOLOGICAL SCIENCES

Report No. 74/9

ASSESSMENT OF BRITISH SAND AND GRAVEL RESOURCES No. 11

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

Description of 1 : 25 000 resource sheet TM 13

S. E. Hollyer, BSc

London: Her Majesty's Stationery Office 1974

CORRECTION

Report No. 73/13. The sand and gravel resources of the country around Shotley and Felixstowe: Description of 1:25 000 resource sheet TM 23

Page 48: Water struck at (+8.6 m) +28 ft *should read* (+18.0 m) +59 ft

Page 49: Water struck at (+6.6 m) +21.5 ft *should read* (+19.1 m) +62.5 ft

Page 50: Water struck at (+5.5 m) +18 ft *should read* (+19.8 m) +65 ft

Page 51: Water struck at (+5.5 m) +18 ft *should read* (+19.2 m) +63 ft

Page 55: Water struck at (+4.6 m) +15 ft *should read* (+20.1 m) +66 ft

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1974

LONDON: HER MAJESTY'S STATIONERY OFFICE

CORRECTION

Report No. 74/9. The sand and gravel resources of the country around Tattingstone, Suffolk: Description of 1 : 25 000 resource sheet TM 13

Page 3, R. H. column, line 35 should read 'the results are quoted on pp. 15 to 21'.

Pages 8 and 9. The diagrams on pages 8 and 9 (but not the captions) should be transposed.

INSTITUTE OF GEOLOGICAL SCIENCES

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It is recommended that reference to this report be made in the following form:

HOLLYER, S. E. 1974. The sand and gravel resources of the country around Tattingstone, Suffolk: Description of the 1 : 25 000 resource sheet TM 13. *Rep. Inst. Geol. Sci.*, No. 74/9. 86 pp.

ISBN 0 11 880675 0

PREFACE

It has become increasingly clear in recent years that an assessment of resources of many minerals should be undertaken. This is a report of the Mineral Assessment Unit which was set up in May 1968 to undertake such work. It describes and quantifies the resources of sand and gravel of 63.1 km^2 of country around Tattingstone, Suffolk, shown on the accompanying 1 : 25 000 resource sheet TM 13.

This survey is concerned with assessing sand and gravel resources on a regional scale at the indicated level; the deposits are not outlined completely nor their grade established throughout. The work may be regarded as the application to large areas of methods used commercially for evaluating reserves on small sites. It may also be regarded as an extension of geological mapping by providing information about the thickness and quality of deposits.

The field survey was conducted by Mr S.E. Hollyer and Dr R. Allender, assisted by Mr S.J. Booth. The preparation of data for publication was by Mr Hollyer under the general supervision of Dr Allender. The work is based on the 1 : 63 360 geological survey, originally published in 1882 on Old Series sheets 48 NW and NE. Part of this was transferred to New Series Sheet 207 (Ipswich) and published with minor amendments in 1927. The geology is now presented at 1 : 25 000 scale, incorporating minor amendments resulting from the present work. Ground south of the estuary of the Stour is excluded from this survey pending revision of the mapping.

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

Financial support for the survey was provided by the Department of the Environment.

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CONTENTS

ILLUSTRATIONS

Page

TABLES

Summary

The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 53 boreholes drilled for the Mineral Assessment Unit form the basis of the assessment of sand and gravel resources in the Tattingstone area, Suffolk.

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

The mineral-bearing ground shown on the 1 : 25 000 map is divided into resource blocks, each ideally containing approximately 10 km^2 of sand and gravel. For each block the mineral-bearing area, the mean thickness of overburden and mineral, and the mean grading are given and the geomorphology and geology of the deposits described.

The position of the boreholes and exposures, the geology and topography and the outlines of the blocks are shown on the accompanying map TM 13. Detailed borehole data are given.

Sommaire

Les cartes géologiques de l'Institute of Geological Sciences, les renseignements sur des trous de sonde qui existaient déjà, et 53 trous de sonde, forés pour le Mineral Assessment Unit, constituent la base de l'évaluation des ressources en sable et en gravier dans la région de Tattingstone, Suffolk.

Tous les dépôts dans la région, qui présentent la possibilité d'exploitation pour le sable et le gravier (mineral) ont été étudiés du point de vue géologique, et on s'est servi d'une méthode statistique simple pour en évaluer le volume. Les évaluations de volume sont tenues d'être à 95 pour cent exactes.

Le terrain minéralisé montré a la carte 1 : 25 000 est divisés en blocs de ressources, chacun d'eux ayant idéalement environ 10 km^2 de sable et de gravier. On donne pour chaque bloc l'étendue minéralisée, l'épaisseur moyenne de recouvrement et de minéral, et la gradation moyenne. On décrit la géomorphologie et la géologie des dépôts.

La situation des trous de sonde et des affleurements, la géologie et la topographie, et la configuration des blocs sont montrés sur la carte TM 13. Des données détaillées des trous de sonde sont donnëes.

Zusammenfassung

Die geologischen Karten von der Institute of Geological Sciences, die vorher existierende Information in Bezug auf Bohrlöchern, und 53 Bohrlöcher, die für das Mineral Assessment Unit gemacht waren, bilden den Grund fur die Einschätzung der Sand- und Schotter-mittel im Tattingstone Gebiet, Suffolk.

Man hat im Gebiet alle Ablagerungen, die möglich bearbeitbar für Sand und Schotter (Mineral) sind, geologisch untersucht, und man hat auch eine einfache statistische Methode benutzt, um das Volumen zu schätzen. Man gibt die Zuverlässigkeit der Volumenschätzungen mit 95% Vertrauensgrenzwerten.

Man teilt den mineralhatligen Grund auf der 1 : 25 000 Karte in Mittelsblöcke, wovon feder idealisch ungefähr 10 km^2 von Sand und Schotter einschliesst.

Für jeden Block gibt man das mineralhaltige Gebiet, die Durchschnittsdicke von Überlastung und Mineral und die Durchschnittsklassifizierung. Man beschreibt auch die Geomorphologie und Geologie der Ablagerung.

Man zeigt die Lage von den Bohrlöchern und Aufschlüssen, die Geologie und Topographie, auch die Skizzen von den Blöcken auf der Begleitkarte TM 13. Man gibt ausführliche Bohrlöcherdaten.

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

Description of 1 : 25 000 resource sheet TM 13

S. E. HOLLYER[1], BSc

Introduction

AIMS AND LIMITATIONS

National resources of many of the 'bulk' or 'industrial' minerals may seem so large that stocktaking is unnecessary, but the demand for land for all purposes and for minerals is intensifying. In contrast with other developments of land there may be little or no choice of area for the working of minerals and in the case of low-price materials such as sand and gravel transport costs will be an important factor. Whereas the economic benefit of using land for many other purposes can be assessed, hitherto little has been known of the potential value, on a regional scale, of any mineral resources which may be present. An important aim of the work is to improve the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971).

Sand and gravel, considered together as naturally occurring aggregate, was selected as the bulk mineral demanding the most urgent attention, particularly in the south-east of England, where about half the national output is won and very few sources of alternative aggregates are available. Following a short feasibility project, initiated in 1966 by the Ministry of Land and Natural Resources, the Mineral Assessment Unit began systematic surveys on a regional scale in Essex, Suffolk, and Norfolk in May 1968. This work is being supported by the Department of the Environment (which incorporates the former Ministry of Housing and Local Government and the Ministry of Public Building and Works) and is being undertaken with the cooperation of the Sand and Gravel Association of Great Britain (SAGA). The detail is at the 'indicated' level, a term introduced in the United States in connection with the estimation of national mineral resources. The level is that 'for which tonnage and grade are computed partly from specific measurements, samples, or production data and partly from specific measurements, samples, or production data and partly from projection for a reasonable distance on geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout.' (Anon., 1948, p. 15).

The survey is therefore concerned not with the estimation of reserves (which can only be assessed in the light of particular or existing economic considerations), but rather with resources, which include deposits not currently exploitable but having a foreseeable use. Clearly, the social and economic criteria used to decide whether a deposit may be workable at some time in the future cannot be rigorously defined. After discussion with the industry, the following arbitrary physical criteria were adopted for this survey:

a. the deposit should average at least 3 ft (0.9 m) in thickness.
b. the ratio of overburden to sand and gravel should be no more than 3:1.
c. the proportion of fines (that is, particles passing 1/16 mm (approximately No. 200 mesh B.S. sieve)) should not exceed 40 per cent.

Ground below 80 ft (24.4 m) from the surface is seldom explored, this being taken as the likely maximum working depth under most circumstances. It follows that boreholes are drilled no deeper than 60 ft (18.3 m) if they are still in overburden.

A deposit of sand and gravel that broadly fulfils the above criteria is considered to be 'potentially workable' and is assessed as 'mineral'. It is recognised that small parts of such a deposit may not satisfy all the requirements.

The volume and chief characteristics of sand and gravel within defined but relatively large areas, referred to as resource blocks, are assessed. Ideally, each resource block contains roughly 10 km^2 of sand and gravel.

The consequent limitation of the use to which the results can be put must be emphasised. The assessments of quantity and composition apply 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.

[1]Institute of Geological Sciences, 199 Knightsbridge, London, SW7 1DZ

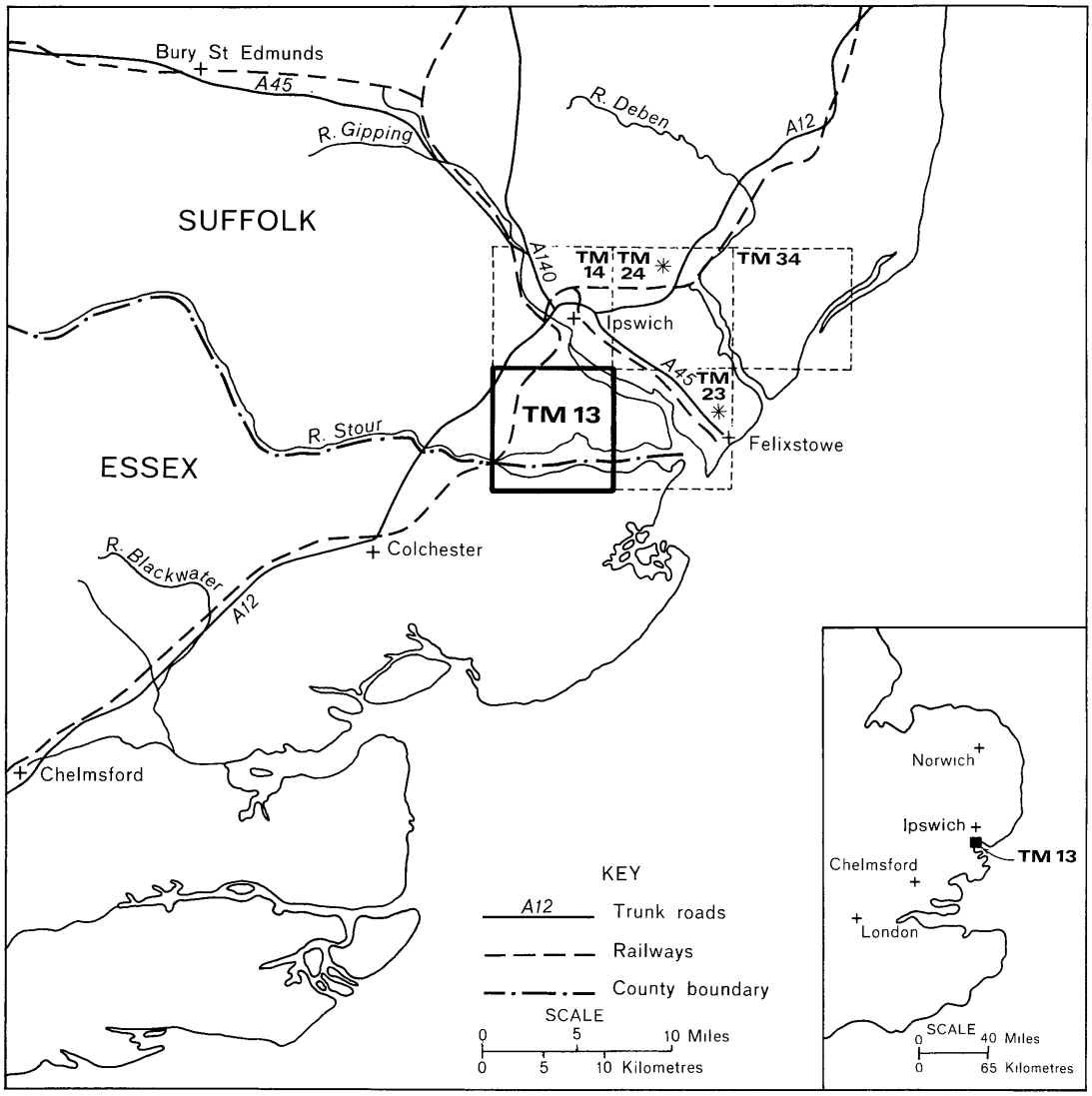


Fig. 1. Sketch map showing the location of sheet TM 13. An asterisk denotes that a report is available describing the sand and gravel resources of the area

It follows that reserves, which are accurately demarcated areas of economically workable mineral, must be proved by the customary detailed exploration undertaken by the industry. However, the information provided about the resource blocks in an area may assist in the selection of the best targets for such commercial exploration and evaluation.

Thus the work can be regarded as the statistically controlled application to large areas of methods similar to those applied by industry to establish the existence of workable reserves on a relatively small site, and also as an extension of conventional geological mapping techniques, which delineate (with varying degrees of accuracy, depending, for example, on the presence of cover) the areal extent of deposits.

PROCEDURE

Trial and error during preliminary studies showed that for the complex and variable glacial deposits of East Anglia and Essex, an absolute minimum of five sample-points evenly distributed across the sand and gravel are needed to provide a worthwhile statistical assessment, but that, ideally, there should be no fewer than ten. Sample-points are any points for which there exists adequate information about the nature and thickness of the deposit and, apart from the holes drilled during the survey, may include exposures and other boreholes. In particular, the cooperation of sand and gravel operators has ensured that boreholes have not been drilled where reliable information was already available. Such data are held confidentially by the Institute and cannot be disclosed, although they may have been used in the calculations.

The mineral 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 and to provide sufficient sample-points in each block. As far as possible the block boundaries are determined

by geological boundaries; for example, wherever practicable plateau 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 establish whether there are 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. Ideally the distribution should be unbiassed with respect to the geology, to ensure that the data obtained are representative of any broad trend in the variation in thickness or grading, as this will govern spot values.

However, because broad trends are independently overlaid by smaller scale variations, characteristically random in form, 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 have been taken into account in siting the holes: at the same time it has been 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. In siting the boreholes and in the subsequent calculations, no account is taken of any factors, for example, roads, villages and areas of high agricultural and landscape value, which might stand in the way of sand and gravel being exploited. The estimate of total volume of sand and gravel therefore bears no simple relationship to the amount that could be extracted in practice.

Ideally, 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 100 ft (30 m) at a diameter of about 6 in (150 mm) to 8 in (200 mm), and 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) and it should be fast. Although uncased continuous flight power augers can meet these requirements in some ground, they fail below the water table in some clay-free sand and gravel when the mineral does not stay on the flights or when the borehole caves. On the area covered by this sheet the German Wirth B1 drill (or B0 modified) was used extensively. With this machine, casing can be advanced at the same time as the hole is being drilled, thus minimising disturbance to the ground, and avoiding contamination and caving. In difficult ground a bailer can be substituted for the auger although this method suffers from the disadvantage that there is a tendency for the pumping action to draw unwanted material into the hole either from the sides or the bottom. Conventional 'shell and auger' rigs were also used.

A continuous series of bulk samples is taken throughout the thickness of sand and gravel. Ideally, samples are composed exclusively of the whole of the material previously occupying the space defined by the hole's ideal dimensions, as determined by the internal diameter of the casing and the thickness penetrated. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel, or for every 3 ft (0.9 m) and latterly every metre of depth. The samples are despatched in heavy-duty polythene bags to a laboratory for grading. Care is taken to discard, as far as possible, material which has caved, or been pumped from the bottom of a hole. The samples sent for analysis each weigh 60-100 lb (27-45 kg). The grading procedure is based on BS 1377 (Anon., 1967). Random checks are made on the accuracy of the laboratory grading.

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 C. Detailed records may be consulted at the appropriate offices of the Institute, upon application to the Director.

The method used in estimating the volume of mineral and other statistics for each of the resource blocks is described in Appendix A and the results are quoted on p.

THE MAP

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

Geological data

The geological boundary lines, symbols, etc. shown are taken in part from Old Series one-inch sheets 48 NW and NE (published in 1882) and New Series one-inch Sheet 207 (Ipswich), published in 1927. The lines on the relevant parts of the New Series sheet were transferred (with minor revisions) from the Old Series sheets which were mapped on the scale of one inch to a mile. Borehole data, which include the stratigraphic relations and mean particle size distribution of the sand and gravel samples collected during the survey, are also shown.

The geological boundaries are regarded as the best interpretation of the information available

at the time of survey. However, it is inevitable, particularly with glacial deposits (such as those included in the area of sheet TM 13) which change rapidly vertically and laterally, that local irregularities or discrepancies will be revealed by some boreholes (for example, at boreholes NE 29 and SW 2). These are taken into account in the assessment of resources (see below and Appendix A).

Mineral resource information

For assessment purposes the map is divided into areas of mineral and areas where sand and gravel is either not potentially workable or absent. (For definitions of 'mineral' and 'potentially workable' see page 1).

The mineral on TM 13 is subdivided into areas where it outcrops, and areas where it is believed to be present in continuous spreads beneath overburden. The whole area of exposed sand and gravel as mapped is considered as mineral, although there may be small patches where sand and gravel is not present or is not potentially workable.

Areas where bedrock outcrops, where sand and gravel is interpreted to be not potentially workable, and areas not assessed are uncoloured on the map, and where appropriate the relevant criterion is noted. In such areas is it assumed that mineral is absent or cannot be assessed quantitatively in the context of this survey. The area of exposed sand and gravel is measured from the mapped geological boundary lines. Where sufficient borehole information is available the subdrift boundary of the Red Crag has been inserted. This boundary has not been used in assessment calculations.

Description of Sheet TM 13

GENERAL

Lying south of Ipswich, the area described covers 63.1 km^2 (24.4 square miles) of mainly agricultural countryside 77 per cent of which (48.6 km^2) is underlain by sand and gravel deposits; the remaining 14.5 km^2 is occupied by London Clay, brickearth and alluvium. The rest of Sheet TM 13 (36.9 km^2) comprises the ground in Essex south of the river Stour and the area occupied by the Stour and Orwell estuaries. Patches of river terrace gravel, Glacial Sand and Gravel and Red Crag are present south of the river Stour; this area has not been surveyed but may be included with the adjoining sheet to the south when this is assessed.

TOPOGRAPHY

The area is one of moderate relief, dominated by the estuary of the Stour which widens eastwards across the southern part of the sheet. The River Orwell, to the north-east of the area, flows in a south-easterly direction to its confluence with the Stour at Orwell Haven, 4.3 miles (7 km) beyond the eastern margin of the map. Into these two river systems run a number of streams fed by springs which issue from the junction of the London Clay with the overlying predominantly sandy, Pleistocene deposits. In marked contrast to the streams draining southwards into the Stour, which occupy steep-sided valleys dissecting an area of low relief, those flowing north-eastwards into the Orwell are small and, except for Statts Valley, have little influence on the topography. The largest tributary valley, at Tattingstone, trending north-west to south-east to join the Stour just west of Lower Holbrook [180 350][1] is floored by London Clay and alluvium and divides the sand and gravel deposits of the area into two almost equal parts. It has been recently investigated by Ipswich Corporation Water Undertaking for use as a reservoir. Of comparable size is the Dodnash Valley, which bifurcates at Brantham Bridge [1238 3512]. In the area around Harkstead [185 348] the superficial deposits are divided into a number of isolated outcrops by many small valleys.

The ground reaches a maximum height of +157 ft (+47.9 m) above Ordnance Datum in the north-west [1010 3802] and generally slopes gently towards the south and east, steepening as the Stour is approached.

GEOLOGY

The London Clay is the oldest exposed formation, but water wells and boreholes, including those drilled in connection with the Tattingstone Reservoir scheme, have proved Reading and Thanet Beds, consisting of sand and clay, overlying Upper Chalk. The London Clay is overlain by unconsolidated deposits of clay, sand and gravel which can be divided into two major groups according to their age and origin.

The lower group comprises Coralline Crag (of restricted occurrence) and Red Crag, both shallow-water marine or estuarine deposits, and the upper, Glacial Sand and Gravel overlain in part by Chalky Boulder Clay. Locally the two groups are separated by deposits tentatively identified as Chillesford Beds (Allender and Hollyer, 1972). These were recorded in four boreholes but are not seen at outcrop. Brickearth and Recent river deposits of clay, silt, sand and gravel are commonly found in the valleys, where they rest directly on London Clay. The succession is summarised in Table 1.

The London Clay outcrops on the lower slope and floors of the valleys, the broadest outcrop being in the northern bank of the River Stour where it also forms cliffs up to 20 ft (6.1 m) high.

London Clay was reached in 49 of the 53 boreholes drilled for the Mineral Assessment Unit;

[1]National grid references in this publication fall in 100 km square TM

Table 1. Geological succession

Geological Age	Formation	Origin
Recent and Pleistocene	Alluvium	River valley deposits
	River terrace gravel	
	Brickearth	Uncertain
	Chalky Boulder Clay	Glacial
	Glacial Sand and Gravel	
	?Chillesford Beds	Possibly lacustrine/ estuarine
	Red Crag	Shallow-water marine/estuarine
Pliocene	Coralline Crag	
Eocene	London Clay	Marine
	Reading and Thanet Beds*	
Upper Cretaceous	Upper Chalk*	

*Proved in boreholes only

bedrock was not reached in the remaining four boreholes because of difficult drilling conditions. Unweathered London Clay is a stiff blue-grey, rather silty clay with no discernible partings. Where it underlies Red Crag or Glacial Sand and Gravel the surface is often weathered brown to a depth of only 1 ft (0.3 m) or less. Exceptionally, deeper weathering has been noted where the London Clay is exposed, and where overlying deposits are of recent age or are thin, for example, at the feather edge of the Red Crag and in borehole SE 8 where the London Clay is overlain by 6.5 ft (2.0 m) of river terrace gravel and is weathered to a depth of 11 ft+ (3.3 m+).

Occasional layers of calcareous 'cementstone' or septaria in the London Clay outcrop towards the base of the river cliffs of the Stour below Harkstead [185 348] and Stutton [140 348]. They have been used locally as a building stone.

Where overlain by Red Crag or Glacial Sand and Gravel the surface of the London Clay ranges from +81 ft (+24.7 m) O.D. in boreholes NW 4 and NE 12 to +42 ft (+12.8 m) in NE 27. However, in the three boreholes (SW 3, SW 6 and SE 8) where the London Clay is overlain by river terrace gravels the surface of the London Clay is at +45 ft (+13.7 m), -5 ft (-1.5 m) and +37.5 ft (+11.4 m) respectively. Thus this surface at SW 6 is 42.5 ft (13.0 m) lower than at any other borehole, the overlying river terrace gravels filling a deep trough or basin in the London Clay.

In the north-western part of sheet TM 13 the London Clay surface slopes gently towards the south-east (Fig. 2). On the eastern side it undulates considerably, the main feature being a north-west to south-east trending ridge extending from Harkstead [185 348] in the south to Freston [170 390] in the north. Between this ridge in the east and the gentle slope in the north-west the surface forms a basin-like region of low relief at approximately +60 ft (+18.3 m) O.D., which has influenced the deposition of the overlying sediments, notably the Red Crag.

On the east bank of the Tattingstone valley, east of Tattingstone Hall [1419 3736], the London Clay is locally overlain by Coralline Crag. It is a buff marine sand with numerous shells (entire and comminuted) and occasional phosphatic nodules. The deposit is often loosely cemented by iron oxides and calcium carbonate into a friable rock bed containing molluscs, corals and bryozoa. The deposit was not encountered in any boreholes and has not been included in assessment calculations.

The Red Crag overlies the London Clay over the greater part of the area, north of the Stour, although its outcrop is limited to the middle and lower flanks of the valleys, where it emerges from beneath the cover of Glacial Sand and Gravel. Red Crag was proved in 38 of the 53 assessment boreholes; of the remaining 15, 3 proved river terrace gravel and 12 Glacial Sand and Gravel, both on London Clay.

Red Crag can be divided into a lower horizon containing shells and an upper horizon free from shell material. Both divisions were proved in 29 assessment boreholes, nonshelly Crag was absent in two (NW 28 and SW 7) and shelly Crag was absent in six (NW 4, 8, 9: NE 12, 17: SW 1); the full thickness of the nonshelly Crag was not proved in borehole NW 3 and it is not known whether shelly Crag is present.

The thickness of the lower, shelly division of the Red Crag is related to the form of the London Clay surface (Allender and Hollyer, 1972). During the deposition of the shelly Red Crag the sea transgressed the London Clay surface which had previously been folded or eroded into a series of troughs and ridges. Thus, where the surface of the London Clay was lowest, the thickest shelly Red Crag was deposited, while on the ridges little or no deposition occurred.

The best example of this relationship is in the Freston area where thinning of the shelly Red Crag (absent in NE 12 and 17) coincides with a ridge in the London Clay surface (Figs. 2, 3 and 4). The absence of Red Crag in the area between Harkstead and Woolverstone [187 384] is probably due to the influence of the same ridge, although thin Red Crag may have been

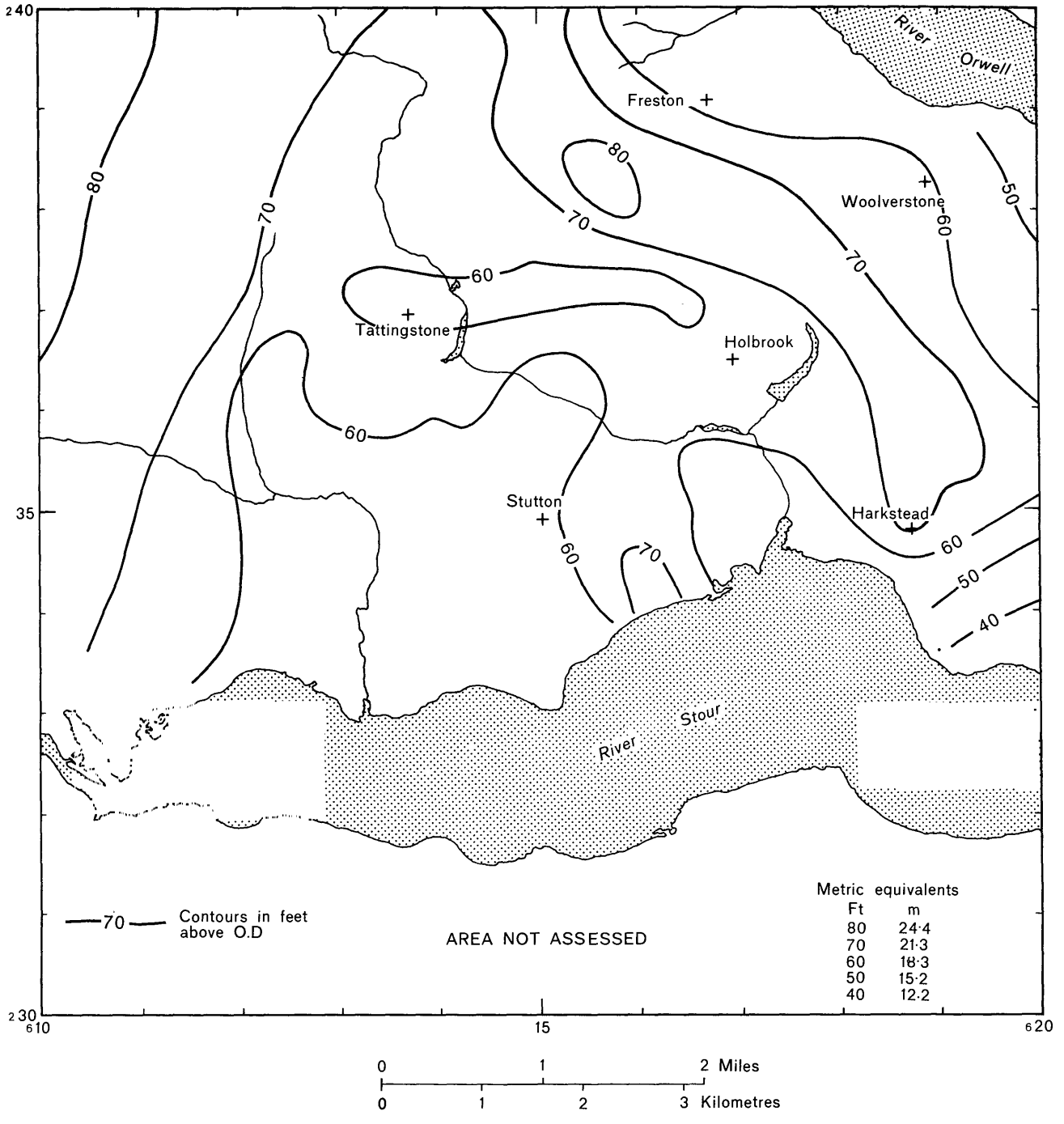


Fig. 2. Contour map showing the form of the London Clay surface based on information from 85 boreholes

deposited and subsequently eroded before the Glacial Sand and Gravel was deposited.

Conversely, the presence of a basin-like structure in the London Clay surface south of Tattingstone probably results in the mean thickness of the shelly Crag being greater in block B than in block A although the mean thickness of the Red Crag as a whole in both blocks is almost the same. The mean elevation of the London Clay surface in block B based on assessment boreholes is +63 ft (+19.2 m) O.D. and that for block A +74.1 ft (+22.6 m) O.D.

The Red Crag consists mainly of medium sand with strongly developed current bedding. It is heavily iron stained, commonly giving the deposit a dark reddish-brown colouring although it varies both laterally and vertically, from light brown to dark purple. The gravel content is low, usually about 4 per cent, except at scattered localities, for example, at boreholes NW 6 and NE 14 where it is 11 per cent and 17 per cent respectively. At the base of the deposit a pebble bed, which may reach 6 ft (1.8 m) in thickness, commonly contains brown and black phosphatic nodules and black flints.

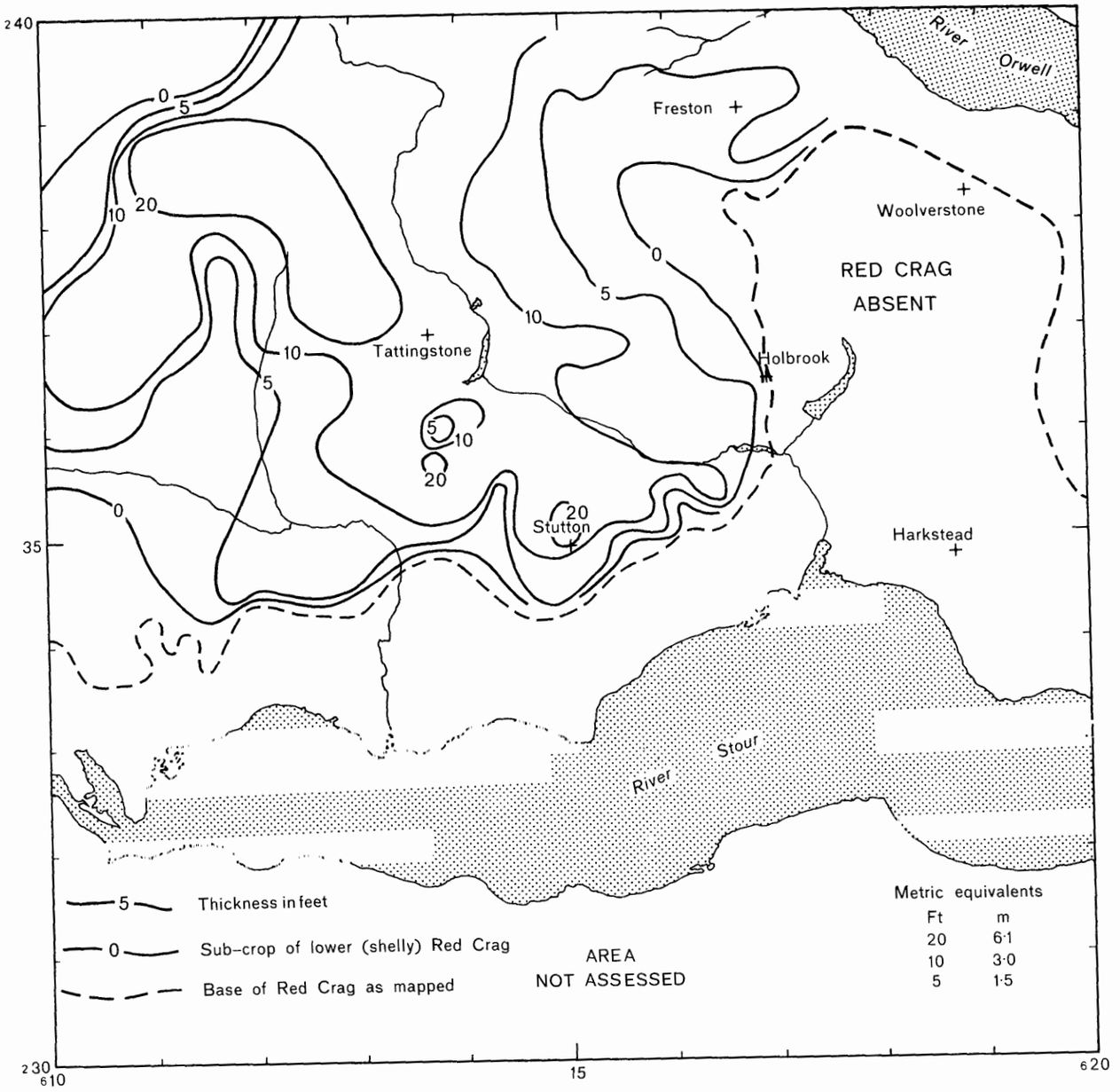


Fig. 3. Isopachytes of the lower (shelly) Red Crag based on information from 75 boreholes. The scale is the same as that in Fig. 2.

The shell content of the lower Red Crag is extremely variable and may be over 45 per cent by weight (Lomas, 1900; Allender and Hollyer, 1972). The shells, mainly mollusca, but including corals, brachiopods and echinoderms, are largely broken, the more massive bivalves and gastropods being the most resistant to abrasion. Where unbroken, the shells are usually in discrete bands, indicating short periods of quieter conditions of deposition. Shell material greater than 4 mm in diameter is regarded as gravel in the grading results. Shell

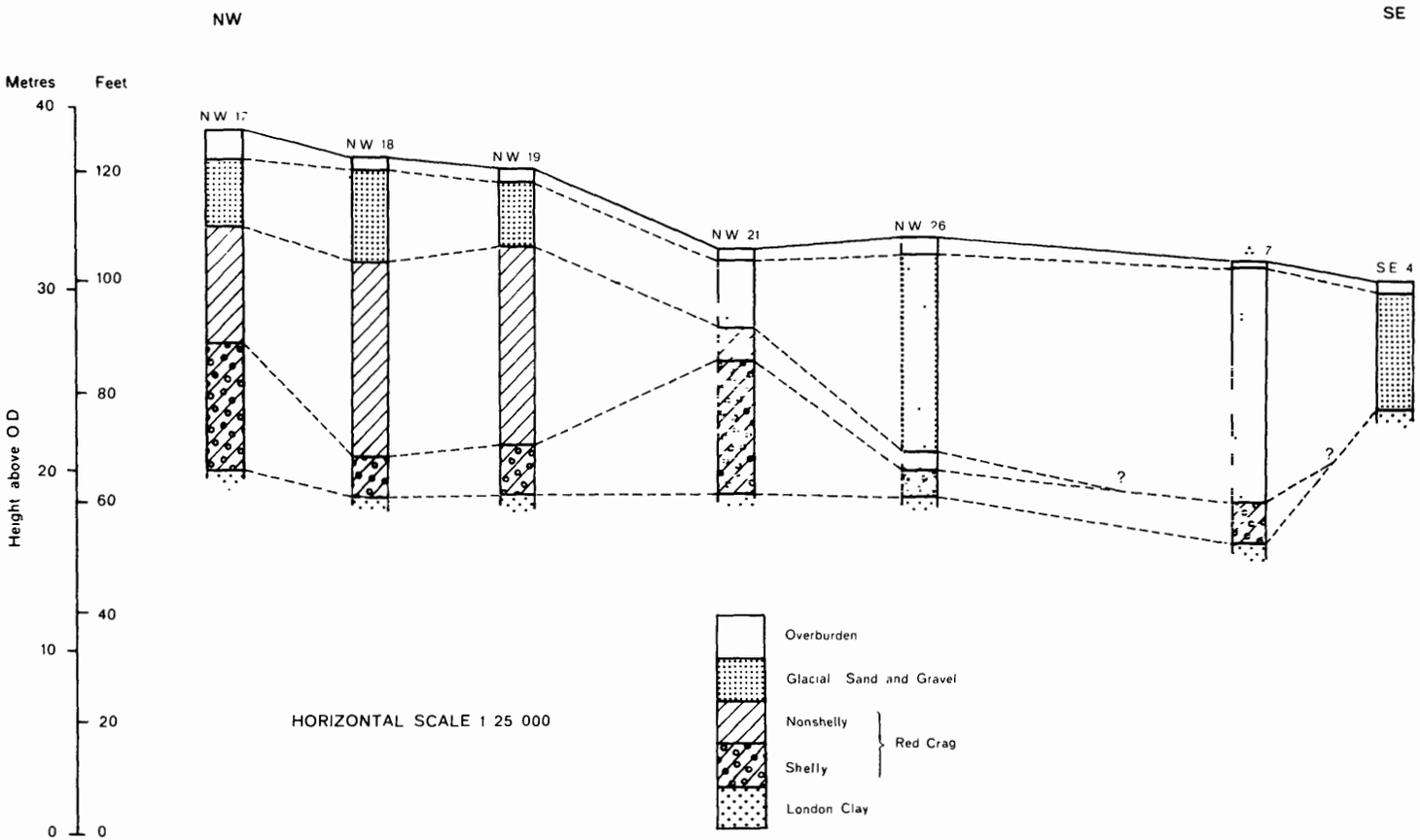


Fig. 4. A south-west to north-east geological section across the Freston area

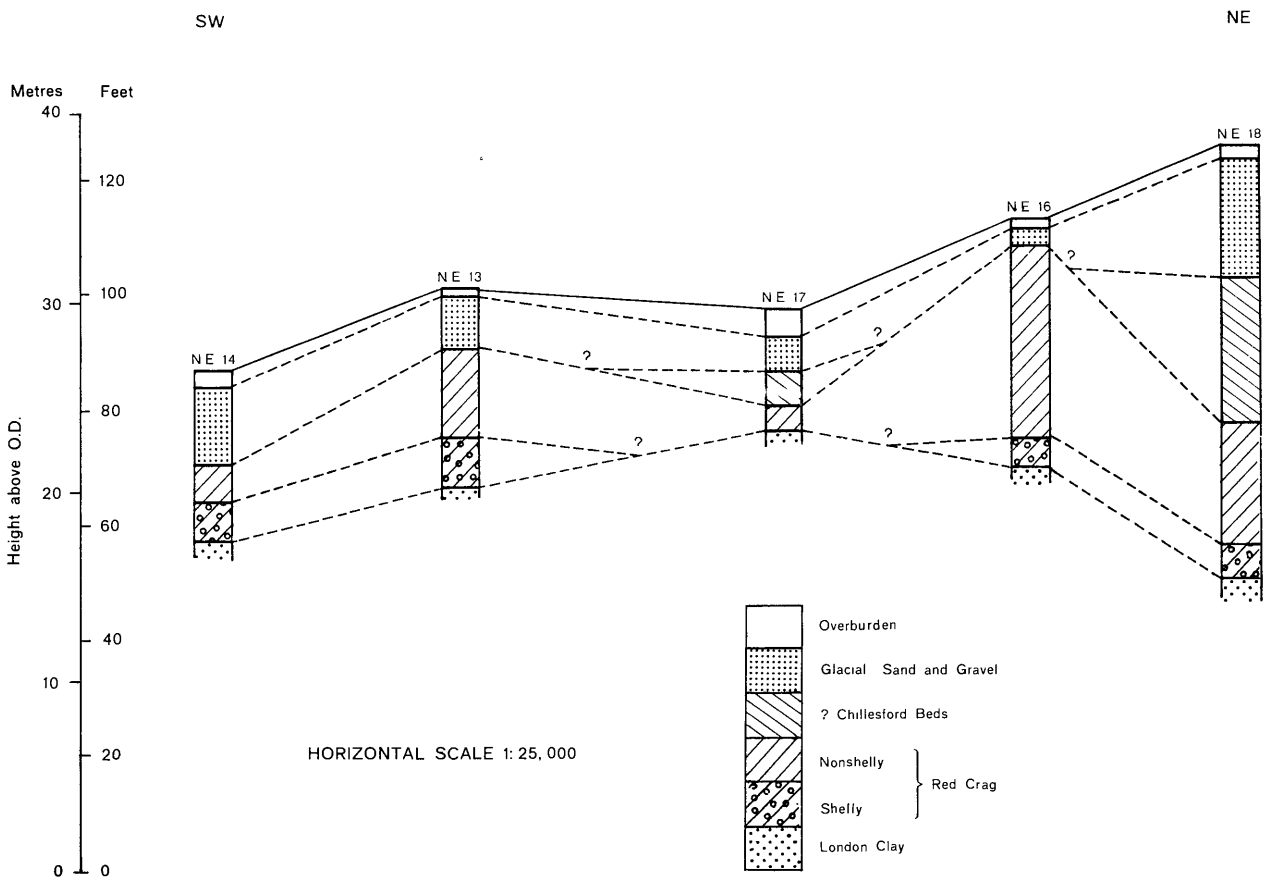


Fig. 5. A geological section from Tattingstone to Stutton

Table 2. Mean thicknesses of the Red Crag and its subdivisions in each resource block

Block	Mean thicknesses		
	Nonshelly ft (m)	Shelly ft (m)	Total Red Crag ft (m)
A	23.9 (7.3)	10.5 (3.2)	30.5 (9.3)
B	17.7 (5.4)	15.4 (4.7)	30.2 (9.2)
C	19.0 (5.8)	9.0 (2.8)	27.2 (8.3)
*D	9.0 (2.8)	22.0 (6.7)	31.0 (9.5)
A to D	20.3 (6.2)	11.8 (3.6)	29.2 (8.9)

The mean for blocks A to D is calculated by weighting the mean for each block by the area of the block.

* Based on one borehole only

material in the gravel fraction is an important consideration in the production of concrete as it may affect its durability and strength.

Over the sheet as a whole, the upper nonshelly Red Crag, has a mean thickness almost twice that of the lower Red Crag (Table 2). Whitaker (1885) and Boswell (1927) suggested that all the Red Crag originally contained shell material and that percolating water dissolved the calcium carbonate from the upper part. Although some solution has occurred, this process is of limited importance as within the shelly deposits undisturbed layers of shell-free sand are common and there is little evidence of the disturbance in bedding to be expected if up to 40 per cent of the volume of the upper part had been removed by solution. Furthermore, in some areas there is often a pebble bed indicating a plane of erosion where the nonshelly Red Crag rests on the level upper surface of the shelly deposits. Occasionally, however, adjacent to the junction of the two divisions there are traces of shell moulds in the nonshelly part.

In four of the assessment boreholes (NW 24, NE 11, 17 and 18), Glacial Sand and Gravel overlies deposits of interbedded green, yellow and grey clay and silty sand, all highly micaceous, which are tentatively correlated with the Chillesford Beds (of Chillesford); they rest on Red Crag. No exposures have been found but similar beds were encountered at the same stratigraphic level in boreholes on two adjacent sheets, TM 23 and TM 24 (Allender and Hollyer, 1973, 1972). Further evidence is needed before a more definite age and origin can be assigned to these deposits; they are probably immediately preglacial lacustrine or estuarine deposits.

The greatest recorded thickness of these beds was proved by borehole NE 11, where beneath 14 ft (4.3 m) of Glacial Sand and Gravel lay 3 ft (0.9 m) of pebbly sand followed by 28 ft (8.5 m) of micaceous green and yellow-brown silt; boreholes NE 18 and NW 24 proved 25 ft (7.6 m) of clayey sand and 21 ft (6.4 m) of interbedded clay and sand respectively while in borehole NE 17, 6 ft (1.8 m) of laminated clay was recorded. It is possible that the 3 ft (0.9 m) of brown and green clayey silt recorded at the base of the Glacial Sand and Gravel in borehole NE 12 is part of the same formation. All these boreholes (which encountered micaceous clay and silt) are in the area around Freston.

Glacial Sand and Gravel, thought to be the outwash deposits of a decaying ice sheet situated immediately to the north, outcrops over the greater part of the area, and was proved in 47 of the 53 boreholes drilled for the Mineral Assessment Unit. In 31 boreholes Glacial Sand and Gravel rests on Red Crag, in four on ?Chillesford Beds and in the remaining 12 directly on bedrock. The maximum recorded thickness, 55 ft (16.8 m), including 3 ft (0.9 m) of clay, was in borehole NE 19, and the weighted mean thickness in all four blocks is 19.3 ft (5.9 m).

Generally, the deposit is thicker in the north, although there are local irregularities. For example, in boreholes NW 26 and SW 7 there is a thickening of the Glacial Sand and Gravel at the expense of the Red Crag (see Fig. 5); the gravel content is also high and it is possible that the Glacial Sand and Gravel is filling an outwash channel.

The Glacial Sand and Gravel oversteps the Red Crag in many places along the southern margin of blocks A, B and C. In block D, Glacial Sand and Gravel lies directly on London Clay except for a restricted occurrence of Red Crag

Table 3. Thickness of Glacial Sand and Gravel in each resource block

Block	Maximum thickness ft (m)	Minimum thickness ft (m)	Mean thickness ft (m)
A	35.0 (10.7)	30.0 (0.9)	16.7 (5.1)
B	35.5 (10.8)	9.9 (3.0)	22.3 (6.8)
C	30.0 (9.2)	3.0 (0.9)	13.4 (4.1)
D	55.0 (16.8)	8.0 (2.5)	24.3 (7.4)

along the south bank of the River Orwell.

The deposit is less iron stained than the Red Crag, being predominantly yellow to pale brown. However, in some areas heavier iron staining, probably derived from reworked Crag, produces a dark reddish-brown sand, difficult to distinguish from nonshelly Red Crag, although the content of gravel, which occurs in lenses or seams commonly towards the base of the deposit, is generally higher. In the absence of good exposures, the removal by erosion of the finer material from the ground surface, leaving a coarse deposit, adds to the difficulty of distinguishing between these deposits. Three boreholes, NW 14, SW 2 and NE 29, sited on deposits mapped as Glacial Sand and Gravel, proved Red Crag at the surface.

Chalky Boulder Clay outcrops over 4.3 km^2 in the north-west corner of the map. It is the feather edge of an extensive sheet of till which thickens to the north-west and covers a large area of Suffolk. Its south-eastern limit is believed to mark approximately the maximum extent of the ice mass which produced much of the outwash Glacial Sand and Gravel of the region.

The Chalky Boulder Clay is stiff, grey clay when fresh, exhibiting no discernible bedding and containing numerous pebbles. These pebbles are predominantly of chalk and flint, but commonly include Jurassic and Lower Cretaceous material and, more rarely, igneous and metamorphic rocks. The pebbles vary considerably in size and shape, the chalk pebbles being rounded and the flints subangular to angular. The deposit often contains lenses and pockets of sand and gravel which are usually thin; they have not been included in the assessment of resources. Weathering, including decalcification, leaves a brown or yellow sandy clay with pebbles, predominantly of flint.

Chalky Boulder Clay was proved in two of the four boreholes sited on its mapped outcrop and in five others (NW 5, 6, 12, 24 and 27). This suggests that the edge of the deposit is more irregular than is indicated by the mapped boundary and that there are a number of isolated patches beyond the more or less continuous sheet.

Two of the six mapped patches of brickearth, both north-north-west of Tattingstone [136 372], overlie Glacial Sand and Gravel. The remaining four rest on London Clay: one on the west flank of the Tattingstone valley west of the hamlet of Tattingstone White Horse [137 383] and three on the north bank of the River Stour. The age and origin of the brickearth is uncertain. At Stutton Ness it has been the subject of numerous investigations (Davis, 1953; Spencer, 1953; Sparks and West, 1963). Sparks and West dated the deposit as 'the second part of the Ipswich Interglacial laid down by the River Stour' (1963, p. 430), the evidence provided by molluscs and pollen.

Except for one small outcrop [194 359] north-east of Harkstead, river terrace gravels are found only on the north bank of the River Stour. On the Old Series one-inch Geological Sheet 48 NE the deposit south-east of Sparrow Hill [1968 3394] was mapped as Glacial Sand and Gravel, but the field relations and the grading results from borehole SE 8, showing 69 per cent gravel, indicate that it is more likely to be a river terrace.

The river terrace gravel deposits overlie London Clay and are fairly thin except for the terrace south of Stutton Hall [140 337] which fills a local trough in the London Clay.

Most valleys contain deposits of modern alluvium consisting of clay and silt, occasionally containing organic material and thin seams of sand and gravel, none considered to be potentially workable.

COMPOSITION OF SAND AND GRAVEL

Sand is dominant in both the Red Crag and Glacial Sand and Gravel, the two major horizons of potentially workable sand and gravel, and in both coarse sand is less abundant than fine or medium sand. The Glacial Sand and Gravel as a whole contains more gravel than the Red Crag, ranging up to 24 per cent in block B compared with a highest mean of only 5 per cent in the Red Crag, but is more often 'clayey', that is, containing more than 10 per cent of fines. The

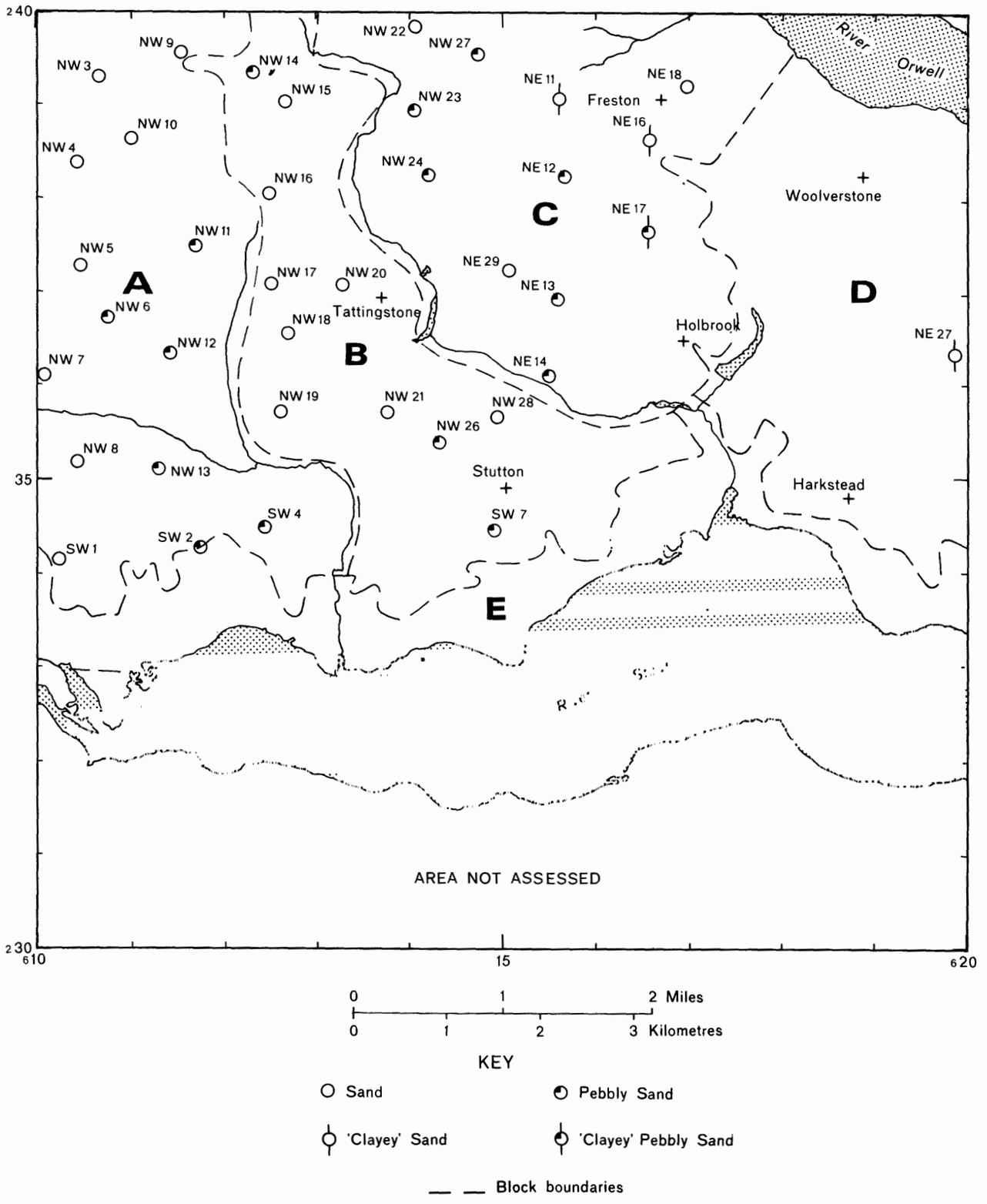


Fig. 6. The grading characteristics of the Red Crag based on the mean grading at 38 boreholes

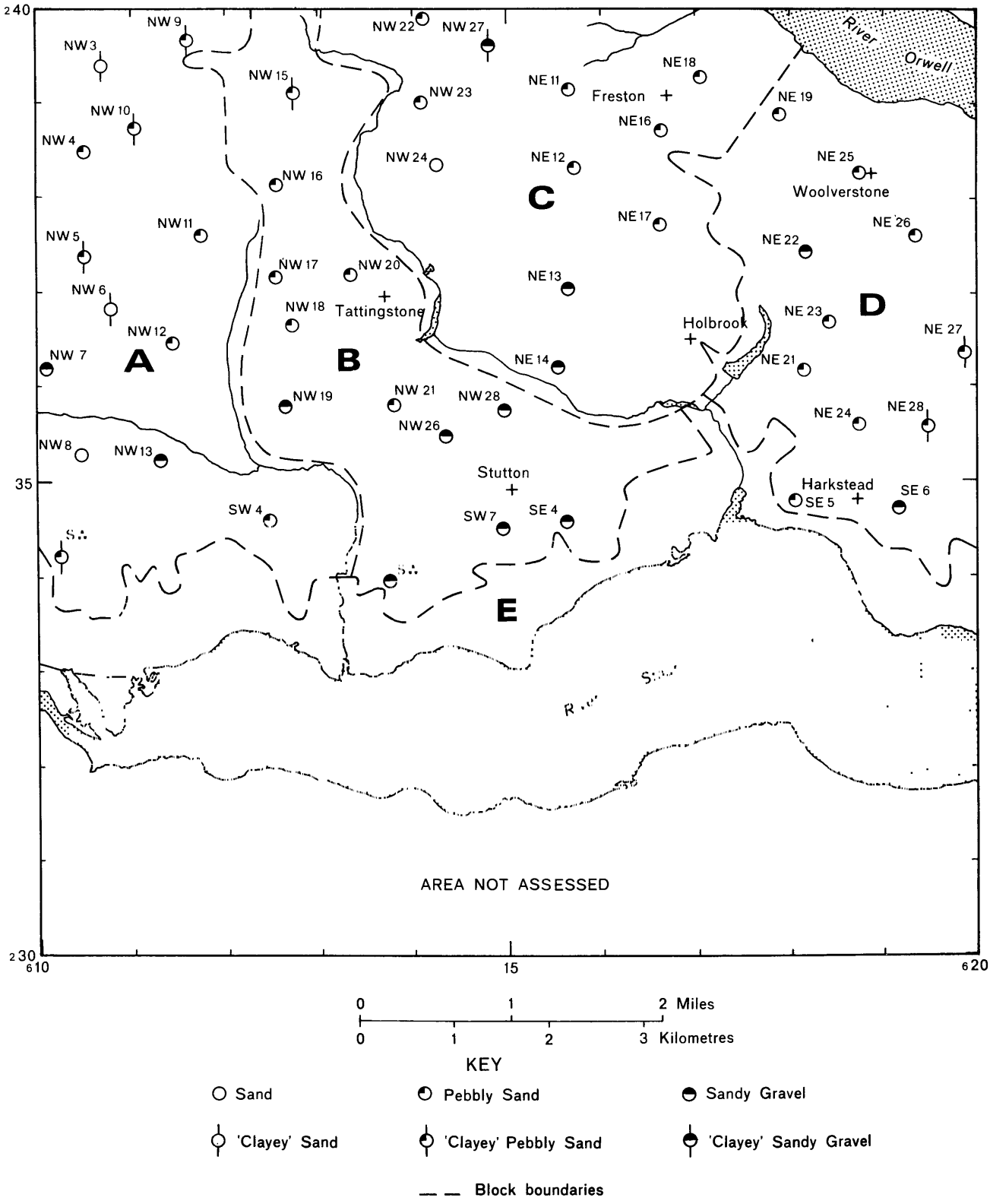


Fig. 7. The grading characteristics of the Glacial Sand and Gravel based on the mean grading at 47 boreholes

river terrace deposits contain over 50 per cent gravel but their volume is small. The ?Chillesford Beds contain waste material as well as mineral.

Red Crag

The overall grading for the deposit is fines 7 per cent, sand 89 per cent and gravel 4 per cent. The mineral is sand (see Fig. 6) in 19 boreholes, pebbly sand in 15 'clayey' sand in three and 'clayey' pebbly sand in one. The lower (shelly) part may contain up to 45 per cent by weight of shell material but the upper part is shell free.

The sand fraction is composed principally of well rounded and often polished quartz grains. Medium sand, which is dominant (48 per cent), and fine sand (32 per cent) account for four-fifths of the mineral in the Red Crag. The order of the abundance of all three sand fractions is the same in all four blocks. The presence of shell material is often accompanied by an increase in the coarse sand fraction, although there is also a tendency for the non-shelly sand to become coarser with depth. In addition to quartz the sand contains mica, garnet and feldspar, although they are relatively rare (Double, 1924).

The gravel fraction consists mainly of rounded to subrounded brown flint with occasional quartzite pebbles, commonly less than 16 mm in diameter (that is, fine gravel). The pebbles tend to occur randomly through the deposit, rather than in discrete lenses as in the Glacial Sand and Gravel, although frequently there is a basal pebble bed containing black flints and brown and black phosphatic nodules together with rolled fossils, many of which are derived. In the lower part of the Red Crag the larger and often unbroken shells contribute to the gravel fraction.

The Red Crag is commonly variably stained and patterned brown to reddish-brown by hydrated iron oxides, which are sometimes present in sufficient quantities to produce a hard iron-cemented sandstone.

?Chillesford Beds

These beds, consisting of interbedded micaceous clay, silt and sand with some quartz-rich gravel are represented in borehole NE 17 by 6 ft (1.8 m) of fawn laminated clay regarded as waste. The maximum development of ?Chillesford Beds, 31 ft (9.4 m), was found in borehole NE 11; only the uppermost 3 ft (0.9 m) is mineral, the remainder being green and yellow-brown silt with thin seams of green clay. The thickest mineral horizon in the deposit, 25 ft (7.6 m), was found in borehole NE 18. Borehole NW 24 contains 11 ft (3.4 m) of mineral in two groups of beds, separated by a 7 ft (2.1 m) sequence of orange and brown clays.

The mean thickness, based on only four observations, of the mineral in the ?Chillesford Beds is 10 ft (3.0 m) and the mean grading is fines 13 per cent, sand 82 per cent, gravel 5 per cent.

Although parts of these beds are potentially workable, they have been proved to be very variable in the only four holes in which they were found. Substantially more exploration would be necessary to establish their potential economic importance.

Glacial Sand and Gravel

The mean thickness, based on 47 assessment boreholes, is 19.3 ft (5.9 m) with a mean grading of fines 8 per cent, sand 74 per cent, gravel 18 per cent. In 12 boreholes the mineral is classified as sandy gravel; in the remainder it is most commonly pebbly sand or 'clayey' pebbly sand (Fig. 7). The grading varies greatly both laterally and vertically although local grading patterns are apparent. In the Stutton area the mean grading for a group of five boreholes indicates that pebbles exceed 50 per cent of the deposit. This high gravel content coincides with a thickening of the deposit (see Fig. 5) and is thought to be due to the presence of an outwash channel in which the gravel is concentrated.

The sand is predominantly (44 per cent) medium grained with 22 per cent of fine sand and 8 per cent of coarse sand and the same order applies in each of the four blocks. The sand is composed mainly of quartz with quartzite and flint represented, especially in the coarse fraction. Grains of feldspar and chalk are occasionally seen, but other minerals are rare. The sand grains are usually subangular.

The gravel fraction (+4 mm -64 mm) is mainly composed of flint pebbles with subordinate vein quartz and quartzite. The flint varies in colour from black through brown to white and is usually angular to subrounded. Locally, rounded white vein quartz and brown quartzite pebbles are more abundant than the flint in the fine gravel fraction. Other rock-types include chalk and Jurassic limestones and, rarely, igneous and metamorphic rocks.

River Terrace Gravels

These deposits, which are mainly restricted to block E, occupy an area of less than 1 km^2 and their volume is very small compared with the Red Crag and Glacial Sand and Gravel; their gravel content is, however, very much higher (Figs. 8 and 9). The pebbles are mainly of sub-rounded to angular flint but include rounded vein quartz, which are characteristic of the fine fraction (+4 -16 mm). The sand is medium to coarse and pale yellow. The fraction smaller

than $\frac{1}{4}$ mm diameter, that is, fine sand and fines, is much smaller than in the other deposits described in this Report (Fig. 9).

RESULTS

The mineral-bearing ground has been divided into five resource blocks. Statistical assessments are offered for four and an inferred assessment for the fifth (block E).

The results are summarised in Table 4 and fuller particulars of the grading are shown in Figs. 8 and 9.

Accuracy of Results

For four of the five resource blocks the accuracy of the results at the 95 per cent confidence level (that is, the probability that 19 times out of 20 the true volume present lies within the given limits) varies between 11 and 34 per cent. It should be remembered, however, that the true values are more likely to be nearer the figure estimated than either of the limits. Moreover it is probable that roughly the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say 200 acres) containing similar sand and gravel deposits if the results from the same number of sample-points (as provided by, say, 10 boreholes) were used in the calculation. Thus if closer limits are needed for quotation of reserves as part of a block, it can be expected that data from more than 10 sample-points are required, even if the area were quite small. This point can be illustrated by considering the whole of the potentially workable sand and gravel (as already defined) in resource blocks A to D. The volume (593 million m^3) of this can be estimated to limits of $\pm$ 11 per cent at the 95 per cent confidence level, by a calculation based on the data from as many as 83 sample-points (MAU boreholes, wells and commercial boreholes) spread across the four 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 land for mineral working.

For the fifth block (block E) an inferred assessment is offered based on evidence from three boreholes and field relationships.

NOTES ON RESOURCE BLOCKS A TO E

Block A

The block covers an area of 14.5 km^2 of which 12.5 km^2 is mineral bearing, the remainder being exposed London Clay and alluvium. The mineral-bearing area is divided by the Dodnash Valley into a northern portion covering 8.8 km^2 and a southern part covering 3.7 km^2. The mapped boundary of the Chalky Boulder Clay should be taken only as a generalised indication of its extent or outcrop.

London Clay was reached in all assessment boreholes except NW 3 and NW 10, which were abandoned in mineral at 60 ft (18.3 m) and 59 ft (18.0 m) respectively, because of difficult drilling conditions. In the northern part of the block the London Clay surface is fairly uniform in height, varying only from +73 ft (+22.3 m) O.D. in borehole NW 9 to +81 ft (+24.7 m) in NW 4; in the south it slopes perceptibly towards the south-east to +55 ft (+16.8 m) at borehole SW 4.

North of the Dodnash Valley the Red Crag outcrops almost continuously along the south-eastern and southern margin of the mineral, but to the south of this valley the Red Crag is usually concealed, the Glacial Sand and Gravel extending to lie directly on London Clay. The overstep is small, however, as Red Crag is present in all assessment boreholes in this block.

The minimum recorded thickness of Red Crag, 13 ft (4.0 m), was at borehole NW 13 and the maximum, 46 ft (14.0 m), at borehole SW 2. Both shelly and nonshelly divisions of the Red Crag were present in nine assessment boreholes; in four (NW 3, 8, 9 and SW 1) of the remaining five, the shelly Crag was absent, while only a trace of shell debris was found at the base of the deposit in NW 4. In borehole NW 10 the full thickness of shelly Crag was not proved. As borehole NW 3 also did not prove bedrock, it is possible that shelly Crag is present but it was not reached. Data on the thicknesses of the Red Crag can be summarised as follows:

	Thickness		
	Maximum (m)	Minimum (m)	Mean (m)
Whole Red Crag	14.0	4.0	9.3
Nonshelly	12.5	2.9	7.3
Shelly	7.0+	0.3	3.2

Based on the mean grading of samples from 14 boreholes the Red Crag is classified as sand at eight and as pebbly at the remaining six. The boreholes proving pebbly sand tend to be grouped towards the south and east of the block (see Fig. 6). The highest gravel content recorded in the Red Crag was 11 per cent in borehole NW 6 and the lowest in NW 9 and 10, both only 1 per cent; the mean is only 5 per cent (Fig. 9).

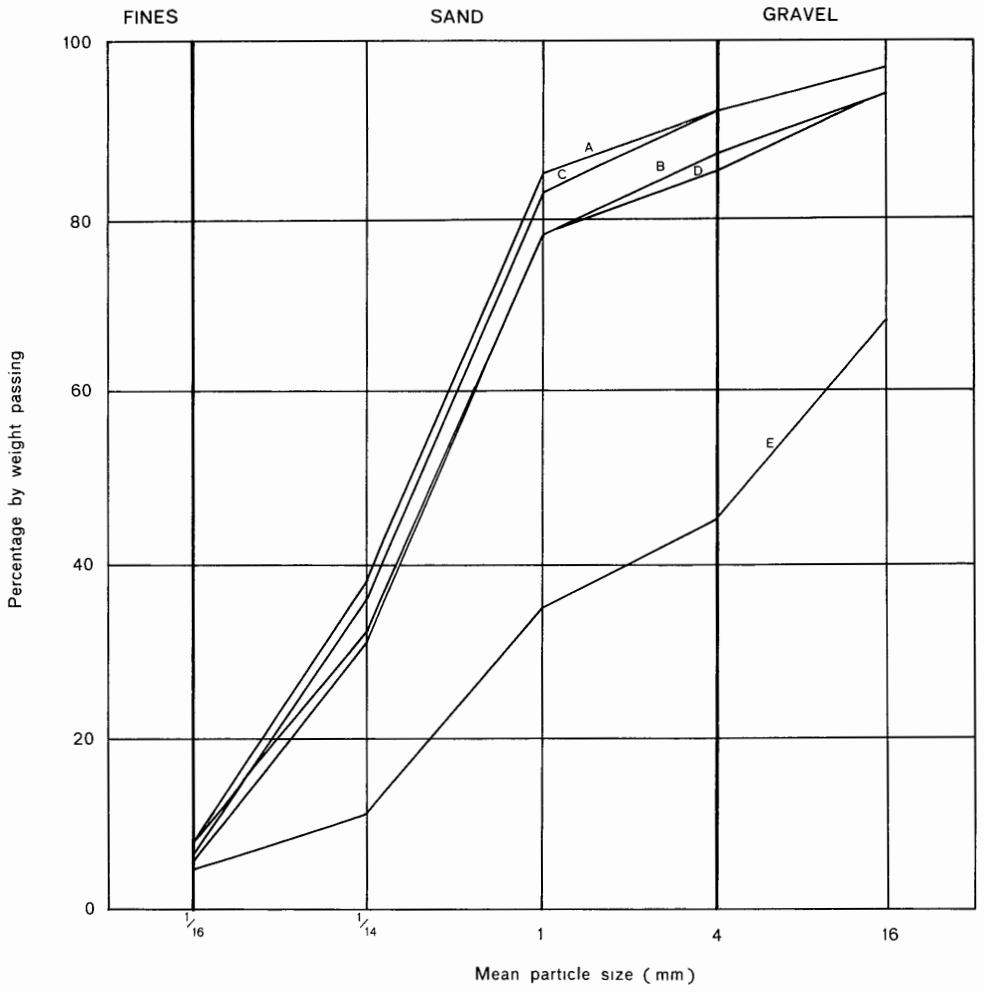
Glacial Sand and Gravel rests on Red Crag except where this is overstepped towards the southern margin and was recorded in all assessment boreholes except SW 2.

The mean thickness of the Glacial Sand and

Table 4. The sand and gravel resources of sheet TM 13

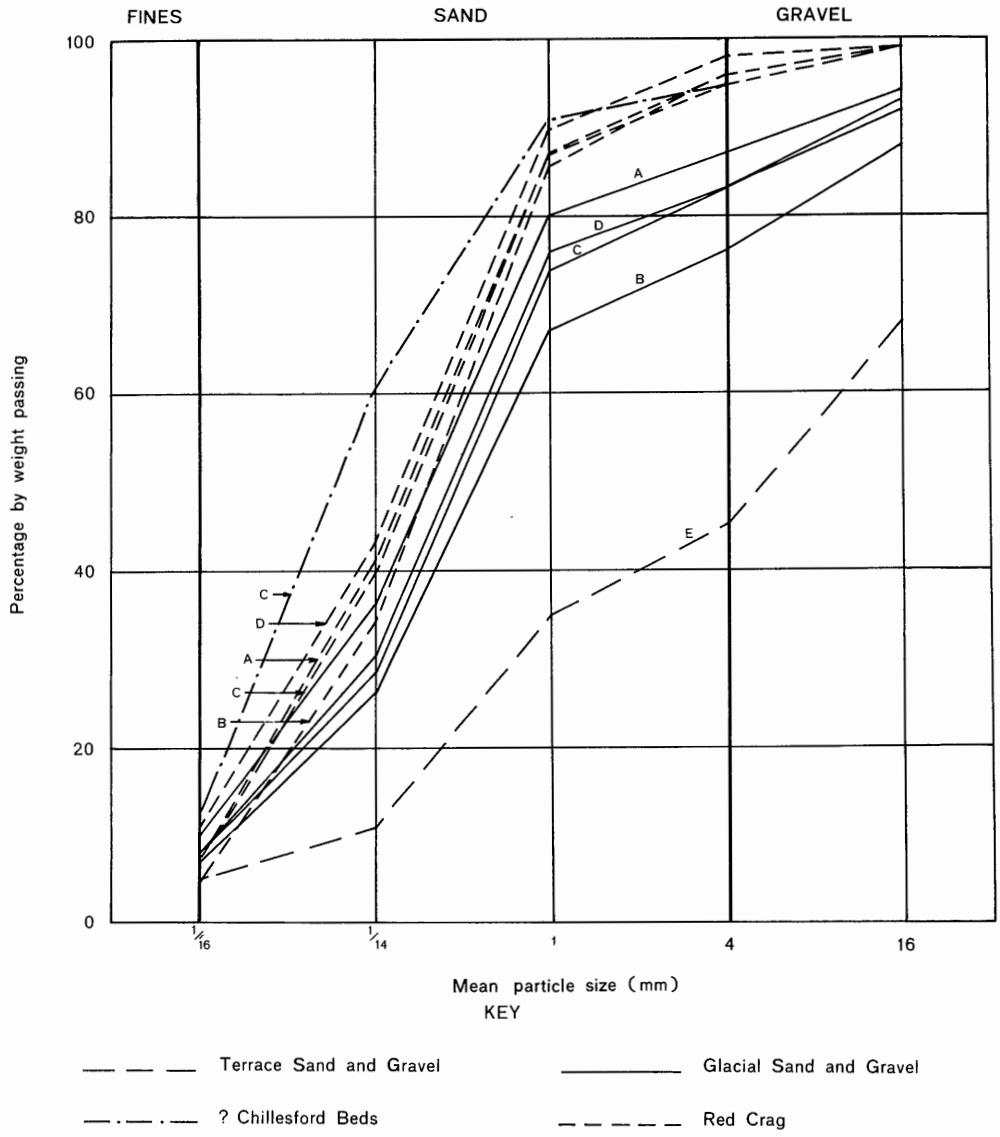
(a) Statistical assessment

Block	Area		Mean thickness				Volume of mineral				Mean grading percentages					
	Block	Mineral	Over-burden		Mineral		Million m^3	Million m^3	Limits at the 95% confidence level		Fines	Sand			Gravel	
	km^2	km^2	m	ft	m	ft			±%	± Volume million m^3	-1/16 mm	+1/16-¼ mm	+¼-1 mm	+1-4 mm	+4-16 mm	+16 mm
A	14.5	12.5	1.7	5.6	14.1	46.4	175	229	11	20	8	30	47	7	5	3
B	13.3	12.3	1.4	4.6	13.6	44.7	167	218	18	29	6	25	47	9	7	6
C	15.4	13.7	1.3	4.3	13.0	42.7	178	233	25	45	7	29	47	9	5	3
D	12.2	9.4	1.4	4.6	7.8	25.5	73	95	34	25	8	24	46	7	9	6
A-D (Total)	55.4	47.9	1.4	4.6	12.4	40.6	593	776	11	65	7	28	47	8	6	4
(b) Inferred assessment																
E	7.7	0.7	0.9	3.0	2.3	7.5	c.2	c.3			5	6	24	10	25	32
Area of resource sheet not assessed	36.9	Comprises ground south of the River Stour and area of the Stour and Orwell estuaries below Mean High Water Level														



Block	Percentage by weight passing				
	1/16 mm	1/14 mm	1 mm	4 mm	16 mm
A	8	38	85	92	97
B	6	31	78	87	94
C	7	36	83	92	97
D	8	32	78	85	94
E	5	11	35	45	68

Fig. 8. Particle size distribution for the assessed thickness of mineral in resource blocks A to E



Block	Deposit	Percentage by weight passing				
		1/16 mm	1/14 mm	1 mm	4 mm	16 mm
A	Glacial Sand and Gravel	10	36	80	87	94
	Red Crag	7	41	87	95	99
B	Glacial Sand and Gravel	7	26	67	76	88
	Red Crag	5	34	86	96	99
C	Glacial Sand and Gravel	8	28	74	83	92
	? Chillesford Beds	13	61	91	95	99
	Red Crag	7	40	87	96	99
D	Glacial Sand and Gravel	8	30	76	83	93
	Red Crag	11	43	90	98	99
E	Terrace Sand and Gravel	5	11	35	45	68

Fig. 9. Comparison of the particle size distribution in the Terrace Sand and Gravel, Glacial Sand and Gravel and Red Crag for the assessed thickness of mineral in blocks A to E

Gravel is 16.7 ft (5.1 m), ranging from 3 ft (0.9 m) in boreholes NW 5 and 8 to 35 ft (10.7 m) at NW 9. Where overlain by boulder clay the Glacial Sand and Gravel is thinner, having been cut out or replaced before or during the deposition of the boulder clay. A comparison of the thicknesses of Glacial Sand and Gravel is as follows:

	Thickness		
	Maximum (m)	Minimum (m)	Mean (m)
Beneath boulder clay	5.5	0.9	3.6
At outcrop	10.7	0.9	6.0
All Glacial Sand and Gravel	10.7	0.9	5.1

Of the 13 MAU boreholes that proved Glacial Sand and Gravel, in eight it is classified as pebbly sand (in four of which it is 'clayey'), in three as sand ('clayey' in two) and in two as sandy gravel. The highest percentage of gravel recorded was in borehole NW 13 (46 per cent) and the lowest in boreholes NW 3 and NW 8 each with only 2 per cent. There is no obvious pattern in the distribution of the different grading results obtained.

The mean thickness of overburden, 5.6 ft (1.7 m), is greater than in the other five blocks (see Table 4).

The estimate of the volume of mineral (Glacial Sand and Gravel and Red Crag) is 175 million m^3 ± 11 per cent at the 95 per cent confidence level.

Block B

On the eastern and western margins of the block the ground slopes steeply into the Tattingstone valley and that of a tributary of the Dodnash, but in the south there is a more gentle slope to the estuary of the Stour. Generally, the ground slopes gently from about +145 ft (+44.2 m) O. D. in the north to +100 ft (+30.5 m) in the south.

The block covers an area of 13.3 km^2 of which 12.3 km^2 is exposed Glacial Sand and Gravel and Red Crag. Two small patches of brickearth overlying Glacial Sand and Gravel occupy a total area of 0.2 km^2 at Bentley Manor [128 392] and Malting Farm [127 382]. In addition, however, in boreholes NW 14 and 16, 4.1 ft (1.2 m) and 6 ft (1.8 m) respectively of sandy clay, tentatively identified as brickearth, were recorded, suggesting that this may be more extensive than is shown on the map.

Bedrock (London Clay) was proved in all but one of the 13 MAU boreholes; the exception, NW 16, was abandoned in Red Crag because of drilling difficulties.

Red Crag was proved in 11 of the assessment boreholes, but is overstepped by Glacial Sand and Gravel which rests on London Clay in SW 5 and SE 4 in the south of the block. However, this evidence, other boreholes and the presence of Red Crag east of Lower Street [152 345] and north of the Royal Hospital School [165 354] indicates that the overstep probably involves an area of less than 1 km^2.

The thickness of the Red Crag in the 11 boreholes ranges from 6 ft (1.8 m) in borehole SW 7 to 44.5 ft (13.6 m) in NW 19, the mean being 30.2 ft (9.2 m). Both nonshelly and shelly divisions were proved in nine boreholes, but in two, SW 7 and NW 28, only shelly Red Crag was found. Thicknesses are summarised below.

	Thickness		
	Maximum (m)	Minimum (m)	Mean (m)
Whole Red Crag	13.6	1.8	9.2
Nonshelly	11.0	1.0	5.4
Shelly	7.3	1.5	4.7

Although the mean thicknesses of the Red Crag as a whole in blocks A and B are very similar, in block B there is a relative thickening of the shelly Red Crag at the expense of the nonshelly upper part (see Table 2).

The mean grading of the Red Crag in the block shows that medium sand (52 per cent) is predominant with only 4 per cent of gravel. The highest proportion of gravel is 11 per cent, in borehole NW 14. At three boreholes the Crag is classified as pebbly sand and at eight as sand (Fig. 6).

Glacial Sand and Gravel was encountered in all but one (NW 14) of the 13 assessment boreholes. It ranges in thickness from 10 ft (3.0 m) in borehole NW 19 to 35.5 ft (10.8 m) in NW 26 with a mean for the block of 22.3 ft (6.8 m).

Based on mean grading results the Glacial Sand and Gravel contains 24 per cent gravel, a higher proportion in this deposit than in any of the other three resource blocks. The highest proportion is in borehole NW 26, 40 per cent. The mineral at six boreholes is pebbly sand and in the other six, concentrated in the southern part of the block, it is classified as sandy gravel, suggesting that the deposit is likely to be generally more gravelly in the southern part of the block. In only one borehole, the most northerly, is the mineral 'clayey'.

The estimate of the volume of mineral is 167 million m^3 ± 18 per cent at the 95 per cent confidence level.

Block C

This block, which contains 13.7 km^2 of mineral,

is bounded to the west and south by the Tattingstone valley and to the east by a valley passing through Holbrook Gardens [176 365]. The central area is flat and undissected. The surface drops gently from +145 ft (+44.2 m) O.D. in the north-west to about +100 ft (+30.5 m) at Holbrook [170 365].

Although sheets 48 NW and NE of the one-inch Old Series Geological Map, from which the geological lines on the resource map are taken, suggested that no significant spreads of overburden should be expected in block C, in fact, 6 ft (1.8 m) of boulder clay (consisting of brown clay with chalk and flint pebbles) was proved in assessment boreholes NW 24 and NW 27. At all other boreholes, overburden consists only of soil and subsoil and it is assumed, therefore, that the boulder clay is present only as isolated patches.

London Clay was proved in all assessment boreholes except one, NW 22, which was stopped at 75 ft (22.9 m) in shelly Red Crag. The top of the London Clay varies in height from +81 ft (+24.7 m) O.D. in borehole NE 12 to +50 ft (+15.2 m) in NE 18 and is generally lower towards the margins of the block. The height of this surface at boreholes NE 12, NE 16 and NE 17, respectively, at 81 ft (24.7 m), 70 ft (21.3 m) and 76 ft (23.2 m) above O.D., probably indicates a continuation of the south-east to north-west-trending ridge in the London Clay described below in block D (see Fig. 2).

Over most of the block Red Crag rests directly on London Clay but at Tattingstone Hall [142 373] it overlies an isolated patch of Coralline Crag which, in turn, rests on London Clay. No other outcrops of Coralline Crag are known and it has not been found in any boreholes so that the extent of its subcrop is unknown and it has not been included in the mineral assessment. Red Crag outcrops along the western and north-eastern margins of the block, but except in the vicinity of Brook Farm [163 367] it is overstepped by Glacial Sand and Gravel in the south and east. However, since all boreholes proved Red Crag it seems likely that it is very nearly co-extensive with the outcrop of the Glacial Sand and Gravel.

On the evidence of 12 assessment boreholes, the thickness of the Red Crag ranges from 4 ft (1.2 m) in NE 17 to 57 ft (17.4 m) in NE 29, and has a mean value of 27.2 ft (8.3 m). The upper, nonshelly part is present in all 12 boreholes but in two, NE 12 and NE 17 the lower, shelly part is absent. Thickness data are as follows.

	Thickness		
	Maximum (m)	Minimum (m)	Mean (m)
Whole Red Crag	17.4	1.2	8.3
Nonshelly	15.6	1.2	5.8
Shelly	5.5	0.6	2.8

The Red Crag is classified as pebbly sand at seven assessment boreholes (qualified as 'clayey' in one) and as sand at five ('clayey' in two). The distribution shows no consistent pattern (Fig. 6). The mean gravel content is only 4 per cent and the highest is 17 per cent in borehole NE 14.

Deposits identified as ?Chillesford Beds were found in four boreholes, NW 24, NE 11, NE 17 and NE 18. The mineral in these variable beds ranges from nil in NE 17 to 25 ft (7.6 m) of 'clayey' sand in NE 18.

Glacial Sand and Gravel is present in 11 of the assessment boreholes, the exception being NE 29. It ranges from 3 ft (0.9 m) thick in boreholes NW 24 and NE 16 to 30 ft (9.2 m) in NW 22. The mean thickness is 13.4 ft (4.1 m).

The mean grading for the Glacial Sand and Gravel in block C is fines 8 per cent, sand 75 per cent, gravel 17 per cent; the highest proportion of gravel was found in borehole NE 14 which had 27 per cent. In the two most southerly boreholes, the deposit is sandy gravel and it is 'clayey' sandy gravel in another. The mineral is sand in one borehole and in the remaining seven boreholes it is pebbly sand (see Fig. 7).

The estimate of the total volume of mineral in the block is 178 million $m^3 \pm 25$ per cent at the 95 per cent confidence level.

Block D

This block contains 9.4 km^2 of mineral which occurs as a large continuous sheet in the north extending to 8.7 km^2 and three smaller areas in the south covering 0.7 km^2. The very small area of terrace gravels north-east of Harkstead [187 347] is ignored.

The level of the London Clay surface varies from +54 ft (+16.5 m) O.D. in SE 6 to +76 ft (+23.2 m) in NE 24 in the 11 assessment boreholes. Generally it is highest near the centre of the block (Fig. 2).

Block D differs from blocks A, B and C in the limited occurrence of the Red Crag. It outcrops on the northern margin of the block adjacent to the River Orwell and on the eastern side of the block; in the 11 boreholes drilled, undoubted Red Crag was proved only in borehole NE 27. In two other boreholes, NE 19 and NE 26, material similar to Red Crag was encountered towards the base of the Glacial Sand and Gravel, separated from it by bands of clay. However, the absence of shell debris and the high pebble content (21 per cent in NE 19 and 20 per cent in NE 26) suggests that the deposit should be

included with the Glacial Sand and Gravel. It seems likely, therefore, that the deposit is confined to a narrow strip towards the northern margin of the block (Fig. 3). Elsewhere it was probably removed by erosion prior to the deposition of the Glacial Sand and Gravel, which rests directly on the London Clay. Over the ridge in the London Clay only thin Red Crag may have been deposited.

The Glacial Sand and Gravel, thickest in the north (for example, 55 ft (16.8 m), including 3 ft (0.9 m) of clay in NE 19), thins towards the south (for example, 8 ft (2.5 m) in SE 6) and has a mean thickness of 24.3 ft (7.4 m). The variation in the thickness of the deposit is greater in this block than in blocks A, B and C. This may be related to a ridge in the London Clay and the absence of Red Crag in the centre and south of the block. Thus, the surface level at boreholes NE 24 and 21 is the same, +97 ft (+29.6 m) O.D., but in the latter the Glacial Sand and Gravel is 7 ft (2.1 m) thicker. There is also a ridge of London Clay extending in a north-westerly direction from Harkstead Hall [196 354] (see Fig. 2), which may account for the relative thinness of the mineral in boreholes NE 21, NE 23 and NE 28 compared with that in boreholes to the north at a similar height.

Based on the mean grading results for each borehole, the Glacial Sand and Gravel is classified as pebbly sand in nine boreholes (in two of which it is 'clayey') and sandy gravel in two. The highest recorded pebble content (46 per cent) is in borehole SE 6 which coincides with a low point in the London Clay surface (+54 ft (+16.5 m) O.D.) suggesting the presence of a minor channel or depression in which pebbles may have been concentrated.

The absence over most of the block of the Red Crag with its generally low pebble content is reflected in the mean grading percentages for the block (Fig. 8); the glacial deposits contain 17 per cent of pebbles and the Glacial Sand and Gravel and Red Crag combined 15 per cent. Comparative figures for block B, where Red Crag is much more strongly represented, are 24 per cent and 13 per cent.

The estimate for the volume of mineral is 73 million m^3 ± 34 per cent at the 95 per cent confidence level, the wider limits reflecting the greater variation in the thickness of the mineral in this block as recorded from a similar number of sample points.

Block E

Only 0.7 km^2 of this block is mineral bearing, the remaining 7.0 km^2 being occupied by London Clay, brickearth and alluvium. Potentially workable sand and gravel is confined to 16 river terrace remnants varying in area from 0.01 km^2 to 0.13 km^2. Only three assessment boreholes were drilled to provide data on thickness and grading. An inferred assessment of the resources has, therefore, been made.

Three areas of sand and gravel shown on the Old Series one-inch Geological sheet 48 NE, one at Nether Hall [191 339] and two north-east and south-west of Sparrow Hall [196 339], like that to the south-east, are now believed to be river terrace deposits rather than Glacial Sand and Gravel.

The river terrace gravels at Stutton Ness pass laterally into stoney fossiliferous brickearth (Spencer, 1953) which has been dated as the second part of the Ipswichian Interglacial (Sparks and West, 1963). The brickearth and alluvial deposits contain little sand and gravel and have not been included in the assessment.

Unlike the other deposits of sand and gravel on the sheet, most of which stand at well over +100 ft (+30.5 m) O.D., the river terrace gravels are to be found at lower levels. The highest terraces reach about +60 ft (+18.3 m) O.D. at Brantham Hall [121 339].

Pebble grade material (+4 mm) was recorded as 69 per cent and 60 per cent in boreholes SE 8 and SW 6 respectively, the greatest thickness of mineral, 33 ft (10.1 m), being found in the latter borehole in which London Clay was proved at -5 ft (-1.5 m) O.D., the lowest level recorded on the sheet. Mineral in borehole SW 3 contains only 34 per cent pebbles and is classified as sandy gravel.

The mean thickness of the deposit is 7.5 ft (2.3 m) and of overburden 3.0 ft (0.9 m). The volume is inferred to be 2 million m^3.

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Appendix A: Assessment Procedure

1. Within a resource block, a statistical assessment is made for a sampled area of mineral greater than 2 km^2 and containing a minimum of five evenly-spaced boreholes.

2. If the sampled area of mineral is between 0.25 and 2 km^2 and contains one or two suitably sited boreholes an inferred assessment is made. An inferred assessment may also be attempted for any area where the deduced mineral content is small and which consequently has not been sampled by boreholes. No specific level of accuracy is claimed for such subjective assessments.

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

Statistical Assessment

4. The simple methods used in the calculations are consistent with the amount of data provided by the survey. Conventional confidence limits (that is, the tolerance on the estimate or the range within which the result falls) are calculated at the two-sided 95 per cent confidence level, that is, there is a $2\frac{1}{2}$ per cent or 1 in 40 chance that the result exceeds the stated upper limited and a corresponding $2\frac{1}{2}$ per cent chance that it is less than the stated lower limit.

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

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

where S_V, S_A and $S_{\bar{l}}$ are the standard deviations for volume, area and mean thickness, expressed as proportions of V, A and $\bar{l}$, respectively.

6. The above relationship may be transposed such that

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

From this it can be seen that as $\left(\frac{S_A}{S_{\bar{l}}}\right)$ tends to 0, S_V tends to $S_{\bar{l}}$. 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.

7. Given that the number of approximately evenly spaced sample points in the sampled area is n, with mineral thickness measurements $l_1, l_2, \ldots l_n$, then the best estimate of mean thickness, $\bar{l}$ =

$$\frac{\sum(l_1 + l_2 \ldots l_n)}{n}$$

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

$$S_{\bar{l}} = \frac{1}{\bar{l}} \sqrt{\frac{\sum(l - \bar{l})^2}{(n - 1)}}$$ where l is any value in the series l_1 to l_n.

8. The sampled area A in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of a deposit). Generally, therefore, the only error in determining the area is the negligible planimetering error and S_A is 0. Where the area is not defined by a mapped boundary, that is, where the boundary is inferred (and the distinctive symbol is used), experience suggests that S_A is small relative to $S_{\bar{l}}$.

The relationship

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

It follows from equation (2) that

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

9. The two-sided 95 per cent confidence limits, $L_{\bar{l}}$, for the estimate of mean thickness of mineral in the sampled area, for values of n between 5 and 20, may be expressed in absolute units

$$\bar{l} \pm (t \times S_{\bar{l}} \times \bar{l}),$$

or as a percentage

$$\bar{l} \pm (t \times S_{\bar{l}} \times 100) \text{ per cent}$$

where t is Student's t at the two-sided 95 per cent confidence level for (n - 1) degrees of freedom and is evaluated by reference to statistical tables. In applying Student's t it is assumed that the measurements are distributed normally.

10. Values of t at the two-sided 95 per cent confidence level for values of n up to 20 are set out below:

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

(From Table 12, Biometrika Tables for Statisticians, Volume 1, Second Ed. Cambridge University Press, 1962).

The value of t, 1.96, when n is infinity is used when n is greater than 20.

11. In calculating the two-sided 95 per cent confidence limits for volume, L_V, the following inequality corresponding to (3) is applied:

$$L_{\bar{1}} \leqslant L_V \leqslant 1.05\ L_{\bar{1}}$$

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

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

and when n is greater than 20, as

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

13. An illustration of the procedures outlined above is given in Figs. 10 and 11, where a volume estimate with confidence limits at the 95 per cent level of confidence is derived from fictitious data.

Inferred Assessments

14. 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 suitably sited boreholes. The volume of mineral is calculated as the product of the sampled area, chosen from interpretation of field data as in the statistical assessment, and the judged average mineral thickness. Confidence limits are not calculated.

15. In some cases in addition to the sampled area of mineral a resource block includes an area left uncoloured on the map, generally based on interpretation of mapping and sample data. On occasions some mineral may be present in such areas and an assessment is made on the basis of the average mineral thickness deduced from exposures and any other evidence available.

Note on Weighting

16. The thickness of a deposit at any point in a sampled area may be governed solely by the position of the point in relation to a broad trend. However, most sand and gravel deposits in addition exhibit a random pattern of local, and sometimes considerable, variation in thickness.

17. Thus, in estimating mean thickness of sand and gravel from a number of data points in a sampled area only the use of simple weighting factors is justified, and the distribution of data points need be only approximately regular. In practice, equal weighting can often be applied to thicknesses at all data points within the sampled area. If, however, there is a distinctly unequal distribution of points, the thicknesses must be weighted to avoid the bias this creates. Weighting factors are determined by first 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.

Appendix B: Classification and Description of Sand and Gravel

The terminology commonly used by geologists when describing sedimentary rocks (Wentworth, 1922) is not entirely satisfactory for the purposes of this Report. For example, Wentworth proposed that a deposit should be described as a 'gravelly sand' when the proportion of sand is greater than that of gravel which must exceed 10 per cent, fines and oversize materials (that is, with diameter greater than 64 mm) being less than 10 per cent. Because deposits containing more than 10 per cent fines (material less than 1/16 mm) are not embraced by this system a modified binary classification based on Willman (1942) has been adopted.

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.

When the fines content exceeds 40 per cent the material is considered to be not 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 and 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

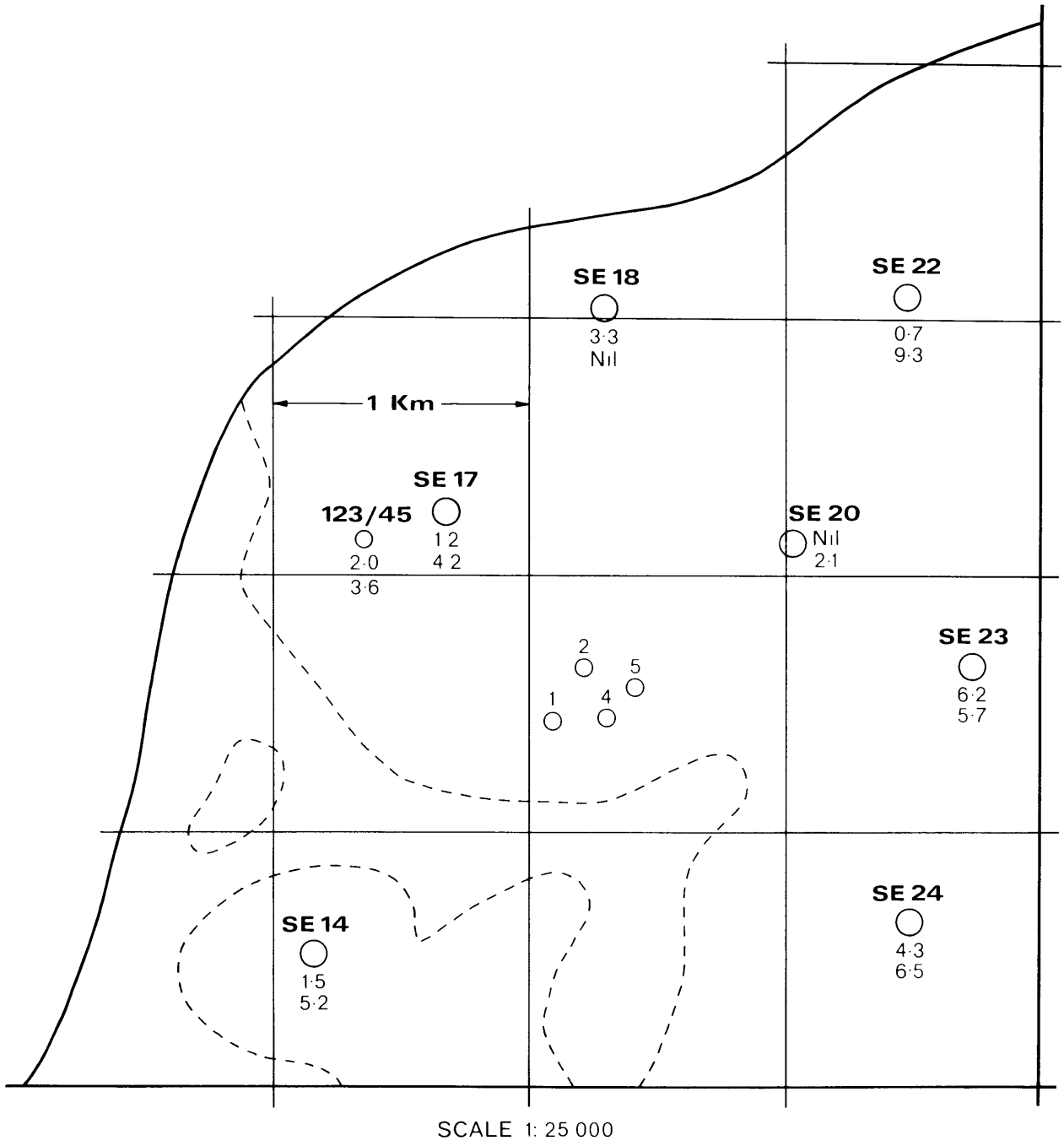


Fig. 10. Example of resource block assessment: map of fictitious block

BLOCK CALCULATION

1:25 000 Sheet } Fictitious
Block }

Area

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

Thickness

Overburden: 2.5 m
Mineral: 4.5 m

Volume

Overburden: 21 million m^3
Mineral: 38 million m^3

95 per cent confidence limits of the estimate of mineral volume

Percentage: ± 53 per cent
Units of volume: ± 20 million m^3

Thickness estimate (l = thickness)
Measurements in metres

Sample point	Weighting w	Overburden lo	Overburden wlo	Mineral lm	Mineral wlm	Remarks
SE 14	1	1.5	1.5	5.2	5.2	MAU Boreholes
SE 18	1	3.3	3.3	nil	-	
SE 20	1	nil	-	2.1	2.1	
SE 22	1	0.7	0.7	9.3	9.3	
SE 23	1	6.2	6.2	5.7	5.7	
SE 24	1	4.3	4.3	6.5	6.5	
SE 17	½	1.2	1.6	4.2	3.9	
123/45	½	2.0		3.6		Hydrogeol. Dept. record
1	¼	2.4	2.5(25)*	3.4	3.6(25)*	Close group of four boreholes (commercial)
2	¼	4.5		0.8		
4	¼	0.4		4.3		
5	¼	2.8		6.0		
Totals	∑w = 8		∑wlo = 20.1(25)*		∑wlm = 36.3(25)*	
Averages			$\bar{l}o$ = 2.5(16)*		$\bar{l}m$ = 4.5(41)*	

Calculation of Confidence Limits

l	$(l - \bar{l})$	$(l - \bar{l})^2$
5.2	0.7	0.49
nil	4.5	20.25
2.1	2.4	5.76
9.3	4.8	23.04
5.7	1.2	1.44
6.5	2.0	4.00
3.9	0.6	0.36
3.6	0.9	0.81
∑l = 36.3 (25)	$\sum(l - \bar{l})^2$ = 56.15	
n = 8		
$\bar{l}$ = 4.5 (41)		
≃ 4.5		

n = 8
t = 2.365

$$L_V = 1.05 \frac{t}{\bar{l}} \sqrt{\frac{\sum(l - \bar{l})^2}{n(n-1)}} \times 100$$

$$= 1.05 \times \frac{2.365}{4.541} \sqrt{\frac{56.15}{8 \times 7}} \times 100$$

= 54.77

≃ 55%

* The figures in brackets are additional decimal places used only in the calculation of confidence limits.

Fig. 11. Example of resource block assessment: statement and calculation

1/16 mm. Thus it has no mineralogical significance and includes particles falling within the size limits of silt. Wherever the term clay does not appear in single quotation marks the normal meaning applies.

The ratio of sand to gravel defines the boundaries between Sand, Pebbly Sand, Sandy Gravel and Gravel (at 19:1, 3:1 and 1:1).

Thus it is possible to classify the mineral into one of twelve descriptive categories (see Fig 12) The procedure is as follows.

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

For example, a deposit grading: gravel, 11 per cent; sand, 70 per cent; fines, 19 per cent is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Note 10, p.30).

Many differing proposals exist for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the 1/16 mm size, which approximates to the generally accepted boundary between silt and sand. In this and other respects the system shown in Table 5, used in this report, is satisfactory, but see Anon, 1970). It is based on Udden's geometric scale and a simplified form of Wentworth's terminology.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the quantitative assessments of the resource blocks. Three sizes of sand are recognised, fine (-¼ + 1/16 mm), medium (-1 + ¼ mm) and coarse (-4 +1 mm). The boundary at 16 mm distinguishes a range of finer gravel (-16 + 4 mm), often characterised by abundance of worn tough pebbles of vein quartz, from coarser ranges often of notably different average composition. The boundary at 64 mm distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

The size distribution of borehole samples is determined by sieve analysis, and is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standard 1377:67). In this report the grading is tabulated on the borehole record sheets (Appendix C), the intercepts corresponding with the simple geometric scale 1/16 mm, ¼ mm, 1 mm, 4 mm, 16 mm, and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

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

The relative proportions of the rock types present in the gravel fraction are indicated by 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 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.

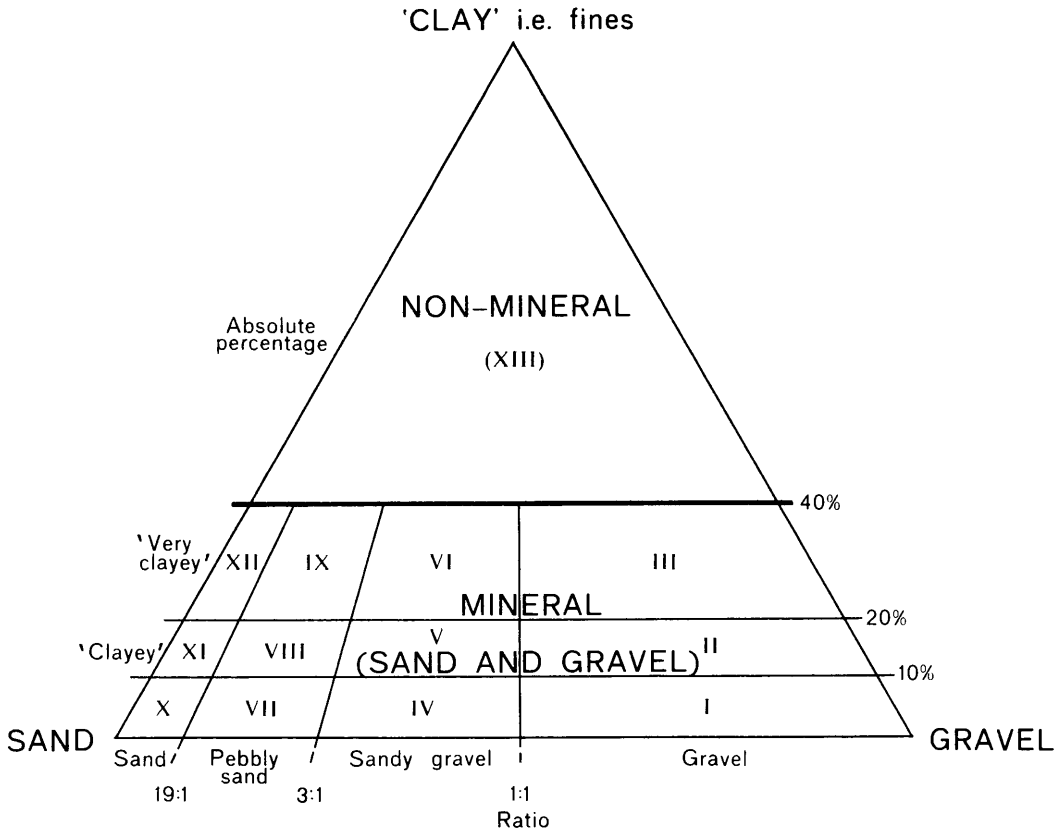
Subrounded: showing considerable wear. The edges and corners are rounded off to smooth curves. Original grain shape is still distinct.

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 5 Classification of gravel, sand and fines

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



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

(XIII) NON-MINERAL

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

Appendix C: Borehole Records

EXPLANATION

Annotated Example of a Borehole Record

TM 13 NW 27[1] 1481 3961[2] Wherstead, Suffolk[3]

Surface level (+43.6 m) +143 ft[4]
Water struck at (+23.5 m) +77 ft[5]
Wirth B0, 8 inch diameter
April 1970[6]

Overburden (2.7 m) 9 ft[7]
Mineral (6.4 m) 21 ft
Waste (2.8 m) 9 ft
Mineral (9.1 m) 30 ft
Bedrock (1.2 m+) 4 ft+[8]

		Thickness (m)	Thickness ft	Depth[11] (m)	Depth ft
Soil and Subsoil		(0.9)	3	(0.9)	3
Boulder Clay[9]	Brown clay with chalk and flint pebbles[10]	(1.8)	6	(2.7)	9
Glacial Sand and Gravel	(a) 'Clayey' Sandy Gravel Fine to medium brown to orange-brown silty sand with fine to coarse gravel coarse of angular to subrounded flint and subrounded to rounded quartz (and occasionally chalk) pebbles.	(6.4)	21	(9.1)	30
	Brown clay with flint pebbles.	(2.8)	9	(11.9)	39
Red Crag	(b) Pebbly Sand Medium sand becoming finer towards the base, orange-brown with flint gravel.	(7.3)	24	(19.2)	63
	Fine to medium brown sand with shell fragments.	(1.8)	6	(21.0)	69
London Clay	Clay	(1.2+)	4+	(22.2)	73

		%	mm	%	Depth below surface[12] ft	Percentage[13] Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)[15]	Gravel	23	+16	: 12	9 - 12	26	32	17	5	9	11
			-16+4	: 11	12 - 15	16	27	17	9	9	22
					15 - 21	No grading information available[14]					
			-4+1	: 9	21 - 24	12	37	37	5	6	3
	Sand	62	-1+¼	: 27	24 - 27	7	8	37	19	18	11
			-¼+1/16	: 26	27 - 30	No grading information available					
	Fines	15	-1/16	: 15							
(b)	Gravel	6	+16	: 1	39 - 42	7	16	69	4	4	0
			-16+4	: 5	42 - 45	5	8	56	11	12	8
					45 - 48	4	11	63	8	6	8
			-4+1	: 10	48 - 51	3	29	63	3	2	0
	Sand	89	-1+¼	: 53	51 - 54	4	32	59	3	2	0
			-¼+1/16	: 26	54 - 57	7	25	47	15	6	0
					57 - 60	4	26	52	16	2	0
	Fines	5	-1/16	: 5	60 - 63	No grading information available					
					63 - 66	4	40	35	17	3	1
					66 - 69	4	46	33	15	2	0

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

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

1) The number of the 1 : 25 000 sheet on which the borehole lies, for example, TM 13.
2) The quarter of the 1 : 25 000 sheet on which the borehole lies and its number in a series for that quarter, for example, NW 27.

Thus the full Registration Number is TM 13 NW 27. Usually this is abbreviated to NW 27 in the text.

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

3. Location.
The borehole location is referred generally to the parish named on the 1 : 25 000 base map.

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

5. Groundwater Conditions.
Two kinds of entry are made: either the level at which groundwater was encountered is given in metres and feet above Ordnance Datum or, where no groundwater was encountered, this is stated, or, where there is no record of the groundwater conditions, this is stated.

6. Type of Drill and Date of Drilling.
Three types of drilling machine have been used in this survey: a Shell and Auger rig and a Wirth (a cased power auger). The type of machine, the external diameter of the casing used and the month and year of the completion of the borehole are stated.

7. Overburden, Mineral, Waste and Bedrock.
Mineral is sand and gravel which, as part of a deposit, falls within the arbitrary definition of potentially workable material (see p.1). Bedrock is the formation, rock type, country rock or rock-head below which potentially workable sand and gravel will not be found. In the Tattingstone area the bedrock is London Clay.

Waste is any material other than bedrock or mineral. Where waste occurs between the surface and a mineral horizon it is classified as overburden.

Thicknesses are given in metres and feet.

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

The borehole log

9. Geological Classification.
A geological classification of the strata encountered in drilling is given whenever possible. (For an explanation of the terms used see p.4).

10. Lithological Description.
When sand and gravel is recorded, a general description based on the mean grading characteristics is followed by more detailed particulars. (For explanation of conventions see Appendix B). A description of other rock types is based on visual field examination.

11. Depth.
The figures relate to depths from surface to base of the strata recorded on the log.

Grading information

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

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

14. Exceptionally the results of the grading of a sample or horizon may not be available. No attempt has been made to estimate the probable grading of such samples, and the grading diagram may not be shown on the map.

15. Mean Grading.
The mean grading for the mineral thickness is the mean of the individual sample gradings, but where the thicknesses of mineral represented by the samples are not constant each grading result is first weighted by its relative thickness.

The results are given for the three main classes, gravel, sand and fines, and for the smaller ranges within these classes.

Since fully representative sampling of sand and gravel is difficult to achieve, particularly where groundwater levels are high, there may be differences between the gradings determined during the survey and the corresponding in-situ grading of the deposit. Comparison with exposures suggests that the proportion of sand in the samples collected from boreholes may be somewhat higher. Conversely the results suggest that the proportion of fines and of +16 mm material may be lower.

Note on metrication

1) Although most measurements were made in feet, some were recorded in metres. In case conversions to metres or feet, as appropriate, appear in brackets in the logs.
2) Metric conversions of measurements of the depth and thickness of beds have been rounded off to the nearest 0.1 m, because quotation to two places of decimals would imply a higher order of accuracy than could be justified by the original figures. Similarly, conversions from metres to feet have been rounded off to the nearest 0.5 ft. To eliminate any discrepancy appearing after conversion between depth as recorded and depth as obtained by summing thicknesses, adjustment has been made where necessary to one or more of the thickness figures. However, the recorded mineral thickness is not adjusted.

LIST OF MINERAL ASSESSMENT UNIT BOREHOLES

Borehole No. by sheet quadrants	Grid reference (all fall in 100 km square TM)	Borehole No. by sheet quadrants	Grid reference (all fall in 100 km square TM)
TM 13 NW		TM 13 NE	
3	1061 3951	11	1565 3918
4	1045 3843	12	1575 3829
5	1040 3742	13	1566 3701
6	1084 3694	14	1551 3619
7	1001 3631	16	1664 3872
8	1021 3513	17	1666 3774
9	1162 3974	18	1705 3925
10	1102 3874	19	1793 3884
11	1180 3765	21	1813 3617
12	1126 3646	22	1819 3740
13	1114 3513	23	1845 3665
14	1240 3941	24	1873 3557
15	1271 3912	25	1876 3825
16	1255 3818	26	1938 3760
17	1258 3718	27	1996 3634
18	1272 3665	28	1951 3551
19	1265 3583	29	1509 3732
20	1338 3718		
21	1382 3582	TM 13 SE	
22	1413 3994		
23	1412 3901	4	1575 3453
24	1425 3832	5	1805 3477
26	1432 3549	6	1919 3469
27	1481 3961	8	1970 3365
28	1499 3573		
TM 13 SW			
1	1025 3420		
2	1178 3436		
3	1228 3381		
4	1248 3457		
5	1375 3397		
6	1416 3331		
7	1493 3451		

THE RECORDS

TM 13 NW 3 1061 3951 Copdock, Suffolk

Surface level (+ 45.1 m) + 148 ft
Water struck at (+ 36.0 m) + 118 ft
Wirth B1, 8 inch diameter
April 1970

Overburden (5.2 m) 17ft
Mineral (13.1 m +) 43 ft +

Soil and sub-soil			Thickness (m)	Thickness ft	Depth (m)	Depth ft
			(0.9)	3	(0.9)	3
Boulder Clay		Brown clay becoming chalky at (2.7 m) 9 ft.	(4.3)	14	(5.2)	17
Glacial Sand and Gravel	(a)	"Clayey" Sand Fine to medium sand, orange-brown at top with bands of yellow and grey sand at depth; rather silty. Occasional flint and quartz pebbles.	(5.5)	18	(10.7)	35
Red Crag	(b)	Sand Fine to medium dark orange-brown sand, rather silty, occasional pebbles. (0.3 m) 1 ft orange-brown clay band at (15.2 m) 50 ft.	(7.6+)	25+	(18.3)	60

			%	Depth below surface (ft)	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Gravel +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	2% +16 mm	0	17 - 20	22	19	42	5	9	3
		-16 +4	2	20 - 23	3	40	55	2	0	0
				23 - 26	11	64	24	1	0	0
	Sand	85% -4 +1	3	26 - 29	6	61	32	1	0	0
		-1 +¼	34	29 - 32	25	66	9	0	0	0
		-¼ +1/16	48	32 - 35	8	40	40	12	0	0
	Fines	13% -1/16	13							
(b)	Gravel	2% +16 mm	0	35 - 38	8	41	49	1	1	0
		-16 +4	2	38 - 41	3	35	60	1	1	0
				41 - 44	No grading information available					
	Sand	91% -4 +1	5	44 - 47	5	47	42	5	1	0
		-1 +¼	48	47 - 50	5	43	40	11	1	0
		-¼ +1/16	38	51 - 54	8	39	46	7	0	0
				54 - 57	9	31	50	1	7	2
	Fines	-1/16	7	57 - 60	8	31	54	6	1	0

TM 13 NW 4 1045 3843 Bentley, Suffolk

Surface level (+ 41.5 m) + 136 ft
Water level (+ 35.4 m) + 116 ft
Wirth B1, 8 inch diameter
April 1970

Overburden (1.5 m) 5 ft
Mineral (15.3 m) 50 ft
Bedrock (0.3 m +) 1 ft +

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil		(1.5)	5	(1.5)	5
Glacial Sand and Gravel	(a) Pebbly Sand Fine to medium orange-brown sand with rounded to sub-rounded flint gravel. Sand rather silty at top.	(5.5)	18	(7.0)	23
Red Crag	(b) Sand Fine to medium orange-brown sand with occasional flint pebbles. Trace of shelly material at base.	(9.8)	32	(16.8)	55
London Clay	Blue clay	(0.3+)	1+	(17.1)	56

				%	Depth below surface ft	Fines -1/16	Sand +1/16-4	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	10%	+16 mm	5	5 - 8	16	34	32	5	4	9
			-16 +4	5	8 - 14	No grading information available					
					14 - 17	7	18	63	5	5	2
	Sand	82%	-4 +1	6	17 - 20	6	18	56	10	8	2
			-1 +¼	51	20 - 23	5	29	50	6	5	5
			-¼ +1/16	25							
	Fines	8%	-1/16	8							
(b)	Gravel	2%	+16 mm	0	23 - 26	6	20	64	6	4	0
			-16 +4	2	26 - 29	7	24	61	5	2	1
					29 - 32	4	29	55	6	4	2
	Sand	92%	-4 +1	5	32 - 35	1	27	64	7	1	0
			-1 +¼	57	35 - 38	2	28	63	5	2	0
			-¼ +1/16	30	38 - 41	1	29	65	5	0	0
					41 - 44	15	29	52	3	1	0
	Fines	6%	-1/16	6	44 - 47	7	40	48	3	1	1
					47 - 50	8	33	53	5	1	0
					50 - 51	8	31	55	4	2	0
					51 - 54	6	41	48	3	2	0
					54 - 55	No grading information available					

TM 13 NW 5 1040 3742 Bentley, Suffolk

Surface level (+ 37.2 m) + 122 ft
Water struck at (+ 33.8 m) + 111 ft
Wirth B1, 8 inch diameter
April 1970

Overburden (2.4 m) 8 ft
Mineral (10.7 m) 35 ft
Bedrock (0.6 m +) 2 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil			(0.6)	2	(0.6)	2
Boulder Clay		Brown clay with some sand	(1.8)	6	(2.4)	8
Glacial Sand and Gravel	(a)	'Clayey' Pebbly Sand Orange-brown fine to medium sand with fine flint gravel.	(0.9)	3	(3.3)	11
Red Crag	(b)	Sand Dark orange-brown fine to medium sand with occasional subrounded flint.	(3.7)	12	(7.0)	23
		Grey clay with some sand and gravel.	(0.3)	1	(7.3)	24
		Orange-brown medium sand, shell content increasing with depth.	(5.8)	19	(13.1)	43
London Clay		Blue clay.	(0.6+)	2+	(13.7)	45

		%	Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	One sample only (see opposite)		8 - 11	13	16	52	2	14	3
(b)	Gravel 3% +16 mm	0	11 - 14	3	22	66	6	3	0
	-16 +4	3	14 - 17	3	20	69	6	2	0
			17 - 20	16	29	48	4	3	0
	Sand 91% -4 +1	7	20 - 23	3	22	62	10	2	1
	-1 +¼	61	24 - 27	8	22	60	8	2	0
	-¼ +1/16	23	27 - 30	4	19	61	10	5	1
			30 - 43	No grading information available					
	Fines 6% -1/16	6							

TM 13 NW 6 1084 3694 Bentley, Suffolk

Surface level (+ 40.5 m) + 133 ft
Water struck at (+ 30.8 m) + 101 ft
Wirth B1, 8 inch diameter
April 1970.

Overburden (2.1 m) 7 ft
Mineral (0.9 m) 3 ft
Waste (1.3 m) 4 ft
Mineral (14.6 m) 48 ft
Bedrock (0.9 m +) 3 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil			(0.3)	1	(0.3)	1
? Boulder Clay		Brown clay with pebbles	(1.8)	6	(2.1)	7
Glacial Sand and Gravel	(a)	"Clayey" sand. Orange-brown medium sand with occasional pebbles. Rather silty.	(0.9)	3	(3.0)	10
		Grey and white clay with some sand.	(1.3)	4	(4.3)	14
		Fine to medium grey sand becoming coarser and orange-brown with depth.	(2.7)	9	(7.0)	23
Red Crag	(b)	Pebbly Sand. Dark orange-brown fine to medium sand with some subrounded flint gravel.	(6.4)	21	(13.4)	44
		Orange-brown sand, medium to coarse with shell fragments.	(5.5)	18	(18.9)	62
London Clay		Blue clay	(0.9+)	3+	(19.8)	65

(a) Gravel 3% +16 mm : 1
-16 +4 : 2
Sand 84% -4 +1 : 3
-1 +¼ : 48
-¼ +1/16 : 33
Fines 13% -1/16 : 13

(b) Gravel 11% +16 mm : 3
-16 +4 : 8
Sand 84% -4 +1 : 9
-1 +¼ : 44
-¼ +1/16 : 31
Fines 5% -1/16 : 5

Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
7 - 10	22	20	53	2	3	0
14 - 17	12	43	39	3	1	2
17 - 20	6	36	51	4	2	1
20 - 23	No grading information available					
23 - 26	9	25	30	7	14	15
26 - 29	3	71	14	5	5	2
29 - 32	8	19	45	8	13	7
32 - 35	6	36	46	9	2	1
35 - 38	0	48	42	8	2	0
38 - 41	3	39	46	7	3	2
41 - 44	3	28	52	8	5	4
44 - 47	8	10	58	14	8	2
47 - 50	5	28	50	8	7	2
50 - 53	5	17	50	18	10	0
53 - 56	6	23	44	15	12	0
56 - 62	No grading information available					

TM 13 NW 7 1001 3631 Capel St. Mary, Suffolk

Surface level (+ 39.0 m) + 128 ft
Water struck at (+ 27.1 m) + 89 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.9 m) 3 ft
Mineral (14.9 m) 49 ft
Bedrock (1.2 m +) 4 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil			(0.9)	3	(0.9)	3
Glacial Sand and Gravel	(a)	Sandy Gravel Brown to red brown silty medium to coarse sand with gravel of angular to subrounded flint.	(3.7)	12	(4.6)	15
Red Crag	(b)	Sand Red-brown and yellow-brown fine to medium sand with a trace of fine to coarse gravel.	(8.2)	27	(12.8)	42
		Medium sand, brown, with shell fragments.	(3.0)	10	(15.8)	52
London Clay		Brown to blue clay.	(1.3+)	4+	(17.1)	56

		%		%
(a)	Gravel	33%	+16 mm	16
			-16 +4	17
	Sand	59%	-4 +1	11
			-1 +¼	40
			-¼ +1/16	8
	Fines	8%	-1/16	8
(b)	Gravel	4%	+16 mm	1
			-16 +4	3
	Sand	91%	-4 +1	4
			-1 +¼	46
			-¼ +1/16	41
	Fines	5%	-1/16	5

Depth below surface ft	Fines -1/16	Fines +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	6	3	34	10	20	27
6 - 9	8	2	34	18	20	18
9 - 12	8	5	44	14	18	11
12 - 15	8	22	49	4	8	9
15 - 18	8	9	61	7	8	7
18 - 21	4	53	39	2	0	2
21 - 24	3	69	25	2	1	0
24 - 27	2	36	57	4	1	0
27 - 30	12	44	40	2	2	0
30 - 33	5	58	34	1	2	0
33 - 36	4	48	39	2	5	2
36 - 39	2	36	59	3	0	0
39 - 42	4	21	65	8	2	0
42 - 45	2	33	51	9	4	1
45 - 48	4	42	44	7	3	0
48 - 49	13	41	34	8	3	1
49 - 52	No grading information available					

TM 13 NW 8 1021 3513 East Bergholt, Suffolk

Surface level (+ 35.4 m) + 116 ft
Water struck at (+ 25.9 m) + 85 ft
Wirth BO, 8 inch diameter
April 1970

Overburden (2.1 m) 7 ft
Mineral (9.5 m) 31 ft
Bedrock (0.9 m +) 3 ft+

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil			(0.9)	3	(0.9)	3
Brickearth?		Clay with some sand.	(1.2)	4	(2.1)	7
Glacial Sand and Gravel	(a)	Sand Medium to coarse yellow-brown sand.	(0.9)	3	(3.0)	10
Red Crag	(b)	Sand Fine to medium orange-brown sand, rather silty, with occasional pebbles.	(8.6)	28	(11.6)	38
London Clay		Brown to blue clay.	(0.9+)	3+	(12.5)	41

		%	Depth below surface ft	Fines -1/16	+1/16-¼	Percentages Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	One sample only, see opposite.		7-10	10	11	63	14	1	1
(b)	Gravel 2% +16 mm	0	10 - 13	9	78	9	2	2	0
	-16 +4	2	13 - 16	5	34	54	7	0	0
			16 - 19	12	41	28	12	7	0
	Sand 90% -4 +1	9	19 - 22	5	63	14	17	1	0
	-1 +¼	43	22 - 25	6	53	31	8	1	1
	-¼ +1/16	38	25 - 28	8	32	47	10	3	0
	Fines 8% -1/16	8	28 - 31	8	26	56	8	2	0
			31 - 34	6	17	69	6	2	0
			34 - 37	7	18	63	10	2	0
			37 - 38	12	21	54	11	2	0

TM 13 NW 9 1162 3974 Bentley, Suffolk

Surface level (+ 42.4 m) + 139 ft
Water struck at (+ 31.4 m) + 103 ft
Wirth B1, 8 inch diameter
April 1970

Overburden (0.9 m) 3 ft
Mineral (19.2 m) 63 ft
Bedrock (0.6 m +) 2 ft +

Soil			Thickness (m)	Thickness ft	Depth (m)	Depth ft
			(0.9)	3	(0.9)	3
Glacial Sand and Gravel	(a)	'Clayey' Pebbly Sand Mainly fine to medium sand organge-brown to yellow. Some subrounded flint gravel, mainly in upper (3.7 m) 12 ft. A (0.6 m) 2 ft band of light grey-brown clay is present at (7.3 m) 24 ft.	(10.7)	35	(11.6)	38
Red Crag	(b)	Sand Fine to medium sand, dark red-brown, rather silty. Some subrounded flint gravel.	(8.5)	28	(20.1)	66
London Clay		Blue Clay	(0.6+)	2+	(20.7)	68

				%	Depth below surface ft	Fines -1/16	Fines +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	5%	+16 mm	2	3 - 6	23	17	47	7	3	3
			-16 +4	3	6 - 9	7	15	61	6	8	3
					9 - 12	7	18	55	10	7	3
	Sand	85%	-4 +1	4	12 - 15	4	24	64	4	3	1
			-1 +¼	48	15 - 18	7	52	40	1	0	0
			-¼ +1/16	33	18 - 21	No grading information available					
					21 - 24	13	15	52	8	5	7
	Fines	10%	-1/16	10	26 - 29	3	44	52	1	0	0
					29 - 32	12	75	13	0	0	0
					32 - 35	26	34	39	1	0	0
					35 - 38	2	37	57	3	1	0
(b)	Gravel	1%	+16 mm	0	38 - 41	2	28	62	6	2	0
			-16 +4	1	41 - 44	3	24	63	8	2	0
					44 - 47	26	62	31	1	0	0
	Sand	89%	-4 +1	4	47 - 50	6	61	28	5	0	0
			-1 +¼	45	50 - 53	3	50	39	6	1	1
			-¼ +1/16	40	53 - 56	7	44	44	5	0	0
					56 - 59	11	42	42	3	2	0
	Fines	10%	-1/16	10	59 - 62	23	31	44	1	1	0
					62 - 66	No grading information available					

TM 13 NW 10 1102 3874 Bentley, Suffolk

Surface level (+ 41.8 m) + 137 ft
Water struck at (+ 35.1 m) + 115 ft
Wirth B1, 8 inch diameter
April 1970

Overburden (1.8 m) 6 ft
Mineral (16.2 m +) 53 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil			(0.3)	1	(0.3)	1
?Boulder Clay		Orange-brown sandy clay	(1.5)	5	(1.8)	6
Glacial Sand and Gravel	(a)	"Clayey" Pebbly Sand Fine to medium brown and orange-brown sand, with seams of light grey clay. Gravel, concentrated in middle of deposit, composed of coarse sub-rounded black and fine rounded white quartz.	(3.7)	12	(5.5)	18
Red Crag	(b)	Sand Fine to medium sand, dark orange-brown occasional pebbles, rather silty.	(5.5)	18	(11.0)	36
		Red-brown fine to medium sand with shell fragments.	(7.0+)	23+	(18.0)	59

(a) Gravel 15% +16 mm : 6%
-16 +4 : 9
Sand 70% -4 +1 : 6
-1 +¼ : 40
-¼ +1/16 : 24
Fines 15% -1/16 : 15

(b) Gravel 1% +16 mm : 0
-16 +4 : 1
Sand 90% -4 +1 : 4
-1 +¼ : 40
-¼ +1/16 : 46
Fines 9% -1/16 : 9

Depth below surface ft	Fines -1/16	Fines +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
6 - 9	18	36	42	2	2	0
9 - 12	9	19	25	12	18	17
12 - 15	17	18	54	4	5	2
15 - 18	No grading information available					
18 - 21	13	53	32	1	1	0
21 - 24	11	39	46	3	1	0
24 - 27	5	53	40	2	0	0
27 - 30	7	43	46	2	2	0
30 - 33	0	60	34	6	0	0
33 - 36	12	42	36	8	1	1
36 - 39	12	48	38	2	0	0
39 - 42	7	40	48	4	1	0
42 - 45	7	44	42	7	0	0
45 - 48	10	46	39	4	1	0
48 - 51	12	43	38	6	1	0
51 - 54	8	42	42	6	2	0
54 - 57	8	45	40	6	1	0

TM 13 NW 11 1180 3765 Bentley, Suffolk

Surface level (+ 39.0 m) + 128 ft
Water struck at (+ 30.2 m) + 98 ft
Wirth B1, 8 inch diameter
April 1970

Overburden (0.9 m) 3 ft
Mineral (14.6 m) 48 ft
Bedrock (1.3 m +) 4 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil			(0.9)	3	(0.9)	3
Glacial Sand and Gravel	(a)	Pebbly Sand Medium to fine sand, light-brown to orange-brown, with angular to sub-rounded flint and subrounded quartz gravel. Gravel concentrated in top (2.7 m) 9 ft. Deposit rather silty.	(8.2)	27	(9.1)	30
Red Crag	(b)	Pebbly Sand Medium to coarse sand, dark orange-brown with some mainly fine sub-rounded flint gravel.	(4.6)	15	(13.7)	45
		Medium to coarse dark orange-brown sand with shell fragments.	(1.8)	6	(15.5)	51
London Clay		Blue clay	(1.3+)	4+	(16.8)	55

			%
(a)	Gravel	9% +16 mm :	3
		-16 +4 :	6
	Sand	82% -4 +1 :	4
		-1 +$\frac{1}{4}$:	48
		-$\frac{1}{4}$ +1/16 :	30
	Fines	9% -1/16 :	9
(b)	Gravel	5% +16 mm :	1
		-16 +4 :	4
	Sand	91% -4 +1 :	18
		-1 +$\frac{1}{4}$:	56
		-$\frac{1}{4}$ +1/16 :	17
	Fines	4% -1/16 :	4

Depth below surface ft	Fines -1/16	Fines +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	22	21	41	3	6	7
6 - 9	14	19	37	8	14	8
9 - 12	9	10	40	9	19	13
12 - 15	11	34	52	1	2	0
15 - 18	8	41	45	2	4	0
18 - 21	8	17	63	7	4	1
21 - 24	6	14	78	3	1	2
24 - 27	0	31	64	4	1	0
27 - 30	3	83	12	0	1	0
30 - 33						
33 - 36	6	26	56	8	2	2
36 - 39	6	12	69	11	2	0
39 - 42	3	16	58	21	2	0
42 - 45	4	16	53	20	5	2
45 - 48	2	18	47	29	4	0
48 - 51	5	13	54	16	10	2

TM 13 NW 12 1126 3646 Bentley, Suffolk

Surface level (+ 38.1 m) + 125 ft
Water struck at (+ 25.9 m) + 85 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (2.4 m) 8 ft
Mineral (12.2 m) 40 ft
Bedrock (0.3 m +) 1 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil			(0.9)	3	(0.9)	3
Boulder Clay		Brown clay with flint pebbles	(1.5)	5	(2.4)	8
Glacial Sand and Gravel	(a)	Pebbly Sand Medium to coarse fawn brown and yellow sand with angular to sub-rounded black flint and rounded white quartz gravel. Rather clayey at the top.	(4.1)	13.5	(6.5)	21.5
Red Crag	(b)	Pebbly Sand Medium sand, orange-brown to red-brown, becoming finer with depth. Occasional flint and quartz pebbles.	(7.8)	25.5	(41.3)	47
		Medium sand, brown with shell fragments.	(0.3)	1	(14.6)	48
London Clay		Brown clay	(0.3+)	1+	(14.9)	49

		%		Depth below surface ft	Fines -1/16	Percentages Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	17%	+16 mm : 7	5 - 11	13	32	38	3	4	10
			-16 +4 : 10	11 - 14	12	23	47	20	9	8
				14 - 17	7	8	60	11	11	3
	Sand	74%	-4 +1 : 7	17 - 20	7	8	47	11	19	8
			-1 +¼ : 51	20 - 23	7	6	64	9	6	8
			-¼ +1/16 : 16							
	Fines	9%	-1/16 : 9							
(b)	Gravel	6%	+16 mm : 1	23 - 26	8	5	76	8	3	0
			-16 +4 : 5	26 - 29	6	6	71	14	2	1
				29 - 32	5	7	66	10	10	2
	Sand	87%	-4 +1 : 11	32 - 35	5	9	68	11	5	2
			-1 +¼ : 54	35 - 38	4	39	47	8	1	1
			-¼ +1/16 : 22	38 - 41	4	60	19	9	8	0
				41 - 44	5	38	42	8	4	3
	Fines	7%	- : 7	44 - 47	13	18	49	12	6	2
				47 - 48	10	19	49	15	7	0

TM 13 NW 13 1114 3513 Brantham, Suffolk

Surface level (+ 33.2 m) + 109 ft
Water struck at (+ 21.8 m) + 68.5 ft
Wirth B1, 8 inch diameter
April 1970

Overburden (0.6 m) 2 ft
Mineral (11.9 m) 39 ft
Bedrock (0.5 m +) 1.5 ft +

Soil			Thickness (m)	Thickness ft	Depth (m)	Depth ft
			(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a)	Sandy Gravel * Medium sand and medium to coarse gravel. Sand mainly medium becoming coarse with depth; orange brown throughout the deposit. Gravel of angular to rounded flint and quartz.	(7.9)	26	(8.5)	28
Red Crag	(b)	Pebbly Sand? Medium to coarse orange brown sand with gravel. Gravel decreasing with depth.	(2.9)	9.5	(11.4)	37.5
		Medium orange-brown sand with shell fragments.	(1.1)	3.5	(12.5)	41
London Clay		Brown silty clay becoming blue with depth.	(0.5+)	1.5+	(13.0)	42.5

*Detailed grading results not available

(a)

			%
Gravel	46%	+16 mm	: 26
		-16 +4	: 20
Sand	49%	-4 +1	: 11
		-1 +$\frac{1}{4}$	: 29
		-$\frac{1}{4}$ +1/16	: 9
Fines	5%	-1/16	: 5

(b) No grading information available

TM 13 NW 14 1240 3941 Bentley, Suffolk

Surface level (+ 32.3 m) + 106 ft
Water struck at (+ 30.8 m) + 101 ft
Pilcon Shell, 8 inch diameter
May 1970

Overburden (1.8 m) 6 ft
Mineral (8.6 m) 28 ft
Bedrock (1.2 m +) 4 ft +

Soil		Thickness (m)	ft	Depth (m)	ft
		(0.6)	2	(0.6)	2
Brickearth	Brown sandy clay	(1.2)	4	(1.8)	6
Red Crag	Pebbly sand Fine to medium rather silty brown sand. High concentration of gravel at (2.7 to 3.6 m) 9 to 12 ft probably iron-stone bands.	(4.6)	15	(6.4)	21
	Medium to coarse brown sand with shell fragments composing of gravel content	(4.0)	13	(10.4)	34
London Clay	Brown silty clay turning blue with depth	(1.2+)	4+	(11.6)	38

		%
Gravel	11% +16 mm	4
	-16 +4	7
Sand	85% -4 +1	15
	-1 +$\frac{1}{4}$	40
	-$\frac{1}{4}$ +1/16	30
Fines	4% -1/16	4

Depth below surface ft	Fines -1/16	Fines +1/16-$\frac{1}{4}$	Sand +1-1	Sand +1-4	Gravel +4-16	Gravel +16
6 - 9	8	54	36	2	0	0
9 - 12	8	19	19	5	17	32
12 - 15	4	45	34	16	1	0
15 - 18	3	48	46	3	0	0
18 - 21	5	38	49	6	5	0
21 - 24	0	20	63	17	0	0
24 - 27	3	14	52	23	6	2
27 - 30	3	14	44	21	15	3
30 - 33	3	24	33	23	15	2
33 - 34	5	22	30	31	11	1

TM 13 NW 15 1271 3912 Bentley, Suffolk

Surface level (+ 44.2 m) + 145 ft
Water struck at (+29.0 m) + 95 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.9 m) 3 ft
Mineral (22.0 m) 72 ft
Bedrock just touched

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil			(0.9)	3	(0.9)	3
Glacial Sand and Gravel	(a)	"Clayey" Pebbly Sand Medium to fine orange-brown to brown sand with angular to subrounded white flint gravel. Gravel increasing and becoming generally coarser with depth. A (0.9 m) 3 ft clay band is present at (4.9 m) 16 ft.	(8.5)	28	(9.4)	31
Red Crag	(b)	Sand Fine to medium red-brown sand with occasional flint pebbles.	(8.3)	27	(17.7)	58
		Fine to medium red-brown sand with shell fragments.	(5.2)	17	(22.9)	75
London Clay		Clay	Just touched			

						Depth below surface ft	Fines	Percentages Sand		Gravel	
					%		-1/16	+1/16-¼	+¼-1	+1-4	+4-16	+16
(a)	Gravel	17%	+16 mm	:	8	3 - 6	11	23	55	7	4	0
			-16 +4	:	9	6 - 9	9	24	57	7	3	0
						9 - 12	10	22	44	12	9	3
	Sand	71%	-4 +1	:	7	12 - 15	9	21	49	10	8	3
			-1 +¼	:	43	15 - 16	13	13	43	16	12	3
			-¼ +1/16		21	19 - 22	17	25	32	6	9	11
						22 - 25	9	8	21	6	15	41
	Fines	12%	-1/16	:	12	25 - 28	22	20	35	5	12	6
						28 - 31	6	36	46	2	7	3
	Gravel	3%	+16 mm	:	1							
			-16 +4	:	2	31 - 34	15	22	51	6	4	2
						34 - 37	5	25	62	6	2	0
	Sand	92%	-4 +1	:	5	37 - 40	0	33	57	6	4	0
			-1 +¼	:	53	40 - 43	0	62	35	2	1	0
			-¼ +1/16	:	34	43 - 46	6	21	67	6	0	0
						46 - 49	6	41	45	4	4	0
	Fines	5%	-1/16	:	5	49 - 52	3	47	43	3	3	1
						52 - 55	6	38	46	5	3	2
						55 - 58	8	27	62	2	1	0
						58 - 61	4	31	55	7	3	0
						61 - 64	4	20	60	13	2	1

TM 13 NW 16 1255 3818 Bentley, Suffolk

Surface level (+ 38.7 m) + 127 ft
Water struck at (+ 27.7 m) + 91 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (1.8 m) 6 ft
Mineral (17.1 m +) 56 ft +

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and clayey sub-soil (possibly brickearth).		(1.8)	6	(1.8)	6
Glacial Sand and Gravel	(a) Pebbly Sand Fine to medium orange-brown to light yellow sand with fine and coarse gravel of subrounded to rounded white and black flint. White quartz pebbles towards base. Deposit is split by a (1.2 m) 4 ft layer of grey clay at (4.6 m) 15 ft.	(6.7)	22	(8.5)	28
Red Crag	(b) Sand Medium to coarse dark brown sand.	(3.7)	12	(12.2)	40
	Fine to medium (with some coarse) light brown sand with shell fragments. Shell fraction increasing with depth.	(6.7+)	22+	(18.9)	62

(a) Gravel 15% +16 mm : 6
-16 +4 : 9
Sand 77% -4 +1 : 7
-1 +¼ : 37
-¼ +1/16 : 33
Fines 8% -1/16 : 8
Gravel 3% +16 mm : 0
-16 +4 : 3
Sand 91% -4 +1 : 15
-1 +¼ : 53
-¼ +1/16 : 23
Fines 6% -1/16 : 6

Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
6 - 9	11	44	35	4	5	1
9 - 12	9	26	32	6	19	8
12 - 15	14	41	18	5	14	8
19 - 22	6	11	50	11	11	11
22 - 25	6	31	49	4	2	8
25 - 28	0	47	37	10	3	3
28 - 31	5	19	53	19	4	0
31 - 34	No grading information available					
34 - 37	6	17	59	14	4	0
37 - 40	No grading information available					
40 - 43	10	25	50	15	0	0
43 - 46	5	25	53	13	3	1
46 - 49	7	26	55	10	2	0
49 - 52	4	23	50	20	3	0
52 - 62	No grading information available					

TM 13 NW 17 1258 3718 Bentley, Suffolk

Surface level (+ 38.4 m) + 126 ft
Water struck at (+ 22.6 m) + 74 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (1.5 m) 5 ft
Mineral (17.1 m) 56 ft
Bedrock (0.6 m +) 2 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sandy clay sub-soil			(1.5)	5	(1.5)	5
Glacial Sand and Gravel	(a)	Pebbly Sand Fine to medium orange-brown sand with fine gravel. Gravel mainly rounded quartz.	(3.7)	12	(5.2)	17
Red Crag	(b)	Sand Medium sand, red-brown to orange-brown, with occasional flint pebbles. Rather silty.	(6.4)	21	(11.6)	38
		Fine to medium sand, with shell fragments. Some gravel.	(7.0)	23	(18.6)	61
London Clay		Brown weathered clay.	(0.6+)	2+	(19.2)	63

				%	Depth below surface ft	Fines -1/16	Fines +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	7%	+16 mm :	1	5 - 8	3	42	40	6	7	2
			-16 +4 :	6	8 - 11	4	32	52	11	1	0
					11 - 14	3	40	72	13	12	0
	Sand	90%	-4 +1 :	8	14 - 17	3	60	30	2	5	0
			-1 +¼ :	38							
			-¼ +1/16 :	44							
	Fines	3%	-1/16 :	3							
(b)	Gravel	3%	+16 mm :	0	17 - 20	No grading information available					
			-16 +4 :	3	20 - 23	13	7	65	13	1	1
					23 - 26	5	28	53	11	2	1
	Sand	90%	-4 +1 :	8	26 - 29	5	14	77	2	2	0
			-1 +¼ :	58	29 - 32	6	7	80	6	1	0
			-¼ +1/16 :	24	32 - 35	11	23	63	2	1	0
					35 - 38	14	31	53	2	1	0
	Fines	7%	-1/16 :	7	38 - 40	No grading information available					
					40 - 43	12	22	42	12	10	2
					43 - 46	2	20	48	26	4	0
					46 - 49	3	29	56	9	3	0
					49 - 52	3	29	66	1	1	0
					52 - 55	3	42	52	2	1	0
					55 - 58	3	37	54	4	2	0
					58 - 61	7	18	44	19	10	2

TM 13 NW 18 1272 3665 Tattingstone, Suffolk

Surface level (+ 36.9 m) + 121 ft
Water struck at (+ 22.3 m) + 73 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.3 m) 1 ft
Mineral (18.3 m) 60 ft
Bedrock (0.9 m +) 3 ft

Soil			Thickness (m)	Thickness ft	Depth (m)	Depth ft
			(0.3)	1	(0.3)	1
Glacial Sand and Gravel	(a)	Pebbly Sand Medium yellow-brown sand, (some fine and coarse sand) with fine to coarse subangular flint and subrounded to rounded quartz and quartzite gravel.	(5.5)	18	(5.8)	19
Red Crag	(b)	Sand Fine to medium red and red-brown sand, coarser towards the base with a little fine gravel.	(10.7)	35	(16.5)	54
		Fine to medium red-brown sand with shell fragments.	(2.1)	7	(18.6)	61
London Clay		Blue clay	(0.9+)	3+	(19.5)	64

(a) Gravel 12% +16 mm : 6
-16 +4 : 6
Sand 78% -4 +1 : 7
-1 +¼ : 62
-¼ +1/16: 9
Fines 10% -1/16 : 10

(b) Gravel 4% +16 mm : 1
-16 +4 : 3
Sand 88% -4 +1 : 8
-1 +¼ : 48
-¼ +1/16: 32
Fines 8% -1/16 : 8

Depth below surface ft	Percentages Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
1 - 4	9	5	55	14	13	4
4 - 7	14	16	66	3	1	0
7 - 10	No grading information available					
10 - 13	10	8	66	7	6	3
13 - 16	8	4	49	6	10	23
16 - 19	9	12	75	2	2	0
19 - 22	7	10	65	11	7	0
22 - 25	8	35	49	2	4	2
25 - 28	9	70	19	0	2	0
28 - 31	9	29	50	8	4	0
31 - 34	5	30	57	2	4	2
34 - 37	3	29	57	8	1	2
37 - 40	8	30	50	10	2	0
40 - 43	6	37	39	16	2	0
43 - 46	7	36	39	15	2	1
46 - 49	7	29	47	13	2	0
49 - 52	11	32	45	10	2	0
52 - 55	9	26	52	10	3	0
55 - 58	19	27	48	4	2	0
58 - 61	No grading information available					

TM 13 NW 19 1265 3583 Tattingstone, Suffolk

Surface level + 36.3 m (+ 119 ft)
Water struck at + 32.0 m (+ 105 ft)
Pilcon shell, 8 inch diameter
December 1970

Overburden 1.3 m (4 ft)
Mineral 16.6 m (54.5 ft)
Bedrock 0.8 m + (3 ft +)

		Thickness m	(ft)	Depth m	(ft)
Soil and sandy sub-soil		0.7	(2)	0.7	(2)
Glacial Sand and Gravel	Brown clayey sand with a trace of gravel.	0.6	(2)	1.3	(4)
	(a) Sandy Gravel Medium, brown-red sand with fine to coarse subrounded flint and subrounded to rounded quartz gravel. Gravel mainly at top and bottom of deposit.	3.0	(10)	4.3	(14)
Red Crag	(b) Sand Fine to medium red-brown sand, becoming coarser towards base. Occasional rounded flint and quartz pebbles.	11.0	(36)	15.3	(50)
	Fine to medium red-brown sand with shell fragments.	2.6	(8.5)	17.9	(58.5)
London Clay	Red-brown clay, becoming blue-grey with depth.	0.8+	(3.0+)	18.7	(61.5)

(a) Gravel 24% +16 mm : 14
-16 +4 : 10
Sand 70% -4 +1 : 10
-1 +¼ : 47
-¼ +1/16 : 13
Fines 6% -1/16 : 6

(b) Gravel 2% +16 mm : 0
-16 +4 : 2
Sand 94% -4 +1 : 11
-1 +¼ : 50
-¼ +1/16 : 33
Fines 4% -1/16 : 4

Depth below surface m	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
1.3 - 2.3	3	10	30	15	20	22
2.3 - 3.3	6	16	66	8	2	2
3.3 - 4.3	8	15	44	8	7	18
4.3 - 5.3	7	33	53	5	2	0
5.6 - 6.3	8	32	57	2	1	0
6.3 - 7.3	6	34	57	2	1	0
7.3 - 8.3	6	28	56	9	1	0
8.3 - 9.3	3	35	46	14	2	0
9.3 - 10.3	5	38	45	12	0	0
10.3 - 11.3	6	44	42	6	2	0
11.3 - 12.3	4	27	44	20	4	1
12.3 - 13.3	1	32	51	15	1	0
13.3 - 14.3	No grading information available					
14.3 - 15.3	5	27	52	13	2	1
15.3 - 16.3	0	33	46	13	7	1
16.3 - 17.3	No grading information available					
17.3 - 17.9	3	32	48	15	2	0

TM 13 NW 20 1338 3718 Tattingstone, Suffolk

Surface level (+ 37.5 m) + 123 ft
Water struck at (+ 21.9 m) + 72 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (1.2 m) 4 ft
Mineral (18.9 m) 62 ft
Bedrock (1.2 m +) 4 ft+

Soil and Subsoil			Thickness (m)	Thickness ft	Depth (m)	Depth ft
			(1.2)	4	(1.2)	4
Glacial Sand and Gravel	(a)	Pebbly Sand Medium, brown, rather clayey sand, becoming finer and yellow to orange-brown with depth. Gravel of subrounded flint, quartz (and some chalk pebbles) concentrated in top (3.7 m) 12 ft	(7.8)	25.5	(9.0)	29.5
Red Crag	(b)	Sand Fine to medium brown to red brown sand with occasional brown flint pebble.	(5.0)	16.5	(14.0)	46
		Medium, brown sand with shell fragments.	(6.1)	20	(20.1)	66
London Clay		Clay	(1.2+)	4+	(21.3)	70

				%
(a)	Gravel	12%	+16 mm:	6
			-16 +4 :	6
	Sand	80%	-4 +1 :	6
			-1 +¼	51
			-¼ +1/16	23
	Fines	8%	-1/16	8
(b)	Gravel	4%	+16 mm	1
			-16 +4	3
	Sand	92%	-4 +1	11
			-1 +¼	48
			-¼ +1/16	33
	Fines	4%	-1/16	4

Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
4 - 7	9	3	45	10	15	18
7 - 10	12	1	54	10	13	10
10 - 13	11	2	70	6	3	8
13 - 16	4	14	59	6	10	7
16 - 19	8	53	35	3	1	0
19 - 22	No grading information available					
22 - 25	8	42	47	1	1	1
25 - 28	1	46	44	8	1	0
28 - 31	3	23	55	15	3	1
31 - 34	1	37	49	11	1	1
34 - 37	3	49	36	10	1	1
37 - 40	3	39	40	10	6	2
40 - 43	6	29	43	15	4	3
43 - 46	6	40	42	7	5	0
46 - 49	2	28	66	1	3	0
49 - 52	7	29	53	10	1	0
52 - 55	7	24	45	19	4	1
55 - 56	No grading information available					

TM 13 NW 21 1382 3582 Stutton, Suffolk

Surface level (+ 31.7 m) + 104 ft
Water struck at (+ 21.0 m) + 69 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.6 m) 2 ft
Mineral (12.8 m) 42 ft
Bedrock (0.9 m +) 3 ft+

Soil		Thickness (m)	Thickness ft	Depth (m)	Depth ft
		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a) Pebbly Sand Medium, yellow sand with fine to coarse subrounded flint gravel.	(3.7)	12	(4.3)	14
Red Crag	(b) Sand Mainly medium, orange-brown sand with a trace of fine sub-rounded flint gravel.	(1.8)	6	(6.1)	20
	Orange-brown fine to medium sand with shell fragments.	(7.3)	24	(13.4)	44
London Clay	Blue clay	(0.9+)	3+	(14.3)	47

				%
(a)	Gravel	8%	+16 mm	3
			-16 +4	5
	Sand	87%	-4 +1	12
			-1 +¼	71
			-¼ +1/16	4
	Fines	5%	-1/16	5
(b)	Gravel	2%	+16 mm	0
			-16 +4	2
	Sand	94%	-4 +1	11
			-1 +¼	55
			-¼ +1/16	28
	Fines	4%	-1/16	4

Depth below surface ft	Percentages Fines -1/16	+1/16-¼	Sand +¼-1	+1-4	Gravel +4-16	+16
2 - 5	No grading information available					
5 - 8	5	5	73	10	4	3
8 - 11	5	3	68	14	7	3
11 - 14	No grading information available					
14 - 17	3	29	54	11	2	1
17 - 20	3	40	34	19	4	0
20 - 23	2	35	42	14	7	0
23 - 26	3	25	56	12	4	0
26 - 29	5	27	62	6	0	0
29 - 32	4	20	64	11	1	0
32 - 35	5	17	70	7	1	0
35 - 38	No grading information available					
38 - 41	1	27	60	9	2	1
41 - 44	6	34	49	9	1	1

TM 13 NW 22 1413 3994 Wherstead, Suffolk

Surface level (+ 41.8 m) + 137 ft
Water struck at (+ 25.6 m) + 84 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.9 m) 3 ft
Mineral (22.0 m +) 72 ft +

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and subsoil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	(a) Pebbly Sand Brown to yellow-brown sand, mainly medium, with fine to coarse gravel of angular to subrounded brown and white flint and rounded quartz. Gravel concentrated towards the centre of the deposit.	(9.2)	30	(10.1)	33
Red Crag	(b) Sand Fine to medium red-brown sand (occasionally yellow to orange-brown) with some flint pebbles.	(7.3)	24	(17.4)	57
	Fine to medium (with coarse) brown sand and shell fragments.	(5.5+)	18+	(22.9)	75

				%
(a)	Gravel	15%	+16 mm	: 7
			-16 +4	: 8
	Sand	78%	-4 +1	: 10
			-1 +$\frac{1}{4}$	: 55
			-$\frac{1}{4}$ +1/16	: 13
	Fines	7%	-1/16	: 7
(b)	Gravel	4%	+16 mm	: 1
			-16 +4	: 3
	Sand	91%	-4 +1	: 11
			-1 +$\frac{1}{4}$	: 50
			-$\frac{1}{4}$ +1/16	: 30
	Fines	5%	-1/16	: 5

Depth below surface ft	Percentages Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	18	20	43	5	6	8
6 - 9	9	19	40	7	10	15
9 - 12	2	28	61	5	2	2
12 - 15	6	14	62	10	7	1
15 - 18	7	3	76	7	5	2
18 - 21	7	3	42	15	20	13
21 - 24	6	4	41	16	14	19
24 - 27	6	5	55	21	8	5
27 - 30	6	18	62	8	4	2
30 - 33	6	19	65	7	3	0
33 - 36	3	22	62	6	4	3
36 - 39	No grading information available					
39 - 42	5	27	56	7	3	2
42 - 45	3	43	42	10	1	1
45 - 48	6	31	51	9	2	1
48 - 51	6	30	47	13	3	1
51 - 54	6	41	37	14	2	0
54 - 57	5	30	46	13	5	1
57 - 60	5	27	49	16	2	0
60 - 63	4	28	51	14	3	0
63 - 64	8	19	55	11	4	3

TM 13 NW 23 1412 3901 Wherstead, Suffolk

Surface level (+ 39.6 m) + 130 ft
Water struck at (+ 23.5 m) + 77 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (1.8 m) 6 ft
Mineral (18.0 m) 59 ft
Bedrock (0.9 m +) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil and clayey sub-soil		(1.8)	6	(1.8)	6
Glacial Sand and Gravel	(a) Pebbly Sand Medium yellow-brown sand with gravel. Gravel, fine to coarse subangular flint and rounded white quartz, concentrated towards the base. A (0.6 m) 2 ft layer of grey clay is present at (7.3 m) 24 ft.	(7.0)	23	(8.8)	29
Red Crag	(b) Pebbly Sand Mainly medium sand, yellow and orange-brown with occasional pebbles. Fine and coarse sand fractions increasing towards base.	(7.3)	24	(16.1)	53
	Medium to coarse brown sand with shell fragments.	(3.7)	12	(19.8)	65
London Clay	Clay	(0.9+)	3+	(20.7)	68

(a) Gravel 14% +16 mm : 7
-16 +4 : 7
Sand 79% -4 +1 : 9
-1 +¼ : 51
-¼ +1/16 : 19
Fines 7% -1/16 : 7

(b) Gravel 5% +16 mm : 1
-16 +4 : 4
Sand 90% -4 +1 : 14
-1 +¼ : 53
-¼ +1/16 : 23
Fines 5% -1/16 : 5

Depth below surface ft	Fines -1/16	Percentages Sand +1/16-¼	+¼-1	+1-4	Gravel +4-16	+16
6 - 9	8	29	45	5	8	5
9 - 12	1	46	40	11	2	0
12 - 15	10	17	64	5	4	0
15 - 18	No grading information available					
18 - 21	8	8	51	11	8	14
21 - 24	8	7	62	16	10	7
26 - 29	6	9	52	8	9	16
29 - 32	5	11	71	8	4	1
32 - 35	5	6	86	1	1	1
35 - 38	4	18	75	3	0	0
38 - 41	6	31	48	12	2	1
41 - 44	4	20	53	19	4	0
44 - 47	6	21	48	22	3	0
47 - 50	3	34	47	14	0	2
50 - 53	7	24	39	20	8	2
53 - 56	0	38	35	18	9	0
56 - 59	4	18	50	22	6	0
59 - 62	3	34	41	14	6	2
62 - 65	7	26	40	21	5	1

TM 13 NW 24 1425 3832 Tattingstone, Suffolk

Surface level (+ 38.7 m) + 127 ft
Water struck at (+ 23.2 m) + 76 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (2.7 m) 9 ft
Mineral (2.5 m) 8 ft
Waste (2.1 m) 7 ft
Mineral (1.8 m) 6 ft
Waste (1.0 m) 3 ft
Mineral (8.2 m) 27 ft
Bedrock (0.9 m +) 3 ft +

			Thickness (m)	ft	Depth (m)	ft
Soil and subsoil			(0.9)	3	(0.9)	3
?Boulder Clay		Brown clay with flint pebbles.	(1.8)	6	(2.7)	9
Glacial Sand and Gravel	(a)	Sand Fine to medium brown sand with occasional flint and quartz pebble.	(0.9)	3	(3.6)	12
?Chillesford Beds	(b)	'Clayey' Pebbly Sand Fine to medium clayey sand with a trace of gravel.	(0.4)	1	(4.0)	13
		Grey clay with flint and quartz pebbles.	(0.3)	1	(4.3)	14
		Medium to coarse greyish brown sand with fine flint and quartz gravel.	(0.9)	3	(5.2)	17
		Brown, orange and grey clay, with some sand and quartz and and flint gravel in uppermost (0.3 m) 1 ft.	(2.1)	7	(7.3)	24
		Fine to medium light brown silty sand with seams of grey clay and occasional flint pebbles.	(1.8)	6	(9.1)	30
		Orange-brown sandy clay.	(1.0)	3	(10.1)	33
Red Crag	(c)	Pebbly Sand Fine to medium brown sand with a trace of subrounded to rounded flint gravel.	(5.4)	18	(15.5)	51
		Some fine and coarse, but mainly medium sand with shell fragments.	(2.8)	9	(18.3)	60
London Clay		Clay	(0.9+)	3+	(19.2)	63

		%	Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	One sample only		9 - 12	4	34	49	11	2	0
(b)	Gravel 11% +16 mm :	2	12 - 13	28	20	32	7	11	2
	-16 +4 :	9	14 - 17	15	8	45	13	16	3
			24 - 27	18	21	51	4	5	1

	Sand	69%	-4 +1	: 6	27 - 30	17	39	35	2	3	4
			-1 +$\frac{1}{4}$	: 41							
			-$\frac{1}{4}$ +1/16	: 22							
	Fines	20%	-1/16	: 20							
(c)	Gravel	5%	+16 mm	: 1	33 - 36	6	16	67	10	1	0
			-16 +4	: 4	36 - 39	5	53	32	5	3	2
					39 - 42	5	59	31	3	1	1
	Sand	90%	-4 +1	: 9	42 - 45	8	41	46	3	2	0
			-1 +$\frac{1}{4}$	: 46	45 - 48	5	49	43	3	0	0
			-$\frac{1}{4}$ +1/16	: 35	48 - 51	2	25	41	15	7	0
					51 - 54	3	25	45	17	8	2
	Fines	5%	-1/16	: 5	54 - 57	5	18	47	18	10	2
					57 - 60	3	19	56	12	9	1

TM 13 NW 26 1432 3549 Stutton, Suffolk

Surface level (+ 32.3 m) + 106 ft
Water struck at + 20 .3 m (+ 66.5 ft)
Pilcon shell, 6 inch diameter
December 1970

Overburden 1.0 m (3.5 ft)
Mineral 13.3 m (43.5 ft)
Bedrock 1.0 m + (3.5 ft+)

		Thickness m	Thickness (ft)	Depth m	Depth (ft)
Soil and clayey sub-soil		1.0	(3.5)	(1.0)	(3.5)
Glacial Sand and Gravel	(a) Sandy Gravel. Medium to coarse orange-brown sand and fine to coarse mainly angular to subrounded black flint and subrounded to rounded quartz and quartzite gravel. Rare pebbles of jasper. A 0.4 m silty clay, orange to grey-green is present at 2.4 m. Cobbles up to 100 mm.	10.8	(35.5)	11.8	(38.5)
Red Crag	(b) Pebbly Sand. Medium to coarse sand with some flint gravel.	1.0	(3.5)	12.8	(42)
	Fine, medium and coarse sand with shell fragments and a trace of gravel.	1.5	(5.0)	14.3	(47)
London Clay	Clay-brown becoming blue with depth.	1.0+	(3.0+)	15.3	(50)

(a) Gravel 40% +16 mm : 20
-16 +4 : 20

Sand 55% -4 +1 : 16
-1 +¼ : 30
-¼ +1/16 : 9

Fines 5% -1/16 : 5

(b) Gravel 8% +16 mm : 4
-16 +4 : 4

Sand 92% -4 +1 : 24
-1 +¼ : 45
-¼ +1/16 : 23

Fines 0% -1/16 : 0

Depth below surface m	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
1.0 - 2.0	13	20	45	10	9	3
2.0 - 2.4	No grading information available					
2.8 - 3.8	25	21	31	11	8	4
3.8 - 4.8	3	7	25	25	24	16
4.8 - 5.8	2	6	38	11	19	24
5.8 - 6.8	1	10	31	21	24	13
6.8 - 7.8	1	7	35	20	14	23
7.8 - 8.8	1	2	32	20	23	22
8.8 - 9.8	2	1	12	13	32	40
9.8 -10.8	0	3	9	15	28	45
10.8 -11.8	2	13	45	18	14	8
11.8 -12.8	0	18	39	33	7	3
12.8 -13.8	0	22	48	27	2	1
13.8 -14.3	0	29	48	11	4	8

TM 13 NW 27 1481 3961 Wherstead, Suffolk

Surface level (+ 43.6 m) + 143 ft
Water struck at (+ 23.5 m) + 77 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (2.7 m) 9 ft
Mineral (6.4 m) 21 ft
Waste (2.8 m) 9 ft
Mineral (9.1 m) 30 ft
Bedrock (1.2 m +) 4 ft +

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and subsoil		(0.9)	3	(0.9)	3
Boulder Clay	Brown clay with chalk and flint pebbles.	(1.8)	6	(2.7)	9
Glacial Sand (a) and Gravel	'Clayey' Sandy Gravel Fine to medium brown to orange-brown silty sand with fine to coarse gravel of angular to subrounded flint and subrounded to rounded quartz (and occasionally chalk) pebbles.	(6.4)	21	(9.1)	30
	Brown clay with flint pebbles.	(2.8)	9	(11.9)	39
Red Crag (b)	Pebbly Sand Medium sand becoming finer towards the base, orange-brown with flint gravel.	(7.3)	24	(19.2)	63
	Fine to medium brown sand with shell fragments.	(1.8)	6	(21.0)	69
London Clay	Clay	(1.2+)	4+	(22.2)	73

		%	Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	Gravel 23% +16 mm	12	9 - 12	26	32	17	5	9	11
	-16 +4	11	12 - 15	16	27	17	9	9	22
			15 - 21	No grading information available					
	Sand 62% -4 +1	9	21 - 24	12	37	37	5	6	3
	-1 +¼	27	24 - 27	7	8	37	19	18	11
	-¼ +1/16	26	27 - 30	No grading information available					
	Fines 15% -1/16	15							
(b)	Gravel 6% +16 mm	11	39 - 42	7	16	69	4	4	0
	-16 +4	5	42 - 45	5	8	56	11	12	8
			45 - 48	4	11	63	8	6	8
	Sand 89% -4 +1	10	48 - 51	3	29	63	3	2	0
	-1 +¼	53	51 - 54	4	32	59	3	2	0
	-¼ +1/16	26	54 - 57	7	25	47	15	6	0
			57 - 60	4	26	52	16	2	0
	Fines 5% -1/16	5	60 - 63	No grading information available					
			63 - 66	4	40	35	17	3	1
			66 - 69	4	46	33	15	2	0

TM 13 NW 28 1499 3573 Stutton, Suffolk

Surface level (+ 30.8 m) + 101 ft
Water struck at (+ 20.4 m) + 67 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (12.8 m) 42 ft
Bedrock (0.9 m +) 3 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and subsoil			(0.9)	3	(0.9)	3
Glacial Sand and Gravel	(a)	Sandy Gravel Fine to medium yellow sand, becoming orange-brown with depth, with gravel composed of angular to subrounded flint and rounded quartz. Gravel concentrated in lower half of the deposit.	(8.2)	27	(9.1)	30
Red Crag	(b)	Sand Dark orange-brown mainly medium sand with shell fragments.	(4.6)	15	(13.7)	45
London Clay		Clay	(0.9+)	3+	(14.6)	48

				%
(a)	Gravel	29%	+16 mm	: 17
			-16 +4	: 12
	Sand	66%	-4 +1	: 7
			-1 +¼	: 37
			-¼ +1/16	: 22
	Fines	5%	-1/16	: 5
(b)	Gravel	4%	+16 mm	: 1
			-16 +4	: 3
	Sand	92%	-4 +1	: 10
			-1 +¼	: 64
			-¼ +1/16	: 18
	Fines	4%	-1/16	: 4

Depth below surface ft	Percentages Fines -1/16	Fines +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	3	27	61	5	3	1
6 - 9	13	25	27	10	10	15
9 - 12	11	38	27	5	11	8
12 - 15	1	40	41	5	6	7
15 - 18	3	20	44	9	14	10
18 - 21	6	12	30	7	13	32
21 - 24	2	14	34	8	17	25
24 - 27	3	14	32	9	17	25
27 - 30	5	10	32	7	18	28
30 - 33	7	10	53	23	6	1
33 - 36	3	30	55	8	3	1
36 - 39	3	14	76	5	2	0
39 - 42	3	16	69	8	3	1
42 - 45	4	19	69	6	2	0

TM 13 NE 11 1565 3918 Freston Suffolk

Surface level (+ 39.9 m) + 131 ft
Water struck at (+ 22.6 m) + 74 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.6 m) 2 ft
Mineral (4.6 m) 15 ft
Waste (8.5 m) 28 ft
Mineral (7.0 m) 23 ft
Bedrock (0.9 m +) 3 ft +

			Thickness (m)	ft	Depth (m)	ft
Soil			(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a)	Pebbly Sand Medium to coarse red-brown sand with coarse subangular flint and fine rounded quartz gravel.	(3.7)	12	(4.3)	14
?Chillesford Beds	(b)	Pebbly Sand Green, yellow and brown silty sand with occasional pebbles.	(0.9)	3	(5.2)	17
		Pale green, occasionally yellow-brown silt. Abundent mica; occasional thin layers of green clay.	(8.5)	28	(13.7)	45
Red Crag	(c)	'Clayey' Sand Fine to medium sand, brown with layers of brown and red clay. Deposit greenish grey at (15.5 m) 51 ft to (16.5 m) 54 ft.	(6.4)	21	(20.1)	66
		Red-brown fine to medium sand with shell fragments.	(0.6)	2	(20.7)	68
London Clay		Blue clay.	(0.9+)	3+	(21.6)	71

			%	Depth below surface ft	Fines -1/16	Percentages Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	11% +16 mm	5	2 - 5	5	45	35	5	3	7
		-16 +4	6	5 - 8	7	16	47	7	10	13
				8 - 11	11	47	34	3	4	1
	Sand	81% -4 +1	7	11 - 14	8	13	60	12	6	1
		-1 +¼	44							
		-¼ +1/16	30							
	Fines	8% -1/16	8							
(b)	One sample only			14 - 17	8	29	46	9	6	2
(c)	Gravel	4% +16 mm	1	45 - 48	15	56	26	1	2	0
		-16 +4	3	48 - 51	11	40	48	1	0	0
				51 - 54	5	40	53	1	0	0
	Sand	84% -4 +1	3	54 - 57	2	38	58	1	1	0
		-1 +¼	48	57 - 60	16	31	41	8	3	1
		-¼ +1/16	33	60 - 63	18	27	48	4	3	0
				63 - 66	6	37	40	7	6	4
	Fines	12% -1/16	12	66 - 68	21	22	44	4	7	2

TM 13 NE 12 1575 3829 Freston, Suffolk

Surface level (+ 35.1 m) + 115 ft
Water struck at (+ 25.9 m) + 85 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (1.8 m) 6 ft
Mineral (8.6 m) 28 ft
Bedrock (0.9 m +) 3 ft +

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and subsoil (possibly Head)			(1.8)	6	(1.8)	6
Glacial Sand and Gravel	(a)	Pebbly Sand Medium to coarse yellow sand with gravel, brown and green clayey silt in basal (0.9 m) 3 ft.*	(3.1)	10	(4.9)	16
Red Crag	(b)	Pebbly Sand Sand: Red-brown, fine to medium sand, becoming chocolate-brown, medium to coarse in lower (0.9 m) 3 ft of the deposit.	(5.5)	18	(10.4)	34
London Clay		Blue clay.	(0.9+)	3+	(11.3)	37

				%	Depth below surface ft	Fines -/16	Fines +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	18%	+16 mm	: 10	6 - 9	9	24	55	5	5	2
			-16 +4	: 8	9 - 12	11	9	52	6	8	14
					12 - 15	9	2	57	9	10	13
	Sand	72%	-4 +1	: 7							
			-1 +¼	: 54							
			-¼ +1/16	: 11							
	Fines	10%	-1/16	: 10							
(b)	Gravel	5%	+16 mm	: 1	16 - 19	6	29	54	6	5	0
			-16 +4	: 4	19 - 22	5	48	29	6	8	4
					22 - 25	No grading information available					
	Sand	90%	-4 +1	: 9	25 - 28	2	55	33	7	3	0
			-1 +¼	: 42	28 - 31	13	30	47	7	3	0
			-¼ +1/16	: 37	31 - 34	10	21	47	19	3	0
	Fines	7%	-1/16	: 7							

* Possibly Chillesford Beds

TM 13 NE 13 1566 3701 Tattingstone, Suffolk

Surface level (+ 30.8 m) + 101 ft
Water struck at (+ 21.9 m) + 72 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.6 m) 2 ft
Mineral (10.0 m) 33 ft
Bedrock (0.9 m +) 3 ft +

Soil			Thickness (m)	ft	Depth (m)	ft
			(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a)	Sandy Gravel Medium, red-brown sand with subrounded to irregular flint gravel. Gravel fraction increasing with depth.	(2.7)	9	(3.3)	11
Red Crag	(b)	Pebbly Sand Medium to coarse chocolate-brown sand with bands of brown silty clay in upper (1.8 m) 6 ft.	(4.6)	15	(7.9)	26
		Medium to coarse sand with abundant shell fragments.	(2.7)	9	(10.6)	35
London Clay		Blue clay	(0.9+)	3+	(11.5)	38

				%	Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Gravel +1-4	Gravel +4-16	Gravel +16
(a)	Gravel	24%	+16 mm	8	2 - 5	4	19	57	8	7	5
			-16 +4	16	5 - 8	12	23	43	6	13	3
					8 - 11	8	12	30	7	26	17
	Sand	68%	-4 +1	7							
			-1 +¼	43							
			-¼ +1/16	18							
	Fines	8%	-1/16	8							
(b)	Gravel	5%	+16 mm	0	11 - 14	8	37	40	10	5	0
			-16 +4	5	14 - 17	8	36	44	7	5	0
					17 - 20	8	39	39	14	0	0
	Sand	88%	-4 +1	15	20 - 23	14	31	30	16	9	0
			-1 +¼	42	23 - 26	8	25	44	14	6	3
			-¼ +1/16	31	26 - 29	6	25	54	13	1	1
					29 - 32	3	20	50	24	3	0
	Fines	7%	-1/16	7	32 - 35	3	35	32	23	7	0

TM 13 NE 14 1551 3619 Stutton, Suffolk

Surface level (+26.5 m) + 87 ft
Water struck at +18.6 m (+ 61 ft)
Shell, 6 inch diameter
December 1970

Overburden 1.0 m (3.5 ft)
Mineral 8.0 m (26 ft)
Bedrock 0.5 m + (1.5 ft +)

			Thickness m	Thickness (ft)	Depth m	Depth (ft)
Soil and subsoil			1.0	(3.5)	1.0	(3.5)
Glacial Sand and Gravel	(a)	Sandy Gravel 1.5 m of silty, organge-brown, fine to medium sand with some white subangular flint gravel including some clay, passing down into 0.5 m gravel, followed by 2.0 m of gravel with sand, gravel here ranging from 60% of sample in upper 1.0 m to 31% below.	4.0	(13)	5.0	(16.5)
Red Crag	(b)	Pebbly Sand Fine to medium dark red-brown sand with a silty matrix, and mainly fine subangular to sub-rounded, flint and quartzite gravel.	2.0	(6.5)	7.0	(23.0)
		Medium to coarse sand with shell fragments. Small amount of subangular to subrounded flint gravel in upper 1.0 m, which also contains an iron-rich band.	2.0	(6.5)	9.0	(29.5)
London Clay		Brown to blue clay	0.5+	(1.5+)	9.5	(31.0)

				%
(a)	Gravel	27%	+16 mm	: 15
			-16 +4	: 12
	Sand	67%	-4 +1	: 11
			-1 +¼	: 40
			-¼ +1/16	: 16
	Fines	6%	-1/16	: 6
(b)	Gravel	17%	+16 mm	: 6
			-16 +4	: 11
	Sand	80%	-4 +1	: 18
			-1 +¼	: 46
			-¼ +1/16	: 16
	Fines	3%	-1/16	: 3

Depth below surface m	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
1.0 - 2.0	11	19	56	9	4	1
2.0 - 3.0	10	28	37	12	7	6
3.0 - 4.0	0	10	21	9	25	35
4.0 - 5.0	2	8	45	13	13	19
5.0 - 6.0	3	13	53	11	10	10
6.0 - 7.0	2	20	50	11	13	4
7.0 - 8.0	6	12	36	23	11	12
8.0 - 9.0	1	17	46	29	7	0

TM 13 NE 16 1664 3872 Freston, Suffolk

Surface level (+ 34.4 m) + 113 ft
Water struck at (+ 23.8 m) + 78 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.6 m) 2 ft
Mineral (12.5 m) 41 ft
Bedrock (0.3 m +) 1 ft +

Soil			Thickness (m)	Thickness ft	Depth (m)	Depth ft
			(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a)	Pebbly Sand Medium sand, orange-brown, with subrounded to rounded flint gravel.	(0.9)	3	(1.5)	5
Red Crag	(b)	'Clayey' Sand Medium, orange-brown sand with a little gravel passing down into fine to medium sand with a trace of gravel, then into yellow-brown fine sand with a small amount of angular to subangular flint gravel.	(10.1)	33	(11.6)	38
		Orange-brown medium sand with shell fragments and some gravel. Gravel angular to subangular flints. Percentage of shell fragments increasing with depth.	(1.5)	5	(13.1)	43
London Clay		Blue clay.	(0.3+)	1+	(13.4)	44

		%	Depth below surface ft	Fines -1/16	Percentages Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
(a)	One sample only (see opposite)		2 - 5	4	9	66	9	7	5
(b)	Gravel	2% +16 mm : 0	5 - 8	26	37	30	1	6	0
		-16 +4 : 2	8 - 11	32	50	15	0	3	0
			11 - 14	6	31	58	3	2	0
	Sand	86% -4 +1 : 4	14 - 17	4	57	37	1	1	0
		-1 +¼ : 42	17 - 20	9	46	42	2	1	0
		-¼ +1/16 : 40	20 - 23	3	62	28	4	1	2
			23 - 26	3	50	40	5	2	0
	Fines	12% -1/16 : 12	26 - 29	No grading information available					
			29 - 32	6	30	62	2	0	0
			32 - 35	8	32	58	1	1	0
			35 - 38	17	28	52	1	2	0
			38 - 41	14	33	44	7	2	0
			41 - 43	14	22	42	19	2	1

TM 13 NE 17 1666 3774 Freston, Suffolk

Surface level (+29.6 m) +97 ft
Water struck at (+23.5 m) +77 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (1.5 m) 5 ft
Mineral (1.9 m) 6 ft
Waste (1.8 m) 6 ft
Mineral (1.2 m) 4 ft
Bedrock (0.9 m+) 3 ft+

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil			(1.5)	5	(1.5)	5
Glacial Sand and Gravel	(a)	Pebbly Sand Yellow-brown fine sand with angular to subrounded flint gravel.	(1.9)	6	(3.4)	11
? Chillesford Beds		Fawn laminated clay.	(1.8)	6	(5.2)	17
Red Crag	(b)	'Clayey' Pebbly Sand Orange-brown medium sand with silty matrix, with angular to subangular flint gravel.	(1.2)	4	(6.4)	21
London Clay		Clay	(0.9+)	3+	(7.3)	24

			%
(a)	Gravel 21%	+16 mm :	6
		-16+4 :	15
	Sand 69%	-4+1 :	8
		$-1+\frac{1}{4}$:	26
		$-\frac{1}{4}+1/16$:	35
	Fines 10%	-1/16 :	10
(b)	Gravel 7%	+16 mm :	1
		-16+4 :	6
	Sand 81%	-4+1 :	7
		$-1+\frac{1}{4}$:	54
		$-\frac{1}{4}+1/16$:	20
	Fines 12%	-1/16 :	12

Depth below surface ft	Percentage Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Sand +4-16	Gravel +16
5 - 8	4	31	29	12	21	3
8 - 11	16	38	23	5	8	10
17 - 20	8	21	53	10	6	2
20 - 21	16	19	54	5	6	0

TM 13 NE 18 1705 3925 Freston, Suffolk

Surface level (+38.1 m) +125 ft
Water struck at (+19.2 m) +63 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.6 m) 2 ft
Mineral (22.3 m) 73 ft
Bedrock (0.3 m+) 1 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a) Pebbly Sand Red-brown sand, medium, becoming coarser with depth, with gravel. Gravel rounded to subrounded quartz and sub-angular flints. Rather silty towards the tip of the deposit.	(6.4)	21	(7.0)	23
?Chillesford Beds	(b) 'Clayey' Sand Medium sand, becoming finer with depth; red-brown at the top becoming yellow and green at (9.1 m) 30 ft with layers of green and brown clay. Deposit rather silty. A (0.3 m) 1 ft green clay band occurs at the top of the deposit.	(7.6)	25	(14.6)	48
Red Crag	(c) Sand Fine to medium red-brown sand becoming dark chocolate brown towards base. Occasional quartzite pebble.	(6.4)	21	(21.0)	69
	Medium red-brown sand with shell fragments and coprolites and phosphatic pebbles.	(1.9)	6	(22.9)	75
London Clay	Blue-grey clay	(0.3+)	1+	(23.2)	76

			%	Depth below surface ft	Fines -1/16	Percentage Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Sand +4-16	Gravel +16
(a) Gravel	14%	+16 mm	5	2 - 5	16	28	34	9	9	4
		-16+4	9	5 - 8	10	28	38	6	10	8
				8 - 11	10	33	42	6	6	3
		-4+1	9	11 - 14	13	10	59	8	7	3
Sand	78%	-1+$\frac{1}{4}$	50	14 - 17	5	11	51	10	14	9
		-$\frac{1}{4}$+1/16	19	17 - 20	2	11	62	11	12	2
				20 - 23	1	12	64	10	7	6
Fines	8%	-1/16	8							
(b) Gravel	2%	+16 mm	0	24 - 27	8	17	73	1	1	0
		-16+4	2	27 - 30	11	37	46	4	2	0
				30 - 33	12	47	31	5	3	2
		-4+1	2	33 - 36	11	64	23	1	1	0
Sand	87%	-1+$\frac{1}{4}$	23	36 - 39	11	73	15	0	1	0
		-$\frac{1}{4}$+1/16	62	39 - 42	15	45	37	1	2	0
				42 - 45	7	83	8	0	2	0
Fines	11%	-1/16	11	45 - 48	No grading information available					
(c) Gravel	4%	+16 mm	1	48 - 51	3	31	54	9	1	2
		-16+4	3	51 - 54	4	42	46	6	1	1
				54 - 57	No grading information available					

	-4+1 : 9	57 - 60	9	13	68	8	2	0
Sand 89%	-1+$\frac{1}{4}$: 57	60 - 63	10	15	70	3	2	0
	-$\frac{1}{4}$+1/16 : 23	63 - 66	7	19	55	16	0	3
		66 - 69		No grading information available				
Fines 7%	-1/16 : 7	69 - 72	4	24	50	11	7	2
		72 - 75	9	17	59	11	2	2

TM 13 NE 19 1793 3884 Woolverstone, Suffolk

Surface level (+35.1 m) +115 ft
Water struck at (+19.8 m) +65 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (1.5 m) 5 ft
Mineral (9.2 m) 30 ft
Waste (0.9 m) 3 ft
Mineral (6.7 m) 22 ft
Bedrock (0.3 m+) 1 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil		(1.5)	5	(1.5)	5
Glacial Sand and Gravel	(a) Pebbly Sand Fine to medium sand, orange-brown to yellow-brown, with angular to subangular white flint gravel.	(9.2)	30	(10.7)	35
	Blue brown clay with some sand and gravel (?boulder clay)	(0.9)	3	(11.6)	38
	(b) Pebbly Sand Medium sand, yellow to orange becoming orange-brown with depth. Gravel of fine sub-rounded flint.	(6.7)	22	(18.3)	60
London Clay	Clay	(0.3+)	1+	(18.6)	61

			%	Depth below surface ft	Fines -1/16	Percentage Sand +1/16-$\frac{1}{4}$	+$\frac{1}{4}$-1	+1-4	+4-16	+16
(a)	Gravel 13%	+16 mm	: 6	5 - 8	11	8	42	7	10	22
		-16+4	: 7	8 - 11	10	13	49	13	8	7
				11 - 14	8	12	63	8	7	2
	Sand 79%	-4+1	: 6	14 - 17	18	17	45	7	10	3
		-1+$\frac{1}{4}$	: 50	17 - 20	7	7	73	5	6	2
		-$\frac{1}{4}$+1/16	: 23	20 - 23	2	19	72	5	2	0
				23 - 26	4	33	56	5	2	0
	Fines 8%	-1/16	: 8	26 - 29	8	62	18	2	4	6
				29 - 32	8	26	38	5	12	11
				32 - 35	8	26	49	5	8	4
(b)	Gravel 20%	+16 mm	: 5	38 - 41	6	13	43	11	19	8
		-16+4	: 15	41 - 44	7	10	41	10	20	12
				44 - 47	3	9	60	10	16	2
	Sand 73%	-4+1	: 10	47 - 50	4	8	57	11	13	7
		-1+$\frac{1}{4}$	: 50	50 - 53	17	36	39	4	4	0
		-$\frac{1}{4}$+1/16	: 13	53 - 56	No grading information available					
				56 - 59	2	6	50	16	20	6
	Fines 7%	-1/16	: 7							

TM 13 NE 21 1813 3617 Holbrook, Suffolk

Surface level (+29.6 m) +97 ft
Water struck at (+23.5 m) +77 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (1.5 m) 5 ft
Mineral (7.6 m) 25 ft
Bedrock (0.3 m+) 1 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil		(1.5)	5	(1.5)	5
Glacial Sand and Gravel	Pebbly Sand Fine to medium yellow-brown sand with gravel. Gravel: mainly fine to concentrated in the upper (0.9 m) 3 ft and lower (3.0 m) 10 ft of the deposit. The upper gravels are made up of irregular flints; the lower contains a fine fraction of rounded quartz pebbles, and subrounded to irregular flints.	(7.6)	25	(9.1)	30
London Clay	Brown Clay	(0.3+)	1+	(9.4)	31

			%
Gravel	20%	+16 mm	: 8
		-16+4	: 12
Sand	76%	-4+1	: 5
		-1+$\frac{1}{4}$	: 41
		-$\frac{1}{4}$+1/16	: 30
Fines	4%	-1/16	: 4

Depth below surface ft	Fines	Sand			Gravel	
	-1/16	+1/16-$\frac{1}{4}$	+$\frac{1}{4}$-1	+1-4	+4-16	+16
5 - 8	8	21	29	5	11	26
8 - 11	No grading information available					
11 - 14	3	37	59	0	1	0
14 - 17	5	55	39	0	1	0
17 - 20	No grading information available					
20 - 23	2	28	48	3	12	7
23 - 26	2	22	45	9	15	7
26 - 29	No grading information available					
29 - 30	2	16	26	13	35	8

TM 13 NE 22 1819 3740 Woolverstone, Suffolk

Surface level (+31.7 m) +104 ft
Water struck at (+23.2 m) +76 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (9.8 m) 32 ft
Bedrock (0.3 m+) 1 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	Sandy Gravel Medium to coarse, brown and yellow sand with gravel. Gravel concentrated in upper (0.9 m) 3 ft and lower (5.8 m) 19 ft of the deposit. The upper gravels being composed of sub-rounded to subangular flints with occasional chalk pebbles, and the lower gravels of rounded to sub-rounded flints and rounded white quartz pebbles. A (0.3 m) 1 ft band of brown and grey clay with flints was found between (4.6 - 4.9 m) 15 - 16 ft.	(9.8)	32	(10.7)	35
London Clay	Clay	(0.3+)	1+	(11.0)	36

			%
Gravel	23%	+16 mm	: 10
		-16+4	: 13
Sand	69%	-4+1	: 9
		$-4+\frac{1}{4}$	: 45
		$-\frac{1}{4}+1/16$	: 15
Fines	8%	-1/16	: 8

Depth below surface ft	Percentage Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	11	10	36	13	17	13
6 - 9	11	29	54	4	2	0
9 - 12	No grading information available					
12 - 15	18	19	46	5	8	4
16 - 19	12	14	47	10	10	7
19 - 22	11	18	51	7	8	5
22 - 25	3	18	44	10	17	8
25 - 28	5	15	52	17	10	1
28 - 31	4	9	37	12	16	22
31 - 34	2	7	35	9	18	29
34 - 35	5	12	40	11	17	15

TM 13 NE 23 1845 3665 Holbrook, Suffolk

Surface level (+30.2 m) +99 ft
Water struck at (+25.9 m) +85 ft
Wirth B1, 8 inch diameter
May 1970

Overburden (1.5 m) 5 ft
Mineral (7.0 m) 23 ft
Bedrock (0.6 m+) 2 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil		(1.5)	5	(1.5)	5
Glacial Sand and Gravel	Pebbly Sand Fine to medium orange-brown silty sand with some subrounded flint gravel.	(3.7)	12	(5.2)	17
	Medium to coarse sand, orange-brown, with coarse gravel. Gravel of angular to subangular flint and subrounded quartzite.	(3.3)	11	(8.5)	28
London Clay	Blue-grey clay.	(0.6+)	2+	(9.1)	30

		%	Depth below surface ft	Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Gravel +1-4	Gravel +4-16	Gravel +16
Gravel 20%	+16mm	: 9	5 - 8	10	33	50	4	3	0
	-16+4	: 11	8 - 11	5	24	44	5	8	14
			11 - 14	2	58	38	0	2	0
Sand 76%	-4+1	: 7	14 - 17	2	46	50	1	1	0
	-1+$\frac{1}{4}$	: 41	17 - 20	3	24	47	7	10	9
	-$\frac{1}{4}$+1/16	: 28	20 - 23	2	15	38	14	21	10
			23 - 26	2	15	34	15	19	15
Fines 4%	-1/16	: 4	26 - 28	4	14	26	9	19	28

TM 13 NE 24 1873 3557 Harkstead, Suffolk

Surface level (+29.6 m) +97 ft
Water struck at (+27.1 m) +89 ft
Wirth B1, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (5.5 m) 18 ft
Bedrock (0.6 m+) 2 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil and sub-soil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	Pebbly Sand Medium sand, brown to yellow-brown with mainly fine gravel of subrounded black and white flint and rounded quartz. Some clay in top (0.9 m) 3 ft.	(5.5)	18	(6.4)	21
London Clay	Brown weathered clay.	(0.6+)	2+	(7.0)	23

		%	Depth below surface ft	Fines	Percentage Sand			Gravel	
				-1/16	+1/16-$\frac{1}{4}$	+$\frac{1}{4}$-1	+1-4	+4-16	+16
Gravel 12%	+16 mm	3	3 - 6	18	17	47	6	9	3
	-16+4	9	6 - 9	8	17	62	3	7	3
			9 - 12	5	20	57	8	7	3
	-4+1	7	12 - 15	7	31	46	7	7	2
Sand 79%	-1+$\frac{1}{4}$	54	15 - 18	3	12	58	10	14	3
	-$\frac{1}{4}$+1/16	18	18 - 21	12	9	55	7	10	7
Fines 9%	-1/16	9							

TM 13 NE 25 1876 3825 Woolverstone, Suffolk

Surface level (+31.4 m) +103 ft
Water struck at (+24.1 m) +79 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (10.7 m) 35 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	Pebbly Sand Medium to coarse sand, red-brown to yellow-brown, with a little fine to coarse gravel. Gravel of subrounded flints and rounded quartz and quartzite. A (0.6 m) 2 ft layer of red clay with flints is present at (2.7 m) 9 ft.	(4.3)	14	(5.2)	17
	Fine to medium yellow sand, with occasional flint pebbles. Top (0.9 m) 3 ft sand ochreous to red, containing thin layers of red clay.	(6.4)	21	(11.6)	38
London Clay	Brown clay turning blue with depth.	(0.9+)	3+	(12.5)	41

			%
Gravel	9%	+16 mm	3
		-16+4	6
Sand	86%	-4+1	5
		-1+¼	46
		-¼+1/16	35
Fines	5%	-1/16	5

Depth below surface ft	Percentage Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	No grading information available					
6 - 9	7	5	65	16	5	2
11 - 14	4	19	37	10	17	13
14 - 17	3	16	44	9	16	12
17 - 20	8	52	39	0	1	0
20 - 23	0	65	32	1	1	1
23 - 26	2	53	41	1	3	0
26 - 29	7	50	40	0	1	2
29 - 32	7	38	50	3	2	0
32 - 35	10	43	44	2	1	0
35 - 38	2	10	68	7	10	3

TM 13 NE 26 1938 3760 Chelmondiston, Suffolk

Surface level (+30.5 m) +100 ft
Water struck at (+20.7 m) +68 ft
Wirth B1, 8 inch diameter
May 1970

Overburden (2.4 m) 8 ft
Mineral (4.6 m) 15 ft
Waste (1.8 m) 6 ft
Mineral (4.6 m) 15 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil and made-ground		(2.4)	8	(2.4)	8
Glacial Sand and Gravel	(a) 'Clayey' Pebbly Sand Fine to medium sand with gravel. Gravel, composed of coarse angular flint, decreasing with depth. Sand orange-brown to yellow-brown.	(4.6)	15	(7.0)	23
	Orange-brown to light grey laminated clay.	(1.8)	6	(8.8)	29
	(b) Pebbly Sand Medium to coarse dark orange-brown sand with fine to coarse gravel of rounded to angular flint.	(4.6)	15	(13.4)	44
London Clay	Blue clay	(0.9+)	3+	(14.3)	47

			%	Depth below surface ft	Percentage Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
(a) Gravel	18%	+16 mm	: 7	8 - 11	7	5	36	16	26	10
		-16+4	: 11	11 - 14	14	24	39	4	12	7
				14 - 17	13	23	42	2	8	12
Sand	72%	-4+1	: 10	17 - 20	8	26	49	9	5	3
		-1+$\frac{1}{4}$	: 42	20 - 23	18	35	42	3	2	0
		-$\frac{1}{4}$+1/16	: 20							
Fines	10%	-1/16	: 10							
(b) Gravel	20%	+16 mm	: 8	29 - 32	13	20	40	9	12	6
		-16+4	: 12	32 - 35	5	18	44	10	9	14
				35 - 38	7	14	45	13	9	12
Sand	72%	-4+1	: 12	38 - 41	6	22	37	15	13	7
		-1+$\frac{1}{4}$	: 42	41 - 44	7	17	45	15	13	3
		-$\frac{1}{4}$+1/16	: 18							
Fines	8%	-1/16	: 8							

TM 13 NE 27 1996 3634 Harkstead, Suffolk

Surface level (+29.9 m) +98 ft
Water struck at (+17.7 m) +58 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (2.1 m) 7 ft
Mineral (15.0 m) 49 ft
Bedrock (0.6 m+) 2 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and clayey sub-soil		(2.1)	7	(2.1)	7
Glacial Sand and Gravel	(a) 'Clayey' Pebbly Sand Medium yellow-brown and orange-brown sand with fine to coarse gravel of angular to sub-angular flint. Deposit silty.	(5.5)	18	(7.6)	25
Red Crag	(b) 'Clayey' Sand Dark red-brown fine to medium sand with occasional flint pebbles.	(2.8)	9	(10.4)	34
	Red-brown medium sand with shell fragments. Rather silty.	(6.7)	22	(17.1)	56
London Clay	Clay	(0.6+)	2+	(17.7)	58

			%	Depth below surface ft	Fines	Sand			Gravel	
					-1/16	+1/16-¼	+¼-1	+1-4	+4-16	+16
(a) Gravel	19%	+16 mm	9	7 - 10	17	36	30	3	7	7
		-16+4	10	10 - 13	12	8	48	9	11	12
				13 - 16	8	8	72	4	8	0
Fines	70%	-4+1	5	16 - 19	21	19	42	1	6	11
		-1+¼	49	19 - 22	5	6	53	9	18	8
		-¼+1/16	16	22 - 25	1	21	48	7	10	13
Fines	11%	-1/16	11							
(b) Gravel	2%	+16 mm	1	25 - 28	11	28	44	13	2	2
		-16+4	1	28 - 31	28	24	46	2	0	0
				31 - 34	No grading information available					
Sand	87%	-4+1	8	34 - 37	8	36	47	7	2	0
		-1+¼	47	37 - 40	6	47	36	8	2	1
		-¼+1/16	32	40 - 43	6	27	57	8	2	0
				43 - 46	8	31	51	8	1	1
Fines	11%	-1/16	11	46 - 56	No grading information available					

TM 13 NE 28 1951 3551 Harkstead, Suffolk

Surface level (+28.0 m) +92 ft
Water struck at (+25.9 m) +85 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (1.8 m) 6 ft
Mineral (4.3 m) 14 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and clayey sub-soil		(1.8)	6	(1.8)	6
Glacial Sand and Gravel	'Clayey' Pebbly Sand Medium sand, orange-brown, silty, with some gravel. Gravel mainly fine, angular to subangular flint.	(4.3)	14	(6.1)	20
London Clay	Mottled brown and green clay becoming blue with depth.	(0.9+)	3+	(7.0)	23

		%	Depth below surface ft	Fines	Sand			Gravel	
				-1/16	+1/16-$\frac{1}{4}$	+$\frac{1}{4}$-1	+1-4	+4-16	+16
Gravel 16%	+16 mm	: 3	6 - 9	6	8	53	8	18	7
	-16+4	: 13	9 - 12	No grading information available					
			12 - 15	No grading information available					
Sand 64%	-4+1	: 6	15 - 18	31	2	32	5	3	2
	-1+$\frac{1}{4}$	: 40	18 - 20	22	11	34	5	17	1
	-$\frac{1}{4}$+1/16	: 18							
Fines 20%	-1/16	: 20							

TM 13 NE 29 1509 3732 Halbrook, Suffolk

Surface level (+35.4 m) +116 ft
Water struck at (+21.3 m) +70 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (17.4 m) 57 ft
Bedrock (0.3 m+) 1 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil and sub-soil		(0.9)	3	(0.9)	3
Red Crag	Sand Fine to medium red-brown sand, with occasional layers of brown and green silt. Some pebbles.	(15.6)	51	(16.5)	54
	Medium brown sand with shell fragments.	(1.8)	6	(18.3)	60
London Clay	Clay	(0.3+)	1+	(18.6)	61

		%
Gravel	1%	+16 mm : 0
		-16+4 : 1
Sand	92%	-4+1 : 5
		-1+¼ : 42
		-¼+1/16 : 45
Fines	7%	-1/16 : 7

Depth below surface ft	Percentage Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	No grading information available					
6 - 9	8	32	51	6	3	0
9 - 12	8	42	47	1	2	0
12 - 15	7	22	64	5	1	1
15 - 18	9	32	53	6	0	0
18 - 21	6	39	51	3	1	0
21 - 24	2	65	30	2	1	0
24 - 27	3	30	59	5	3	0
27 - 30	3	48	44	4	1	0
30 - 33	7	32	54	5	2	0
33 - 36	20	47	31	2	0	0
36 - 39	22	34	42	1	1	0
39 - 42	8	27	54	8	2	1
42 - 45	3	72	22	3	0	0
45 - 48	4	63	29	3	1	0
48 - 51	3	55	36	4	2	0
51 - 54	6	37	45	11	1	0

TM 13 SW 1 1025 3420 Brantham, Suffolk

Surface level (+36.6 m) +120 ft
Water struck at (+25.9 m) +85 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.6 m) 2 ft
Mineral (12.2 m) 40 ft
Bedrock (0.3 m+) 1 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a) 'Clayey' Pebbly Sand Orange-brown fine to medium sand with some fine grading to coarse gravel. Gravel mainly sub-rounded flint, concentrated in top (1.8 m) 6 ft. Fines increasing with depth, with a (0.3 m) 1 ft clay band at (3.4 m) 11 ft.	(4.0)	13	(4.6)	15
Red Crag	(b) Sand Dark orange-brown to red-brown fine to medium sand with some fine gravel. Gravel of subrounded flint.	(8.2)	27	(12.8)	42
London Clay	Blue clay	(0.3+)	1+	(13.1)	43

			%
(a)	Gravel	9% +16 mm	: 3
		-16+4	: 6
	Sand	72% -4+1	: 5
		$-1+\frac{1}{4}$	: 40
		$-\frac{1}{4}+1/16$	: 27
	Fines	19% -1/16	: 19
(b)	Gravel	4% +16 mm	: 1
		-16+4	: 3
	Sand	90% -4+1	: 6
		$-1+\frac{1}{4}$	: 54
		$-\frac{1}{4}+1/16$	: 30
	Fines	6% -1/16	: 6

Depth below surface ft	Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
2 - 5	5	8	74	5	4	4
5 - 8	8	3	52	13	17	7
8 - 11	39	29	28	1	3	0
12 - 15	23	70	6	0	1	0
15 - 18	8	35	50	5	2	0
18 - 21	6	22	67	4	1	0
21 - 24	5	26	40	14	14	1
24 - 27	10	30	58	1	1	0
27 - 30	5	18	74	2	1	0
30 - 33	No grading information available					
33 - 36	5	37	48	6	2	2
36 - 39	4	34	48	8	5	1
39 - 42	8	33	43	9	2	1

TM 13 SW 2 1178 3436 Brantham, Suffolk

Surface level (+34.7 m) +114 ft
Water struck at (+21.9 m) +72 ft
Wirth B0, 8 inch diameter
April 1970

Overburden (0.9 m) 3 ft
Mineral (14.0 m) 46 ft
Bedrock (0.6 m+) 2 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and sub-soil		(0.9)	3	(0.9)	3
Red Crag	Pebbly Sand Orange-brown to brown silty sand, fine to medium with some rounded brown flint gravel. Basal (1.5 m) 5 ft contains numerous black phosphatic pebbles.	(12.5)	41	(13.4)	44
	Fine to medium brown sand, rather silty with comminuted shells increasing with depth.	(1.5)	5	(14.9)	49
London Clay	Brown to blue clay	(0.6+)	2+	(15.5)	51

		%
Gravel 7%	+16 mm	: 2
	-16+4	: 5
Sand 86%	-4+1	: 7
	$-1+\frac{1}{4}$	: 38
	$-\frac{1}{4}+1/16$	: 41
Fines 7%	-1/16	: 7

Depth below surface ft	Fines	Sand			Gravel	
	-1/16	+1/16-$\frac{1}{4}$	+$\frac{1}{4}$-1	+1-4	+4-16	+16
3 - 6	12	77	9	1	0	0
6 - 9	2	26	56	8	5	3
9 - 12	10	22	46	10	6	6
12 - 15	13	30	50	4	2	1
15 - 18	0	87	11	2	0	0
18 - 21	No grading information available					
21 - 24	5	44	39	9	1	2
24 - 27	5	32	45	8	9	1
27 - 30	12	28	37	11	9	3
30 - 33	6	38	35	8	6	7
33 - 36	9	16	68	6	0	1
36 - 39	2	48	32	8	9	1
39 - 42	6	37	30	12	12	3
42 - 45	0	56	29	8	6	1
45 - 48	20	36	29	9	6	0
48 - 49	7	38	32	15	7	1

TM 13 SW 3 1228 3381 Brantham, Suffolk

Surface level (+18.0 m) +59 ft
Water struck at (+17.1 m) +56 ft
Wirth B1, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (3.7 m) 12 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil and subsoil		(0.9)	3	(0.9)	3
Valley Gravels (Terrace)	Sandy Gravel Medium orange-brown sand, rather silty with fine to coarse angular to subangular flint gravel.	(3.7)	12	(4.6)	15
London Clay	Brown clay becoming blue with depth	(0.9+)	3+	(5.5)	18

		%	Depth below surface ft	Fines	Percentage Sand			Gravel	
				-1/16	+1/16-$\frac{1}{4}$	+$\frac{1}{4}$-1	+1-4	+4-16	+16
Gravel 34%	+16 mm	: 14	3 - 6	11	6	36	10	21	16
	-16+4	: 20	6 - 9	6	8	37	9	23	17
			9 - 12	No grading information available					
Sand 60%	-4+1	: 9	12 - 15	2	5	57	8	16	10
	-1+$\frac{1}{4}$	: 44							
	-$\frac{1}{4}$+1/16	: 7							
Fines 6%	-1/16	: 6							

TM 13 SW 4 1248 3457 Brantham, Suffolk

Surface level (+34.7 m) +114 ft
Water struck at (+25.6 m) +84 ft
Wirth B1, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (17.1 m) 56 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil and sub-soil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	(a) Pebbly Sand Fine to medium orange-brown sand, rather silty, with angular to subangular flint gravel.	(7.3)	24	(8.2)	27
Red Crag	(b) Pebbly Sand Fine to medium orange-brown sand with some subangular flint gravel.	(7.3)	24	(15.5)	51
	Fine to medium brown sand with layers of brown clay. Shell fragments and a trace of gravel present. A (0.6 m) 2 ft layer of brown clay occurs at (16.5 m) 54 ft.	(2.5)	8	(18.0)	59
London Clay	Brown weathered clay	(0.9+)	3+	(18.9)	62

			%
(a) Gravel	8%	+16 mm	: 2
		-16+4	: 6
Sand	85%	-4+1	: 15
		$-1+\frac{1}{4}$	: 42
		$-\frac{1}{4}+1/16$	: 28
Fines	7%	-1/16	: 7
(b) Gravel	6%	+16 mm	: 1
		-16+4	: 5
Sand	88%	-4+1	: 13
		$-1+\frac{1}{4}$	: 37
		$-\frac{1}{4}+1/16$	: 38
Fines	6%	-1/16	: 6

Depth below surface ft	Percentage Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
3 - 6	0	31	45	16	6	2
6 - 9	8	14	48	12	10	8
9 - 12	8	18	61	8	5	0
12 - 15	No grading information available					
15 - 18	5	52	33	7	2	1
18 - 21	11	35	37	8	6	3
21 - 24	8	18	51	15	7	1
24 - 27	No grading information available					
27 - 30	4	34	46	14	2	0
30 - 33	5	43	33	14	4	1
33 - 36	3	42	38	12	4	1
36 - 39	5	44	32	15	4	0
39 - 42	11	20	48	13	6	2
42 - 45	No grading information available					
45 - 48	8	45	27	11	8	1
48 - 51	4	41	36	11	7	1
51 - 54	No grading information available					
54 - 56	No sample taken					
56 - 59	8	37	35	13	6	1

TM 13 SW 5 1375 3397 Stutton, Suffolk

Surface level (+29.6 m) +97 ft
Water struck at (+20.7 m) +68 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (1.5 m) 5 ft
Mineral (9.2 m) 30 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil and sub-soil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	Brown stoneless silt and clay	(0.6)	2	(1.5)	5
	Sandy Gravel Medium sand, yellow and red-brown with subangular to subrounded flint gravel. Rounded quartz up to 40 mm at base. Contains two (0.3 m) 1 ft bands of brown and green clay at (2.4 m) 8 ft and (7.3 m) 24 ft.	(9.2)	30	(10.7)	35
London Clay	Blue clay.	(0.9+)	3+	(11.6)	38

Gravel 35% +16 mm : 20
-16+4 : 15

Sand 58% -4+1 : 8
-1+¼ : 36
-¼+1/16 : 14

Fines 7% -1/16 : 7

Depth below surface ft	Fines	Sand			Gravel	
	%					
	-1/16	+1/16-¼	+¼-1	+1-4	+4-16	+16
5 - 8	22	19	36	6	9	8
8 - 9	No sample taken					
9 - 12	6	14	41	6	10	23
12 - 15	3	9	36	5	15	32
15 - 18	No grading information available					
18 - 21	5	37	41	3	7	7
21 - 24	6	18	35	9	15	17
24 - 25	No sample taken					
25 - 28	4	6	27	14	29	20
28 - 31	7	9	41	9	14	20
31 - 34	5	6	32	9	16	32
34 - 35	8	6	30	10	23	23

TM 13 SW 6 1416 3331 Stutton, Suffolk

Surface level (+10.1 m) +33 ft
Water struck at (-0.6 m) -2 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (1.5 m) 5 ft
Mineral (10.1 m) 33 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil, passing into red silt		(1.5)	5	(1.5)	5
River Terrace Gravel	Gravel Predominantly coarse rounded to subrounded flint gravel; some rounded quartz, subordinate to flint. Sand yellow, mainly medium to coarse.	(10.1)	33	(11.6)	38
London Clay	Blue clay	(0.9+)	3+	(12.5)	41

			%
Gravel	60%	+16 mm :	37
		-16+4 :	23
Sand	35%	-4+1 :	9
		$-1+\frac{1}{4}$:	20
		$-\frac{1}{4}+1/16$:	6
Fines	5%	-1/16 :	5

Depth below surface ft	Percentages Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
5 - 8	16	32	20	7	22	3
8 - 11	No grading information available					
11 - 14	5	3	19	13	36	24
14 - 17	6	3	16	8	25	42
17 - 20	4	4	18	8	18	48
20 - 23	5	3	18	14	25	35
23 - 26	2	1	9	6	10	72
26 - 29	8	4	36	6	24	22
29 - 32	2	2	14	7	24	51
32 - 35	2	5	26	14	27	26
35 - 38	3	4	16	8	25	44

TM 13 SW 7 1493 3451 Stutton, Suffolk

Surface level (+30.8 m) +101 ft
Water struck at (+18.6 m) +61 ft
Wirth B1, 8 inch diameter
May 1970

Overburden (4.9 m) 16 ft
Mineral (10.0 m) 33 ft
Bedrock (0.3 m+) 1 ft+

			Thickness (m)	ft	Depth (m)	ft
Soil			(0.3)	1	(0.3)	1
Glacial Sand and Gravel		Brown silty clay with a (0.9 m) 3 ft layer of sand at (1.8 m) 6 ft.	(4.6)	15	(4.9)	16
	(a)	Sandy Gravel Fine to medium yellow to orange-brown sand becoming darker with depth. Gravel fine to coarse, angular to subangular flints, percentage increasing with depth.	(8.2)	27	(13.1)	43
Red Crag	(b)	Pebbly Sand Orange-brown medium sand with shell fragments and a trace of angular to subangular flint gravel.	(1.8)	6	(14.9)	49
London Clay		Brown weathered clay.	(0.3+)	1+	(15.2)	50

				%
(a)	Gravel	22%	+16 mm	10
			-16+4	12
	Sand	69%	-4+1	5
			$-1+\frac{1}{4}$	39
			$-\frac{1}{4}+1/16$	25
	Fines	9%	-1/16	9
(b)	Gravel	7%	+16 mm	3
			-16+4	4
	Sand	88%	-4+1	4
			$-1+\frac{1}{4}$	56
			$-\frac{1}{4}+1/16$	28
	Fines	5%	-1/16	5

Depth below surface ft	Percentages Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
16 - 19	18	36	34	0	12	0
19 - 22	No grading information available					
22 - 25	7	34	35	2	14	8
25 - 28	10	20	53	5	5	7
28 - 31	9	20	45	6	9	11
31 - 34	12	28	31	6	13	10
34 - 37	8	14	33	6	20	19
37 - 40	0	20	40	9	20	11
40 - 43	6	10	45	7	13	19
43 - 46	5	28	56	4	4	3
46 - 49	No grading information available					

TM 13 SE 4 1575 3453 Stutton, Suffolk

Surface level (+29.6 m) +97 ft
Water struck at (+24.4 m) +80 ft
Wirth B0, 8 inch diameter
May 1970

Overburden (0.6 m) 2 ft
Mineral (6.4 m) 21 ft
Bedrock (0.6 m+) 2 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	Sandy Gravel Fine to medium yellow-brown sand becoming coarser and darker with depth. Gravel of rounded to sub-rounded flint and rounded quartz, fine at top becoming coarser and more angular with depth.	(6.4)	21	(7.0)	23
London Clay	Brown to blue clay.	(0.6+)	2+	(7.6)	25

			%	Depth below surface ft	Fines -1/16	Sand +1/16-$\frac{1}{4}$	Sand +$\frac{1}{4}$-1	Sand +1-4	Gravel +4-16	Gravel +16
Gravel	30%	+16 mm	: 13	2 - 5	12	26	17	9	31	6
		-16+4	: 17	5 - 8	2	21	52	9	13	3
				8 - 11	3	27	45	6	10	9
Sand	65%	-4+1	: 8	11 - 14	2	18	40	4	13	23
		-1+$\frac{1}{4}$	: 36	14 - 17	No grading information available					
		-$\frac{1}{4}$+1/16	: 21	17 - 20	7	12	26	13	17	25
				20 - 23	No grading information available					
Fines	5%	-1/16	: 5							

TM 13 SE 5 1805 3477 Harkstead, Suffolk

Surface level (+22.3 m) +73 ft
Ground water conditions not recorded
Wirth B1, 8 inch diameter
May 1970

Overburden (0.6 m) 2 ft
Mineral (3.7 m) 12 ft
Bedrock (1.2 m+) 4 ft+

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	Pebbly Sand Medium brown sand, rather silty with rounded brown flint and white quartz gravel. Very little gravel at base.	(3.7)	12	(4.3)	14
London Clay	Brown to blue clay.	(1.2+)	4+	(5.5)	18

			%	Depth below surface ft	Fines -1/16	Sand +1/16-¼	Sand +¼-1	Sand +1-4	Gravel +4-16	Gravel +16
Gravel	9%	+16 mm	5	2 - 5	No grading information available					
		-16+4	4	5 - 8	6	17	56	8	10	3
				8 - 11	8	25	50	5	1	11
Sand	83%	-4+1	6	11 - 14	9	39	44	6	2	0
		-1+¼	50							
		-¼-1/16	27							
Fines	8%	-1/16	8							

TM 13 SE 6. 1919 3469 Harkstead, Suffolk

Surface level (+19.8 m) +65 ft
Ground water conditions not recorded
Wirth B1, 8 inch diameter
May 1970

Overburden (0.9 m) 3 ft
Mineral (2.5 m) 8 ft
Bedrock (1.2 m+) 4 ft+

		Thickness (m)	ft	Depth (m)	ft
Clayey soil and sub-soil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	Sandy Gravel Medium brown sand with rounded flint gravel becoming coarse with medium sand at depth.	(2.5)	8	(3.4)	11
London Clay	Blue clay.	(1.2+)	4+	(4.6)	15

		%	Depth below surface ft	Fines -1/16	Percentages Sand +1/16-¼	+¼-1	+1-4	Gravel +4-16	+16
Gravel 47%	+16 mm	: 28	3 - 6	10	16	39	7	17	11
	-16+4	: 19	6 - 9	2	7	29	9	14	39
			9 - 11	7	9	17	9	25	33
Sand 49%	-4+1	: 8							
	-1+¼	: 28							
	-¼+1/16	: 11							
Fines 6%	-1/16	: 6							

TM 13 SE 8 1970 3365 Harkstead, Suffolk

Surface level (+13.7 m) +45 ft
Water struck at (+12.6 m) +41.5 ft
Pilcon shell, 8 inch diameter
December 1970

Overburden 0.3 m (1.0 ft)
Mineral 2.0 m (6.5 ft)
Bedrock 3.3 m+ (11.0 ft+)

		Thickness m	(ft)	Depth m	(ft)
Soil		0.3	(1.0)	0.3	(1.0)
River Terrace Gravel	Gravel Yellow fine to coarse gravel with coarse yellow sand. Gravel angular to subrounded flint and subrounded to rounded quartz. Quartz mainly in finer fraction.	2.0	(6.5)	2.3	(7.5)
London Clay	Brown-red weathered clay.	3.3+	(11.0+)	5.6	(18.5)

			%	Depth below surface m	Fines -1/16	Percentages Sand +1/16-¼	+¼-1	+1-4	Gravel +4-16	+16
Gravel 69%	+16 mm	:	38	0.3 - 1.3	1	1	8	23	37	30
	-16+4	:	31	1.3 - 2.3	1	2	15	10	26	46
Sand 30%	-4+1	:	17							
	-1+¼	:	11							
	-¼+1/16	:	2							
Fines 1%	-1/16	:	1							

Dd. 505157 K 16

Printed in England for Her Majesty's Stationery Office
by Unwin Brothers Limited, The Gresham Press, Old Woking, Surrey

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INSTITUTE OF GEOLOGICAL SCIENCES

MINERAL ASSESSMENT UNIT

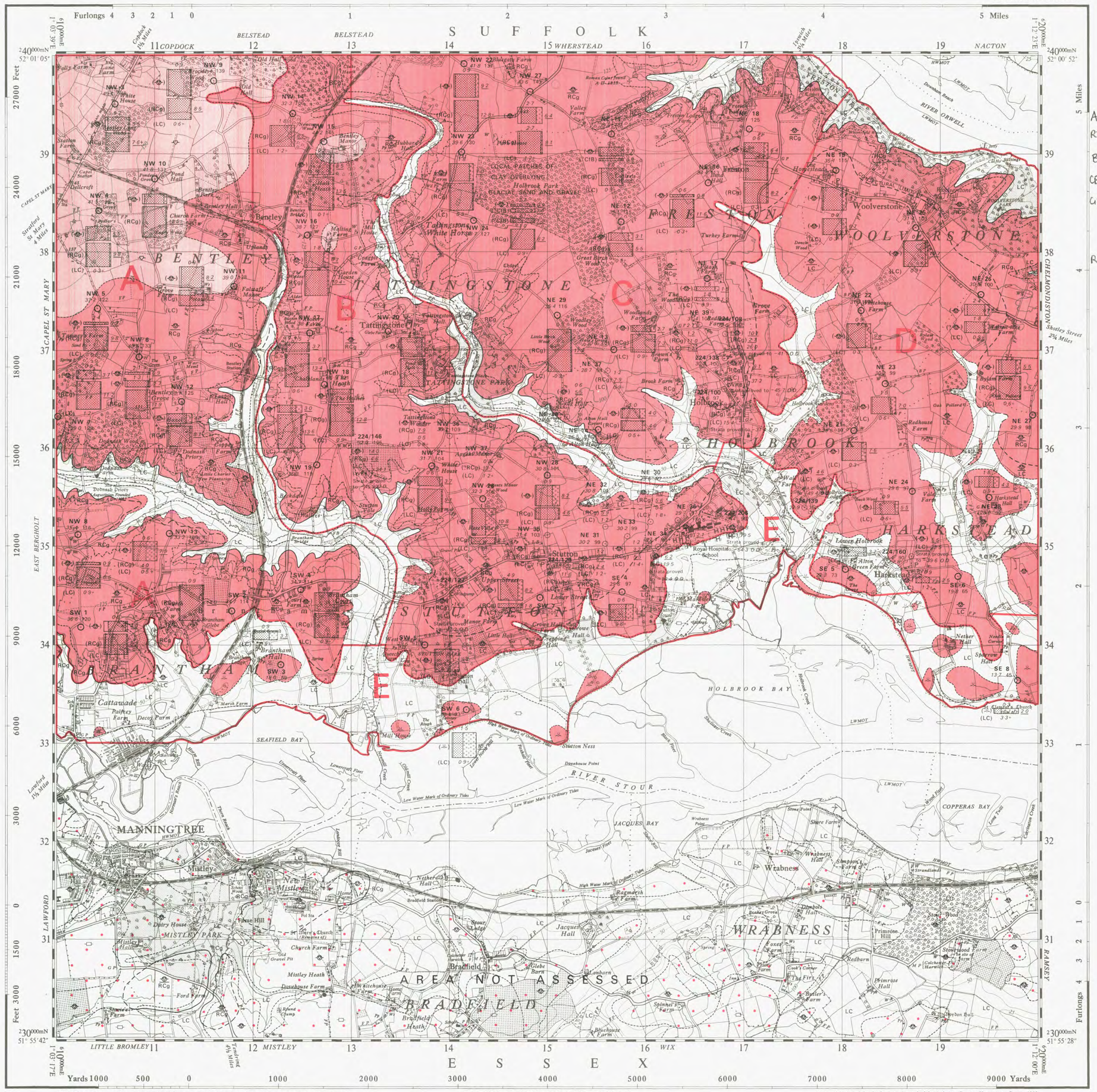
THE SAND AND GRAVEL RESOURCES OF SHEET TM 13 (TATTINGSTONE, SUFFOLK)

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

ORDNANCE SURVEY
SHEET TM13
PROVISIONAL EDITION

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

11



EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

A-2	~	**Alluvium**
RT-3	⊻	**River Terrace Deposits** (undifferentiated) - flint and quartz gravel with medium to coarse sand.
B-3	▭	**Brickearth** (undifferentiated) - laminated silt and clay.
CBC-2	⊹	**Chalky Boulder Clay** - stiff brown and bluish-grey with chalk and flint pebbles.
GS-3	(◈)	**Glacial Sand and Gravel** - yellow to brown medium sand with flint and quartz gravel.

RECENT AND PLEISTOCENE

SOLID

	?CIB	**Chillesford Beds (of Chillesford)** - micaceous green and brown clay, silt and sand with some gravel (proved in boreholes only).
RC-3	RCg ✓	**Red Crag** - fine to medium red-brown sand with shells in the lower part.
	CCg	**Coralline Crag** - buff and yellow sand with variable shell material often cemented.
	LC ✓	**London Clay** - stiff blue-grey clay, weathering to brown, with occasional cementstones.
	WRB	**Woolwich and Reading Beds** - variagated clay and sand (proved in boreholes only).

PLIOCENE

EOCENE

BOUNDARY LINES

- Geological boundary, Drift.
- Geological boundary, Solid. Broken line denotes uncertainty.
- Resource Block boundary.

BOREHOLE DATA

SITE LOCATIONS

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

M.A.U. BOREHOLES

Borehole Registration Number → NW 27
43·6 143 ← Surface level in metres and feet above O.D. (Newlyn)
Borehole Site →
Grading Diagram →
2·7 ← Overburden
6·4 ← Mineral (sand and gravel)
2·7 ← Waste
Geological Classification → (RCg) 9·1 ← Mineral (sand and gravel)
(LC) 1·2+ ← Bedrock

Note:
1. Figures underlined denote thicknesses used in the assessment of resources.
2. The + sign indicates that the base of the deposit was not reached.
3. The figures in *italics* are conversions to metres of measurements recorded in feet.
4. The Geological Classification is given only for mineral and bedrock.

Borehole Registration Number

Each M.A.U. borehole is indentified by a Registration Number, eg. NW 27. The letters refer to the quarter sheet and the figures to the I.G.S. serial number for that quarter. The unigue designation for borehole NW 27 is TM 13 NW 27.

Grading Diagrams

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

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

The widths of the divisions show the proportions of **Fines** **Sand** and **Gravel**

OTHER BOREHOLES

The layout of information is the same as for M.A.U. boreholes, although data available may not be as comprehensive. They are registered in the same series, except for records in the Hydrogeological Department: for example, **224/206** signifies Hydrogeological Department borehole 206 on New Series One-Inch Geological Sheet 224.

CATEGORIES OF DEPOSITS

- **Exposed sand and gravel, as mapped and assessed.** CAT-E4
- **Continous or almost continuous spreads of mineral beneath overburden.** CAT-C1
- **Sand and gravel either not potentially workable (see Report) or absent.** CAT-A2
- **Sand and gravel not assessed (at surface and beneath overburden).** CAT-N2

RESOURCE BLOCKS

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

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

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

Geological lines from a one-inch survey by W. Whitaker and W. H. Dalton, published on Old Series Sheets 48 NW and NE in 1882. Transferred in part to New Series Sheet 207 with minor corrections and published in 1927. Minor additions and corrections by S. E. Hollyer 1972. S. C. A. Holmes, District Geologist.

Sand and Gravel Survey by R. Allender, S. E. Hollyer and S. J. Booth in 1970. R. G. Thurrell, Head, Mineral Assessment Unit.

1:25 000 Sand and Gravel Resource Sheet published 1974.
Sir Kingsley Dunham, D.Sc., F.R.S., Director, Institute of Geological Sciences, incorporating the Geological Survey of Great Britain, the Museum of Practical Geology and Overseas Geological Surveys.
2050/74

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

Compiled from 6" sheets last fully revised 1902-25. Other partial systematic revision 1938-54 has been incorporated.

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.

Diagram showing the relation of the National Grid 1:25 000 sheets with the One-Inch Geological sheets 207, 208, 224, and 225.

Made and published by the Director General of the Ordnance Survey, Chessington, Surrey, 1955.

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