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FOR THE ATTENTION OF Mr. C. PLACE, SOUTH EASTERN ARCHAEOLOGICAL SERVICES.

A GEOARCHAEOLOGICAL EVALUATION OF THE PROPOSED A259, BROOKLANDS DIVERSION

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GEOARCHAEOLOGICAL SERVICE FACILITY
SITE ASSESSMENT REPORT 95/01.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

This study was designed to assess the nature of the stratigraphic sequences present beneath the proposed route-corridor for the A259 Brooklands Diversion. Emphasis was placed on assessing i) the nature and location of the palaeoenvironmental sequences in the area, ii) the potential for identified sequences to contain evidence for buried landsurfaces, iii) the identification of any units likely to contain archaeology and iv) the likely scheme impact on the sequences identified in the area. Eleven test pits, three inspection pits and five borehole logs were examined and assessed in this study.

The stratigraphic sequences observed conform in part with previously published data from the area. Study of the geotechnical logs suggested that buried landsurfaces are preserved in the area (both within and above the peat) and that the palaeoenvironmental potential of the sediments is high. The route corridor crosses a sequence of sediment interpreted as channel marginal marshland through channel edge stratigraphies and into channel fill stratigraphies. Three Areas of Geoarchaeological Interest (AGI's) have been defined and discussed.

The report is, however, limited both in detail and scope by the depth of the excavated test pits and an abscence of detailed knowledge regarding the construction methods to be employed. The following additional stages of work are therefore recommended:

1. Drilling, at two locations, to recover stratigraphic sequences and samples for areas below the zone of direct impact of the scheme. This is necessary inorder to determine the significance of the sequences lying within the zone of disturbance.

2. Excavation/test pitting in areas of high archaeological and palaeoenvironmental potential, which coincide with high engineering to record and investigate sequences lying within the zone of disturbance.

3. Laboratory based assessment of recovered samples to produce a time calibrated model for sequence development of the area impacted by the route corridor. This will necessitate radiometric dating of key horizons (^{14}C or OSL), preliminary stratigraphic/sedimentological descriptions to provide facies data and microfossil determinations to characterise key stratigraphic units.

1.0 INTRODUCTION

This study was commissioned by Mr.Chris Place of South Eastern Archaeological Services (SEAS) as part of an SEAS response to a brief set out by Kent County Council Planning Department Archaeological Division. The route-corridor lies within Walland Marsh to the south of Appledore and runs from Hamilton Farm (TQ 9845 2550) to Pepperland Nursery (TQ 9930 2605) through the village of Brooklands. Preliminary archaeological desk-top evaluation has been undertaken (Eddison, 1992a) and the current report represents a geoarchaeological assessment report of the route-corridor.

The study is based on an evaluation of a set of geotechnical borehole, test pit and inspection pit logs provided by Kent County Council Highways Department (Appendix I) and drainage and service ditches drawing plans 7247/107 and 7247/108. No fieldwork was undertaken as part of this assessment.

The report was written after examination of the report produced by Eddison (1992a), study of previous extant data sources (e.g. Smart, *et al.*, 1966; Green, 1968; Eddison, 1983; various papers in Eddison and Green, 1988; Innes and Long, 1992; Long and Innes, 1993) and the study of geoarchaeological assessment reports produced by the GSF for areas of modification to the A259 to the east (Bates, 1994a and b; Bates and Barham, 1994; Bates *et al.*, 1994).

2.0 AIMS AND OBJECTIVES OF THE STUDY

In order to enable this study to be undertaken the borehole and test pit logs were studied and an attempt was made to integrate this data with known geological and archaeological information within a geomorphological framework. Eleven test pits, three inspection pits and five boreholes were examined along the route corridor length of approximately 1.2km (Figure 1 - see Appendix I for borehole and test pit locations). The route corridor traversed the boundary between the Snargate Series and the Snargate-Finn Complex of soils typifying Creek Ridge systems, as mapped by Green (1968), and given the likely complex history of infilling of the area the interpretation presented in this study are likely to be over simplified. At the outset it was decided that this study should:

1. Examine the borehole and test pit stratigraphies to attempt to define the range of environments of deposition and time periods represented in the study area.

2. Discuss the nature of landscape change through time based on previous work and general geomorphological principles with particular reference to areas of the landscape where investigation may produce palaeoenvironmental sequences and evidence for human occupation and utilisation of the landscape.

3. Formulate recommendations for fieldwork along the route corridor where the engineering scheme will impact on sequences and areas of potential archaeology.

4. To recommend laboratory based procedures for assessing any recovered core/monolith material from the fieldwork phase.

5. Attempt to place potential discoveries in the area within a local, regional and national context.

Background data (geology, geomorphology, archaeology and the engineering background) is presented in Section 3.0 and stratigraphies along the route corridor are described in Section 4.0. This information is discussed in Section 5.0 and recommendations for further work made in Section 6.0. Conclusions are presented in Section 7.0.

2.1 Assessment of impact and the significance of archaeological sequences

Before areas of impact of engineering works on archaeological and palaeoenvironmental sequences are made it is important to define the criteria on which the significance of the archaeological and palaeoenvironmental records can be assessed. Likely types of engineering impact are discussed in Section 3.4 and the nature of the archaeological and palaeoenvironmental record in Section 4.2. A number of criteria can be used to assess significance of sequences (N.B. these include criteria listed in Annex 4, of PPG 16 - Department of the Environment, 1990). These criteria can be listed:

1. Are the sequences likely to be well preserved or poorly preserved? **(Annex 4, PPG 16 - DoE, 1990)**

2. Are the sequences likely to be well stratified, poorly stratified or non-stratified?

3. Are the sequences likely to be ecotonal and therefore of importance to humans?

4. Are the sequences rare or abundant? **(Annex 4, PPG 16 - DoE, 1990)**

5. Are the sequences fragile or robust? **(Annex 4, PPG 16 - DoE, 1990)**

6. Are the sequences variable or homogenous?

7. Are the sequences poorly known and/or understood, moderately well known or well known?

8. Is the impact to be major or minor?

9. Are well articulated research objectives available or are research objectives poorly articulated?

10. Is the importance local, regional, national or international?

11. Can material be reasonably obtained or will material prove difficult to recover?

12. Is the archaeology of the area well known or poorly known?

13. Are archaeologically or palaeoenvironmentally significant sequences likely to be encountered?

14. Is there or is there not an amenity value to the sequences?

15. Is there or is there not a conservation/education value to the sequences?

Clearly these criteria cannot always be applied to any area or given set of sequences and the interpretation of levels of importance will often depend on an individuals level of expertise and areas of prime interest. However, these criteria provide a basis on which discussion may be based.

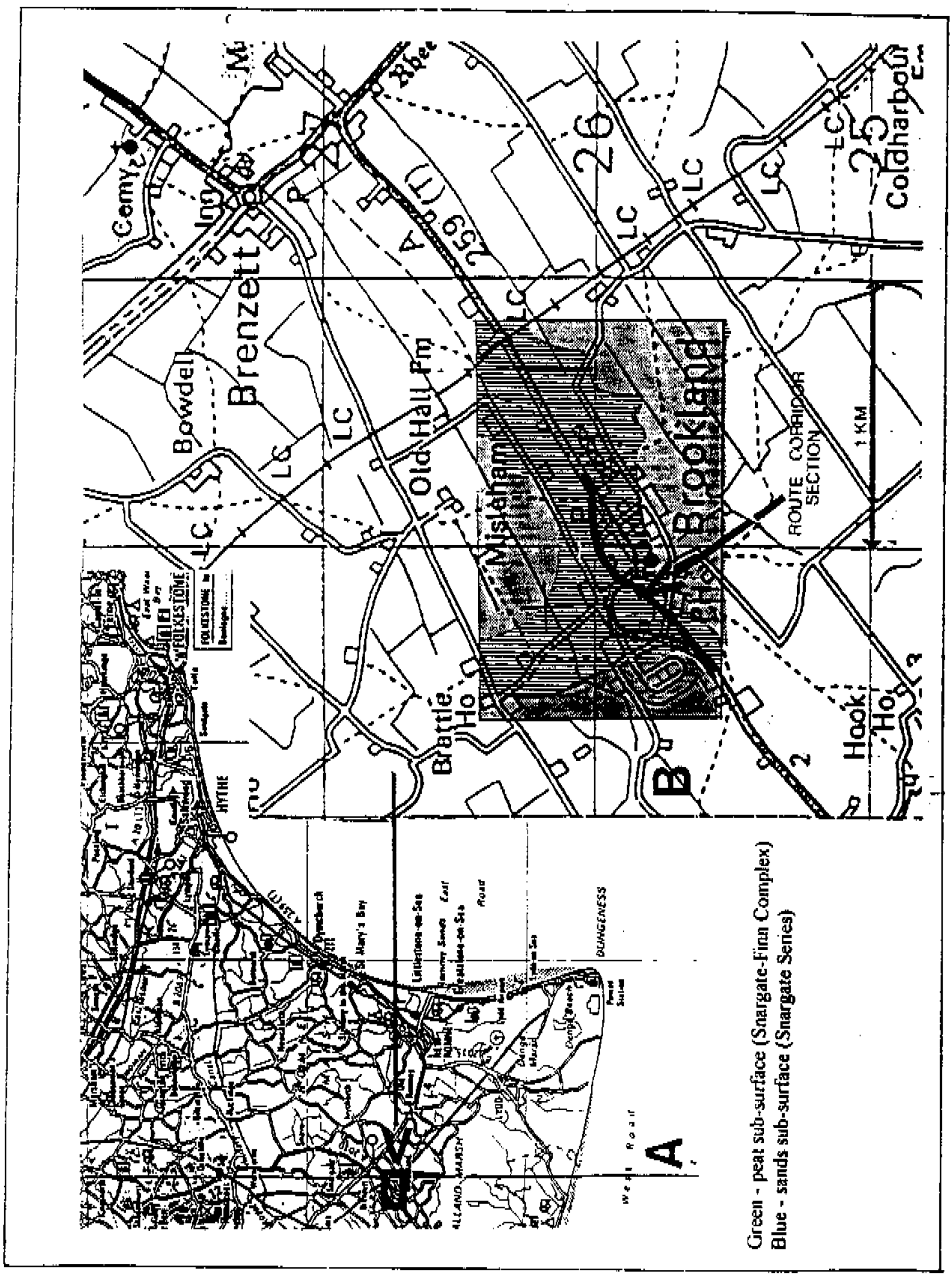

Figure 1. Site location of route corridor for proposed A259 Brooklands Diversion.

3.0 BACKGROUND TO THE STUDY

Early research into the origins of Romney Marsh are summarised by Lewis (1932, 1937), Lewis and Balchin (1940), Steers (1964), Smart *et al.* (1966) and Green (1968). More recently Eddison (1983), Waller *et al.* (1988), Burrin (1988), Tooley and Switzur (1988), Green (1988), Innes and Long (1992) and Long and Innes (1993) have all discussed landscape change in the area. The role of human activity in the marsh area and the role of past societies in altering or modifying patterns of landscape evolution has also been examined and much of this work is summarised in a monograph edited by Eddison and Green (1988). In addition to these works a series of studies along the route corridor for the proposed A259 by-passes to the east of New Romney have been carried out by the GSF (Bates, 1994a and b; Bates and Barham, 1994; Bates, Barham and Roberts, 1994).

3.1 Regional geology and geomorphology

The area occupied by Romney Marsh (Figure 1) lies to the south of the Weald and represents an area of major sediment accumulation during the last 10 thousand years. The interaction between changes in sea-level, patterns of sedimentation, isostatic history, river catchment changes and human occupation resulted in the development of landforms and associated Holocene[1] stratigraphies of great complexity. Generalised statements applicable to the whole area regarding sequence generation, geomorphological change, human activities and the impact of development are therefore of limited value to an archaeologically predictive model.

Today the area generally lies below +5m O.D. and is drained by a series of sewers and drainage ditches. These may, in part, reflect the spatial pattern of former (now relict) creek systems. A large canal (the Royal Military Canal) runs around the inland side of the marsh. Land reclamation and sea defences have largely stabilised the modern environment and extensive gravel deposits are visible in the Dungeness Foreland area. Infilling of the marshland behind the gravel beach barriers appears to have been an episodic process and differences in carbonate content of the soils and drainage patterns suggest the presence of open water in parts of the area until at least the Medieval period (Green, 1988). Closer study of the historical record would, in part, allow calibration of this where due to marsh reclamation (see Eddison 1992b and c).

Bedrock geology lies at depths in excess of -10.0m O.D. in the vicinity of the route corridor and only outcrops at the surface more than 6km to the north of the area of investigation at the relict cliff line inland of the Royal Military Canal. Rockhead contacts dip steeply from the relict cliff line southwards towards Dungeness where bedrock was not reached below the power station in boreholes penetrating to depths in excess of -30m O.D. (Greensmith and Gutmanis, 1990). The stratigraphic sequences present below the marsh (a wedge shaped stack thinning to the north) are a complex of peats, sands, silts, clays and gravels deposited in response to rising sea-level and the interplay between

[1]Holocene refers to the time interval since the last cold or glacial period ended 10,000 years ago.

patterns of coastal deposition/erosion, fluvial activity associated with channels of rivers entering the area from the highground of Kent and East Sussex and marshland development in areas of impeded drainage.

Extensive data sources exist for stratigraphic sequences lying between -6.0m O.D. and the modern marsh surface. However, deeper sequences below -6m O.D. are poorly understood. Sequences lying between the modern marsh surface and depths of 6 to 8m have been described at a number of sites and previous work by Green (1968) suggested that four lithological associations may occur in the area of investigation (Table 1).

SEDIMENT ASSOCIATION	LIKELY ENVIRONMENTS OF DEPOSITION	AGE ESTIMATES
Young Alluvium	Low energy brackish to freshwater conditions	<2200 yrs B.P.
Peat	Marine marginal salt marsh replaced by fully freshwater peat development and subsequent drying before a return to salt marsh development	3700-2200 yrs B.P.
Blue Clay	Lower energy sub-tidal conditions representing a shallowing of water depths	>3700 yrs B.P.
Midley Sand	Sub-tidal, moderately high energy marine conditions	>3700 yrs B.P.

Table 1. Main lithostratigraphic units, likely environments of deposition and approximate ages for sediments within 6 to 8 metres of ground surface in the study area (Based on Green, 1968).

However, this simplified sequence has been modified by Innes and Long (1992) who discussed the evidence from the area around Midley where sands, similar to those described by Green (1968) as the Midley Sand, occur both below and above the peat. This evidence confirms that the history of sedimentation in the area is still poorly known and that local variation characterises the stratigraphic sequence in the marsh. As a result of this study Innes and Long (1992) have suggested that the term Midley Sand should be avoided.

The near surface and surface marshland area has been subdivided into two areas, the 'Old' and 'New' marshland. These areas are identified on the basis of variations in the carbonate content of the sediment (e.g. Green, 1968) that appear to correspond to drainage patterns persistent to at least the Saxon period (Green, 1988). The area of the route corridor lies entirely within sediments classified as 'Old' or decalcified marshland.

Within these two regions differing soil types have been identified and mapped and can be related to local patterns of sedimentation and subsequent soil formation. In the area of the route corridor differing soil types have been mapped that correspond to sub-surface topographic features associated with the infilling of relict creeks. A creek pattern has been mapped across the marshland surface and is typified by sandy soils developed in the channel fill sediments (Snargate Series). These soils typify much of the route corridor and Figure 1 shows the distribution of these sequences as shown by Eddison (1992a). Adjacent to these channel fill areas are regions where peat and clay-silt units underlie the surface soils (Snargate-Finn Complex). These sequences may occur at the western end of the route corridor. Currently it is unclear whether the channels are incised through the peat sequences or channel and peat development were contemporary.

The complexity of the history of sedimentation in the area has been noted by Long and Innes (1993, page 236) who state that

> 'the variability in sedimentation within Romney Marsh between the protected and more open sites creates difficulties in distinguishing distinct phases of coastal sedimentation and subsequently comparing these over local and regional scales'

and conclude that

> 'our knowledge of the Holocene sediments of Romney Marsh remains incomplete due to the poor stratigraphic integration of the detailed local studies'.

This point is also made by Green (1968, page 27) when discussing the area of the creek systems:

> 'The patterns of creek relicts and ridges shows that creeks in this land type developed at different times, and that renewed flooding disturbed older sediments'.

3.2 Archaeology

Archaeological material has been discovered in the Romney Marsh area and includes finds from the Mesolithic to post-Medieval periods. Recorded Mesolithic archaeology appears to be restricted to river valley contexts feeding into the marsh (Holgate and Woodcock, 1988). Bronze age axes have been recorded from gravels north of Lydd that suggest deposition either through loss at sea or directly on the shingle (Needham, 1988). Roman occupation is well documented at Lympne (Cunliffe, 1980, 1988) and a buried landsurface at St.Mary's Bay was identified by Green (1968). Further Roman finds have been made at Lydd (Jones, 1953, Philp and Willson, 1984) and Ruckinge (Bradshaw, 1970).

Extensive documentary evidence is available in the form of written records and maps (e.g. Ward, 1952; Eddison, 1988; Tatton-Brown, 1988) for the Saxon and post-Saxon periods. These sources provide very useful information and if integrated with stratigraphic, palaeoenvironmental and geomorphological data should provide a powerful synthetic overview of the last 1000 years of change in the marsh area.

3.3. Archaeological sites, site visibility and formation contexts

Archaeological material is usually located by chance, as a result of previous discoveries in the area or as a result of the surface expression of buried features (e.g. depressions, mounds, crop marks etc.). The visibility of archaeological material to the modern fieldworker depends on a series of factors that relate to the nature of the archaeological material and activity responsible for the production of that material, the environment of deposition of the material, the depositional history of the area, post-depositional factors and modern landuse history. The combined result of these factors will render archaeological material visible or hidden to the researcher. It is not considered appropriate that detailed consideration of the many factors is undertaken here. However, certain points are noted:

1 Within areas of substantial Holocene sediment accumulation, such as Romney Marsh, archaeological artefacts are likely to be buried often at considerable depth, below the modern ground surface (this contrasts with the adjacent chalk downlands where artefacts from all archaeological periods may be concatenated within or close to the topsoil).

2 Zones of rapid sedimentation may produce stratigraphic resolution of considerable detail where subtle changes in palaeoenvironmental and archaeological occupation may be recorded in the sequence (Ferring, 1986).

3 With the exception of 'burial mounds' or tumuli (physically obtrusive sites in the landscape) older prehistoric sites are commonly more difficult to locate due to a general lack of surface morphology.

4 Prehistoric activities are often of a temporary nature (in comparison to Roman and post-Roman activities) and therefore site size/visibility and obtrusiveness will be low. Roman and post-Roman sites with formerly large standing structures are often significantly easier to identify.

5 The environment of deposition is often related directly to both the activities taking place there (e.g. river channel margins are good places for fishing and hunting) and processes likely to affect the material after loss (e.g. loss of material on shingle beaches is unlikely to result in *in situ* archaeological sites as the following tide is likely to cause removal/damage to the site. Conversely loss of material within an edge lagoonal situation may result in better preservation through gentle burial by low energy silts and clays).

Based on a knowledge of the factors listed above and the nature of the environments of deposition and likely archaeological material it is possible to suggest the likely types and nature of archaeological material present within sediments recorded in the marsh area. This has been determined from a study of the extant literature, a knowledge of geomorphological processes in the area and data gathered from similar exercises elsewhere. The result is a model (Table 2) that requires testing and it cannot be taken as representative of all archaeological finds and ages that are likely to be made in the area.

SEDIMENT TYPE	ENVIRONMENT TYPE	PRESERVATION POTENTIAL
Gravel	High energy beach margins or stream bed.	Poor - artefacts broken, damaged and shifted from point of deposition. Organic preservation - low.
Sand	High energy beach margins or stream bed to medium energy channel or sub-tidal environments and dunes.	Poor - artefacts damaged and moved except in exceptional circumstances where rapid burial occurs (e.g. dune migration). Organic preservation low to moderate
Silt	Low energy sub-tidal or lagoonal areas, channel infills (cut-offs) and overbank flooding.	Good - artefacts likely to remain at site of loss, little damage to artefacts. Organic preservation moderate to high.
Clay	Very low energy overbank flooding, channel infill, lagoons.	Excellent - artefacts unlikely to have moved or been damaged. Organic preservation high.
Peat	Waterlogged wetland marsh.	Good/excellent - artefacts unlikely to have moved. Organic preservation high.

Table 2. Sediment type, likely environments of deposition and associated archaeological/ palaeoenvironmental potential for common sediment types in the marshland.

Clearly this type of model can only be used to focus investigation and certainly exceptions to the rule will occur (e.g. the bronze axes found in beach gravels at Lydd - Needham, 1988). However, *in situ* assemblages with high levels of contextual preservation are predicted by this model. Preservation potential will also reflect groundwater conditions including ground pH and waterlogging. Hence clays that have suffered drying out are unlikely to preserve high quality organic archaeological material.

Within the marshland area it is known that archaeological material dating to all periods from the Mesolithic to the present day is present within the stratigraphic stack and 'site visibility' will be dependant on depth of burial of given time surfaces. The wedged shaped sediment stack present beneath the modern marsh surface (see Section 3.1 above) suggests that from south to north, towards the relict cliff line, depth to a given time surface will decrease. Hence in the vicinity of the Royal Military Canal Mesolithic time surfaces are likely to be closer to the modern ground surface than at Dungeness Foreland. It follows that potential concatenation and sequence thickness reduction will become more pronounced towards the north. The result is that while archaeological material dating to a longer timespan may occur within a near surface zone of likely disturbance in the north of the marsh it is also in this area that increased concatenation is likely to occur.

It is common for significant archaeological sites with little or no visibility at the modern land surface to be located when sub-surface works are conducted in such environments. Archaeological material within the study area is likely to lie close to the groundwater table and thus preservation of material not normally associated with dry ground sites may be present within certain contexts. The potential of wetland archaeology has been amply demonstrated in the Somerset Levels (Coles, 1984; Coles and Coles, 1986), the English Fenlands (Pryor, 1992), the Northwest Wetlands (Howard-Davies *et al.*, 1988) and the Humber Lowlands (Van de Noort and Davies, 1993). Within Kent, the area of the Medway Estuary appears to have similar potential (Pine *et al.*, 1994). It is possible that locally within the area of the route corridor archaeological sites, with waterlogged preservation may occur. Where present these sites will contain a range of archaeological material not usually preserved on archaeological sites in addition to a wide range of palaeoenvironmental evidence. If present these sites are likely to be less than 4000 years old (Long and Innes, 1993). It should not be assumed that such sites, when preserved sub-surface, will necessarily be located by preliminary analysis of aerial photographs or archaeological field walking of the modern landscape surface.

3.4 Engineering design and impact

Impact is defined as modification (both detrimental and beneficial) to the ground conditions within which significant archaeological and palaeoenvironmental material may lie. Levels of impact will vary dependant on the type of construction, nature of sediment being impacted on and the length of time of impact on the sediment (i.e. permanent or temporary). Impact is likely to consist of one or a combination of the following factors:

1. Excavation and removal of sediment during construction (e.g. flanking drainage ditches, re-routing of existing services).

2. Compression, compaction and probable deformation of sediment following construction of embankments or other structures.

3. Piling causing destruction and deformation of the sediment.

4. Modification to groundwater conditions due to temporary or permanent alteration of the subsurface conditions through drainage, cuttings, modification to porosity/permeability of sediments, and de-watering/pumping activities.

5. Modification of ground sediment and water chemical conditions, through drainage modifications and the presence of "foreign bodies" (e.g. piles).

Within the area of investigation major changes and excavations are unlikely to be undertaken and it is assumed that the road bed consists of a small embankment resting on the marshland surface. If topsoil stripping is planned along the route corridor this activity is unlikely to damage material and stratigraphy not previously modified by ploughing but may cause subtle alterations to the subsurface conditions (e.g. allowing oxidation of sediments). This may result in rapid alteration of subsurface conditions in areas previously buffered against such change.

Compression and compaction of sediments beneath the road bed are likely. The effects are difficult to model in sediments exhibiting considerable internal variation[2] and therefore "best practice" assumes some modification to archaeological material preserved at depth in this zone. This may cause compaction and deformation of artefacts, differential movement of material (thus modifying any *in situ* spatial relationships between artefacts (e.g. within a knapping scatter) and collapse of the internal structure in organic material making future identification more difficult (e.g. collapse of tissue structure in wood).

Modifications may occur to the groundwater table as a result of compaction of sediment below the roadway. Construction of a heavy, elongated platform on a relatively soft sediment may cause a linear reduction in ground permeability. This can result in a permanent subsurface "damming" effect with respect to shallow groundwater throughflow. As a result groundwater tables may rise on one side (upstream) and be depressed on the other side (downstream - the hydraulic shadow zone). The result may be oxidation of artefacts and palaeoenvironmental material previously below the permanent groundwater table in the hydraulic shadow zone. Conversely, areas previously above the ground water table may be permanently submerged below it in the 'upstream' section. Where considerable variability is present in the sub-surface stratigraphy it will be difficult to predict these changes.

Piling operations do not appear to be necessary for the construction of the road but if undertaken require careful consideration. Compaction of sediments and modifications to the groundwater table may occur leading to detrimental effects on the subsurface archaeological resource. Additionally destruction of stratigraphy will occur in association with the piling operation. Trenching in advance of the construction activity to record archaeological stratigraphy will be difficult due to the high groundwater table.

Local impact on either side of the route corridor will occur through the digging of drainage ditches and this will be primarily through the removal of sediment during

[2] Calculations for the Thames alluvial tracts indicate that for a 1m high ground bearing embankment consolidation settlements of c.450mm between the crust and depths of -1.0m O.D. are possible. These calculated values increase significantly if the topsoil (crust) has been removed (e.g. values of c.700mm are calculated for a similar height embankment).

construction. Impact to the subsurface stratigraphy will be considerable in the area of the flanking ditches.

In addition to the consideration given to areas of the route corridor where large structural alterations will occur impact may also occur in areas of landtake for temporary work associated with construction, e.g. where a road bed may be constructed to allow heavy plant movement between existing roads and the line of the route corridor. Impact in such areas is likely to cause considerable modification, e.g. disturbance to the top 1.0 - 1.5m of stratigraphy, to areas deemed outside the corridor of risk as perceived from the engineering construction drawings.

While most of the modifications are likely to have negative impacts certain positive impacts can be noted:-

1. Creation of an artificially high ground water table on the 'upstream side' of the road aiding preservation of buried artefacts and ecofacts.

2. Gains to knowledge regarding the archaeological and palaeoenvironmental record in the area, through monitoring, analysis and archiving of the stratigraphic sequences encountered by archaeologists/geoarchaeological specialists in advance of, or during, engineering works.

4.0 STRATIGRAPHIC SEQUENCES IN THE STUDY AREA

The study area lies mainly on the marshland described by Green (1968) as 'Old' Marshland (Figure 1). A total of eleven test pits, three inspection pits and five boreholes were examined during the study.

4.1 Methodology

Standard geotechnical borehole data can be utilised by geoarchaeologists and palaeoenvironmental specialists to model the development of past landscapes and to determine the spatial extent and 3-dimensional subsurface architectures of archaeologically and palaeoenvironmentally important sequences (Barham and Bates, 1994). Data quality and recovery from geotechnical boreholes varies and depends on the skill and training of the drillers in the field, the geotechnical brief, the sampling design and the time availability set by the engineers. Geotechnical investigation requires measurement of parameters that differ significantly from the data required by geoscientists attempting to model the evolution of past landscapes. Hence standard geotechnical borehole logs may contain minimal information regarding specific sedimentological properties of the sequence. The logs do, however, provide a data source that taken in conjunction with other known stratigraphic information, a knowledge of processes likely to have operated in the area and a knowledge of geomorphological principles can yield archaeologically predictive information. In particular, trends in grain size, patterns of mottling, zones of rooting and the nature of contacts between individual units can all provide data on completeness of sequences, location of palaeolandsurfaces, patterns of sedimentation and the location of unconformities and zones of erosion/reworking. The identification of such features are of critical importance in defining the archaeological and palaeoenvironmental potential of the route corridor.

Prospecting through borehole investigation will only exceptionally provide direct proof of archaeological sites or materials buried at depth (e.g. recovery of Medieval metalwork and a Mesolithic core axe from gravels drilled during the Dover A20 Road and Sewer Scheme - Bates and Barham, 1993). It can, however, when used in careful consideration with known stratigraphic data and the application of radiocarbon (^{14}C) dating to recovered organic material, provide a chronostratigraphic model for the major identified sedimentological units, a model for sequence development and indications of the presence of buried landsurfaces and contexts likely to represents environments and sub-surface datum envelopes previously occupied by humans. This approach permits carefully calculated decisions to be made regarding the siting of expensive, time consuming, and ultimately destructive, archaeological excavations.

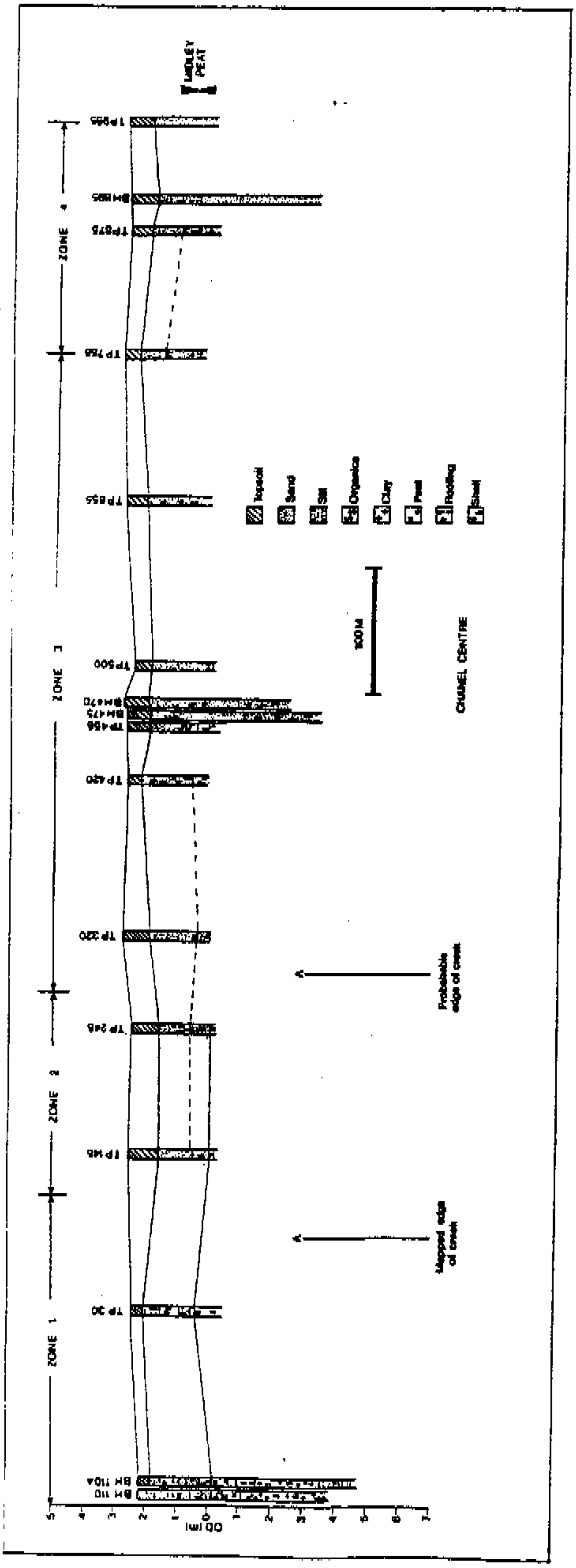

Figure 2. Simplified lithological cross-section along the route-corridor.

4.2 Stratigraphic sequences along the route corridor based on selected profiles

The data studied as part of this assessment is reproduced in Appendix I. Interpretations made are based on the examination of the drillers (modified drillers logs) and the construction of a profile (Figure 2) along the route corridor. The interpretation of the data and the correlation of units along the profile is based on the principals of facies relationships, known sedimentological information on the area of the marsh and the experience of the author in the interpretation of the data. Initial investigation of the borehole/test pit logs indicates that the sequence can be divided into four major zones based on the stratigraphic and geomorphological grounds (Figure 2):

4.2.1. Zone 1.

This zone is dominated by the presence of a major peat unit lying at datums between +0.40m O.D. and -1.0m O.D. The peat is present in boreholes 110 and 110A and test pit 30. The peat is described as dark brown/black and fibrous with well preserved wood in places. Sediments underlying the peat were only recorded in the boreholes, test pit depths were insufficient to penetrate below the peat. Where sampled sub-peat sediments consisted a fine sand with peat fragments overlying a dark blue silty clay with organic material (BH 110A). Sediments above the peat varied from a fine-medium sand with some laminae (BH110A) to a silty clay (TP 30). In places within these overlying sediments zones of rooting and mottling were noted at depths of **c.** 1.3m O.D. (TP 30).

4.2.2. Zone 2.

This zone is similar to zone 1 where peat underlies the sequence. However sediments overlying the peat contain a higher organic content than those described in zone 1 and shell fragments appear is association with the rooted horizon in TP 245.

4.2.3. Zone 3.

Within this zone no sub-surface peat was encountered. On the basis of the evidence from boreholes 470 and 475 peat was absent from the centre of this zone. Towards the eastern and western margins of this zone test pit depths were insufficient to reach datums at which peat may be present (based on observed peat depths in zones 1 and 2). Hence the absence of peat may be a reflection of insufficiently deep test pits however given the nature of the stratigraphy in this area it is unlikely that peat would have been encountered even if test pit depths had been increased. Sediment types within this zone are dominated by sands with variable organic contents and occasional shelly regions. In places, e.g. TP 455, rooted zones have been noted (below 1.0m O.D.).

4.2.4 Zone 4.

This zone is similar to that described above (zone 3) but the rooted horizon noted only in TP 455 is present within this area (TP 755, 875).

<table>
<tr><th colspan="3">Zone
1 + 2</th><th></th><th colspan="3">Zone
3 + 4</th></tr>
<tr><td>Fine sand to silty-clay</td><td>RRR</td><td>Organic sands</td><td rowspan="4"></td><td rowspan="4">Organic sands</td><td rowspan="4">RRR</td><td rowspan="4">Organic sands</td></tr>
<tr><td colspan="3">PEAT</td></tr>
<tr><td>Fine sand</td><td></td><td>Fine sand</td></tr>
<tr><td>Blue clay-silt</td><td></td><td>Blue clay-silt</td></tr>
</table>

Table 3. Major stratigraphic units identified along route corridor.
RRR - rooted zone.

5.0 DISCUSSION

It is clear from the information presented in Section 4.0 that two major sets of stratigraphic sequences are present in the area (Table 3). Peat based stratigraphies, described in zones 1 and 2, have been recorded in boreholes 110 and 110A and test pits 30, 145 and 245. Sand based stratigraphies are present within zones 3 and 4. These sand based stratigraphies occur to at least depths of -5.0m O.D. The transition between zones 1/2 and 3/4 occurs around chainage 500.000 (Western End). Present intermittently throughout zones 1 to 4 is a zone of rooting/mottling within the sediments lying at datums around +1.0m O.D.

The presance of peat suggests deposition within a wetland environment although whether this was a high-level salt marsh or back-marsh area remains to be determined. To the south of the study area at Midley, Long and Innes (1993) have described peats at slightly higher elevations (see Figure 2) that began accumulation under salt marsh environments that became progressively non-saline to produce oak and then alder carr fen. A return of saline conditions was noted higher in the peat sequence. It is possible that the peats at Brooklands may contain similar records.

The sand sequences to the east of zones 1 and 2 are compatible with the data discussed by Green (1968) indicating that these areas were channels and that infilling with coarser sands took place as coastal change elsewhere in the marsh influenced patterns of sedimentation in the area. It is unclear from the evidence studied here whether these channel infill sequences are the lateral time equivalents of the peat sequences or whether the channels are incised through the peat and post-date the peat formation.

The intermittent presence of the rooted/weathered horizon across both zones 1/2 and 3/4 suggest infilling of the entire area was completed prior to the exposure and weathering of this surface. Medieval finds were noted during evaluation work at a depth of 300mm from modern ground surface (c.600-700mm above the zone of rooting described here).

The information suggests that the profile described by the route corridor forms a transect from the ground surrounding one of the infilled channels into and through the channels. The transect describes a route that should bisect all major stratigraphic units infilling the channel and should provide a detailed record of the pattern of infill of the channel and development of the adjacent ground.

^{14}C dates obtained by Long and Innes (1993) suggest peat formation took place between c.3700 and 2200 B.P. at Midley. It is possible that peat formation at Brooklands can be ascribed similar ages however caution is urged (see discussion in 3.1 above). The age of the channel infilling cannot be ascertained and until the relationship between the channel fill and the peat is determined even a relative chronology is difficult to determine. The presence of the Medieval horizons above the rooted zone noted in 4.0 above indicates that a pre-Medieval landsurface (Roman??) may be present at least intermittently along the route corridor.

From the information obtained during the study of the geotechnical data a number of Areas of Geoarchaeological Importance (AGI's) can be defined. The significance of the areas have been based on an assessment using the criteria outlined in Section 2.1. In all cases (AGI's 1-3) sequences are likely to be well preserved and well stratified. As a result of the probable waterlogging of the sequences sediments may well be fragile and prone to damage through dewatering etc. Although the sequences have been mapped through surface expressions of the soil units sub-surface stratigraphies are poorly known but research objectives are well established for the region. The following AGI's are defined:

AGI 1. This area lies between Chainage 000.000 and c.350.000 (Western End) and corresponds with zone 1 (Figure 2, Table 3). Interest in this area lies in the presence of the peat and the overlying weathered horizon. Archaeological and palaeoenvironmental sequences may be encountered in the area and may be of regional or national importance.

AGI 2. This area lies between Chainage 350.00 and 600.000 and overlaps zones 2 and 3 (Figure 2, Table 2). This area represents the channel marginal/channel edge situation where channel edge structures (e.g. waterfronts) may be present. The sequences are therefore ecotonal and represents zones of high potential and coincide with an area of deep (c1.8m) impact associated with the flanking drainage ditches.

AGI 3. This area occupies the remainder of the route corridor and corresponds to zones 3 and 4 representing the channel centre area. Archaeological and palaeoenvironmental potential in this area may be lower due to the likelihood of reworking and erosion of material in the area.

6.0 RECOMMENDATIONS FOR FUTURE WORK

The evaluation of the sequences has provided a basic lithostratigraphic framework (Figure 2) within which future investigation can be framed and articulated. Further work is required both in the field and subsequently in the laboratory to process, assess and archive any samples taken during the field phase.

The following additional stages of work are therefore recommended:

1. Drilling, at two locations, to record stratigraphic sequences and recover samples for areas below the zone of direct impact of the scheme. This is necessary inorder to determine the significance of the sequences lying within the zone of disturbance.

2. Excavation/test pitting in areas of high archaeological and palaeoenvironmental potential which coincide with zones of high engineering impact, to record and investigate sequences lying within the zone of disturbance.

3. Laboratory based assessment of recovered samples to produce a time calibrated model for sequence development of the area impacted by the route corridor. This will necessitate radiometric dating of key horizons (^{14}C or OSL), preliminary stratigraphic/sedimentological descriptions to provide facies data and microfossil determinations to characterise key stratigraphic units.

6.1 Fieldwork program

It is recommended that two purposive boreholes are drilled to sample and determine the nature of the stratigraphy over depths of 6 to 10m below modern ground surface. This will ensure that when observing and sampling sequences lying within 2m of the modern ground surface the stratigraphic framework within which these sequences fall are understood and interpreted. These boreholes should be drilled adjacent to boreholes 110A and 470 with AGI's 1 and 3.

Excavation/test pitting/watching brief should be undertaken in one location in each of the AGI's (precise locations may be determined on the basis of maximum depth of disturbance or where ease of access permits). This will enable the sequences within each area to be characterised, recorded and sampled. Sampling should be undertaken using overlapping monolith tins to provide a continuous sequence through the exposed sediments. Standard sedimentological techniques should be used for the recording of the sequences. Use of kubiena tins (for soil micromorphological analysis) and bulk samples should be made where appropriate. Depth of direct impact in drainage ditches appears to pose the greatest threat to the sequences and therefore excavations should be undertaken to a depth marginally in excess of the proposed depth of disturbance (e.g. 2.0m). Given the uncertainty of the impact of the structure on soft sediments and the likely deformation of the peat the peat surface should be explored and hand excavated in at least one location (perhaps at chainage 400.000, close to TP 245).

Within the route corridor AGI 2 may contain the highest potential archaeological significance due to its proximity marginal to the channel recorded in zones 2 and 3. This AGI (2) may contain evidence for channel marginal structures such as waterfronts etc. Additional monitoring and excavation may be required in this zone.

Excavation of the upper rooted zone could be monitored and undertaken more frequently, as trenching progresses, due to its shallow depth(generally within 1m of the modern ground surface).

6.2 Laboratory program

Laboratory based assessment will be required following fieldwork to i) record and archive stratigraphic sequences recovered during the field program (this will include visual recording and photography of cores/monoliths) and ii) to provide a time and facies calibrated model for sequence generation.

Recording and archiving of stratigraphic sequences should be undertaken through careful laboratory cleaning, photography and recording of core/monolith stratigraphy. This will both enhance the field stratigraphic data and provide material suitable for inclusion in the site archive. Standard sedimentological recording practices coupled to X-radiography of selected cores and possibly Total Phosphate determinations should provide the lithostratigraphic data to produce a detailed facies model for the route corridor. This should be supplemented by ^{14}C/OSL (Optically Stimulated Luminescence) dating of key stratigraphic horizons from which suitable material has been extracted. Six or eight ^{14}C age estimates would probably be required. Finally selected samples from key units should be submitted for pollen and/or diatom assessment to provide information on suitability of sequences to produce detailed vegetation histories and to characterise the main environments of deposition.

7.0 CONCLUSIONS

This study has shown that the stratigraphic data recorded in the borehole and test pit logs indicates that the route corridor provides a transect through the landscape from an area of marshland through and into an area of channel sedimentation. Age estimates available from the area suggest that a sequence of events dating from the Bronze Age may be recorded within the zone of impact of the route scheme. This zone of impact may encounter a wide variety of sediment types and potential archaeology depending on the location within the transect.

Further work has been recommended both in the field during or before route construction and subsequent to route construction within the laboratory. It is difficult to determine the precise nature of impact of the construction of the route on the sub-surface stratigraphy but destruction of archaeological or archaeologically sensitive sequences are likely in some areas.

The opportunity presented by this proposal would allow sequences to be examined that should provide a means of testing hypothesis previously published (e.g. by Green, 1969 or Cunliffe, 1988) and allow access to archaeologically significant sequences where phased and structured investigation may be undertaken.

? Green 1968 or 88

ACKNOWLEDGEMENTS.

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BIBLIOGRAPHY.

Barham, A.J. and Bates, M.R. 1994 Strategies for the use of boreholes in archaeological evaluation: A review of methodologies and techniques. *Geoarchaeological Service Facility Technical Report 94/01*. Geoarchaeological Service Facility University College London: London. 33pp.

Bates, M.R. 1994a A259 Dymchurch - M20 (J11) Link Road; Further geoarchaeological and palaeoenvironmental assessment. *Geoarchaeological Service Facility Site Assessment Report 94/08*. Geoarchaeological Service Facility, University College London: London. 31pp and appendices.

Bates, M.R. 1994b A259 New Romney-Dymchurch By-pass: Further geoarchaeological and palaeoenvironmental assessment. *Geoarchaeological Service Facility Site Assessment Report 94/09*. Geoarchaeological Service Facility, University College London: London. 24pp and appendices.

Bates, M.R. and Barham, A.J. 1993b Dover A20 Road and Sewer Scheme Environmental Archaeological and Palaeoenvironmental Field and Laboratory Assessment Report. *Geoarchaeological Service Facility Technical Report 93/03*. Geoarchaeological Service Facility University College London: London. 138pp.

Bates, M.R. and Barham, A.J. 1994 A geoarchaeological and palaeoenvironmental assessment of the proposed A259 Dymchurch - M20 (J11) link road. *Geoarchaeological Service Facility Site Assessment Report 94/07*. Geoarchaeological Service Facility, University College London: London. 32pp and appendices. *Geoarchaeological Service Facility Site Assessment Report 94/05*. Geoarchaeological Service Facility, University College London: London. 25pp and appendices.

Bates, M.R., Barham, A.J. and Roberts, J.S. 1994 A geoarchaeological and palaeoenvironmental assessment of the proposed A259 New Romney-Dymchurch By-pass.

Bradshaw, J. 1970 Ruckinge. *Archaeologia Cantiana 85*, 179.

Burrin, P. 1988 The Holocene floodplain and alluvial deposits of the Rother Valley and their bearing on the evolution of Romney Marsh. 31-52. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Coles, B. and Coles, J.M. 1986 *Sweet track to Glastonbury*. Thames and Hudson: London.

Coles, J.M. 1984 *The archaeology of wetlands*. Edinburgh University Press: Edinburgh.

Cunliffe, B.W. 1980 Excavation at the Roman Fort at Lympe, Kent. 1976-78. *Britannia 11*, 227-288.

Cunliffe, B.W. 1988 Romney Marsh in the Roman Period. 83-87. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Department of Environment 1990 *Planning Policy Guidance: Archaeology and Planning*. Public Policy Guidance Note 16. HMSO: London.

Eddison, J. 1983 The evolution of the barrier beaches between Fairlight and Hythe. *Geographical Journal 149*, 39-53.

Eddison, J. 1988 'Drowned Lands': changes in the course of the Rother and its estuary, and associated drainage problems, 1635-1737. 142-162. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Eddison, J. 1992a *A report on the archaeological implications of an area north of Brookland, Kent*. Romney Marsh Research Trust. Ashford. 13pp.

Eddison, J. 1992b *A report on the archaeological implication of the proposed by-pass for New Romney, Kent. A259*. Romney Marsh Research Trust. Ashford. 18pp.

Eddison, J. 1992c *A report on the archaeological implications of the proposed by-pass for St Mary's Bay and Dymchurch, Kent. A259*. Romney Marsh Research Trust. Ashford. 18pp.

Eddison, J. and Green, C. 1988 (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Ferring, C.R. 1986 Rates of fluvial sedimentation: implications for archaeological variability. *Geoarchaeology 1*, 259-274.

Green, C. 1988 Palaeogeography of marine inlets of the Romney Marsh area. 167-174. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Green, R.D. 1968 *Soils of Romney Marsh*. Soil Survey of Great Britain. Bulletin No.4. Harpendon.

Greensmith, J.T. and Gutmanis, J.C. 1990 Aspects of the late Holocene depositional history of the Dungeness area, Kent. *Proceedings of the Geologist Association 101*, 225-237.

Holgate, R. and Woodcock, A. 1988 Archaeological and palaeoenvironmental investigations at Pannel Bridge, near Pett Level, East Sussex. 72-76. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Howard-Davies, C., Stocks, C., and Innes, J. 1988 *Peat and the past: a survey and assessment of the prehistory of the lowland wetlands of North-west England*. Lancaster University: Lancaster.

Hutchinson, J. 1988 Recent geotechnical, geomorphological and archaeological investigations of the abandoned cliff backing Romney Marsh at Lympne, Kent. 88-89. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Innes, J.B. and Long, A.J. A preliminary investigation of the 'Midley Sand', Romney Marsh, Kent, UK. *Quaternary Newsletter 67*, 32-39.

Jones, I. 1953 Roman remains on Lydd Rype. *Archaeologia Cantiana 66*, 160-161.

Lewis, W.V. 1932 The formation of Dungeness foreland. *Geographical Journal 80*, 309-324.

Lewis, W.V. 1937 The formation of Dungeness and Romney Marsh. South Eastern Naturalist and Antiquary: *Proceedings and Transactions of the South Eastern Union of Scientific Societies*, 65-70.

Lewis, W.V. and Balchin, W.G.V. 1940 Past sea-levels at Dungeness. *Geographical Journal 96*, 258-285.

Long, A.J. and Innes, J.B. 1993 Holocene sea-level changes and coastal sedimentation in Romney Marsh, southeast England, UK. *Proceedings of the Geologist Association 104*, 223-238.

Needham, S. 1988 A group of Early Bronze Age axes from Lydd. 77-82. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation*. Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Philp, B.J. and Willson, J. 1984 Roman site at Scotney Court, Lydd. *Kent Archaeological Review 68*, 156-161.

Pine, C.A., Williamson, V.D., Bates, M.R. and Barham, A.J. 1994 Assessment report on geoarchaeological and environmental archaeological aspects of the Medway Tunnel Engineering Scheme Archaeological Evaluation. *Geoarchaeological Service Facility Technical Report 94/06.* Geoarchaeological Service Facility, University College London: London. 77pp and appendices (2 vols).

Pryor, F. 1992 Current Research at Flag Fen, Peterborough. *Antiquity 66*, 439-457.

Smart, J.G.O., Bisson, G. and Worssam, B.C. 1966 Geology of the country around Canterbury and Folkestone. *Memoirs of the Geological Survey of Great Britain.*

Steers, J.A. 1964 *The Coastline of England and Wales* (2nd edition). Cambridge University Press: Cambridge.

Tatton-Brown, T. 1988 The topography of the Walland Marsh area between the eleventh and thirteenth centuries. 105-111. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation.* Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

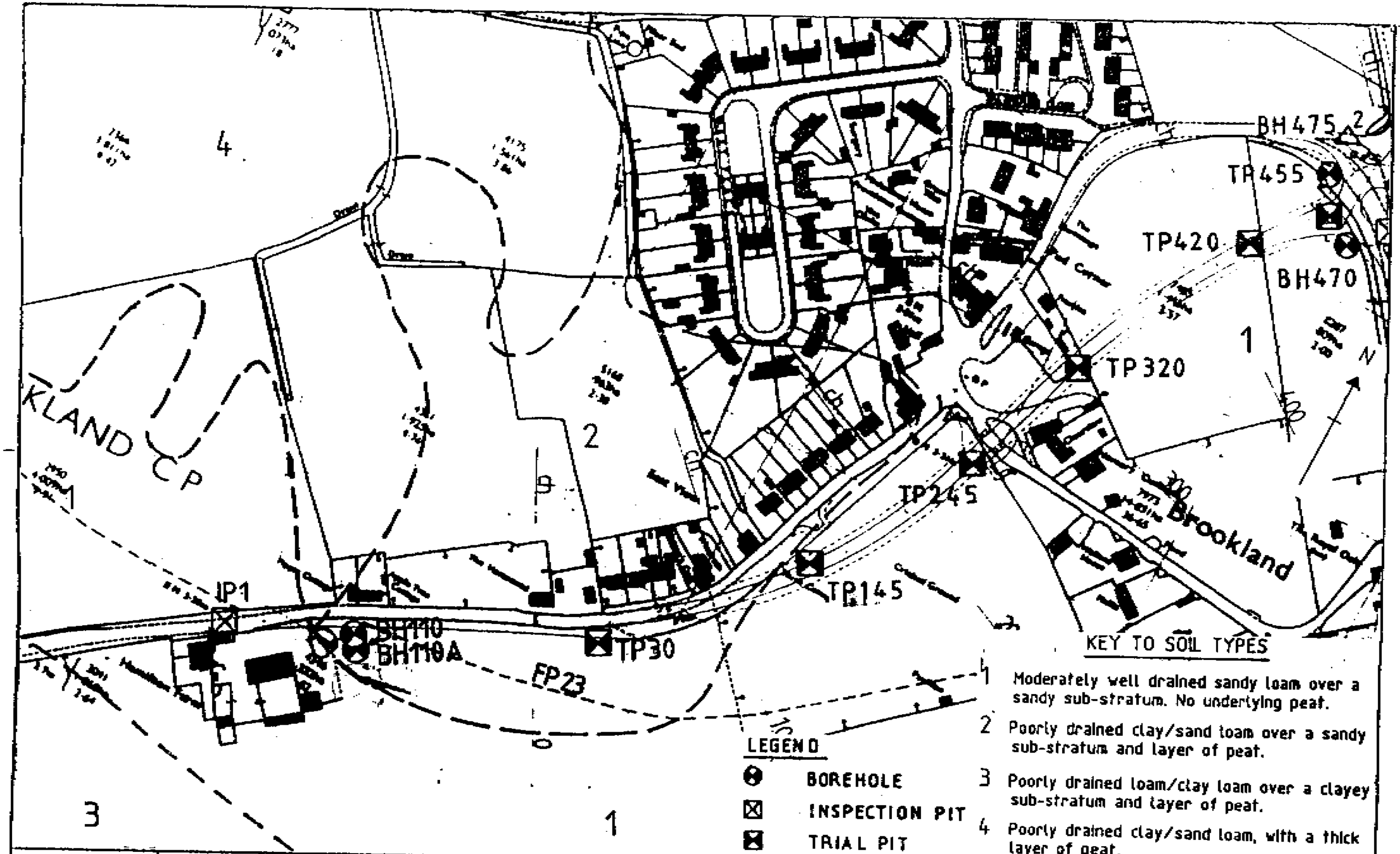
Tooley, M.J. and Switzur, R. 1988 Water level changes and sedimentation during the Flandrian Age in the Romney Marsh area. 53-71. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation.* Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Van de Noort, R. and Davies, P. 1993 *Wetland Heritage. An archaeological assessment of the Humber Wetlands.* University of Hull: Hull.

Waller, M., Burrin, P. and Marlow, A. 1988 Flandrian sedimentation and palaeoenvironments in Pett Level, the Brede and lower Rother valleys and Walland Marsh. 3-30. In Eddison, J. and Green, C. (eds.) *Romney Marsh. Evolution, Occupation, Reclamation.* Oxford University Committee for Archaeology. Monograph No. 24. Oxford.

Ward, G. 1952 The Saxon history of the town and port of Romney. *Archaeologia Cantiana 65*, 12-25.

APPENDIX I. GEOTECHNICAL BOREHOLE AND TEST PIT LOG DISCUSSED IN THIS REPORT.



LEGEND

- BOREHOLE
- INSPECTION PIT
- TRIAL PIT

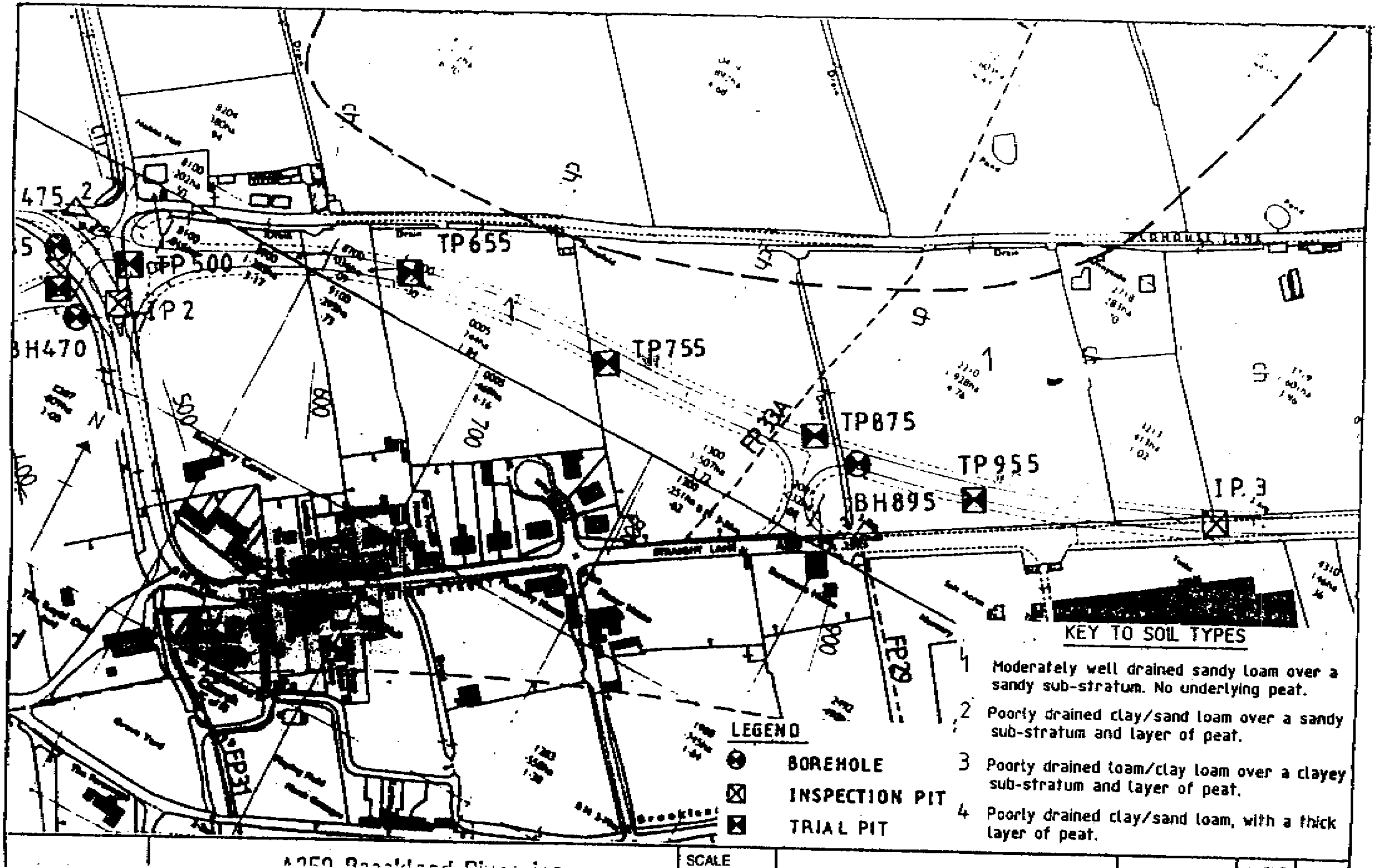
KEY TO SOIL TYPES

1. Moderately well drained sandy loam over a sandy sub-stratum. No underlying peat.
2. Poorly drained clay/sand loam over a sandy sub-stratum and layer of peat.
3. Poorly drained loam/clay loam over a clayey sub-stratum and layer of peat.
4. Poorly drained clay/sand loam, with a thick layer of peat.

KENT C.C.	A259 Brookland Diversion Borehole Location Plan	SCALE 1:2500	M. N. T. COTTELL, OBE, C.Eng, FICE, COUNTY SURVEYOR, MAIDSTONE.		INITLS	DATE
				DRAWN BY		12.90
				TRACED BY		
				DRG. No. 60/90/2 PART		

HILL GRAPHICS 5454/88 (24/78)

A4



TP655
TP500
TP2
475
BH470
TP755
TP875
TP955
BH895
TP3
FP33A
FP29
FP31
500
600
700
800
900
N
STRAIGHT LANE
KEY TO SOIL TYPES
1 Moderately well drained sandy loam over a sandy sub-stratum. No underlying peat.
2 Poorly drained clay/sand loam over a sandy sub-stratum and layer of peat.
3 Poorly drained loam/clay loam over a clayey sub-stratum and layer of peat.
4 Poorly drained clay/sand loam, with a thick layer of peat.
LEGEND
BOREHOLE
INSPECTION PIT
TRIAL PIT
SCALE

RECORD OF BOREHOLE No: 110

START DATE	23rd AUGUST 1990	CASING DETAILS	200mm to 3.00m	SHEET	1 OF 1
DRILLING METHOD	CABLE PERCUSSION	BOREHOLE DIA.	200mm to 6.00m	ORIENTATION	VERTICAL
EQUIPMENT	PILCON WAYFARER	DRILL FLUID	-	CO-ORDINATES	E N
				GROUND LEVEL	2.21 m O.D.

Date & Time	Casing Depth (m)	Water Level-m (Flush Return %)	Sample/Core Recovery Depth (m)	Type / Total %	No / RQD (SCR)	Core Size	Fracture	DESCRIPTION OF STRATA	Depth m (Thickness)	Level (m O.D.)	Strata Symbol
23/8			0.40	D	1			Loose light yellowish-brown slightly clayey, very silty fine SAND, locally a very soft fine sandy SILT.			
	-	DRY	1.00 S(4)	D	2				(2.40)		
			1.50	B	3						
	-	DRY	2.00 S(2)	D	4			becoming very loose at 2.00m			
			2.40	D	5				2.40	-0.19	
			2.80	D	6			Dark brownish-grey organic silty fine and medium SAND	(0.40) 2.80	-0.59	
	3.00	DRY	3.00	U	7			Firm, dark brown to black clayey, friable PEAT.	(0.50) 3.30	-1.09	
			3.50	D	8			Very soft, light grey organic silty CLAY.			
	3.00	DRY	4.00 (0.30m rec)	U	9						
			4.50	D	10			With occasional dark grey partings at 4.50m.	(2.70)		
			4.80	B	11			Becoming grey at 4.80m.			
	3.00	DRY	5.50	U	12						
			6.00	D	13			Becoming dark with with occasional lenses of grey silt at 6.00m.	6.00	-3.79	
								END OF BOREHOLE			

REMARKS

1. Upon completion of boring, a Casagrande type standpipe piezometer was installed with the tip at 5.00m, sand response zone from 4.00m to 5.20m, bentonite seal from 3.50m to 4.50m, grout from 0.50m to 3.50m and concrete to ground level where a stopcock cover was installed.

Logged by: CRR
Date:
Checked by:
Approved by:

SCALE 1 : 50 (When reduced to A4)

FOUNDATION & EXPLORATION SERVICES

A259 BROOKLAND DIVERSION

CONTRACT No 1716

FIGURE 1

A259 Brookland Diversion

Apple Tree Cottage

BOREHOLE: BD 110A

SHEET 2 OF 2

BORING EQUIPMENT & BOREHOLE DIAMETER	LOCATION	GROUND LEVEL METRES A.O.D.
Shell and Auger 150mm	E= N=	2.21
	DATE COMMENCED 09.10.90	DATE COMPLETED 10.10.90

SAMPLES AND INSITU TESTING DEPTH (m)	DRILLING AND CASING DEPTH	BLOWS 'N' Value
9.80-10.25		
10.50-10.70	09.10.90	
11.60-12.05		15
12.50-12.70		
13.00-13.45		4
14.00-14.20		
14.50-14.95		58
15.50-15.70		
16.00-16.45		32
16.75-16.95		
17.50-17.95		17
19.00-19.20		
19.30-19.75		7
19.80-20.00	10.10.90	

DESCRIPTION OF STRATA	DEPTH (m)	LEVEL m (OD)
Medium dense dark grey silty medium/fine SAND.	11.60	-9.39
Medium dense dark grey medium SAND.	13.00	-10.79
Very loose dark grey SILT/fine SAND and very soft black amorphous organic clay.	14.50	-12.29
Dense-very dense dark grey medium SAND.	16.45	-14.24
Medium dense dark grey medium SAND, with some black silt and occasional shells.	19.30	-17.09
Loose/soft thickly laminated black silty CLAY and grey silty fine SAND.	20.00	-17.79

REMARKS Scale 1:50

Borehole completed at 20.00m.

KEY
- —— Drilling Depth
- ▬ Casing Depth
- ∇ Water struck
- ● Disturbed Sample
- | Standard Penetration Test
- ∇ Morning water level
- ↕ Bulk Disturbed Sample
- ∇ Evening water level
- █ 105mm Undisturbed Sample
- △ Water Sample

Kent County Council
Highways Laboratory
Aylesford

M.N.T. Cottell OBE
C. Eng. F.I.C.E.
County Surveyor
Springfield.

FIG.

RECORD OF TRIAL PIT No: 30

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1716

METHOD OF EXCAVATION: JCB 3CX
SURFACE DIMENSIONS OF PIT: 2.50m x 0.60m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N

Sheet 1 of 1
GROUND LEVEL 2.47 m O.D

Insitu Testing Depth m	Insitu Testing Type	Samples Depth m	Samples Type	Samples No	Description of Strata	Thickness m	Depth m	Level m O.D	Time + Date	Strata Symbol
					MADE GROUND: Brown clayey silty fine sand with roadstone, brick fragments, shells and roof tile fragments.	0.42	0.42	2.05		
		0.66	D	1	Firm, friable, dark brown silty CLAY.					
109	HVR (111)				From 1.00m becoming mottled orange and grey with occasional rootlet remains.	1.16				
1.45	CBR (12)	1.41	D	2						
		1.58	B	3			1.58	0.89		
		1.90	D	4	Soft, bluish grey and orange slightly fine sandy silty CLAY. From 1.65m becoming very fine sandy.	0.32	1.90	0.57		
		2.05	D	5	Soft, bluish grey very clayey fine sandy SILT with organic odour.	0.15	2.05	0.42		
					Spongy dark brown/black fibrous PEAT.	0.85+	2.90	-0.43		
					END OF TRIAL PIT					

REMARKS

PLAN

Logged by:	Date:
RH	22/8
Checked by:	
AHG	4/4
Approved by:	

FOUNDATION & EXPLORATION SERVICES

FIGURE 26

RECORD OF TRIAL PIT No: 245

PROJECT: A259 BROOKLAND DIVERSION

LOCATION: BROOKLAND, KENT

CONTRACT No: 1716

METHOD OF EXCAVATION: JCB 3CX

SURFACE DIMENSIONS OF PIT: 2.60m x 0.80m

START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N

Sheet 1 of 1

GROUND LEVEL 2.50 mOD

Insitu Testing Depth m	Insitu Testing Type	Samples Depth m	Samples Type	Samples No.	Description of Strata	Thickness m	Depth m	Level m O.D	Time + Date	Strata Symbol
		0.65	D	1	TOPSOIL: Dark brown sandy (fine) silty CLAY with a little medium and coarse sand, bone fragments, oyster shells and rootlets.	0.91	0.91	1.59		
		0.91	D	2						
1.18	CBR (3%)	1.55	B	3	Loose, light orangish brown mottled silty fine SAND. From 1.55m becoming light bluish grey with small pockets of dark grey silty clay, occasional partially decomposed rootlets and shells and shell fragments.	1.00	1.91	0.59		
		1.91	D	4						
		2.55	D	5	Loose, dark bluish grey silty fine and medium SAND with a slight organic odour.	0.66	2.55	-0.06		
					Spongy, dark brown/black fibrous PEAT.	0.05+	2.60	-0.10		
					END OF TRIAL PIT					

REMARKS:

PLAN

Scale 1:25 (when reduced to A4)

Logged by	Date
RH	22/8
Checked by	
ARG	4/9
Approved by	

FOUNDATION EXPLORATION SERVICES

FIGURE 32

RECORD OF TRIAL PIT No: 145

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1T16

METHOD OF EXCAVATION: JCB 3CX
SURFACE DIMENSIONS OF PIT: 2.10m x 0.80m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N
Sheet 1 of 1
GROUND LEVEL 2.54 m OD

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No.	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m OD	Time - Date	Strata Symbol
		0.57	D	1	TOPSOIL: Brown slightly clayey sandy (fine) silt with fragments of pottery, shell and with rootlets.	0.95				
0.97	CBR (5%)	0.95	D	2			0.95	1.59		
		1.50	D	3	Loose, orange and bluish grey silty fine SAND. From 1.50m, becoming bluish grey.	1.07				
		2.02	B	4			2.02	0.52		
		2.60	D	5	Dark bluish grey silty fine and medium SAND with an organic odour.	0.58	2.60	-0.06		
					Spongy, dark brown/black fibrous PEAT.	0.20+	2.80	-0.26		
					END OF TRIAL PIT					

REMARKS:

1. Seepage was observed from 2.25m leading to unstability in the sidewalls of the pit and eventual collapse at 2.80m.

PLAN

Scale 1:25 (when reduced to A4)

Logged by	Date
RH	22/8
Checked by	
JJG	4/9
Approved by	

FOUNDATION ENGINEERING SERVICES

FIGURE 28

RECORD OF TRIAL PIT No: 320

PROJECT: ... ROOK DIVE ... MOD AVATI ... JCB 3CX

LOCATION: BROOKLAND, KENT	SURFACE DIMENSIONS OF PIT: 2.60m x 0.80m	CO-ORDINATES	Sheet 1 of 1
CONTRACT No: 1716	START DATE: 22/8/90 FINISH DATE: 22/8/90	E N	GROUND LEVEL: 2.80 m O.D

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m O.D	Time - Date	Strata Symbol
		0.30	D	1	TOPSOIL/MADE GROUND: Dark brown slightly clayey silty fine sand with coarse gravel grade fragments of asphalt and various household rubbish.	0.89	0.89	1.91		
0.96 1.05	HVN (97) CBH (25)	1.05	D	2/3	Firm, friable, orangish brown mottled brown and light bluish grey clayey fine sandy SILT with occasional partially decomposed rootlets.	0.16	1.05	1.75		
		1.57	B	4	Loose to medium dense light bluish grey silty fine SAND with an organic odour. From 1.10m to 1.60m; slightly clayey.	1.35				
		2.30	D	5	From 2.30m with pockets of spongy black fibrous peat, some wood pieces and a strong organic odour.		2.40	0.40		
					Loose dark bluish grey silty fine and medium SAND with a strong organic odour and some fine to coarse sand grade shell fragments.	0.20	2.60	0.20		
					END OF TRIAL PIT					

REMARKS:

1. A slight seepage was observed at 2.20m becoming running sand from 2.40m causing instability in the sidewalls of the pit and eventual collapse at 2.60m.

Scale 1:25 (when reduced to A4)

PLAN

Logged by: RH	Date: 22/8
Checked by: ARG	h/y
Approved by:	

FOUNDATION & EXPLORATION SERVICES

FIGURE 35

RECORD OF TRIAL PIT No: 420

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1716

METHOD OF EXCAVATION: JCB
SURFACE DIMENSIONS OF PIT: 2.60m x 0.80m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N
Sheet 1 of 1
GROUND LEVEL: 2.69 mOD

Insitu Testing Depth m	Insitu Testing Type	Samples Depth m	Samples Type	Samples No	Description of Strata	Thickness m	Depth m	Level mOD	Time + Date	Strata Symbol
		0.30	D	1	TOPSOIL: Dark brown sandy (fine) silty clay with rootlets.	0.44	0.44	2.25		
		0.40	D	2						
0.85	CBR (3%)	0.85	D	3	Loose brown silty fine SAND with fine to medium sand grade shell fragments and a slight organic odour. From 0.90m with dark orangish brown pockets.	1.75	2.10	0.59		
		1.65	B	4						
		2.40	D	5	Loose, dark bluish grey slightly clayey silty fine and medium SAND with a strong organic odour and fine to coarse sand grade shell fragments and black speckling.	>0.40	2.50	0.19		
					END OF TRIAL PIT					

REMARKS:
1. Seepage was observed from 2.13m becoming 'running sand' from 2.20m leading to instability in the pit walls and eventual collapse at 2.50m.

PLAN

Scale 1:25 (when reduced to A4)

Logged by:	Date
RH	22/8
Checked by:	
ARG	4/9
Approved by:	

FOUNDATION & EXPLORATION SERVICES

FIGURE 39

RECORD OF TRIAL PIT No: 4[illegible]

LOCATION	BROOKLAND, KENT	SURFACE DIMENSIONS OF PIT:	2.40m x 0.80m
CONTRACT No	1716	START DATE: 22/8/90	FINISH DATE: 22/8/90
CO-ORDINATES: E	N	Sheet 1 of 1	GROUND LEVEL: 2.78 m O.D

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No.	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m O.D	Time - Date	Strata Symbol
					TOPSOIL: Dark brown slightly clayey silty fine sand with rootlets.					
		0.40	D	1		0.83				
		0.57	D	2	From 0.57m becoming orangish brown with fewer rootlets.					
0.83	CBR (3No)	0.83	D	3			0.83	1.95		
					Loose, orangish brown clayey silty fine SAND. From 0.90m becoming mottled bluish grey and with small (5mm) pockets of dark brown silty clay.					
					From 1.58m with fine to coarse sand grade shell fragments and a slight organic odour.	1.52				
		1.87	B	4	From 1.87m with some partially decomposed rootlet remains and dark orange mottling, less clayey.					
		2.35	D	5			2.35	0.43		
					Loose, dark greyish brown silty fine and medium SAND with a strong organic odour, medium to coarse sand grade shell fragments and black decomposed organic debris.					
		2.80	D	6	From 2.70m becoming dark bluish grey.	0.65+				
							3.00	-0.22		
					END OF TRIAL PIT					

REMARKS:

1. Seepage was observed from 2.35m becoming 'running sand' at 2.50m leading to instability in the sidewalls of the pit and eventual collapse at 3.00m.

PLAN

Scale 1:25 (when reduced to A4)

Logged by:	Date:
RH	22/8
Checked by: ARG	4/9
Approved by:	

FOUNDATION & EXPLORATION SERVICES

FIGURE: 42

RECORD OF BOREHOLE No: 475

START DATE	21ST AUGUST 1990	CASING DETAILS	200mm to 5.50m	SHEET 1 OF 1	
DRILLING METHOD	CABLE PERCUSSION	BOREHOLE DIA	200mm to 6.00m	ORIENTATION	VERTICAL
				CO-ORDINATES	E N
EQUIPMENT	PILCON WAYFARER	DRILL FLUID		GROUND LEVEL	2.75 m O.D.

Date & Time	Casing Depth (m)	Water Level m (Flush Return %)	Sample/Core Recovery Depth (m)	Type (Total %)	No (RQD (SCR))	Core Size	Fracture	Description of Strata	Depth m (Thickness)	Level (m O.D.)	Strata Symbol
21/8			0.30	D	1			TOPSOIL: Light brown sandy (mostly fine) silty clay with rootlets.	(0.80)		
			0.80	D	2				0.80	1.95	
	-	DRY	1.30 S(8) 1.50 - 2.00	D B	3 4			Loose, brown slightly clayey silty fine SAND with an organic odour and some black organic debris. From 1.30m; becoming dark orangish brown and dark brown, slightly silty fine sand with fine to medium sand and gravel sized shell fragments.			
	2.00	DRY	2.50 S(4)	D W	5 11,12			From 2.50m; becoming fine to medium and with black speckling.	(3.00)		
	3.50	2.80	3.50 S(4)	D	6						
			3.80	D	7				3.80	-1.05	
	4.50	3.20	4.50 S(12)	D	8			Medium dense greenish grey slightly silty fine and medium SAND with a strong organic odour, up to coarse sand size black organic debris and up to coarse sand size shell fragments.			
			5.00	B	9				(2.20)		
	5.50	3.70	5.50 S(13)	D	10			From 5.50m; becoming greenish brown and dark bluish grey.			
21/8									6.00	-3.25	
								END OF BOREHOLE			

REMARKS

1. On completion of the borehole a Casagrande type standpipe piezometer was installed; 2:1 bentonite/cement grout 6.00m to 5.20m, sand filter 5.20m to 4.00m, piezometer tip at 5.00m, bentonite seal 4.00m to 3.20m, 2:1 bentonite/cement grout and concrete with stopcock cover from 3.20m to ground surface.

Logged by	Date
RH	21/8
Checked by	
Approved by	

SCALE 1 : 50 (When reduced to A4)

FOUNDATION & EXPLORATION SERVICES

A259 BROOKLAND DIVERSION

CONTRACT No 1716

FIGURE 15

RECORD OF BOREHOLE No: 470

START DATE	21ST AUGUST 1990	CASING DETAILS	200mm to 5.50m	SHEET 1 OF 1	
DRILLING METHOD	CABLE PERCUSSION	BOREHOLE DIA	200mm to 6.00m	ORIENTATION	VERTICAL
EQUIPMENT	PILCON WAYFARER	DRILL FLUID		CO-ORDINATES E N	
				GROUND LEVEL	2.81 m.O.D.

Date & Time	Casing Depth (m)	Water Level m (Flush Return %)	Sample/Core Recovery Depth (m)	Type / Total %	No / RQD (SCR)	Core Size	Fracture	Description of Strata	Depth m (Thickness)	Level (m O.D.)
			0.30	D	1			TOPSOIL: Dark orangish brown slightly clayey silty fine sand with rootlets.	(0.80)	
			0.80	D	2				0.80	2.01
	-	DRY	1.00	D	3			Loose, orangish brown clayey silty fine SAND. From 1.00m; with patches of light grey colouration.		
			1.50	B	4					
		DRY	2.00 S(8)	D	5			From 2.00m; becoming fine to medium; speckled black and with fine to medium sand size shell fragments.	(2.90)	
			2.50	W	11,12					
	3.00	2.80	3.00 S(4)	D	6					
			3.70	D	7				3.70	-0.89
	4.00	2.90	4.00 S(7)	D	8			Loose, greenish grey, silty fine to medium SAND speckled black and orange with an organic odour, black organic debris up to 25mm and with many fine to medium sand size shell fragments. From 4.00m; becoming dark bluish grey and brown and slightly silty.		
			5.00	B	9				(2.30)	
	5.50	3.40	5.50	D	10					
									6.00	-3.19
								END OF BOREHOLE		

REMARKS

1. On completion of the borehole a Casagrande type standpipe piezometer was installed: 2:1 bentonite/cement grout 6.00m to 5.20m, sand filter 5.20m to 4.30m, piezometer tip at 5.00m, bentonite seal 4.00m to 3.20m, 2:1 bentonite/cement grout and concrete grout and concrete with stopcock cover from 3.20m to ground surface.

Logged by	Date
RH	23/8
Checked by	
Approved by	

SCALE 1 : 50 (When reduced to A4)

FOUNDATION & EXPLORATION SERVICES

A259 BROOKLAND DIVERSION

CONTRACT No 1716

FIGURE 8

RECORD OF TRIAL PIT No: 500

LOCATION: BROOKLAND, KENT	SURFACE DIMENSIONS OF PIT: 2.70m x 0.80m	CO-ORDINATES:	Sheet 1 of 1
CONTRACT No 1716	START DATE: 22/8/90 FINISH DATE: 22/8/90	E N	GROUND LEVEL: 2.45 m.O.D.

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m.O.D	Time + Date	Strata Symbol
					TOPSOIL: Dark brown and light brown slightly clayey silty fine sand with rootlets.	0.50				
		0.33	D	1						
							0.50	1.95		
		0.55	D	2	Loose, orangish brown clayey silty fine SAND with occasional rootlets.	0.10	0.60	1.85		
					Loose, yellowish brown mottled bluish grey and orange silty fine SAND with a slight organic odour.					
0.93	CBR (3%)			1						
		1.25	D	3						
		1.55	B	4	From 1.55m with fine to medium sand grade shell fragments and occasional whole shells and silty clay pockets.	1.91				
		2.10	D	5	From 2.10m becoming fine and medium with occasional black organic debris.					
		2.51	D	6			2.51	-0.06		
					Loose dark bluish grey and black silty fine SAND with whole shells and fine to medium sand grade shell fragments and a strong organic odour.	0.09+	2.60	-0.15		
					END OF TRIAL PIT					

REMARKS:

1. Seepage was observed from 1.60m becoming 'running sand' from 1.90m leading to instability in the sidewalls and eventual collapse at 2.60m.

Scale 1:25 (when reduced to A4)

PLAN

Logged by: JH	Date 22/8	FOUNDATION & EXPLORATION SERVICES
Checked by: ARG	4/9	FIGURE 12
Approved by		

RECORD OF TRIAL PIT No: 655

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1716

METHOD OF EXCAVATION: JCB 3CX
SURFACE DIMENSIONS OF PIT: 2.20m x 0.80m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES E N
Sheet 1 of 1
GROUND LEVEL: 2.79 mOD

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No.	DESCRIPTION OF STRATA	Thickness m	Depth m	Level mOD	Time - Date	Strata Symbol
					TOPSOIL: Dark brown sandy (fine) silty CLAY with a little medium to coarse sand and some coarse flint gravel.	0.68				
		0.40	D	1						
		0.68	D	2			0.68	2.11		
					Loose, light yellowish brown silty fine SAND with occasional rootlets.	0.22				
0.87	HVN (183)	0.90	D	3			0.90	1.89		
					Loose, light bluish grey and yellowish orange silty fine SAND with some whole shells and occasional pockets of purplish grey silty clay and an organic odour.					
1.49	CBR (MS)	1.54	B	4		1.40+				
					From 1.87m with some purplish black mottling.					
		2.30	D	5	From 2.26m with black decomposed wood fragments.		2.30	0.49		
					END OF TRIAL PIT					

80

REMARKS

1. Seepage was observed from 1.87m becoming 'running sand' from 2.00m leading to instability and eventual collapse of the pit sides at 2.30m.

PLAN

Logged by	Date
RH	22/8
Checked by	
ARG	4/9
Approved by	

FOUNDATION EXPLORATION SERVICES

FIGURE 51

RECORD OF TRIAL PIT No: 755

PROJECT:	A259 BROOKLAND DIVERSION	METHOD OF EXCAVATION:	JCB 3CX
LOCATION:	BROOKLAND, KENT	SURFACE DIMENSIONS OF PIT:	2.70m x 0.60m
CONTRACT No:	1716	START DATE: 22/8/90	FINISH DATE: 22/8/90

CO-ORDINATES: E N

Sheet 1 of 1

GROUND LEVEL: 2.88 mOD

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m OD	Time - Date	Strata Symbol
		0.35	D	1	TOPSOIL: Brown sandy (fine) silty clay with rootlets.	0.50				
		0.50	D	2			0.50	2.38		
0.88	CBR (3%)		D		Dense becoming medium dense from 0.80m, orangish brown silty fine SAND with rootlets and occasional bluish grey discolouration patches.	0.80	1.30	1.58		
					Loose, light bluish grey and orange silty fine SAND with some rootlets, fine to medium sand grade shell fragments and an organic odour.					
		1.79	B	3	From 1.79m with dark orange patches.	1.75+				
					From 2.05m with many fine to medium sand grade shell fragments and occasional whole shells (up to 10mm).					
		2.40	D	4			2.55	0.33		
					END OF TRIAL PIT					

PLAN

REMARKS

1. Seepage was observed from 2.30m as 'running sand' leading to instability in the pit sides and eventual collapse at 2.55m

Logged by	Date
RH	22/8
Checked by:	
ARO	4/9
Approved by:	

FOUNDATION & EXPLORATION SERVICES

FIGURE 55

95

RECORD OF TRIAL PIT No: 875

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1716

METHOD OF EXCAVATION: JCB 3CX
SURFACE DIMENSIONS OF PIT: 2.60m x 0.80m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N
Sheet 1 of 1
GROUND LEVEL: 2.74 m O.D

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m O.D	Time - Date	Strata Symbol
		0.30	D	1	TOPSOIL: Light brown sandy (fine) clayey silt with rootlets.	0.70	0.70	2.04		
0.70	CBR (5%)	0.70	D	2						
		0.88	D	3	Dense, orangish brown clayey silty fine SAND with many rootlet remains and an organic odour.	0.18	0.88	1.86		
1.00	CBRx2 (3%,3%)	0.88	B	4	Loose orangish brown clayey silty fine SAND with pockets of grey colouration and a slight organic odour. From 1.50m, becoming bluish grey mottled dark orangish brown fine to medium, with black organic debris and rootlet traces, fine to medium sand grade shell fragments and occasional whole shells.	2.02+				
		2.80	D	5	From 2.80m, with much wholly and partially decomposed wood pieces.		2.90	-0.16		
					END OF TRIAL PIT					

PLAN

REMARKS.

1. Seepage was observed from 2.30m as 'running sand' leading to instability in the pit sides and eventual collapse at 2.90m.

Logged by	Date
RH	22/8
Checked by	
ARG	4/9
Approved by	

FOUNDATION & EXPLORATION SERVICES

FIGURE 59

RECORD OF BOREHOLE No: 895

START DATE	20TH AUGUST 1990	CASING DETAILS	200mm to 5.50m	SHEET 1 OF 1	
DRILLING METHOD	CABLE PERCUSSION	BOREHOLE DIA	200mm to 6.00m	ORIENTATION	VERTICAL
				CO-ORDINATES E	N
EQUIPMENT	PILCON WAYFARER	DRILL FLUID		GROUND LEVEL	2.75 m O D

Date & Time	Casing Depth (m)	Water Level-m (Flush Returns%)	Sample/Core Recovery Depth (m)	Type / Total %	No / RQD (SCR)	Core Size	Fracture	Description of Strata	Depth m (Thickness)	Level m O D	Strata Symbol
20/8			0.30	D	1			TOPSOIL: Light brown silty fine sand with rootlets.	(0.90)		
									0.90	1.85	
			1.00	B	2			Loose, light orangish brown and light bluish grey clayey silty fine SAND with black speckling and a slight organic odour.			
		DRY	1.50 S(4)	D	3				(1.30)		
									2.20	0.55	
			2.30 S(6)	D	4			Loose, dark greenish brown very silty fine SAND with black coarse sand size organic debris, fine to medium sand size shell fragments and an organic odour.			
			2.50	W	5,6						
			3.50	D	7			Below 3.50m, becoming coarser to a slightly silty fine SAND with a little medium sand.			
			4.00	B	8				(3.80) +		
	5.50	2.80	5.50 S(18)	D	9			Becoming medium dense, brown and bluish grey and fine to medium.			
20/8									6.00	-3.25	
								END OF BOREHOLE.			

REMARKS

1. On completion of the borehole a Casagrande type standpipe piezometer was installed; 2:1 bentonite/cement grout 6.00m to 5.20m, sand filter 5.20m to 4.00m, piezometer tip at 5.00m, bentonite seal 4.00m to 3.20m, 2:1 bentonite/cement grout and concrete with stopcock cover from 3.20m to ground surface.

Logged by	Date
RH	23/8
Checked by	
Approved by	

SCALE 1 : 50 (When reduced to A4)

FOUNDATION & EXPLORATION SERVICES

A259 BROOKLANDS DIVERSION

CONTRACT No 1716

FIGURE 21

RECORD OF TRIAL PIT No: 955

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1716

METHOD OF EXCAVATION: JCB 3CX
SURFACE DIMENSIONS OF PIT: 2.40m x 0.75m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N
Sheet of
GROUND LEVEL: 2.82 m O.D.

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m O.D.	Time - Date	Strata Symbol
					TOPSOIL: Light brown sandy (fine) silty clay with rootlets.					
		0.30	D	1		0.79				
		0.55	D	2	From 0.50m becoming orangish brown.					
		0.79	D	3			0.79	2.03		
					Loose, light greyish brown clayey very silty fine SAND with occasional orangish brown pockets and shell fragments.					
		1.80	D	4	From 1.60m becoming silty fine to medium SAND with some shell fragments.	1.65				
							2.44	0.38		
					END OF TRIAL PIT					

REMARKS.

1. A slight seepage was observed at 2.00m leading to instability in the sidewalls of the pit with eventual collapse at 2.44m.

PLAN

Logged by	Date
RH	22/8
Checked by	
ARC	4/9
Approved by	

FOUNDATION & EXPLORATION SERVICES

FIGURE 61

95

RECORD OF INSPECTION PIT No : 1

PROJECT: A259 BROOKLAND DIVERSION	METHOD OF EXCAVATION: HAND		
LOCATION: BROOKLAND, KENT	SURFACE DIMENSIONS OF PIT: 0.64m x 0.42m	CO-ORDINATES:	Sheet 1 of 1
CONTRACT No: 1716	START DATE: 22/8/90 FINISH DATE: 22/8/90	E N	GROUND LEVEL 2.84 m O D

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m O D	Time + Date	Strata Symbol
					WEARING COURSE: Rolled ashphalt.	0.095	0.095	2.795		
					ROADBASE: Medium to coarse gravel in ashphalt.	0.245	0.29	2.55		
					SUBGRADE: Loose, greyish brown clayey silty fine SAND.	0.26	0.55	2.29		

REMARKS.

PLAN

Logged by	Date
JH	22/8
Checked by:	
MC	4/9
Approved by	

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FIGURE 67

RECORD OF INSPECTION PIT No : 2

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1716

METHOD OF EXCAVATION: HAND
SURFACE DIMENSIONS OF PIT: 0.60m x 0.44m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N

Sheet 1 of 1

GROUND LEVEL: 2.40 m O D

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No.	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m O D	Time & Date	Strata Symbol
					WEARING COURSE: Rolled asphalt.	0.04	0.04	2.36		
					ROAD BASE: Coarse gravel in asphalt.	0.08	0.12	2.28		
					Old Wearing Course: Rolled asphalt.	0.02	0.14	2.26		
					Old Road base: Coarse gravel in asphalt.	0.25	0.39	2.01		
					SUB-BASE: Fine to coarse sand with much subangular to subrounded fine to coarse gravel and asphalt fragments.	0.31	0.70	1.70		
					END OF TRIAL PIT					

REMARKS:

PLAN

Scale 1:12.5 (when reduced to A4)

Logged by:	Date
RH	22/8
Checked by	
AHG	4/9
Approved by	

FOUNDATION EXPLORATION SERVICES

FIGURE 68

RECORD OF INSPECTION PIT No : 3

PROJECT: A259 BROOKLAND DIVERSION
LOCATION: BROOKLAND, KENT
CONTRACT No: 1716

METHOD OF EXCAVATION: HAND
SURFACE DIMENSIONS OF PIT: 0.59m x 0.43m
START DATE: 22/8/90 FINISH DATE: 22/8/90

CO-ORDINATES: E N
Sheet 1 of 1
GROUND LEVEL 2.58 m O.D

INSITU TESTING Depth m	INSITU TESTING Type	SAMPLES Depth m	SAMPLES Type	SAMPLES No.	DESCRIPTION OF STRATA	Thickness m	Depth m	Level m O.D	Time + Date	Strata Symbol
					WEARING COURSE: Rolled asphalt.	0.05	0.05	2.53		
					ROAD BASE: Coarse gravel and asphalt.	0.05	0.10	2.48		
					SUB-BASE: Lean mix concrete.	0.26	0.36	2.22		
					SUBGRADE: Sandy silty CLAY.	0.26	0.62	1.96		
					END OF INSPECTION PIT					

REMARKS:

PLAN

Logged by	Date
RH	22/8
Checked by	
AJG	4/9
Approved by	

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FIGURE 69

102