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GROUND INVESTIGATION REPORT

LAND OFF PETERBOROUGH ROAD
CROWLAND
LINCOLNSHIRE

Report Reference C14639

On behalf of:-

Mr M & Mrs S Blackbird and
Mr P & Mrs J Blackbird
Nos. 9 & 11 Barbers Drove North
Crowland
Lincolnshire
PE6 0BE

February 2019

MR M & MRS S BLACKBIRD

&

MR P & MRS J BLACKBIRD

MOULTON LAND & PLANNING LIMITED

GROUND INVESTIGATION REPORT

FOR

PROPOSED RESIDENTIAL DEVELOPMENT

AT

LAND OFF PETERBOROUGH ROAD

CROWLAND

LINCOLNSHIRE

Report Reference No. C14639 **February 2019**

INTRODUCTION

The clients, Mr & Mrs Blackbird, propose to build two new large detached houses, on a site off Peterborough Road, Crowland in Lincolnshire. The proposed building loads were not known at the time of report writing but the proposed houses were understood to be 'lightly loaded'.

Ground Engineering Limited was commissioned by the client, under the direction of project managers Moulton Land & Planning Limited, to carry out a ground investigation to determine the nature and geotechnical properties of the underlying soils, in relation to the design and construction of the foundations. A contamination assessment was also included within the scope of this report.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The site is located on the eastern side of Peterborough Road, Crowland in Lincolnshire. The site is approximately 500m south of the centre of Crowland. The National Grid Reference for the centre of the site is TF 2422 0972 and its location is shown on a plan following this report text.

At the time of the investigation in December 2018, the western part of the site had been cleared of buildings from a former transport yard, however concrete hardstanding remained. The larger eastern part of the site was an undeveloped field.

Coniferous trees were present along the western boundary of the field, to the rear of the former transport yard area. Trees were also present along the northern and eastern boundaries of the field. The western boundary of the site was defined by gardens of houses off Peterborough Road; the northern boundary by Greenbank Drain; the eastern boundary by a field boundary; and the southern boundary by the gardens of houses off Barbers Drove North.

This part of Crowland stands at about 3.0mOD, on low lying land at a margin of the Lincolnshire Fens.

The geological map, sheet 158 (1984) at 1:50,000 scale, shows superficial Nordelph Peat beneath the western edge of the site adjacent Peterborough Road, with superficial Barroway Drove Beds (now named Tidal Flat Deposits) beneath the majority of the site, overlying the solid geology of the Oxford Clay Formation.

SITE WORK

The site work conducted on 7th December 2018 comprised eight machine excavated trial pits (TP1 to TP8). The trial pit positions are shown on the exploratory hole location plan following this report text.

Public utility service drawings were consulted prior to determining the exploratory hole positions. Prior to excavation, a service scan was made at each position using a CAT (Cable Avoidance Tool) to check for the absence of detectable buried services that may otherwise have been damaged by the investigation.

The trial pits were undertaken using a 'JCB 3CX' type excavator, and the exposed strata were logged and the soils sampled by a Geoenvironmental Engineer. The pits were completed at depths between 1.00m and 3.10m below ground level.

Representative disturbed samples of soil were recovered at regular intervals throughout the depth of the trial pits.

An indication of the shear strength of clay soils within the trial pits was made using a hand shear vane (V) where possible and the readings are presented on the trial pit records. The apparent cohesion results have been plotted against depth in Figure 1.

On completion, the spoil was returned to the pits and placed in layers, which were recompacted, and the surface layers were reinstated.

The trial pit records, presented following the exploratory hole location plan, give the descriptions and depths of the various strata encountered, details of all samples taken, in-situ tests and the groundwater conditions observed during and on completion of excavation.

LABORATORY WORK

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the trial pit records. The soil descriptions have been made in accordance with BS5930:1999. The geotechnical test results, undertaken in accordance with BS1377:1990, are presented following the exploratory hole records. The chemical test results follow the geotechnical test results.

The moisture content of selected soil samples was determined. The index properties of selected soil samples were determined as a guide to soil classification and behaviour. The liquid limit was determined by a cone penetrometer.

Selected samples were subjected to a grading analysis to determine the particle size distribution by wet sieve analysis. The particle size distribution passing the 63µm sieve was obtained by pipette sedimentation. The results of these tests are given as particle size distribution curves.

California Bearing Ratio (C.B.R.) tests were performed on selected recompacted samples at a UKAS accredited laboratory. The samples were recompacted using a 2.5kg rammer within a CBR mould. The tests consisted of jacking into the remoulded soil a cylindrical plunger with a cross sectional area of 1935mm^2. A force of 50N was applied initially to seat the plunger on the soil surface and then the plunger was made to penetrate the soil at a uniform rate of 1mm/min. Readings of force were taken at intervals of penetration of 0.25mm to a penetration not exceeding 7.50mm. The CBR value is the ratio of the force required to achieve 2.50mm or 5.00mm penetration to standard forces expressed as a percentage.

Selected samples of soil were analysed to determine the concentration of soluble sulphates. The pH values were also determined.

Chemical analysis of eight soil samples recovered from the exploratory holes was undertaken, by an independent laboratory, primarily for characterisation purposes. The samples were tested for a suite encompassing a wide range of potential contaminants outlined by the Environment Agency (EA) and National House Building Council (NHBC) document R&D 66;

2008 ‘Guidance for the Safe Development of Housing on Land Affected by Contamination’. In addition four samples were tested for total petroleum hydrocarbons (TPH), a sample of suspected cement-bound asbestos sheet was sent for identification.

GROUND CONDITIONS

The ground conditions found by the investigation have been plotted as a soil profile in Figure 2. The ground conditions encountered comprised made ground to depths of between 0.30m and 0.60m, which rested locally on the expected superficial Nordelph Peat, Tidal Flat Deposits, Marine Sand and locally in turn superficial glacial Till (TP1). The underlying solid geology of the Oxford Clay was not reached during this shallow investigation.

Made Ground

A 0.30m to 0.60m thick surface layer of firm, dark brown and dark grey, slightly sandy, slightly gravelly, silty clay fill was found, varying to silty, sand and gravel fill with occasional cobbles of limestone and concrete in TP7 and TP8 in the western area of the site. The gravel fraction comprised flint, brick, concrete, limestone, ash, asphalt and cement-bound asbestos sheet fragments (TP7).

Nordelph Peat

The Nordelph Peat was met below the made ground at 0.40m and 0.60m depth in the western, former transport yard area of the site (TP7 & TP8). This comprised a firm, brown and black, silty, clayey, amorphous peat. This peat layer was encountered to at least the base of TP7 at 1.00m depth, and to 1.10m depth in TP8. The peat was 0.50m thick in TP8, and at least 0.60m thick in TP7.

Tidal Flat Deposits

The Tidal Flat Deposits were met below the 0.30m to 0.60m thick layers of made ground, and beneath the Nordelph Peat in TP8 at 1.10m depth. These initially comprised a soft or firm, brown, orange brown and light grey, slightly sandy, silty clay, with partings of orange brown silt and amorphous peat (TP1). This clay layer was encountered to depths of between 0.70m and

1.90m depth in the exploratory holes. Trial pit TP8 was completed within the Tidal Flat Deposits at 1.30m depth.

Marine Sand

The Marine Sand was encountered below the Tidal Flat Deposits at depths of between 0.70m and 1.40m. The Marine Sand initially comprised, brown and grey, initially slightly clayey, sandy silt, becoming silty fine sand with depth. Trial pits TP2 to TP6 were completed within this stratum at between 2.50m and 3.10m below ground level.

Till

Beneath the Tidal Flat Deposits at 1.90m depth in TP1, a Glacial Till comprising stiff, orange brown and blue grey, slightly gravelly, silty clay with gravelly sand partings was encountered. The gravel fraction comprised angular to sub-rounded flint and chalk. Trial pit TP1 was completed within this stratum at a depth of 3.10m below ground level.

Groundwater/Excavation Stability

Groundwater seepages were recorded within the Marine Sand at between 2.00m and 2.95m depth, with water recorded at between 2.70m and 2.95m depth on completion. Pit side wall instability was recorded in association with groundwater seepages together with 'running sand' conditions.

Live Roots

Live roots were observed within the majority of the exploratory holes to depths between 0.05m and 1.20m. The greatest depth of live roots was noted in TP4, positioned near trees and a hedgerow along the eastern site boundary.

Evidence of Contamination

The made ground encountered during this investigation was not noted to have olfactory or visual evidence of hydrocarbon contamination. The made ground was noted to contain fragments of brick, concrete, asphalt and cement-bound asbestos sheet fragments (TP7).

COMMENTS ON THE GROUND CONDITIONS IN RELATION TO FOUNDATION DESIGN AND CONSTRUCTION

The investigation found a 0.30m to 0.60m thick cover of made ground over Nordelph Peat and Tidal Flat Deposits. Marine Sand and glacial Till was met below the Tidal Flat Deposits at between 0.70m and 1.90m depth across the site, deepening northwards across the site.

The proposed building loads were not known at the time of report writing, although the anticipated house foundations are expected to be 'lightly' loaded. Shallow traditional footings within the firm 'crust' of the Tidal Flat Deposits might be considered for the lightly loaded houses where settlement of its foundations could be tolerated. As the proposed houses have a large footprint, it is recommended that foundations bear within a consistent stratum, such as the Marine Sand, generally encountered below 0.70m and 1.40m depth, which is likely to provide adequate working loads and minimal settlements, to support the proposed buildings.

Shallow Foundations

The surface made ground layer should not be considered as a suitable bearing stratum. The Nordelph Peat in the western part of the site had modified plasticity indices of 52% and 62%, which are rated as having a high volume change potential. The Tidal Flat Deposits beneath the main site area initially comprised layers of silty clay with modified plasticity indices of 25% and 37%, which are rated as having a medium volume change potential. The underlying Glacial Till had a modified plasticity index of 17%, which is rated as having a low volume change potential. On an open site within Tidal Flat Deposits, at least 30m distant from mature high water demand trees, a minimum foundation depth of 0.90m below current or proposed ground level, whichever is greater, would be required in order to be below the zone of seasonal volume change in accordance with modern building standards.

Trees and shrubs can extend the depth affected by seasonal moisture variation and advice on this is given in the National House Building Council (NHBC) Standards Chapter 4.2 "Building near trees" (2018). Deeper foundations would be required in clay soils close to trees, whether they are to be removed or retained. For example, foundations cast within medium volume change potential clay at a distance of approximately 25m from a mature English Oak, and 12m from a mature Leyland Cypress, will require a minimum depth of 0.90m, in accordance with the aforementioned NHBC document. The NHBC document should be referred to in any areas where trees are to remain, be removed or where any new planting is proposed.

Live roots were observed to a maximum depth of 1.20m in TP4. Where clay is present, foundations should be taken below the last sign of any live roots and ideally 0.50m below the last vestige of roots or into non-shrinkable soil. The Marine Sand was encountered below the clay layer of the Tidal Flat Deposits at 0.70m to 1.40m depth across the site and would be classed as a non-shrinkable soil. In summary, foundations would be locally required; to depths of 0.90m in clay soils away from the trees in the east and west of the site; to be extended below live roots in clay soils or based in the underlying non-shrinkable Marine Sand.

The Tidal Flat Deposits in the area of TP2 to TP6, encountered at the minimum 0.90m depth and away from the influence of live roots, would have a maximum safe bearing capacity of 90kN/m^2 beneath a 0.60m wide strip footing, with a factor of safety of 3.0 applied against shear failure. In the area of TP1, and possibly where the garage for Plot 1 is proposed, due to the underlying soft and peaty clay soils, a reduced maximum safe bearing capacity of 60kN/m^2 beneath a 0.60m wide footing would apply, with a factor of safety of 3.0 applied against shear failure. Total settlement beneath such foundations cast within the Tidal Flat Deposits should be within 25mm and could take years to occur. Care should be taken to ensure that the bearing properties of the firm 'crust' of Tidal Flat Deposits are not compromised by the use of heavy plant and site disturbance.

A net allowable bearing pressure for the underlying non-shrinkable Marine Sand would be in the order of 110kN/m^2 for footings up to 1.20m wide for up to 25mm of immediate settlement.

Differential settlement may occur beneath foundations that are based on varying ground conditions within the silt and clay of the Tidal Flat Deposits or in the underlying Marine Sand with varying rates and amounts of settlement. Differential settlement may be minimised by deepening all foundations into the Marine Sand.

Foundations in the Tidal Flat Deposits, within the range of influence of the trees, will have to be separated from the soil by a suitable void former. The required gap dimensions for footings are detailed in the previously cited NHBC document and should be based on clay with a medium volume change potential.

Floor Slabs

A lightly loaded floor slab could be ground bearing following a careful check for soft ground or root infested clay, providing that it is not sensitive to settlement. If present, any poor ground should be removed and replaced with coarse grained fill. The adoption of a ground bearing floor slab greatly depends on the careful and correctly supervised placement of such fill. For areas of deeper root affected clay, although not encountered across the building plots, a suspended floor slab could be more practical.

The formation beneath the floor slabs will be within the Tidal Flat Deposits, which at shallow depth comprise silt, which is potentially frost susceptible. A minimum construction thickness of 450mm would therefore be required. Consideration should be given to incorporating a geogrid/geotextile layer at the base of the sub-base to prevent loss of hardcore into the underlying sub-grade.

Excavations

It is essential the base of excavations are checked, particularly with regard to live roots in clay soils, to ensure that the condition of the soil complies with that assumed in design. Should pockets of inferior or root infested clay material be present, they should be removed and replaced with well-graded hardcore or lean mix concrete. Care should be taken not to allow water to come into contact with the strata forming the base of excavations, since it is prone to

rapid deterioration in the presence of water. The excavated surface should be protected from deterioration and a blinding layer of concrete used where foundations are not completed without delay.

Based on the conditions observed at the time of the December 2018 investigation, groundwater seepages should be expected within the near surface Tidal Flat Deposits and Marine Sand as encountered during the investigation. Groundwater seepages were noted in some of the trial pits at depths below 2.00m. Inflows are likely to be accompanied by 'running sand' conditions within the layers of silt/sand in the Tidal Flat Deposits or within the underlying Marine Sand. Care should be taken not to excavate below the water table in the absence of suitable groundwater control and side support, such as dewatering via screened sumps.

Deep excavations on this site are likely to be unstable and collapse, with trial pit sides locally unstable below 1.50m depth. Statutory safety precautions should not be neglected and excavations especially those where personnel are to enter, will need to be supported, or have battered sides where space permits. All excavations should be undertaken in accordance with CIRIA Report 97 '*Trenching Practice*'.

Pavement Design

The pavement formation across the site will be within the Nordelph Peat in the west of the site, and Tidal Flat Deposits in the main eastern area, which at shallow depth comprises silt which is a frost susceptible soil. A minimum pavement thickness of 450mm would therefore be required. Consideration should be given to incorporating a geogrid/geotextile layer at the base of the sub-base to prevent loss of hardcore into the underlying sub-grade.

Laboratory test results determined CBR values of between 52% and 101% for the silty sand and gravel fill in the western part of the site. Based on Interim Advice Note (IAN) 73/06 (2009) 'Design Guidance for Road Pavement Foundations (Draft HD25)', Table 5.1 recommends a design CBR value of 3.0%, for clay with a plasticity index of 30%, and 2.0% for a clay with a plasticity index of 60%, both with a thin pavement construction. Therefore a conservative design CBR value of 2.0% for clay could be adopted for flexible hardstanding design

on this site. This assumes that the sub-grade should be suitably compacted and inspected, with any topsoil, made ground, inferior soils, silt or desiccated root affected clays at sub-grade level removed and replaced with suitable well-graded coarse-grained fill. Care should be taken not to allow the exposed soil at sub-grade level to become exposed to inclement weather conditions.

Proof rolling of the formation layer should be carried out prior to construction, and any topsoil, soft or loosely compacted material should be removed and replaced with a well-graded hardcore or lean mix concrete.

Sulphate Requirements

Sulphate analysis on selected soil samples gave results in Design Sulphate Classes DS-1 and DS-2 of the BRE Special Digest 1, Table C1 (2005), presented in Appendix 1. The pH results were acidic to alkaline, ranging from 5.2 to 8.8.

Assuming that the made ground soils are not retained around the foundations or beneath the floor slabs, these results indicate an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-2 for buried concrete. This ACEC Class should be considered when specifying a Design Chemical Class (DC Class) for buried concrete on this site, as detailed in the above cited BRE document.

COMMENTS ON THE SOIL CHEMICAL TEST RESULTS

The results of the laboratory chemical testing on near surface soil samples have primarily been compared to soil screening values (SSVs) produced by Land Quality Management Limited (LQM) and the Chartered Institute for Environmental Health (CIEH) presented in their document 'The LQM/CIEH S4ULs for Human Health Risk Assessment: 2015 (Publication Number S4UL3608)'. The LQM/CIEH S4ULs are intended for use in assessing the potential risks posed to human health by contaminants in soil and are transparently-derived and cautious 'trigger values' above which further assessment of the risks or remedial action may be needed. The S4ULs (Suitable for Use Levels) have been derived, in accordance with UK legislation and Environment Agency policy, using a modified version of the Environment Agency CLEA 1.06 software.

Reference has also been given to ATRISKsoil soil screening values produced by Atkins Limited and provided under licence to Ground Engineering Limited. Atkins SSVs have been derived in line with the Environment Agency 2009 guidance using the CLEA 1.04 and 1.06 software. With the absence of a S4UL for cyanide the ATRISKsoil SSV has been used as the soil screening criteria within this report.

In 2014 the Department for Environment Food and Rural Affairs (DEFRA) published, in their document SP1010, Category 4 Screening Levels (C4SL) for several contaminants including lead. The C4SL represent screening levels below which the land could be considered suitable for a specified use and definitely not contaminated land in respect of those determinands. With the absence of S4UL for lead the C4SL has been used as the soil screening criteria within this report.

For each contaminant the adopted soil screening criteria have been calculated for the following land uses:

- Residential use with home grown produce
- Residential use without home grown produce
- Commercial and industrial usage

The intended purpose of the SSVs are as "intervention values" in the regulatory framework for assessment of human health risks in relation to land use. These values are not binding standards, but are intended to inform judgements about the need for action to ensure that a new use of land does not pose any unacceptable risks to the health of the intended users.

Table 1 compares the test results for the made ground with the SSVs in relation to the specified uses. The number of test results, which exceed these values, are also provided.

Table 1: Comparison of Chemical Test Results with Soil Screening Criteria (SSV)

Determinand	Number of Samples	Min Value mg/kg	Max Value mg/kg	Number of Samples Exceeding SSV for			Measured 95th Percentile mg/kg		Soil Screening Criteria 2.5% SOM		
				Residential with home grown produce	Residential without home grown produce	Commercial/ Industrial		Assessment Method	Residential with home grown produce mg/kg	Residential without home grown produce mg/kg	Commercial/ Industrial mg/kg
Organic Matter	8	3.2%	16%	-	-	-	-	-	-	-	-
Arsenic	8	22	28	0	0	0	26.09	S4UL	37	40	640
Cadmium	8	0.14	0.69	0	0	0	0.41	S4UL	11	85	190
Chromium (III)*	8	12	150	0	0	0	80.18	S4UL	910	910	8600
Chromium (VI)	8	<0.50	<0.50	0	0	0	<0.50	S4UL	6	6	33
Lead	8	9.4	230	1	0	0	103.67	C4SL	200	310	2330
Mercury	8	<0.10	0.27	0	0	0	0.20	S4UL	11	15	320
Selenium	8	<0.20	1.2	0	0	0	1.06	S4UL	250	430	12,000
Nickel	8	10	58	0	0	0	47.52	S4UL	130	180	980
Phenols	8	<0.30	<0.30	0	0	0	<0.30	S4UL	200	690	690
Benzo[a]pyrene	8	<0.10	2.4	0	0	0	0.93	C4SL	5.0	5.3	76
Copper	8	4.8	100	0	0	0	52.34	S4UL	2400	7100	68,000
Zinc	8	30	340	0	0	0	189.05	S4UL	3700	40,000	730,000
Free Cyanide	8	<0.50	0.50	0	0	0	0.50	ATRISK	34	34	34

Notes

*The concentration of Trivalent Chromium is assumed to be equivalent to the Total Chromium concentration. This is because most naturally occurring chromium is in the trivalent (chromic) state.

S4UL and C4SL for metals were derived using 6% SOM. These values are not sensitive to SOM and would also be applicable for 1% SOM and 2.5% SOM.

LQM/CIEH S4ULs 'Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3608. All rights reserved'.

ATRISKsoil SSVs produced by Atkins Limited and provided under licence to Ground Engineering Limited.

Discussion of Soil Results

The results of the laboratory analysis indicate that the made ground in the western area contains an elevated concentration of lead (TP7 at 0.05m depth), which exceeded the soil screening criteria for residential with home grown produce end use. The lead concentrations in the eastern area of the proposed houses and gardens did not exceed the soil screening value for the proposed residential with home grown produce end use.

The lead concentrations did not exceed the associated soil screening criteria for a residential without home grown produce end use, representative of the proposed end use of the western part of the site. The lead concentrations beneath all areas of the site did not exceed the soil screening criteria for a commercial/industrial end use.

Levels of all remaining elements and compounds in the samples tested were within the associated soil screening values for both residential end uses and for a commercial/industrial end use.

The US95 values did not exceed the screening values for either of the residential end uses or for a commercial or industrial usage.

Other Contaminants

The made ground encountered during this investigation was not noted to have olfactory or visual evidence of fuel contamination. Total petroleum hydrocarbon (TPH) concentrations of between less than 10mg/kg (laboratory detection limit) and 120mg/kg were recorded in the samples of made ground tested, which are not considered significant.

Sheet fragments with asbestos containing materials (ACM) were noted within the made ground soils between 0.09m and 0.40m depth in trial pit TP7. The asbestos was identified in the laboratory as chrysotile.

COMMENTS ON GROUND CONTAMINATION IN RELATION TO PROPOSED RESIDENTIAL DEVELOPMENT

Anticipated exposure scenarios relating to the existing site and proposed new residential end use, are discussed as follows.

This investigation may not have revealed the full extent of contamination on the site and appropriate professional advice should be sought if subsequent site work reveals materials that may appear to be contaminated.

Contaminated Soil

On the basis of the ground investigation, the site is underlain by up to 0.60m of made ground. The chemical testing has identified no elevated concentrations in respect to the proposed residential with home grown produce end use within the made ground in the main eastern area of the proposed properties.

The made ground soils encountered beneath the main eastern part of the site would be considered suitable for re-use within the gardens or landscaped areas of this residential development.

Existing Drainage

Redundant drain runs, where encountered, should be removed from beneath the site and their contents disposed off-site. The integrity of existing drainage should be checked, and damaged sections replaced prior to development. The latter measures should remove any future risk to human health and the water environment.

Soil Gas

The site is underlain by a surface layer of made ground, covering the superficial Nordelph Peat, Tidal Flat Deposits, Marine Sand and glacial Till.

The made ground and Nordelph Peat has potential to generate hazardous gases which could migrate into structures, however the proposed houses are located away from the Nordelph Peat. There is a low likelihood that hazardous gas would affect groundworkers during the construction phase and it is unlikely that hazardous gases would affecting future users of the site.

Human Health - Construction Workers

With the exception of the cement-bound asbestos containing made ground in TP7, the made ground would be considered unlikely to affect the groundworkers during the construction phase of development.

Based on the chemical test results, no special precautions would be required during the development of the site by workers who may come into contact with the soil during groundworks, providing standard precautions are adopted which should generally include the procedures given by the Health and Safety Executive (The Blue Book) HS(G)66.

For the protection of workers during groundworks the following is recommended:

a) Limit repeated or prolonged skin contact with soils by wearing gloves with sleeves rolled down.

b) Washing facilities should be made available to groundworkers, so as to minimise the potential for inadvertent ingestion of soil.

c) If any soils are revealed which are different to those encountered by this ground investigation, the advice of a specialist should be sought in view of classifying the material and ascertaining its risk to groundworkers.

d) Suitable precautions, in line with current best practice, should be put in place to protect workers and neighbouring residents from the effects of asbestos containing material, generated during the previous demolition phase.

e) Generation of dust should be limited by damping-down.

f) Suitable precautions, in line with current best practice, should be put in place to protect workers from the effects of asbestos containing material, during the construction phase.

g) Consideration should be given to gas monitoring within deep or confined spaces, particularly where made ground or Nordelph Peat thickens, to ensure safety of personnel entering them, since carbon dioxide could accumulate within any excavations, service chambers or sub-structures.

Human Health - Users of Completed Development

It is considered unlikely that the identified made ground would affect the site users in a residential setting, however excavations in the paved and landscaped western part of the site should consider the presence of asbestos sheet fragments found in the area of TP7.

The results of the chemical analysis undertaken would indicate that the made ground from the main eastern part of the site should be considered suitable for re-use at the surface in any new garden, landscaped or planted areas. No scheme of remediation would be considered necessary for the residential setting, as long as potentially contaminated soils are not moved from the western area into garden and landscaped areas around the proposed houses.

Water Environment

There are no surface water features on the site, the closest is Greenbank Drain adjacent the northern boundary of the site. The site is partly underlain by superficial Nordelph Peat and Tidal Flat Deposits, which are indicated by the EA to be 'Unproductive' strata. The underlying solid geology Oxford Clay is also indicated by the EA to be an 'Unproductive' stratum.

It is considered unlikely that the made ground soils beneath the site could adversely affect the water environment.

Effects on Building Materials and Buried Services

The sulphate requirements for buried concrete have been discussed in the previous section of this report.

The local water supply company should be consulted if new buried plastic water pipes within the made ground soils on this site are proposed.

Off-Site Disposal of Soil Arisings

The results of chemical analysis are provided following the exploratory hole records and can be used within the information necessary for basic characterisation of the soil destined for landfill. The Environment Agency publication Hazardous Waste, Technical Guidance WM2 outlines the methodology for classifying wastes and should be referenced for guidance. The test results (total metals, hydrocarbons and cyanide) should be compared to the relevant thresholds to determine whether they fall into the primary categories of non-hazardous or hazardous waste and will help indicate the likely European Waste Catalogue (EWC) code which is determined by the waste type.

Excavated material and excess spoil should always be classified prior to removal from site as required by 'Duty of Care' (Environmental Protection Act, 1990) legislation. This means that material has to be given a proper description and waste classification prior to removal. Basic characterisation is the responsibility of the waste producer, whilst compliance checking and on-site verification are generally the responsibility of the landfill operator. The landfill operator will need to liaise with the waste producer, as the approach relies on the information from basic characterisation. Asbestos containing materials would be considered hazardous and should be appropriately disposed of.

The clean arisings from the natural soils, excluding topsoil and peat, across this site should fall under the European Waste Catalogue description 'Soil and Stones', EWC code 17 05 04 inert category.

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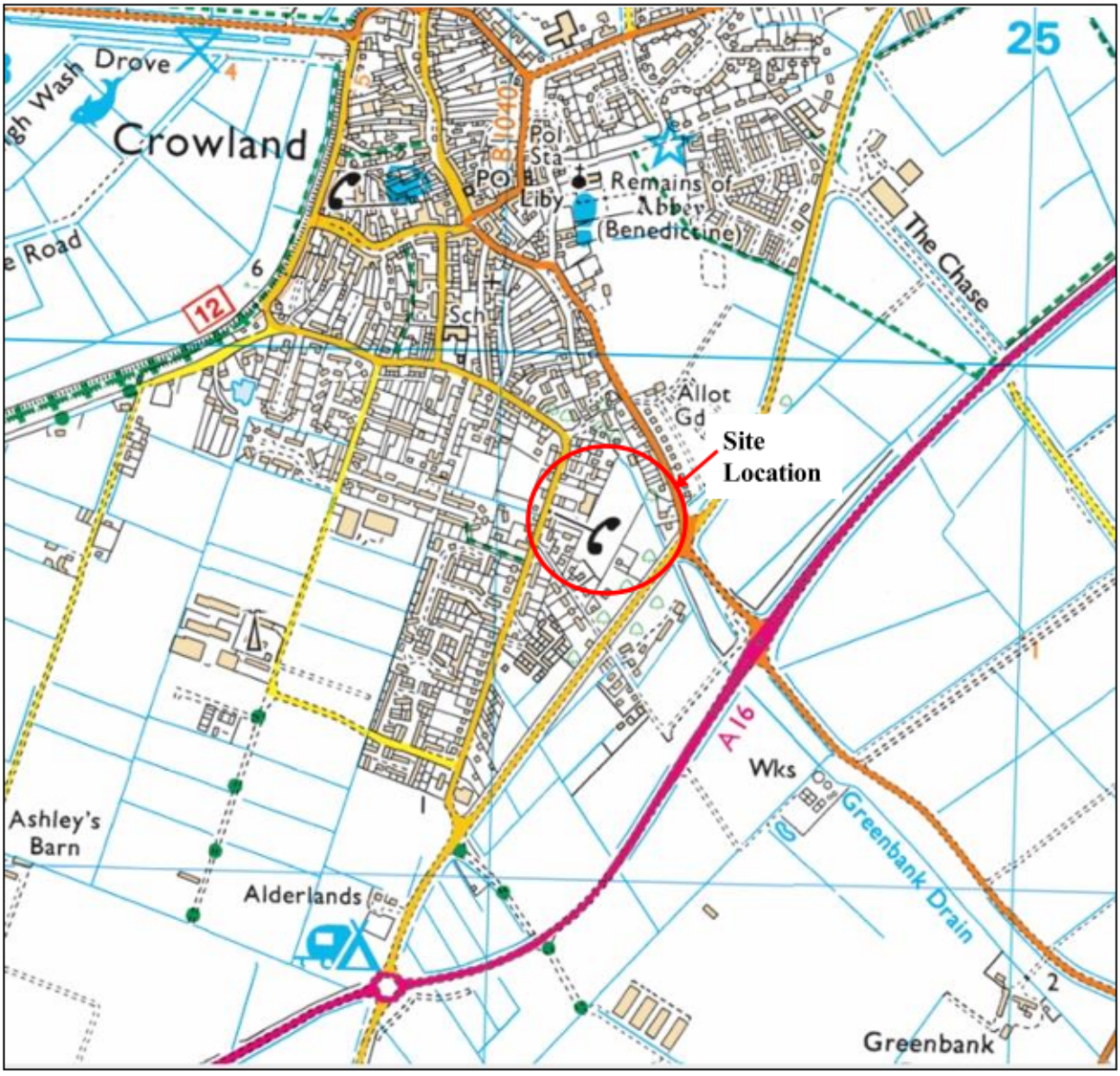
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Site Location Plan

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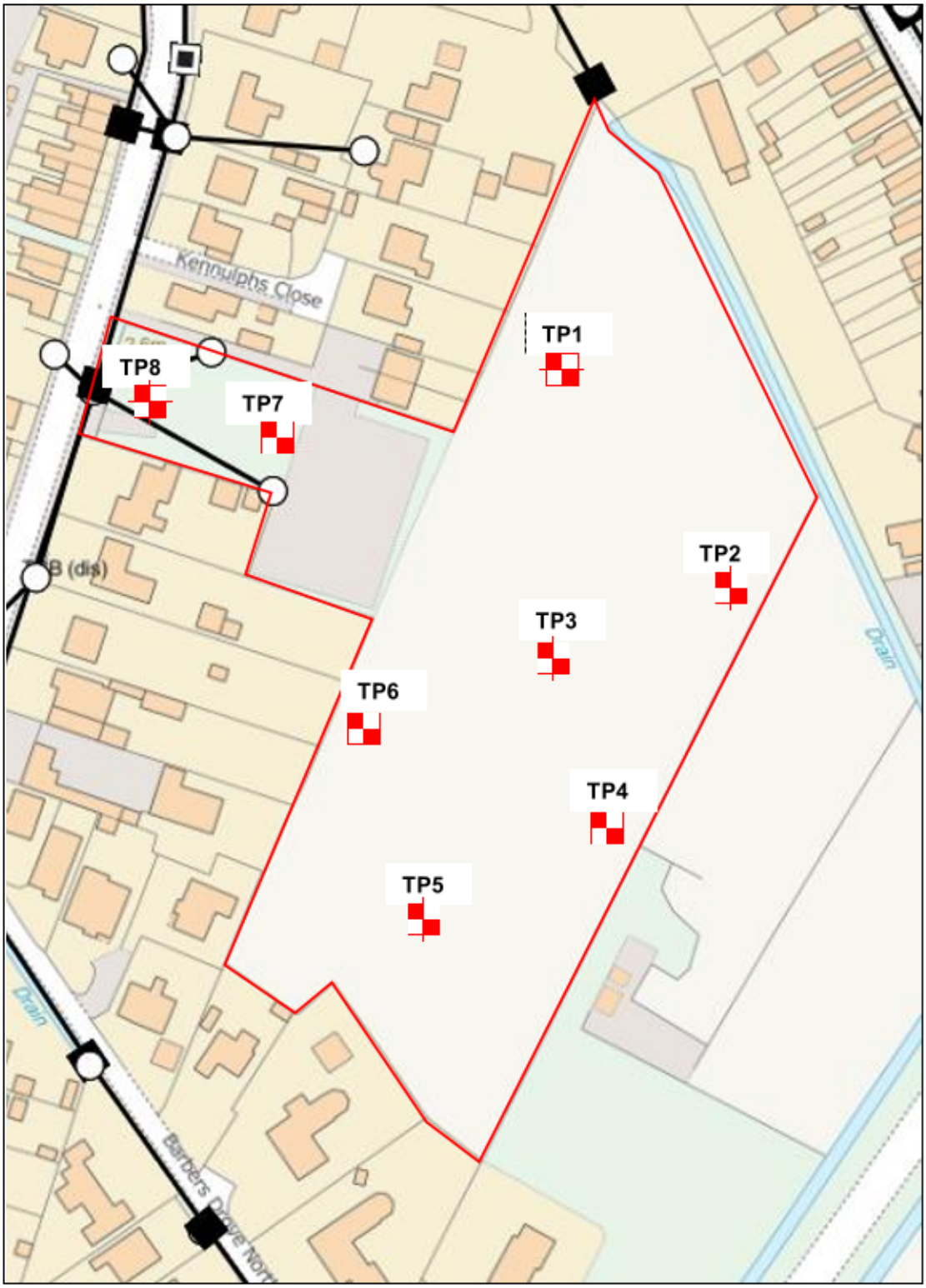


Not To Scale

Project : Land off Peterborough Road, Crowland, Lincolnshire **Client :** Mr & Mrs Blackbird	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No.** **C14639**

Exploratory Hole Location Plan

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Project : Land off Peterborough Road, Crowland, Lincolnshire **Client :** Mr & Mrs Blackbird	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C14639**

Proposed Development Plan

Based on plan provided by the client



Not To Scale

Project:	**Land off Peterborough Road, Crowland, Lincolnshire**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C14639**
Client:	**Mr & Mrs Blackbird**		

GROUND ENGINEERING LIMITED

Tel: 01733-568666
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Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT
TP1

Date: 07/12/18

Pit Size: 0.60m L x 0.30m W x 3.10m D.

Ground Level:

Samples and In-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.20	D1			MADE GROUND - Firm, dark brown, slightly sandy, slightly gravelly CLAY. Gravel is brick, flint and occasional ash.			
0.30	ES1					0.30	
0.50	D2			Firm, dark brown, brown and grey, slightly sandy, silty CLAY. (TIDAL FLAT DEPOSIT)			
0.50	ES2					0.70	
0.80	D3			Firm, brown, grey and orange brown, silty CLAY, with orange brown silt and amorphous peat partings.			
0.80	V1	(61)					
1.00	V2	(53)					
1.20	D4			(TIDAL FLAT DEPOSIT) ...Becoming soft below 1.30m depth.			
1.50	D5						
1.50	V3	(25)					
1.80	D6						
1.80	V4	(26)				1.90	
2.00	V5	(125)	▽1	Stiff, orange brown and blue grey, slightly gravelly, silty CLAY with gravelly sand partings. Gravel is angular to sub-rounded flint and chalk.			
2.10	D7						
2.40	D8		▽2				
2.50	V6	(124)		(TILL)			
2.70	D9						
			▼c				
3.00	D10						
3.00	V7	(130+)					
3.10	D11					3.10	
				Pit completed at 3.10m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. No live roots observed
2. Groundwater met at 2.00m and 2.40m depth
3. Water stood at 2.90m depth on completion
4. Pit sides stable

Project No 14639

Scale 1:25

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GROUND ENGINEERING LIMITED

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www.groundengineering.co.uk

Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT TP2

Date: 07/12/18

Pit Size: 2.30m L x 0.60m W x 3.10m D.

Ground Level:

Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
				MADE GROUND - Firm, dark brown, slightly gravelly, silty CLAY. Gravel is flint and brick fragments.			
0.30	D1						
0.30	ES1					0.40	
0.50	V1	(71)		Firm, brown, slightly sandy, silty CLAY.			
0.60	D2						
0.70	V2	(85)		(TIDAL FLAT DEPOSIT)			
0.90	D3						
0.90	V3	(86)					
1.10	D4					1.20	
1.30	D5			Firm, orange brown, brown and grey mottled silty CLAY. (TIDAL FLAT DEPOSIT)		1.40	
				Grey and brown, silty SAND. Sand is fine grained.			
1.60	D6						
1.90	D7						
2.10	D8						
2.40	D9			(MARINE SAND)			
2.70	D10						
3.00	D11		▽				
						3.10	
				Pit completed at 3.10m depth			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS

1. Live roots observed to 0.70m depth
2. Groundwater met at 2.95m depth
3. Pit sides stable

Project No	
14639	
Scale	Page
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Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT
TP3

Date: 07/12/18

Pit Size: 0.30m L x 0.30m W x 3.00m D.

Ground Level:

Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
				MADE GROUND - Firm, dark brown and dark grey, slightly sandy, slightly gravelly, silty CLAY. Gravel is brick, flint and ash.			
0.30	D1					0.35	
0.30	ES1						
0.45	V1	(110)		Stiff, becoming firm, grey, brown and orange brown, silty CLAY.			
0.60	D2						
0.65	V2	(112)		(TIDAL FLAT DEPOSIT)			
0.90	D3						
0.95	V3	(60)				1.10	
1.20	D4			Orange brown and grey, slightly clayey, sandy SILT. Sand is fine grained.			
1.50	D5			(MARINE SAND)			
1.80	D6						
2.10	D7					2.20	
2.40	D8			Grey and brown, silty SAND. Sand is fine grained.			
2.70	D9			(MARINE SAND)			
3.00	D10		▽c			3.00	
				Pit completed at 3.00m depth			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS

1. Live roots observed to 0.50m depth
2. Pit sides stable down to 2.80m depth, unstable beneath
3. Groundwater stood at 2.95m depth
4. Running sand at 3.00m depth

Project No	
14639	
Scale	Page
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GROUND ENGINEERING LIMITED

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Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT
TP4

Date: 07/12/18

Pit Size: 2.30m L x 0.60m W x 2.80m D.

Ground Level:

Samples and In-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
				MADE GROUND - Firm, dark brown and dark grey, slightly sandy, slightly gravelly, silty CLAY. Gravel of brick and flint.			
0.30	D1					0.35	
0.30	ES1			Firm, brown and grey, silty CLAY with topsoil from roots.			
0.55	D2			(TIDAL FLAT DEPOSIT)			
0.75	D3					0.80	
0.85	V1	(45)		Firm, grey, orange brown, silty CLAY.			
0.90	V2	(43)		(TIDAL FLAT DEPOSIT)		1.00	
1.00	D4			Orange brown, brown and grey, silty SAND.			
1.30	D5						
1.60	D6			(MARINE SAND)			
1.80	D7					1.90	
2.10	D8			Grey brown, silty SAND with occasional black carbonaceous traces.			
2.40	D9		▽	(MARINE SAND)			
			▼c				
2.80	D10					2.80	
				Pit abandoned at 2.80m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to 1.20m depth
2. Groundwater seepage at 2.50m depth
3. Pit sides stable to 2.50m depth, unstable beneath due to running sand
4. Groundwater stood at 2.70m depth

Project No	
14639	
Scale	Page
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Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT
TP5

Date: 07/12/18

Pit Size: 2.30m L x 0.80m W x 2.50m D.

Ground Level:

Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
				MADE GROUND - Firm, dark brown and brown, slightly sandy, slightly gravelly, silty CLAY. Gravel is flint and brick fragments.			
0.30	D1					0.40	
0.30	ES1						
0.50	V1	(61)		Firm, brown and orange brown, silty CLAY. (TIDAL FLAT DEPOSIT)			
0.60	D2					0.70	
0.70	V2	(45)		Orange brown and grey, slightly clayey, sandy SILT. Sand is fine grained.			
0.90	D3						
1.20	D4			(MARINE SAND)			
1.50	D5					1.70	
				Grey and brown, silty SAND. Sand is fine grained.			
1.90	D6						
2.20	D7			(MARINE SAND)			
			▽				
2.50	D8					2.50	
				Pit completed at 2.50m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to 0.70m depth
2. Groundwater met at 2.40m depth
3. Pit sides unstable below 1.50m depth
4. Running sand at 2.50m depth

Project No 14639

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Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT TP6

Date: 07/12/18

Pit Size: 2.30m L x 0.60m W x 2.65m D.

Ground Level:

Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.30	D1			MADE GROUND - Firm, dark brown and brown, slightly sandy, slightly gravelly, silty CLAY. Gravel is flint and brick fragments.			
0.30	ES1					0.40	
0.60	D2			Firm, brown, dark brown and orange brown, slightly sandy, silty CLAY. (TIDAL FLAT DEPOSIT)			
0.80	D3					0.90	
0.80	V1	(55)					
0.85	V2	(61)					
1.10	D4			Orange brown and brown, very silty SAND. Sand is fine grained. (MARINE SAND)			
1.40	D5						
1.70	D6					2.00	
2.10	D7			Grey and brown, silty SAND with occasional partings of clayey sand. (MARINE SAND)			
2.40	D8						
2.65	D9		▽			2.65	
				Pit abandoned at 2.65m depth			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS

1. Live roots observed to 0.40m depth
2. Pit sidewall collapse below 1.80m depth
3. Groundwater seepage at 2.65m depth
4. Pit abandoned due to running sand and side instability at 2.65m depth

Project No	
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Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT
TP7

Date: 07/12/18

Pit Size: 2.30m L x 0.60m W x 1.00m D.

Ground Level:

Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.05	D1			MADE GROUND - Brown, slightly sandy, gravelly SILT. Gravel is brick, flint and limestone.		0.09	
0.05	ES1			MADE GROUND - Brown, clayey/silty, very sandy GRAVEL with occasional cobbles of limestone and concrete. Gravel is limestone, flint, asphalt and asbestos sheet fragments.		0.40	
0.30-0.40	B1			Firm, dark brown and black, silty, clayey amorphous PEAT. (NORDELPH PEAT)		1.00	
0.30	D2			Pit completed at 1.00m depth			
0.30	ES2						
0.50-0.80	B2						

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to 0.05m depth
2. Pit dry
3. Pit sides stable

Project No 14639

Scale 1:25

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Site: LAND OFF PETERBOROUGH ROAD, CROWLAND

TRIAL PIT
TP8

Date: 07/12/18

Pit Size: 2.30m L x 0.60m W x 1.30m D.

Ground Level:

Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.10	D1			MADE GROUND - Light yellow brown, silty SAND AND GRAVEL with occasional cobbles of limestone and concrete.			
0.10	ES1						
0.40-0.60	B1					0.60	
0.90	D2			Firm, black and brown, silty, clayey, amorpheous PEAT. (NORDELPH PEAT)			
						1.10	
1.20	D3			Soft, dark brown, silty CLAY. (TIDAL FLAT DEPOSIT)			
						1.30	
				Pit completed at 1.30m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to 0.40m depth
2. Pit dry
3. Pit sides stable

Project No 14639

Scale 1:25

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LABORATORY TEST RESULTS

CONTRACT LAND OFF PETERBOROUGH ROAD, CROWLAND

Trial-pit	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO_4)			pH	C.B.R		Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m^3	Dry Mg/m^3	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil Total % Dry Wt.	Soil Aqueous Extract mg/l	Water mg/l		Top %	Base %	
TP1	D3	0.80	66	29	37	35														SOIL CLASSIFICATION = CH 0% retained on 425µm sieve
	D4	1.20													165		7.7			
	D7	2.10	37	17	20	27														SOIL CLASSIFICATION = CI 13% retained on 425µm sieve
	D8	2.40													502		7.7			
TP2																				
	D4	1.10	46	21	25	33														SOIL CLASSIFICATION = CI 0% retained on 425µm sieve
	D5	1.30													58		8.5			
TP4																				
	D5	1.30													140		8.5			
TP5																				
	D5	1.50													115		8.7			
TP7	B1	0.30 - 0.40				9.9	2.24	2.04										60	80	53% retained on 20mm sieve

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

C.B.R. - CALIFORNIA BEARING RATIO

14639

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LABORATORY TEST RESULTS

CONTRACT LAND OFF PETERBOROUGH ROAD, CROWLAND

Trial-pit	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO_4)			pH	C.B.R.		Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m^3	Dry Mg/m^3	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil: Total % Dry Wt.	Soil: Aqueous Extract mg/l	Water mg/l		Top %	Base %	
TP7	B2	0.50 - 0.80	116	64	52	85									805		7.0			SOIL CLASSIFICATION = MEO 0% retained on 425µm sieve
TP8	B1	0.40 - 0.60				9.3	2.17	1.98										52	101	33% retained on 20mm sieve
	D2	0.90	142	79	63	106									623		6.3			SOIL CLASSIFICATION = MEO 1% retained on 425µm sieve

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

C.B.R. - CALIFORNIA BEARING RATIO

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GROUND ENGINEERING

Newark Road Peterborough
t: 01733 566586
e: admin@groundengineering.co.uk

TEST CERTIFICATE

Determination of Particle Size Distribution

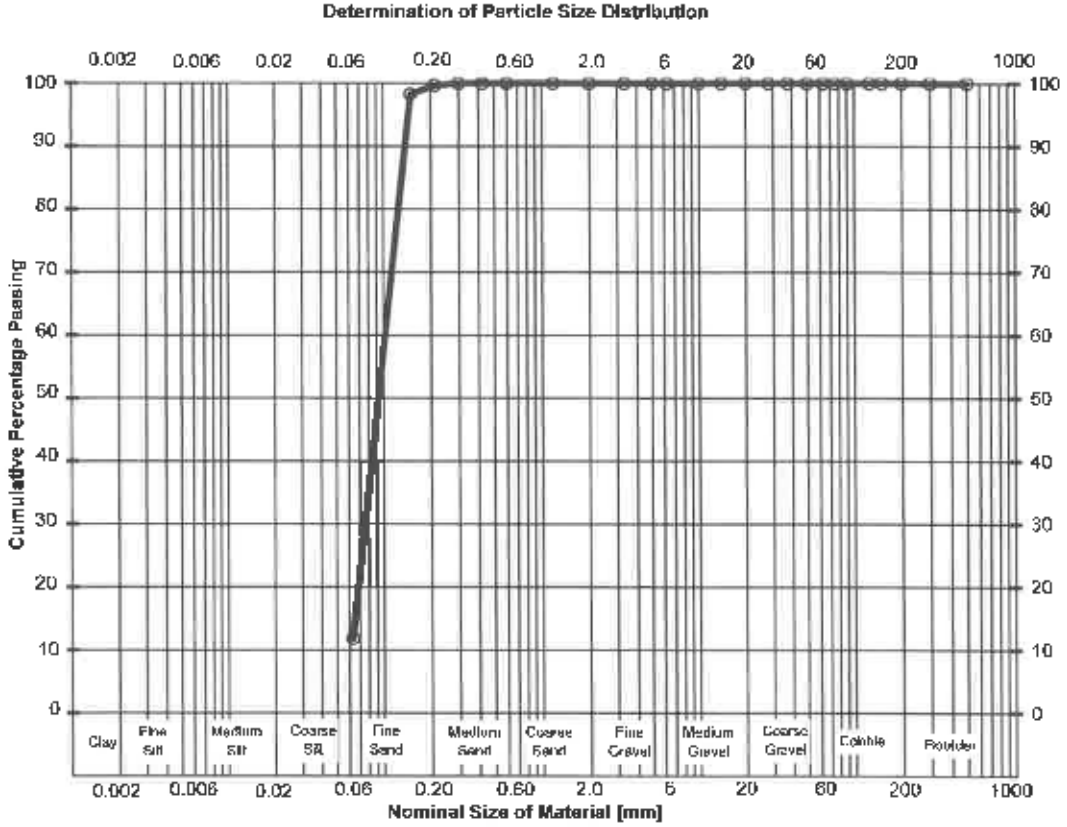
Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Sieved Grading

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/7/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	10.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/7 **Pre-treatment for organic material:** N/A
Client Reference: D9

Sample Description: Grey-brown orange-brown slightly silty SAND.

Material Specification: Not Required **Depth:** 2.40m
Location: TP2
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	100
0.425	100
0.300	100
0.212	100
0.150	98
0.063	12
0.020	
0.006	
0.002	

Comments:

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
Form Number: GELab/C/709-2 Version 51

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TEST CERTIFICATE

Determination of Particle Size Distribution

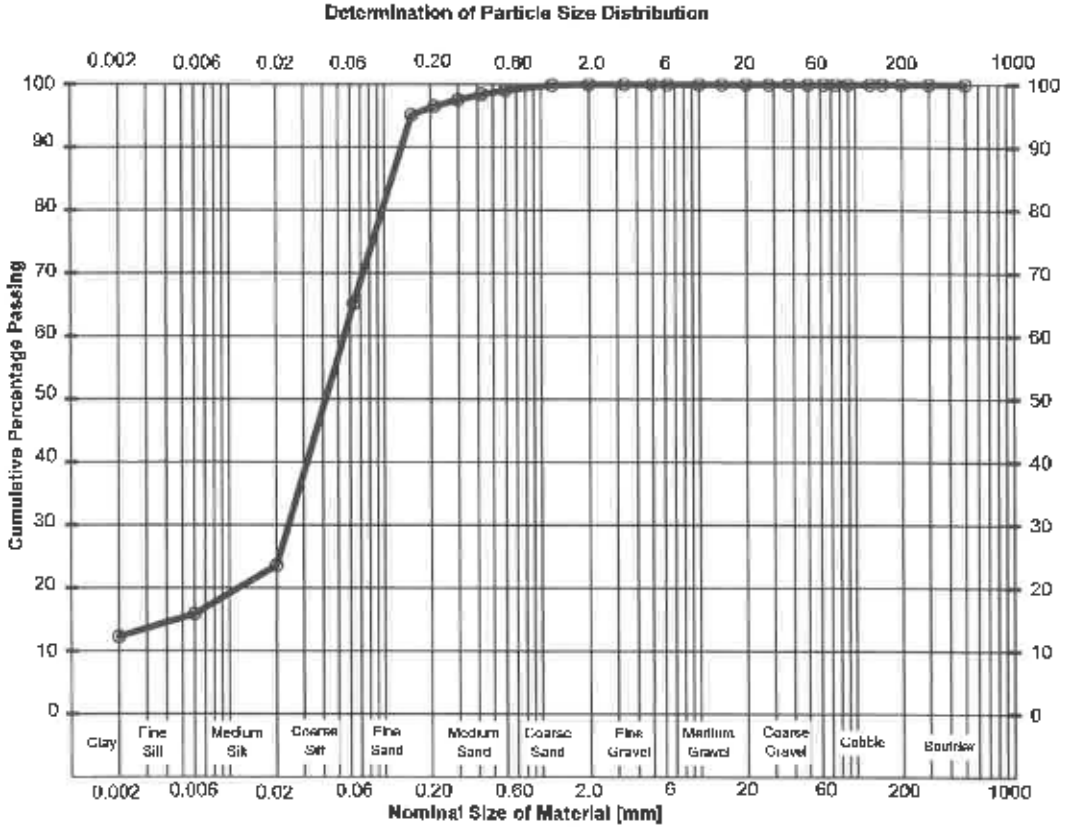
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/8/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	10.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/8 **Pre-treatment for organic material:** No
Client Reference: D4

Sample Description: Brown grey-brown orange-brown clayey silty SAND.

Material Specification: Not Required **Depth:** 1.20m
Location: TP3
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	99
0.425	98
0.300	98
0.212	97
0.150	95
0.063	65
0.020	24
0.006	16
0.002	12

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
Form Number: GELab/C/709-2 Version 51

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TEST CERTIFICATE

Determination of Particle Size Distribution

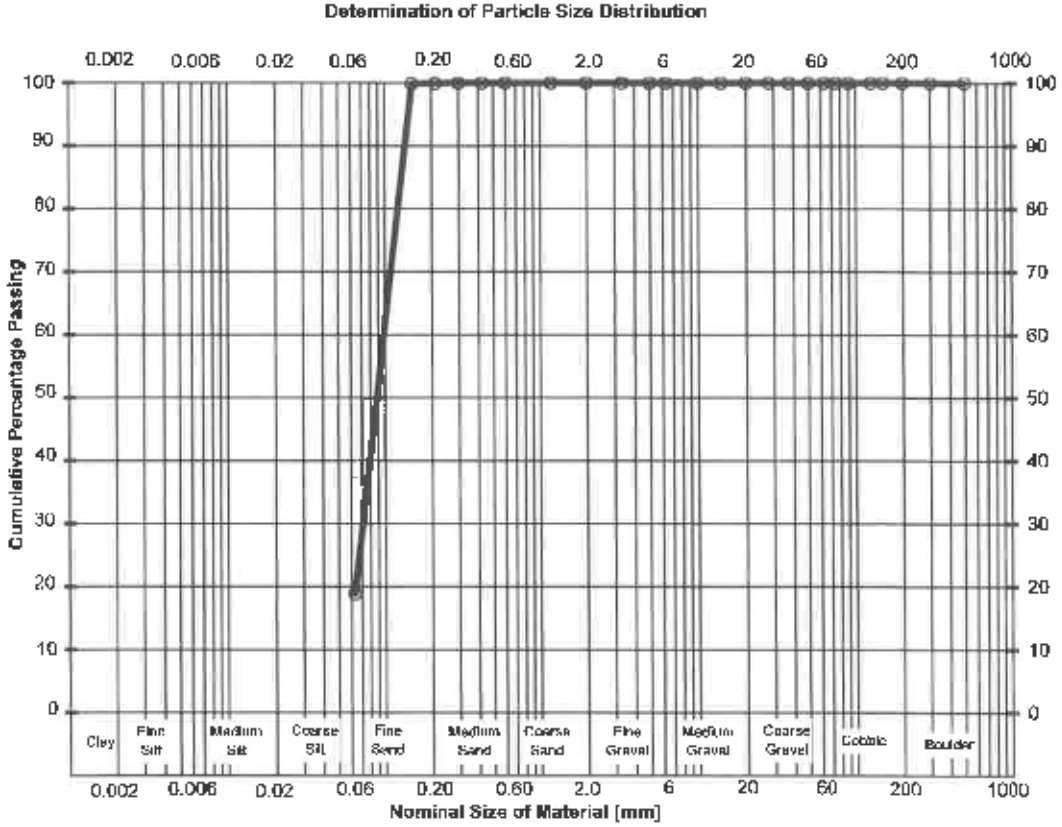
Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Sieved Grading

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/9/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	15.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/9 **Client Reference:** D8 **Pre-treatment for organic material:** N/A

Sample Description: Grey-brown orange-brown silty SAND.

Material Specification: Not Required **Depth:** 2.40m
Location: TP3
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	100
0.425	100
0.300	100
0.212	100
0.150	100
0.063	19
0.020	
0.006	
0.002	

Comments:

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
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GROUND ENGINEERING

Newark Road Peterborough
T 01733 566566
e: admin@groundengineering.co.uk

TEST CERTIFICATE

Determination of Particle Size Distribution

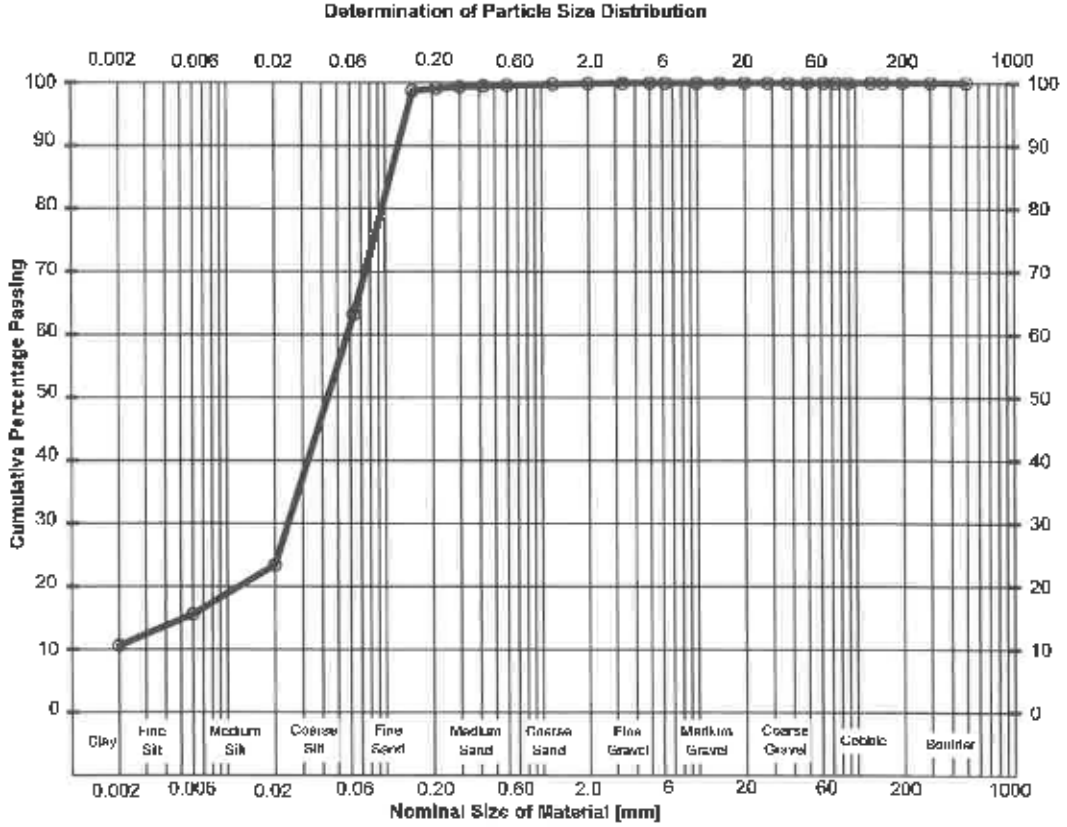
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/10/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	15.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/10 **Pre-treatment for organic material:** No
Client Reference: D4

Sample Description: Brown orange-brown grey-brown clayey SILT/SAND with occasional roots <2mm in diameter.

Material Specification: Not Required **Depth:** 1.00m
Location: TP4
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	100
0.425	100
0.300	99
0.212	99
0.150	99
0.063	63
0.020	23
0.006	15
0.002	11

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
Form Number: GELab/C/709-2 Version 51

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Registration Number: 6929574
Reg Office: Ground Engineering Ltd
Newark Rd, Peterborough PE1 5UA

8180

GROUND ENGINEERING

Newark Road Peterborough
t: 01733 566566
e: admin@groundengineering.co.uk

TEST CERTIFICATE

Determination of Particle Size Distribution

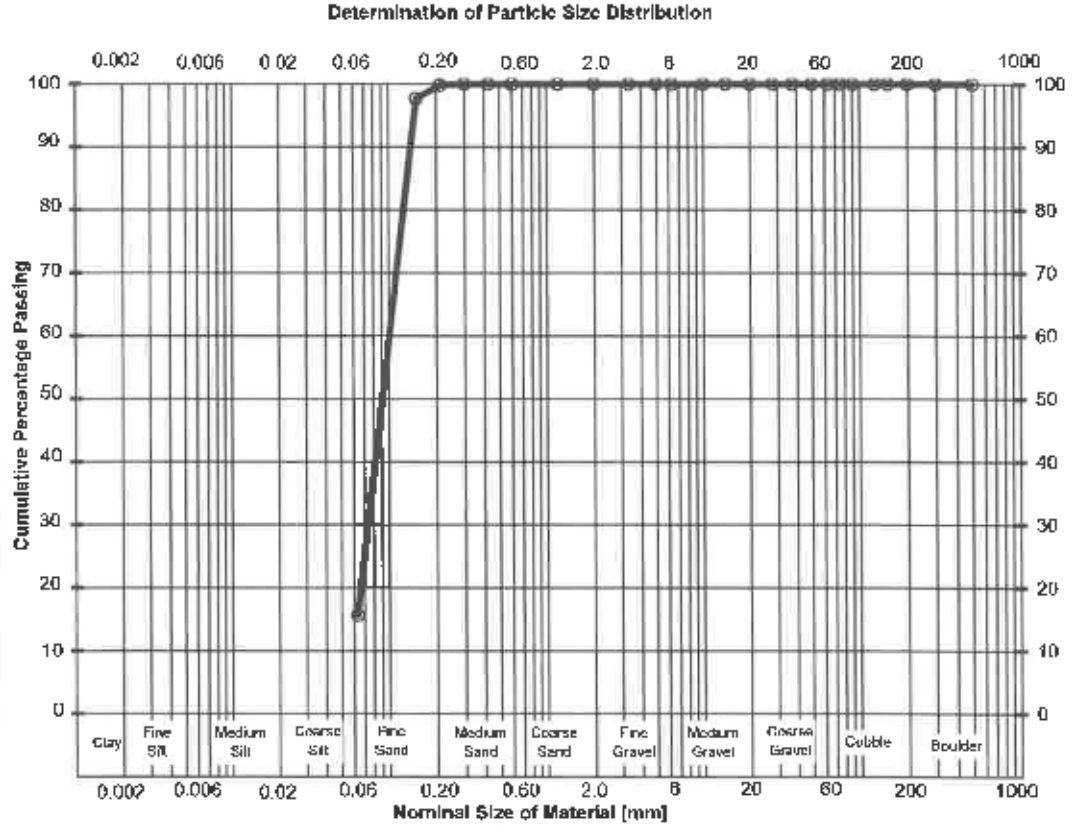
Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Sieved Grading

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/12/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	15.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/12
Client Reference: D7
Pre-treatment for organic material: N/A

Sample Description: Brown orange-brown slightly silty SAND.

Material Specification: Not Required
Location: TP4
Source:
Depth: 1.80m
Supplier:



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	100
0.425	100
0.300	100
0.212	100
0.150	98
0.063	16
0.020	
0.006	
0.002	

Comments:

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
Form Number: GELab/C/709-2 Version 51

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TEST CERTIFICATE

Determination of Particle Size Distribution

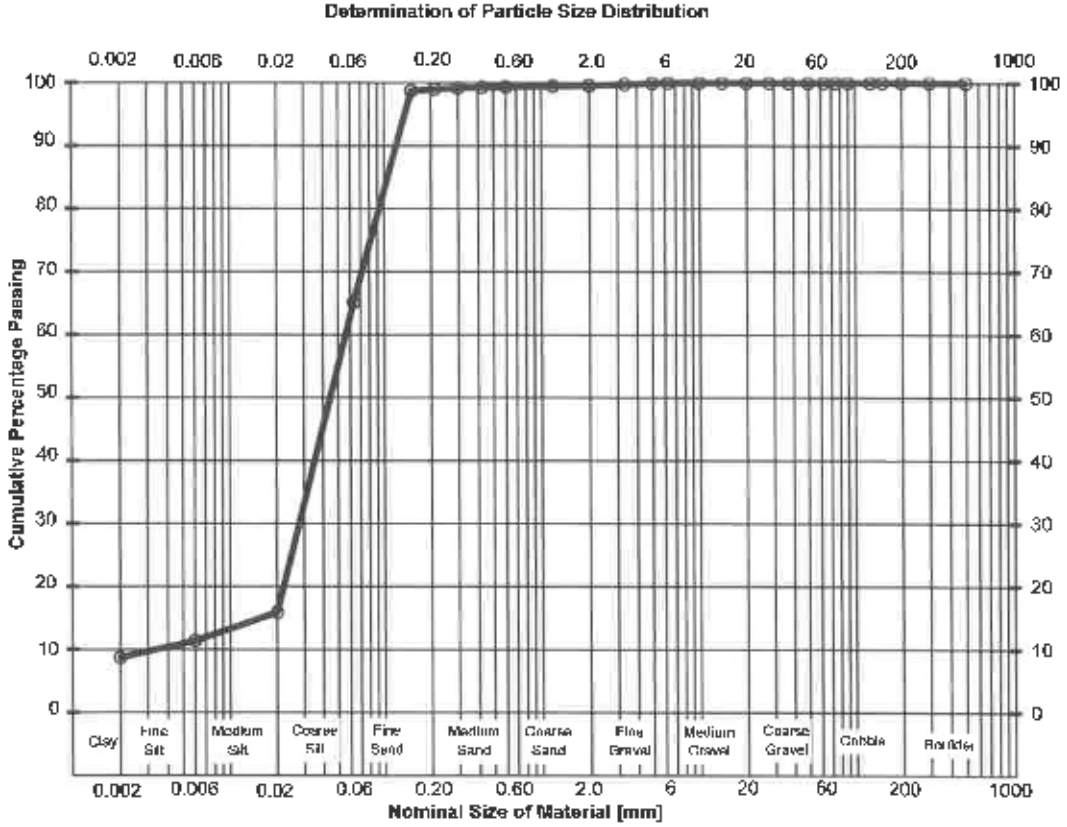
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/13/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	15.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/13 **Pre-treatment for organic material:** N/A
Client Reference: D3

Sample Description: Brown orange-brown dark brown slightly clayey SILT/SAND.

Material Specification: Not Required **Depth:** 0.90m
Location: TP5
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	99
0.600	99
0.425	99
0.300	99
0.212	99
0.150	99
0.063	85
0.020	**16**
0.006	**11**
0.002	**9**

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
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GROUND ENGINEERING

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B160

TEST CERTIFICATE

Determination of Particle Size Distribution

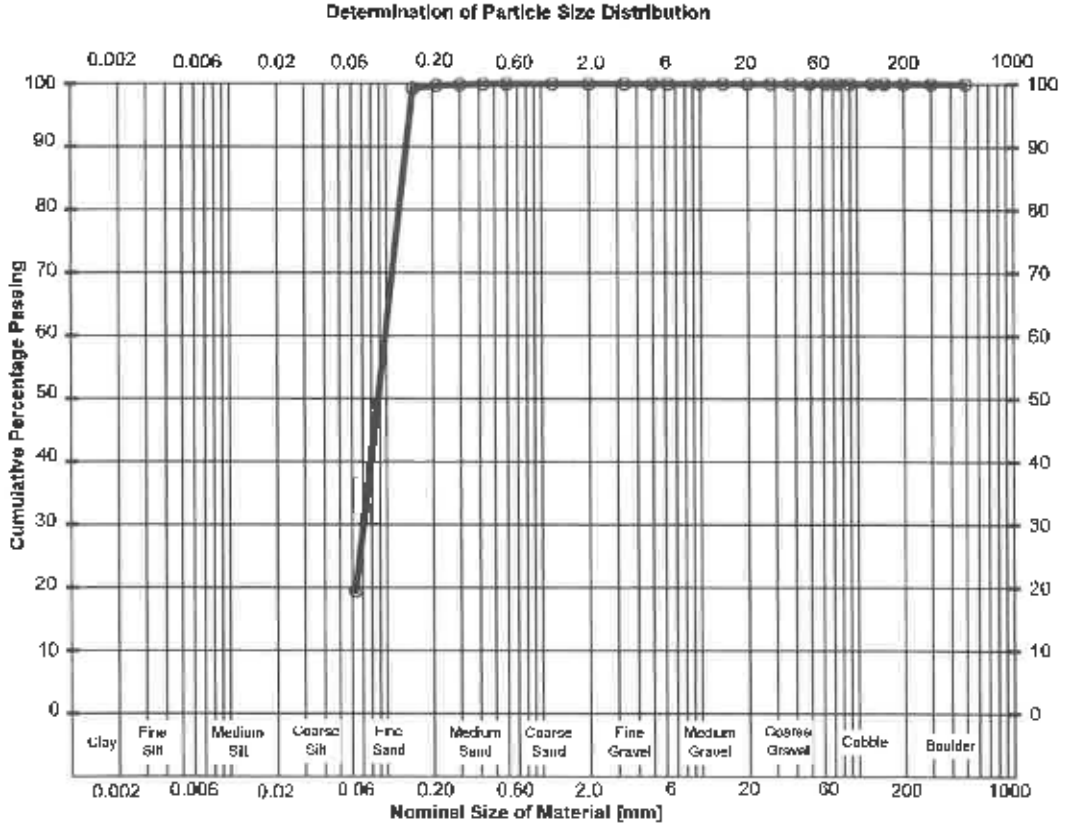
Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Sieved Grading

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/15/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	15.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/15 **Pre-treatment for organic material:** N/A
Client Reference: D6

Sample Description: Grey-brown orange-brown silty SAND.

Material Specification: Not Required **Depth:** 1.90m
Location: TP5
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	100
0.425	100
0.300	100
0.212	100
0.150	99
0.063	19
0.020	
0.006	
0.002	

Comments:

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
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TEST CERTIFICATE

Determination of Particle Size Distribution

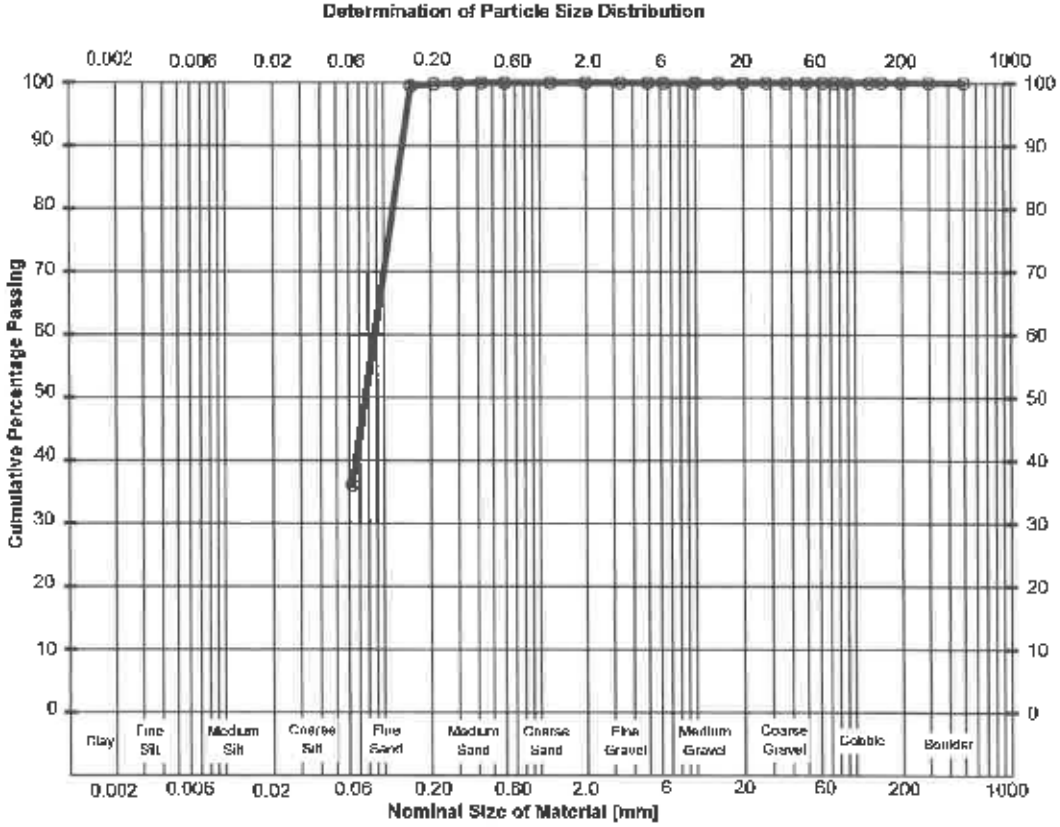
Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Sieved Grading

Client:	Ground Engineering Ltd	Certificate Number:	PL6524-1/16/710-2
Client Address:	Newark Road	Client Reference:	C14639
	Peterborough	Lab Job Number:	PL6524-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	14.12.2018
Contact:	Simon Weatherley	Date Tested:	15.01.2019
		Certificate of Sampling:	N/A
Site Name:	Land off Peterborough Road	Sampling Certificate No.:	N/A
Site Address:	Crowland	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL6524-1/16 **Pre-treatment for organic material:** N/A
Client Reference: D4

Sample Description: Brown orange-brown grey-brown clayey silty SAND.

Material Specification: Not Required **Depth:** 1.10m
Location: TP6
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	100
0.425	100
0.300	100
0.212	100
0.150	99
0.063	36
0.020	
0.006	
0.002	

Comments:

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 18.01.2019 Page 1 of 1
Form Number: GELab/C/709-2 Version 51

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UKAS TESTING
2183

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	18-39539-1
Initial Date of Issue:	03-Jan-2019
Client	Ground Engineering Limited
Client Address:	Newark Road Peterborough Cambridgeshire PE1 5UA
Contact(s):	Simon Weatherley
Project	SW/C14639 Land off Peterborough Road, Cowland

Quotation No.:		**Date Received:**	17-Dec-2018
Order No.:	SW/C14639	**Date Instructed:**	17-Dec-2018
No. of Samples:	12		
Turnaround (Wkdays):	5	**Results Due:**	21-Dec-2018
Date Approved:	03-Jan-2019		

Approved By:

Details: Martin Dyer, Laboratory Manager

Chemtest
The right chemistry to deliver results

Results - Soil

Project: SW/C14639 Land off Peterborough Road, Cowland

Client: Ground Engineering Limited	Chemtest Job No.:				18-39539	18-39539	18-39539	18-39539	18-39539	18-39539	18-39539	18-39539
Quotation No.:	Chemtest Sample ID.:				742525	742526	742527	742528	742529	742530	742531	742532
	Client Sample ID.:				D1	D1	D1	D1	D1	D1	D1	D1
	Sample Location:				TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.20	0.30	0.30	0.30	0.30	0.30	0.05	0.10
	Date Sampled:				07-Dec-2018	07-Dec-2018	07-Dec-2018	07-Dec-2018	07-Dec-2018	07-Dec-2018	07-Dec-2018	07-Dec-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
pH	U	2010		N/A	7.7	7.5	6.3	5.2	7.3	7.6	8.4	8.6
Moisture	N	2030	%	0.020	27	26	22	16	24	19	12	8.6
Stones and Removed Materials	N	2030	%	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.44	1.1	1.1	0.69	1.6	< 0.40	1.0	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	0.011	0.023	< 0.010	< 0.010	< 0.010
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50	< 0.50	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	0.70	1.2	0.60	< 0.50	0.60	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	1.1	1.1	0.93	0.99	< 0.50	0.92	< 0.50	8.3
Arsenic	U	2450	mg/kg	1.0	22	26	28	24	25	24	26	24
Cadmium	U	2450	mg/kg	0.10	0.36	0.24	0.22	0.15	0.17	0.32	0.69	0.14
Chromium	U	2450	mg/kg	1.0	40	50	51	36	42	40	150	12
Copper	U	2450	mg/kg	0.50	31	26	27	23	24	32	100	4.8
Mercury	U	2450	mg/kg	0.10	0.27	0.15	0.18	0.15	0.18	0.18	0.11	< 0.10
Nickel	U	2450	mg/kg	0.50	36	43	45	33	41	41	58	10
Lead	U	2450	mg/kg	0.50	89	55	61	50	49	73	230	9.4
Selenium	U	2450	mg/kg	0.20	0.82	1.0	1.0	1.2	1.0	0.99	0.27	< 0.20
Zinc	U	2450	mg/kg	0.50	150	110	100	68	80	130	340	30
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	8.4	5.5	9.1	16	8.3	8.1	3.2	3.6
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.5	0.94	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	2.4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	3.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	1.8	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	1.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	3.1	0.74	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	1.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	3.6	0.76	< 0.10	0.52	< 0.10	< 0.10	0.31	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	0.90	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	0.90	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	2.8	0.74	< 0.10	0.37	< 0.10	< 0.10	0.35	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	23	3.2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Total TPH >C8-C40	U	2670	mg/kg	10								

Chemtest
The right chemistry to deliver results

Results - Soil

Project: SW/C14639 Land off Peterborough Road, Cowland

Client: Ground Engineering Limited					Chemtest Job No.:	18-39539	18-39539	18-39539	18-39539
Quotation No.:					Chemtest Sample ID.:	742533	742534	742535	742536
					Client Sample ID.:	ES1	ES1	ES2	ES1
					Sample Location:	TP6	TP7	TP7	TP8
					Sample Type:	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.30	0.05	0.30	0.10
					Date Sampled:	07-Dec-2018	07-Dec-2018	07-Dec-2018	07-Dec-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
pH	U	2010		N/A					
Moisture	N	2030	%	0.020		23	18	8.6	9.0
Stones and Removed Materials	N	2030	%	0.020					
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40					
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010					
Cyanide (Free)	U	2300	mg/kg	0.50					
Cyanide (Total)	U	2300	mg/kg	0.50					
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50					
Arsenic	U	2450	mg/kg	1.0					
Cadmium	U	2450	mg/kg	0.10					
Chromium	U	2450	mg/kg	1.0					
Copper	U	2450	mg/kg	0.50					
Mercury	U	2450	mg/kg	0.10					
Nickel	U	2450	mg/kg	0.50					
Lead	U	2450	mg/kg	0.50					
Selenium	U	2450	mg/kg	0.20					
Zinc	U	2450	mg/kg	0.50					
Chromium (Hexavalent)	N	2490	mg/kg	0.50					
Organic Matter	U	2625	%	0.40					
Acenaphthene	U	2700	mg/kg	0.10					
Acenaphthylene	U	2700	mg/kg	0.10					
Anthracene	U	2700	mg/kg	0.10					
Benzo[a]anthracene	U	2700	mg/kg	0.10					
Benzo[a]pyrene	U	2700	mg/kg	0.10					
Benzo[b]fluoranthene	U	2700	mg/kg	0.10					
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10					
Benzo[k]fluoranthene	U	2700	mg/kg	0.10					
Chrysene	U	2700	mg/kg	0.10					
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10					
Fluoranthene	U	2700	mg/kg	0.10					
Fluorene	U	2700	mg/kg	0.10					
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10					
Naphthalene	U	2700	mg/kg	0.10					
Phenanthrene	U	2700	mg/kg	0.10					
Pyrene	U	2700	mg/kg	0.10					
Total Of 16 PAH's	U	2700	mg/kg	2.0					
Total Phenols	U	2920	mg/kg	0.30					
Total TPH >C6-C40	U	2670	mg/kg	10		< 10	120	< 10	< 10

Chemtest
The right chemistry to deliver results

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-01414-1
Initial Date of Issue:	22-Jan-2019
Client	Ground Engineering Limited
Client Address:	Newark Road Peterborough Cambridgeshire PE1 5UA
Contact(s):	Simon Weatherley
Project	SW/C14639 Land off Peterborough Road, Crowland

Quotation No.:		**Date Received:**	16-Jan-2019
Order No.:	SW/C14639	**Date Instructed:**	16-Jan-2019
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	22-Jan-2019
Date Approved:	22-Jan-2019		

Approved By:



Details: Glynn Harvey, Laboratory Manager

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Results - Soil

Project: SW/C14639 Land off Peterborough Road, Crowland

Client: Ground Engineering Limited					**Chemtest Job No.:**	19-01414
Quotation No.:					**Chemtest Sample ID.:**	754621
					Client Sample ID.:	B1
					Sample Location:	TP7
					Sample Type:	SOIL
					Top Depth (m):	0.30
					Bottom Depth (m):	0.40
					Date Sampled:	07-Dec-2018
					Asbestos Lab:	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	Cement	
Asbestos Identification	U	2192	%	0.001	Chrysotile	

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Test Methods

SOP	Title	Parameters included	Method summary
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry

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Report Information

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For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

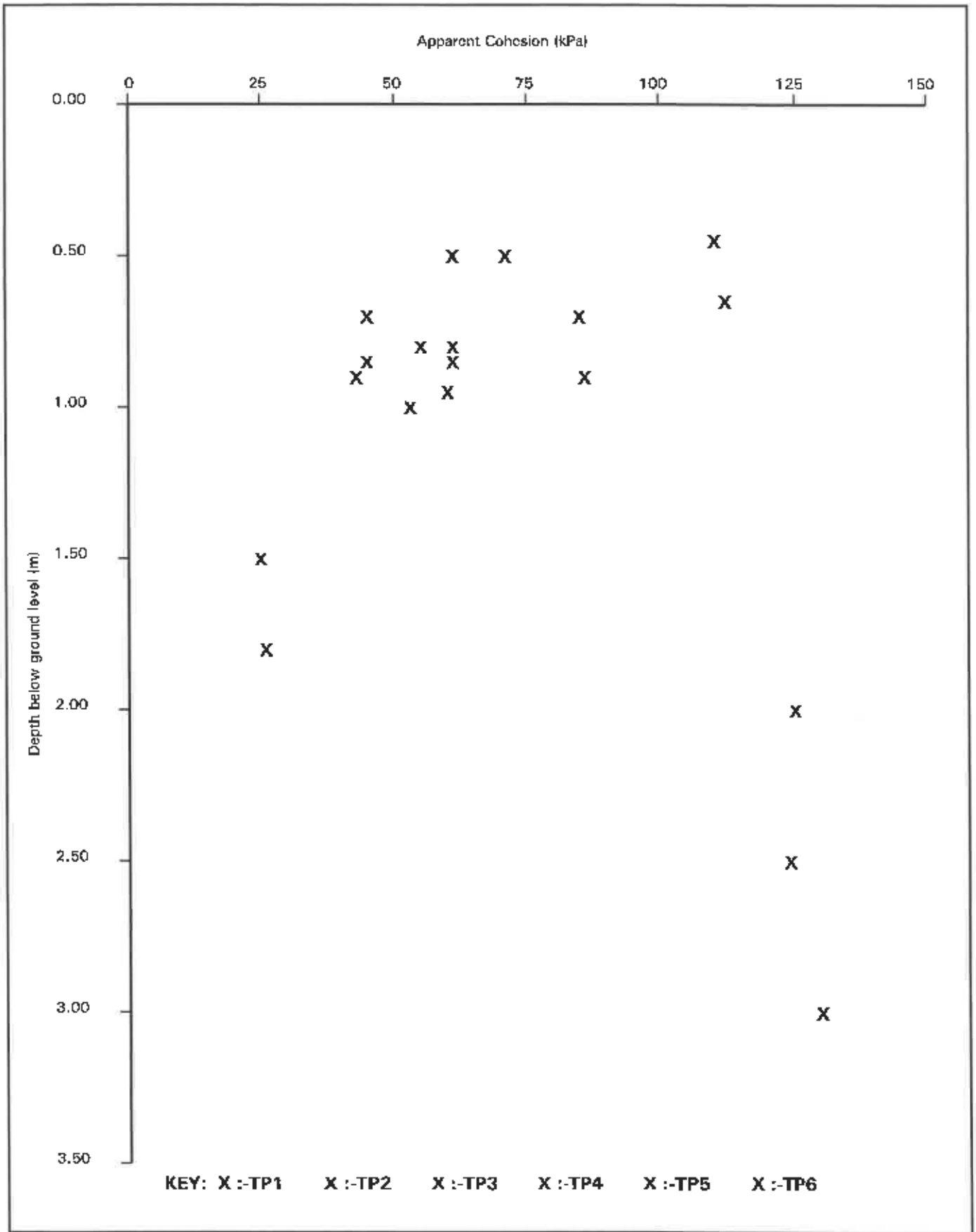
Sample Deviation Codes

A - Date of sampling not supplied
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C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

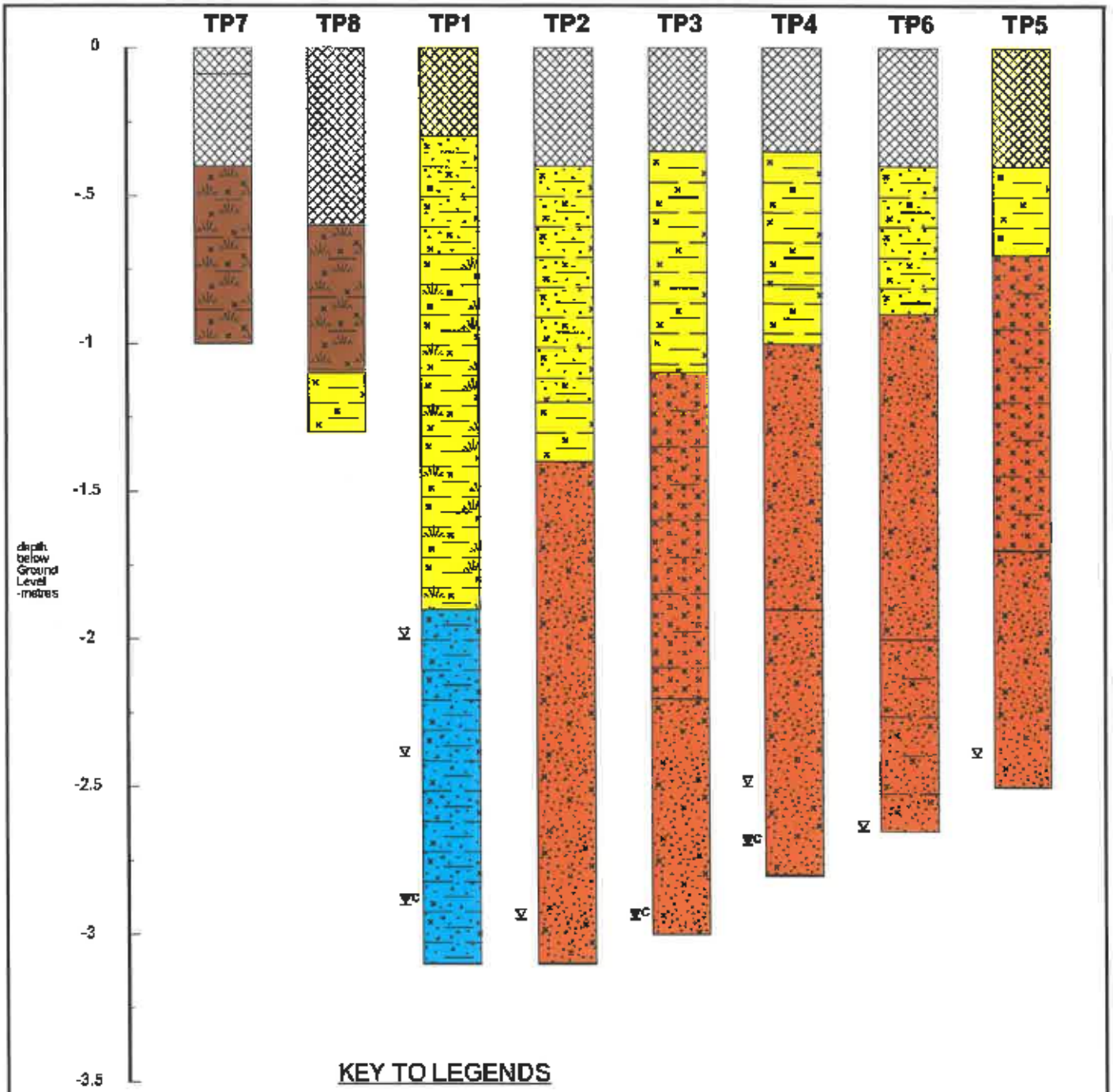
All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



Apparent Cohesion (kPa) vs Depth below ground level (m).

SITE	LAND OFF PETERBOROUGH ROAD, CROWLAND	
CLIENT	MR & MRS BLACKBIRD	Contract Number 14639
GROUND ENGINEERING LIMITED tel: 01733-566566 www.groundengineering.co.uk	Date 13/12/18	Figure 1



KEY TO LEGENDS

- MADE GROUND
- NORDELPH PEAT
- TIDAL FLAT DEPOSIT CLAY
- TIDAL FLAT DEPOSIT ORGANIC CLAY
- MARINE SAND
- MARINE SAND
- TILL

- Groundwater Encountered
- Groundwater Rise
- Level on Completion

SITE	LAND OFF PETERBOROUGH ROAD, CROWLAND		Contract No. 14639
CLIENT	MR & MRS BLACKBIRD	Soil Profile	Vertical Scale 1:20
GROUND ENGINEERING, NEWARK ROAD, PETERBOROUGH. Tel (01733) 586566		Date 13/12/18	Fig. No 2

APPENDIX 1

CLASSIFICATION OF AGGRESSIVE CHEMICAL ENVIRONMENT FOR BURIED CONCRETE

TABLE C1 – AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASSIFICATION FOR NATURAL GROUND LOCATIONS[a]

Table C1 Aggressive Chemical Environment for Concrete (ACEC) classification for natural ground locations[a]

Sulfate				Groundwater		ACEC
Design Sulfate Class for location	2:1 water/soil extract[b]	Groundwater	Total potential sulfate[c]	Static water	Mobile water	Class for location
1	2 (SO_4 mg/l)	3 (SO_4 mg/l)	4 (SO_4 %)	5 (pH)	6 (pH)	7
DS-1	< 500	< 400	< 0.24	≥ 2.5		AC-1s
					> 5.5[d]	AC-1[d]
					2.5 5.5	AC-2z
DS 2	500–1500	400–1400	0.24–0.6	> 3.5		AC-1s
					> 5.5	AC-2
				2.5–3.5		AC-2s
					2.5–5.5	AC-3z
DS-3	1600 3000	1500–3000	0.7–1.2	> 3.5		AC-2s
					> 5.5	AC-3
				2.5–3.5		AC-3s
					2.5–5.5	AC-4
DS-4	3100 6000	3100–6000	1.3–2.4	> 3.5		AC-3s
					> 5.5	AC-4
				2.5 3.5		AC-4s
					2.5–5.5	AC-5
DS-5	> 6000	> 6000	> 2.4	> 3.5		AC-4s
				2.5–3.5	≥ 2.5	AC-5

Notes

a Applies to locations on sites that comprise either undisturbed ground that is in its natural state (ie is not brownfield – Table C2) or clean fill derived from such ground.

b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests (Box C7).

c Applies only to locations where concrete will be exposed to sulfate ions (SO_4) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance (Appendix A1 and Box C8).

d For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15 mg/l (Section C2.2.3), increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class

- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' primarily have to resist acid conditions and may be made with any of the cements or combinations listed in Table D2 on page 42.

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