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GROUND INVESTIGATION REPORT

NEW HOUSING DEVELOPMENT
LAND OFF PARK LANE
DONINGTON
LINCOLNSHIRE

Report Reference C13751

On behalf of:-

Calderdale Homes (Eastern) Limited
c/o Salway & Wright
32 The Crescent
Spalding
Lincolnshire
PE11 1AF

March 2016

CALDERDALE HOMES (EASTERN) LIMITED

ROBERT DOUGHTY CONSULTANCY LIMITED

TOWN PLANNERS & LANDSCAPE ARCHITECTS

GROUND INVESTIGATION REPORT

FOR NEW HOUSING DEVELOPMENT

AT

LAND OFF PARK LANE

DONINGTON

LINCOLNSHIRE

Report Reference No. C13751

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INTRODUCTION

The client, Calderdale Homes (Eastern) Limited, proposes to construct a residential development at their site off Park Lane, Donington, Lincolnshire. The proposed layout and building loads were not known at the time of report writing but the proposed houses were anticipated to be 'lightly loaded'.

Ground Engineering Limited was commissioned by the client, under the direction of town planners Robert Doughty Consultancy, 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 desk study and contamination assessment were not required within the scope of this report.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The site of the proposed new housing is on the southern side of Park Lane, at its junction with Gleed Avenue, and immediately to the west of Millson's Close, Donington, Lincolnshire. The National Grid Reference for the centre of the site is TF 2065 3569 and its location is shown on a plan following this report text.

At the time of the investigation in January 2016 the site comprised an asphalt surfaced yard, with single-storey workshop and office buildings in the south-eastern corner and along the western side of the site. To the south of the building in the south-east of the site was an undeveloped parcel of land with wood, plaster coving and black plastic bags littering the area. The site was approximately 35m wide fronting Park Lane by 27m deep. The site was bound by Millson's Close to the east; the gardens of houses off Station Street (A152) to the south; a private track providing access to the rear of houses fronting Gleed Avenue to the west; and Park Lane to the north. Trees were present on the southern part of the site which included a Fir and an unidentified deciduous tree. A privet hedge and two coniferous trees were also present in the north-western corner of the site fronting Park Lane. Trees including Silver Birch were also present in the communal grassed area in Millson's Close to the east.

The site stands at about 4mOD in the flat lying Lincolnshire Fens.

The geological map, sheet 128 (1995), shows superficial Terrington Beds (Tidal Flat Deposits) covering the site, overlying the solid geology of the Oxford Clay at depth. A borehole record close to the northern edge of the site found 7.60m of superficial Alluvium, covering gravel to 7.75m depth, and in turn Boulder Clay and solid geology Oxford Clay at depth.

SITE WORK

The site work conducted on 22nd January 2016 comprised four machine excavated trial pits (TP1 to TP4). The trial pit positions are shown on the exploratory hole location plan following this report text.

Public utility service drawings were sourced by Ground Engineering Limited before the site work and 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 exploratory hole records, presented following the exploratory hole location plan, give the descriptions and depths of the various strata encountered, details of all samples taken and the groundwater conditions observed during and on completion of excavation.

Machine Excavated Trial Pits

Trial pits TP1 to TP4 were excavated using a JCB 3CX machine to depths of between 0.50m and 2.50m. Trial pit TP4 was limited to 0.50m depth due to very restricted access to that area. The exposed strata were sampled and recorded by a Geoenvironmental Engineer. Representative small and bulk disturbed samples of soil were taken at regular intervals throughout the depth of each trial pit.

A soakaway test was carried out within trial pit TP1 in broad accordance with BRE Digest 365 in order to allow the assessment of the soil infiltration rate. The general method of the test was to excavate the trial pit with vertical sides trimmed square to the base. The dimensions were accurately measured and recorded, and the pit was then filled with clean water. The rate of water dissipation from the pit was measured by recording the depth of water relative to a datum at frequent time intervals. The test was monitored for 142 minutes, and as the water

had not drained away sufficiently the water was not topped up and the test was not repeated a second time. The results are presented and follow the respective trial pit record.

The trial pits were emptied of any remaining water and backfilled with compacted arisings upon completion.

LABORATORY WORK

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the exploratory hole records. The soil descriptions have been made in accordance with BS5930:2015. The geotechnical test results, undertaken in accordance with BS1377:1990, are presented following the exploratory hole records.

The moisture contents and 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.

The particle size distributions of selected samples were obtained by sieve analysis. The particle size distribution passing the 63 μ m sieve was obtained by pipette sedimentation. The results of these tests are given as particle size distribution curves at the end of this report.

California Bearing Ratio (C.B.R.) tests were performed on selected recompacted samples. 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 1935mm². A force of 50N was applied initially to seat the plunger on the soil surface during each test 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.

GROUND CONDITIONS

The ground conditions comprised made ground to depths of between at least 0.50m and at least 2.00m, which rested on the expected superficial Tidal Flat Deposits and underlying Marine Sand. The superficial deposits were found to at least the base of the exploratory holes at 2.50m depth. The solid geology of the Oxford Clay was not encountered within 2.50m depth by this investigation.

Made Ground

Asphalt hardstanding was found at surface in TP1, TP2 and TP3, to between 0.05m and 0.15m depth. Made ground was encountered beneath the asphalt, and from surface in TP4, to depths of between at least 0.50m (TP4) and at least 2.00m (TP3), which beneath the asphalt was initially a light brown gravel sub-base fill of angular and sub-angular limestone. The gravel sub-base fill was encountered to depths of between 0.20m and 0.30m below ground level.

Beneath the hardstanding and sub-base where present, and from surface in TP4, dark brown and brown, slightly sandy, slightly gravelly to gravelly, clayey silt fill, varying to silty clay fill, with occasional cobbles of brick and metal rods encountered. Trial pit TP3 was completed in silt fill at 2.00m depth when a suspected brick culvert was encountered, and trial pit TP4 was completed in made ground at 0.50m due to extremely limited access to the area behind the building. The gravel fraction comprised angular to rounded flint, coal, ash, concrete, brick and a rare suspected cement-bound asbestos sheet fragment (TP3).

Tidal Flat Deposits

The anticipated superficial Tidal Flat Deposits were met in TP1 and TP2, beneath the made ground, at depths of 1.00m and 0.80m respectively, and found to at least the base of TP1 at 2.00m depth and 1.00m depth in TP2, a thickness of between 0.20m and at least 1.00m.

/

The Tidal Flat Deposits comprised brown, sandy, clay/silt. The sand fraction was generally fine grained. Trial pit TP1 was completed within Tidal Flat Deposits.

Marine Sand

Beneath the Tidal Flat Deposits in TP2 at 1.00m depth, to at least the base of the trial pit at 2.50m depth, Marine Sand was encountered. The Marine Sand generally comprised light brown and orange brown, very silty sand, which was dark brown and slightly organic at 1.50m to 1.70m depth. The sand fraction was generally fine grained.

Groundwater

No groundwater was met in TP1, TP2 and TP4. Groundwater was met at 1.80m in TP3, and standing at 2.00m depth on completion.

Observations

Live roots were observed to at least 2.00m depth in TP3, which was excavated close to a mature deciduous tree by the southern boundary.

Evidence of Contamination

The made ground encountered during this investigation was not noted to have olfactory or visual evidence of fuel contamination. The made ground contained fragments of coal, ash, concrete and brick. A rare suspected cement-bound asbestos sheet fragment was also found at 0.50m to 0.80m depth in TP3.

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

The investigation confirmed the site to be underlain by a variable thickness of made ground resting on the expected superficial Tidal Flat Deposits and underlying Marine Sand. The proposed building loads were not known at the time of report writing, however the houses were anticipated to be 'lightly' loaded. The underlying superficial silts have adequate bearing properties and may provide a suitable founding stratum. Foundations may need to be locally deepened due to the presence of a suspected brick culvert beneath the south-western part of the site. The underlying silty Marine Sand would also offer support for traditional foundations for the proposed new houses. Foundation excavations may encounter shallow groundwater. Ground bearing floor slabs could be used locally but would need to be suspended where the made ground is thicker over the suspected culvert.

Traditional Foundations

Foundations should be extended through any made ground, which was found to extend to about 1.00m generally, and to at least 2.00m depth in the south-western part of the site above the suspected culvert.

The naturally deposited Tidal Flat Deposits may provide suitable founding strata for traditional foundations, where encountered at shallow depth. The sandy silt Tidal Flat Deposits would be considered non-shrinkable, but are potentially frost susceptible and a minimum footing depth in this stratum of 0.60m should be adopted in order to avoid the potentially damaging effects of frost action.

Samples of the Tidal Flat Deposits clay/silt had modified plasticity indices of 9% and 10%. These are considered non-shrinkable to having a low volume change potential, based on NHBC Standards Chapter 4.2 'Building near trees' (2014). On an open site, away from the influence of trees, a minimum foundation depth of 0.75m below current or proposed ground

level, whichever is deeper, would be required within the naturally deposited clays in order to be below the zone of seasonal volume change in accordance with the NHBC Standards.

It is likely that some of the proposed houses will be within influencing distance of high water demand trees where clay soils are present at shallow depth. Trees were present on the site and included Cypress, Fir and an unidentified deciduous tree.

Based on high water demand English Oak and Cypress trees, and moderate water demand Fir trees, a minimum foundation depth between 0.75m and 1.00m would locally be required in these clay soils based on the current tree positions and NHBC Standards at 5m distance. The foundations would need to be at least 25m from mature English Oak trees, 15m from mature Fir trees and 12m from mature Cypress trees, for the adoption of the minimum foundation depth of 0.75m in clay soils. Within these distances foundation depths will depend on the proximity of trees to new foundations, which should be determined using the NHBC Standards where clay forms the base of foundation excavations. Tree species along the site boundaries and distances to proposed dwellings should be verified before final design of foundation depths based on NHBC Standards.

Foundations should be taken at least 0.50m below the last vestiges of live roots in clay soils. Live roots were encountered to at least 2.00m depth within TP3 in made ground soils. The depth of roots is likely to vary across the site, and is likely to be deeper closer to the trees adjacent the site boundaries. Foundations would not need to be deepened within the underlying sand once it is reached. Strip footings could be 'stepped' up along the length of wall runs where foundation depths vary due to the influence of trees. Steps should not exceed 0.50m and further guidance is provided in the aforementioned NHBC document.

It is assumed that new trees will be planted within the vicinity of proposed houses. Recommendations for foundation depths related to proposed tree planting are also provided in the NHBC Standards and the volume change potential should be considered for any proposed landscaping within a housing scheme on the site.

In summary, it would be prudent to adopt a minimum depth of 0.75m for foundations for the new buildings, and will need locally to be taken to 1.00m below ground level, in order to penetrate the depths of potential root-induced desiccation within this site.

Bearing Capacity

The non-shrinkable, silty sand of the Marine Sand would provide a suitable founding stratum for the proposed buildings. The naturally deposited silty sand, where present from a depth of 0.75m, has an allowable bearing pressure of 115kN/m² for foundations up to 1.20m wide, which should be sufficient for the proposed houses and limit immediate settlement to within 25mm.

The naturally deposited Tidal Flat Deposit clay/silt, at a depth of 0.75m has a net safe bearing capacity of 80kN/m², increasing to 95kN/m² at 1.50m depth, beneath a 0.60m wide strip footing. These bearing capacities incorporate a factor of safety of 3.0 against shear failure and should be sufficient to support the proposed houses. Settlements are likely to be less than 25mm, although some differential settlements will occur where foundations straddle different soil types. Care should be taken where foundations cross from sand to clay and precautionary measures adopted to minimise differential movements.

Excavations

The made ground together with the underlying soils should be easily removed within excavations for the proposed buildings. The sides of excavations within the made ground are likely to be stable in the short term, but excavations should not be relied upon to stand unsupported, particularly when groundwater is encountered.

Excavations could be expected to encounter groundwater within the Tidal Flat Deposits or Marine Sand with resulting side instability, although groundwater was encountered below 1.80m depth in the trial pits. Care should be taken not to excavate below the water table in the absence of suitable side support and groundwater control, such as dewatering via screened

sumps or even well-points. The silt/clay soils are prone to softening and deterioration, in the presence of either surface water or groundwater, with loss of their modest bearing properties. Care should be taken to keep the excavations dry.

The base of foundation excavations should be inspected on completion to ensure that the condition of the soil complies with that assumed in design. Should pockets of inferior material or made ground be present, they should be removed and replaced with well graded, well compacted hardcore or lean mix concrete. The excavated surfaces should be protected from deterioration and a blinding layer of concrete used where foundations are not completed without delay. The excavated surfaces should be protected from deterioration using a blinding layer of concrete, since the silt/clay soils are prone to rapid deterioration if exposed to water, with resulting loss of their modest bearing properties. Care should therefore be exercised to ensure that neither surface water nor groundwater is allowed to collect in the base of excavations.

Excavations should either avoid or bridge over the suspected culvert crossing the southern part of the site at a depth of 2.00m, and further investigation will be required to determine the details of this feature.

Attention should be given where personnel are to enter deep excavations, when sides should either be safely battered back, or close side support provided, in order to comply with statutory safety requirements and prevent sidewall collapse.

Floor Slabs

Where the proposed houses are in an area close to extant or former trees, the floor slab should be suspended on the foundations in order to avoid any differential movements between them. A suspended floor slab would avoid any volume change movements within any root affected clays, providing that the sub-floor gaps recommended in NHBC Standards Chapter 4.2, Tables 9 and 10, are adopted. Similarly, the floor slabs should be suspended if the suspected culvert is to remain.

Ground bearing floor slabs could be adopted for new buildings where the naturally deposited silty sand is present at shallow depths and where they are remote from trees in clay soils. It may be possible to proof-roll soils present at sub-grade level, although supporting floor slabs across the variable Tidal Flat and Marine Sand deposits are likely to result in some long term minor differential movements beneath them. Settlement of a floor slab bearing on the non-shrinkable silty sand would be negligible.

Drainage

The soakaway test (TP1) gave a soil infiltration rate (f) of $4.88 \times 10^{-7} \text{m/s}$ for the sandy silt Tidal Flat Deposits soils. This result rates Tidal Flat Deposits as having a 'poor' drainage potential according to BS8004:1986.

Perched groundwater was met in trial pit TP3 at 1.80m below ground level, within made ground soils and associated with the suspected culvert in the southern part of the site. Soakaway drainage on this site may deteriorate over time as the chambers could become blocked with silt. Provision should be made for regular cleaning.

Hardstanding

Made ground and Tidal Flat Deposits (clay/silt) were encountered at sub-grade level across this site.

Based on Interim Advice Note (IAN) 73/06 (2009) 'Design Guidance for Road Pavement Foundations (Draft HD25)', Table 5.1 recommends design CBR values of 1% for silt, 3% for clay with a plasticity index of 10%, with a thin pavement construction, and a design CBR value of 20% for a poorly graded sand. Laboratory determined CBR values were between 2.5% and 3.4% for slightly sandy, gravelly, clayey silt fill soils. Therefore a conservative design CBR value of 2.5% could be adopted for hardstanding design on this site. The soils have a high silt content and would be considered to be frost susceptible, requiring a minimum pavement thickness of 450mm.

The sub-grade should be suitably compacted and inspected with any made ground, topsoil, loose, very soft or organic soils being 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 as the condition of the silty soils will rapidly deteriorate in the presence of water.

Sulphate Conditions

Sulphate analysis of selected samples of soil yielded soluble sulphate concentrations within Design Sulphate Class DS-1 of the BRE Special Digest 1, Table C2 (2005), presented in Appendix 1. The pH results of samples ranged between 7.3 and 7.9, indicating alkaline conditions.

These results indicate an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-1 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.

GROUND ENGINEERING LIMITED

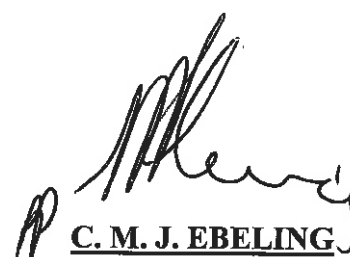


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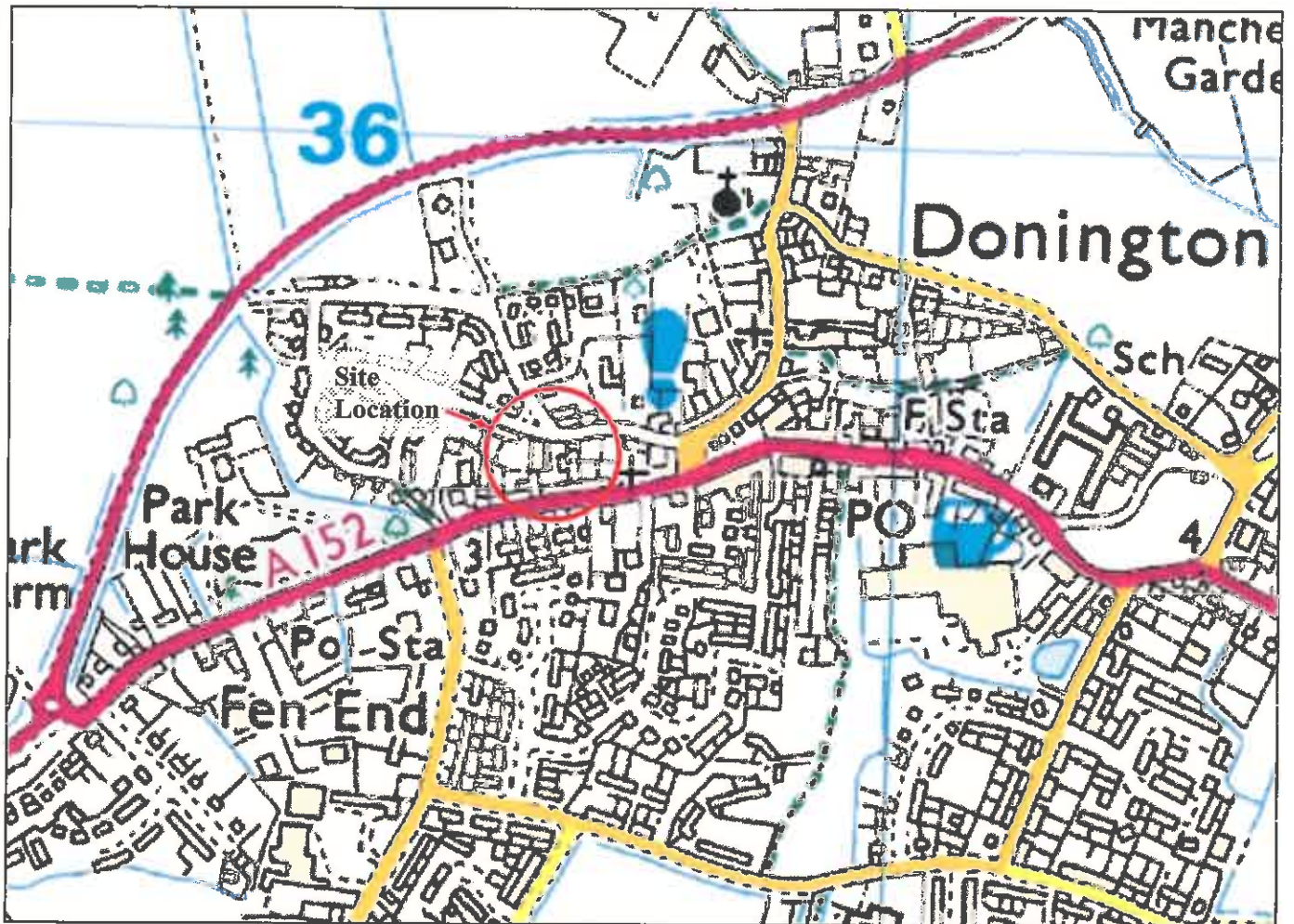
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Director

Site Location Plan

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Not To Scale



Project : Land off Park Lane, Donington, Lincolnshire

Client : Calderdale Homes (Eastern) Limited

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Peterborough

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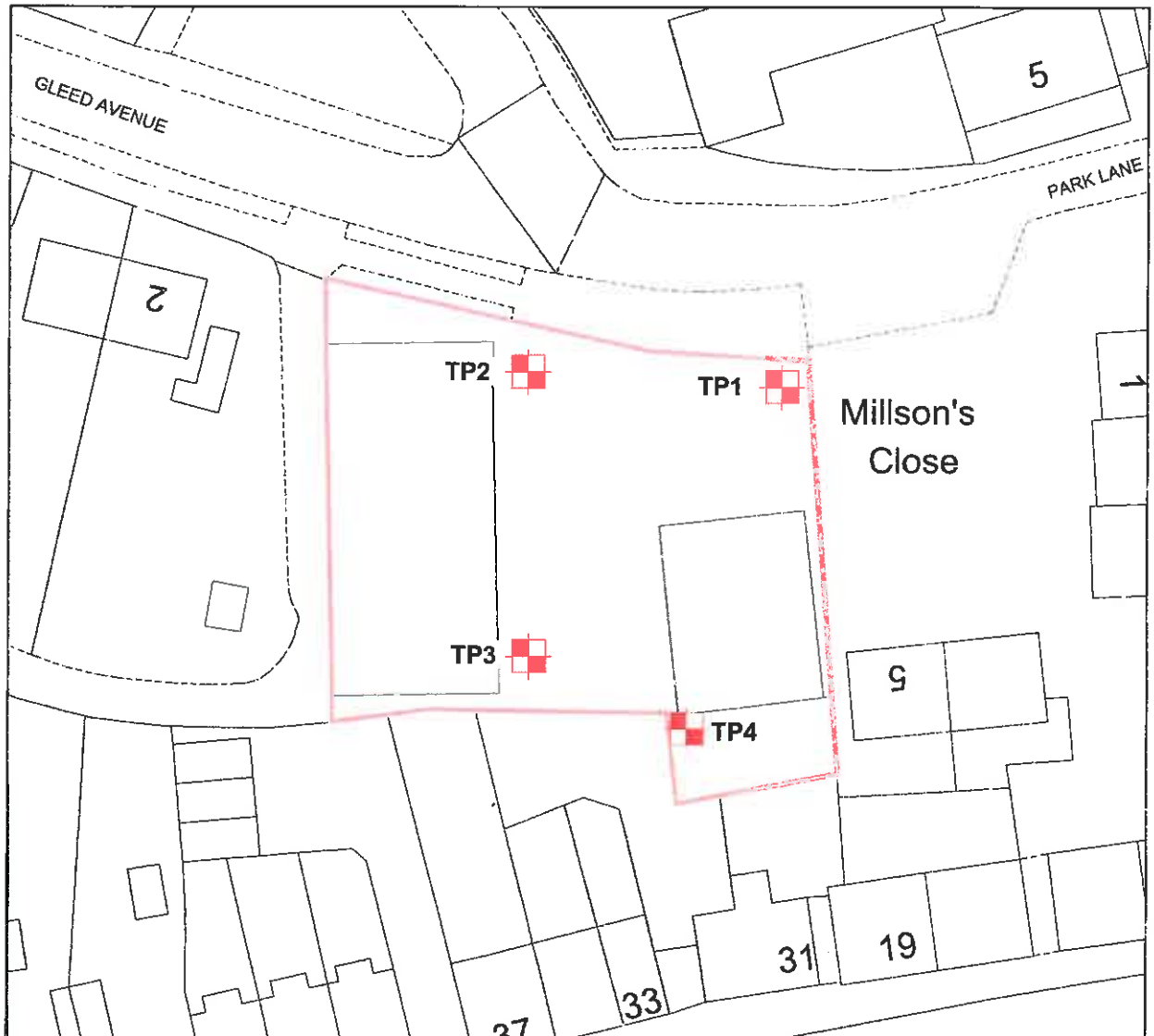
Project No.

C13751

Exploratory Hole Location Plan

Plan based on Robert Doughty Consultancy existing layout drawing 1179-02-EL01

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Project : Land off Park Lane, Donington, Lincolnshire

Client : Calderdale Homes (Eastern) Limited

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Peterborough Tel : 01733 566566

**Project No.
C13751**

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF PARK LANE, DONINGTON		TRIAL PIT TP1	
Date: 22/01/16			Pit Size: 2.40m L x 0.60m W x 2.00m D.		Ground Level:	
Samples and in-situ Tests			(Date)	Description of Strata	Legend	Depth m
Depth m	Type	Result	Water			
0.30 0.30	D1 J1			MADE GROUND - ASPHALT.		0.15 0.20
0.60 0.60	D2 J2			MADE GROUND - Light brown GRAVEL of angular and sub-angular limestone.		0.60
0.90 0.90	D3 J3			MADE GROUND - Firm, brown and dark brown, slightly sandy, slightly gravelly, silty CLAY with occasional cobbles of brick and metal rods. Gravel is angular to sub-rounded brick fragments, concrete, ash and coal.		1.00
1.20 1.20	D4 J4			MADE GROUND - Dark brown, slightly sandy, slightly gravelly SILT. Gravel is angular to sub-rounded coal, ash and brick fragments.		
1.50 1.50	D5 J5			Brown, sandy SILT. Sand is fine grained.		
1.80	D6			(TIDAL FLAT DEPOSIT)		
2.00	D7					2.00
				Pit completed at 2.00m depth		

KEY	REMARKS
D - Disturbed Sample	1. No live roots observed
B - Bulk Sample	2. Pit dry
U - Undisturbed Sample	3. Pit sides stable
R - Root Sample	4. Soakaway test undertaken at 2.00m depth
W - Water Sample	
J - Jar Sample	
▽ - Water Strike	
▽ - Water Rise	
▽c - Level on completion	
MP - Mackintosh Probe	
P () - Hand Penetrometer	
Cohesion () kPa	
V - Vane Shear Test	
Cohesion () kPa	

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SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off Park Lane, Donington, Lincolnshire
Client: Calderdale Homes (Eastern) Ltd

Project No: C13751
Sheet No: 1/1

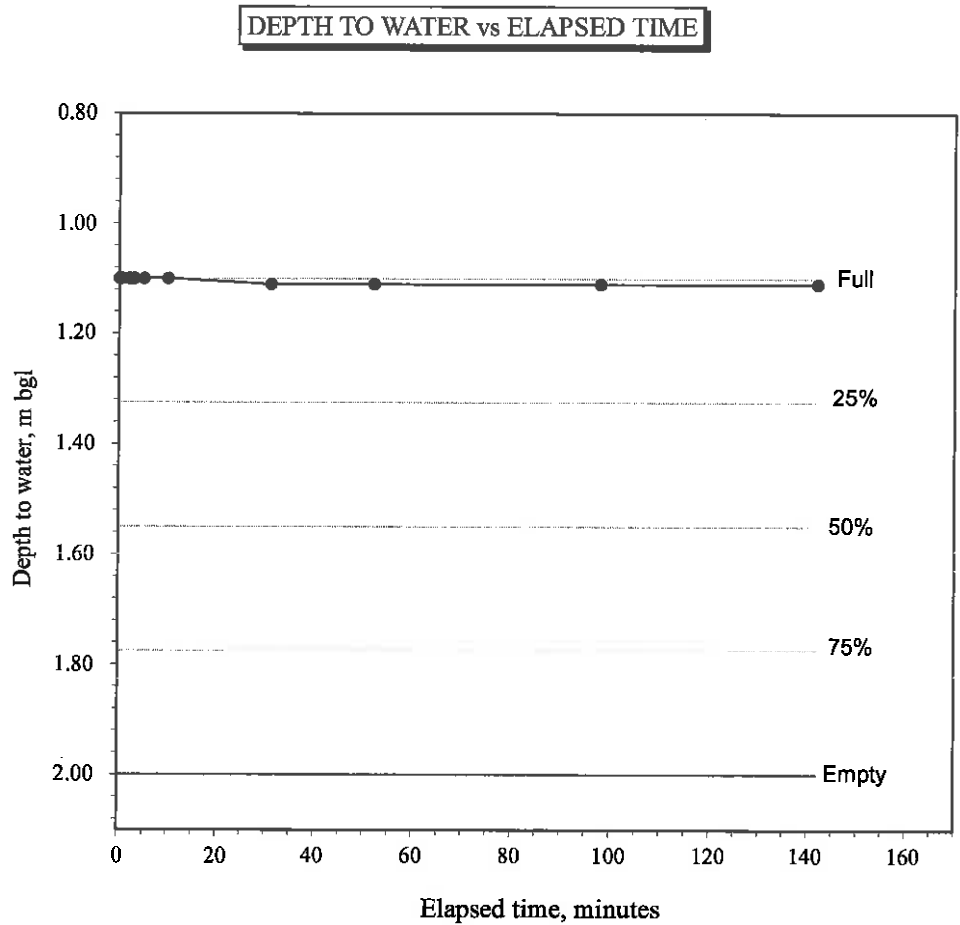
Trial Pit: TP1 FIRST FILLING
Depth: 2.00
Length: 2.40
Width: 0.60

Description of Stratum under test: Brown light brown sandy SILT

Depth to water prior to test: 2m
(below ground level)

Elapsed Time min	Depth to Water m
0	1.10
1	1.10
2	1.10
3	1.10
5	1.10
10	1.10
31	1.11
52	1.11
98	1.11
142	1.11

All dimensions given in metres



$$f = (V75-V25)/A50(T75-T25)$$

V75-V25 = 0.648
A50 = 4.140
T75-T25 = 5350

Soil Infiltration Rate $f = \underline{4.88E-07} \text{ m/s}$

GROUND ENGINEERING L I M I T E D Tel: 01733-588566 www.groundengineering.co.uk			Site: LAND OFF PARK LANE, DONINGTON		TRIAL PIT TP2	
Samples and in-situ Tests			Date: 22/01/16	Pit Size: 2.70m L x 0.60m W x 2.50m D.		Ground Level:
Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m
				MADE GROUND - ASPHALT.		0.05
				MADE GROUND - Light brown GRAVEL of angular and sub-angular limestone.		0.30
0.40	D1			MADE GROUND - Dark brown, slightly gravelly SILT. Gravel is angular to sub-rounded brick fragments, coal and ash.		0.50
0.40	J1					
0.60	D2			MADE GROUND - Dark brown, slightly sandy, gravelly, clayey SILT. Gravel is fine and medium, angular to sub-rounded brick fragments and ash.		0.80
0.60	J2					
0.50-0.80	CBR1					
0.90	D3			Brown, sandy CLAY/SILT. Sand is fine grained. (TIDAL FLAT DEPOSIT)		1.00
				Light brown and orange brown, very silty SAND. Sand is fine grained.		1.50
1.20-1.40	B1			(MARINE SAND)		1.70
1.20	D4					
1.60	D5			Dark brown, slightly organic, silty SAND. Sand is fine grained. (MARINE SAND)		
1.80	D6			Light brown and orange brown, very silty SAND. Sand is fine grained.		
1.90-2.10	B2			(MARINE SAND)		
2.10	D7					
2.30-2.50	B3					
				Pit completed at 2.50m depth		2.50

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  Level on completion MP - Mackintosh Probe P () - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa	REMARKS 1. Live roots observed to 0.80m depth 2. Pit dry 3. Pit sides unstable below 0.40m depth on completion
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Project No 13751	
Scale 1:25	Page 1/1

L I M I T E D
Tel: 01733-566566
www.groundengineering.co.uk

Date: 22/01/16

Pit Size: 2.20m L x 0.60m W x 2.00m D.

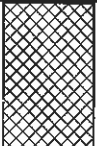
TRIAL PIT
TP3

Ground
Level:

KEY	REMARKS	Project No 13751	
		Scale	Page
D - Disturbed Sample	1. Live roots observed to 2.00m depth	1:25	1/1
B - Bulk Sample	2. Groundwater met at 1.80m depth, and stood at 2.00m depth on completion		
U - Undisturbed Sample	3. Pit sides stable		
R - Root Sample	4. Pit abandoned at 2.00m depth due to brickwork obstruction		
W - Water Sample			
J - Jar Sample			
W Water Strike			
W Water Rise			
Wc Level on completion			
MP - Mackintosh Probe			
P() - Hand Penetrometer			
Cohesion () kPa			
V - Vane Shear Test			
Cohesion () kPa			

Project No
13751

Scale	Page
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GROUND ENGINEERING LIMITED Tel: 01733-568566 www.groundengineering.co.uk			Site: LAND OFF PARK LANE, DONINGTON		TRIAL PIT TP4	
Date: 22/01/16			Pit Size: 1.60m L x 0.80m W x 0.50m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.30	D1			MADE GROUND - Brown, slightly sandy, slightly gravelly SILT. Gravel is sub-angular to rounded flint, concrete and brick fragments.		0.50
				Pit completed at 0.50m depth		
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  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 dry 3. Pit sides stable			
Project No 13751						Scale 1:25
Page 1/1						

LABORATORY TEST RESULTS

CONTRACT LAND OFF PARK LANE, DONINGTON

Trial-pit	Sample	Depth m	Classification				Density		Triaxial Compression						Sulphates (SO ₄)				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	Total % Dry Wt.	Aqueous Extract mg/l	Water mg/l	pH	Top %	Base %		
TP1	D4/J4	1.20	37	28	9	32								230			7.3			SOIL CLASSIFICATION = MI 9% retained on 425µm sieve	
TP2	D5/J5	1.50												206			7.6				
	CBR1	0.50 - 0.80				22	1.87	1.51										2.7	3.2	5% retained on 20mm sieve	
	D3	0.90	34	24	10	31														SOIL CLASSIFICATION = CL/ ML 1% retained on 425µm sieve	
TP3	D4	1.20															7.9				
	D5	1.60												82			7.5				
	CBR1	0.50 - 0.80				24	1.86	1.50						189				2.5	3.4	2% 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



8180

GROUND ENGINEERING

Newark Road Peterborough
t: 01733 566566 f: 01733 315280
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
Client Address: Newark Road
Peterborough
PE1 5UA

Contact: Simon Weatherley

Site Name: Land off Park Lane
Site Address: Donington

Certificate Number: PL5295-1/2/710-2

Client Reference: C13751

Lab Job Number: PL5295-1

Date Sampled: Unknown

Date Received: 05.02.2016

Date Tested: 17.02.2016

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Sampled By: Client

TEST RESULTS

Laboratory Reference: PL5295-1/2

Client Reference: D5 / J5

Pre-treatment for
organic material:

No

Sample Description: Brown slightly clayey very sandy SILT

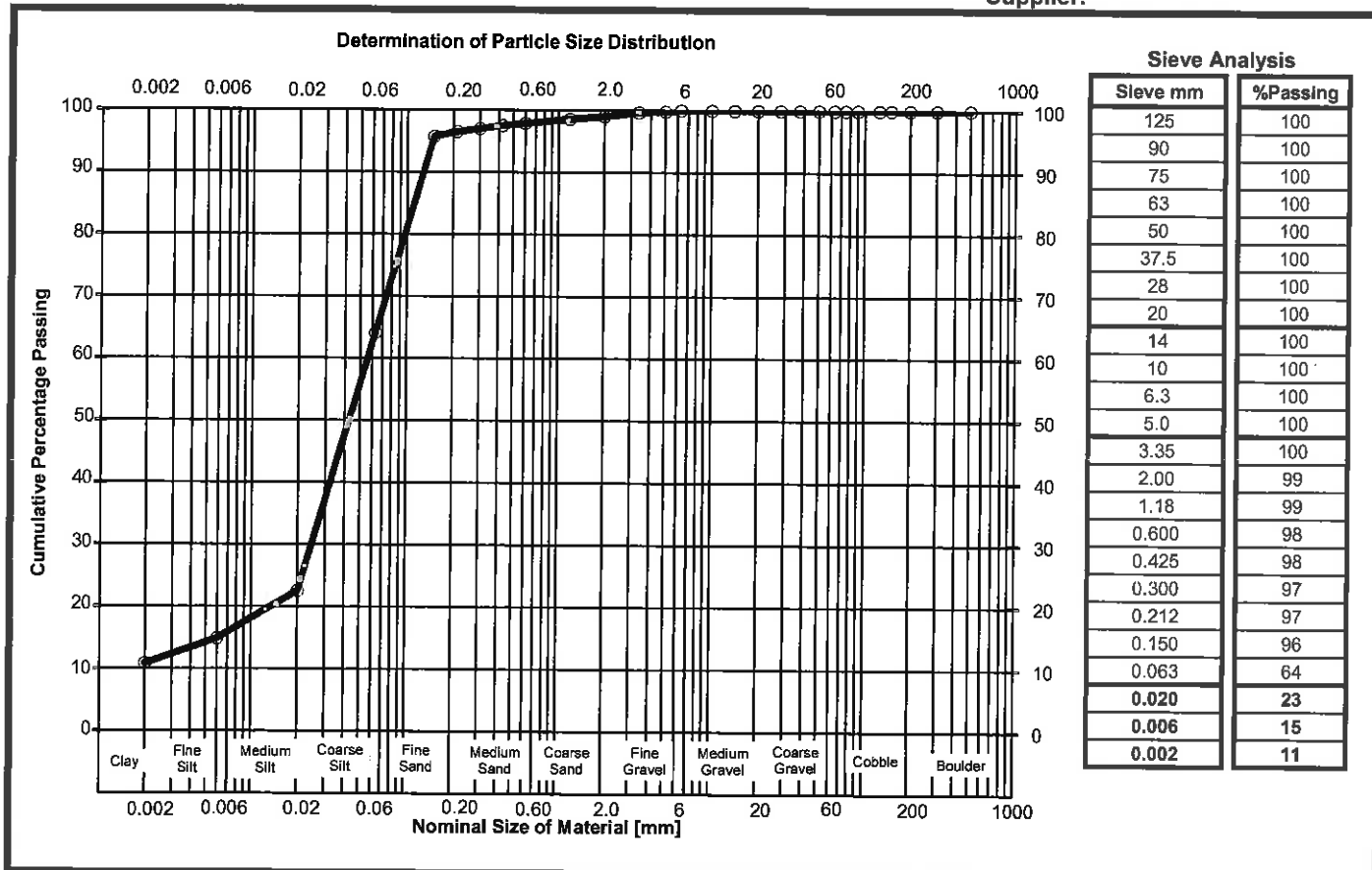
Material Specification: Not Required

Depth: 1.50m

Location: TP1

Source:

Supplier:



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

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

Date Reported: 22.02.2016 Page 1 of 1
Form Number: GELab/C/709-2 Version 46

for and on behalf of Ground Engineering Ltd

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Registered in England & Wales
Registration Number: 6929574
Reg Office: Ground Engineering Ltd
Newark Rd, Peterborough PE1 5UA



8180

TEST CERTIFICATE**GROUND ENGINEERING**

Newark Road Peterborough
t: 01733 566566 f: 01733 315280
e: admin@groundengineering.co.uk

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
Client Address: Newark Road
Peterborough
PE1 5UA

Contact: Simon Weatherley

Site Name: Land off Park Lane
Site Address: Donington

Certificate Number: PL5295-1/5/710-2

Client Reference: C13751

Lab Job Number: PL5295-1

Date Sampled: Unknown

Date Received: 05.02.2016

Date Tested: 18.02.2016

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Sampled By: Client

TEST RESULTS

Laboratory Reference: PL5295-1/5

Client Reference: B1

Pre-treatment for
organic material:

No

Sample Description: Brown grey red brown very sandy SILT

Material Specification: Not Required

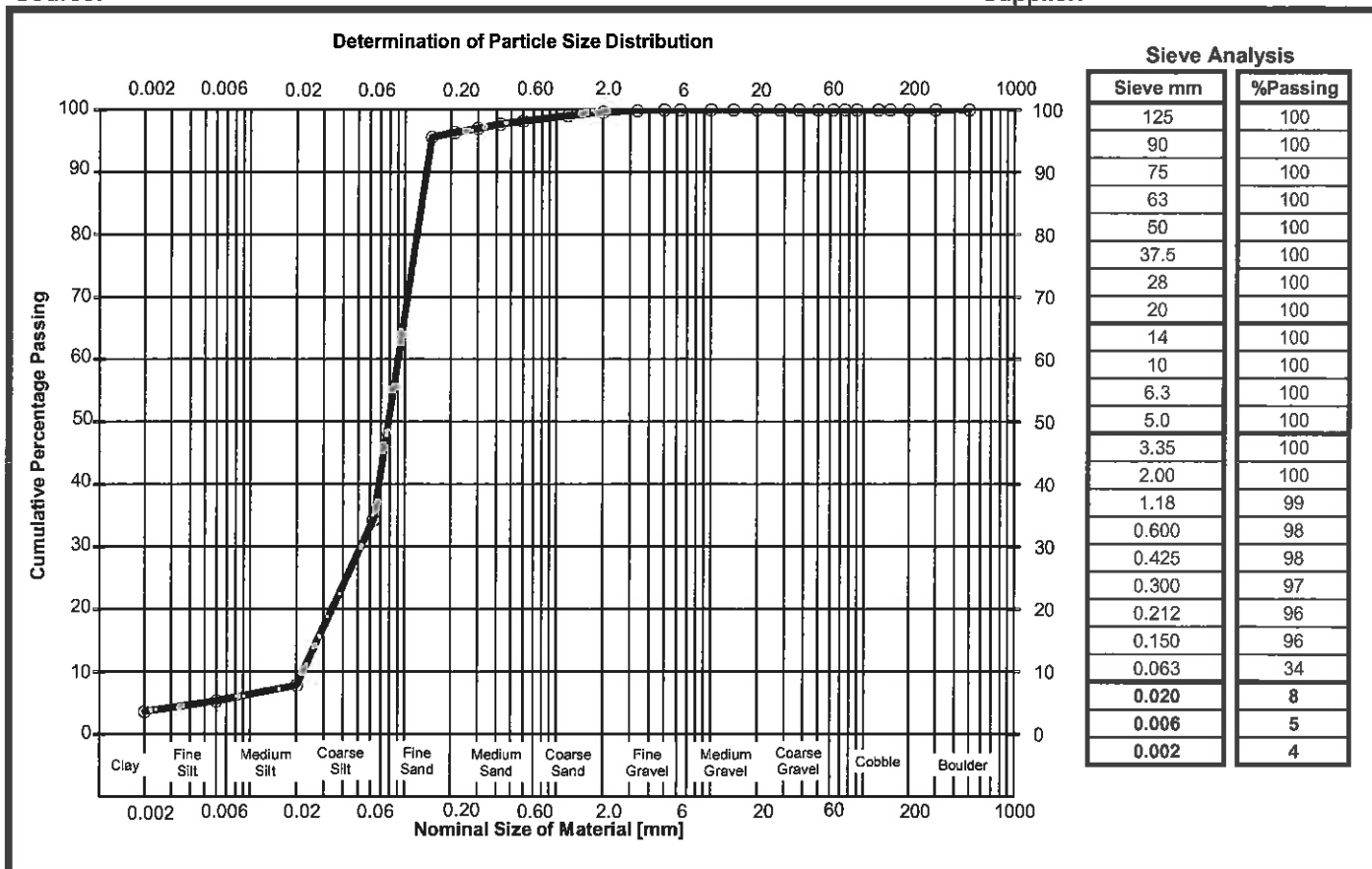
Location: TP2

Source:

Depth Top: 1.20m

Depth Base: 1.40m

Supplier:



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: 22.02.2016 Page 1 of 1
Form Number: GELab/C/709-2 Version 46

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8180

TEST CERTIFICATE**GROUND ENGINEERING**

Newark Road Peterborough
 t: 01733 566566 f: 01733 315280
 e: admin@groundengineering.co.uk

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
 Client Address: Newark Road
 Peterborough
 PE1 5UA

Contact: Simon Weatherley

Site Name: Land off Park Lane
 Site Address: Donington

Certificate Number: PL5295-1/8/710-2

Client Reference: C13751

Lab Job Number: PL5295-1

Date Sampled: Unknown

Date Received: 05.02.2016

Date Tested: 18.02.2016

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Sampled By: Client

TEST RESULTS

Laboratory Reference: PL5295-1/8

Client Reference: B2

Pre-treatment for
organic material:

N/A

Sample Description: Brown grey red brown very sandy SILT

Material Specification: Not Required

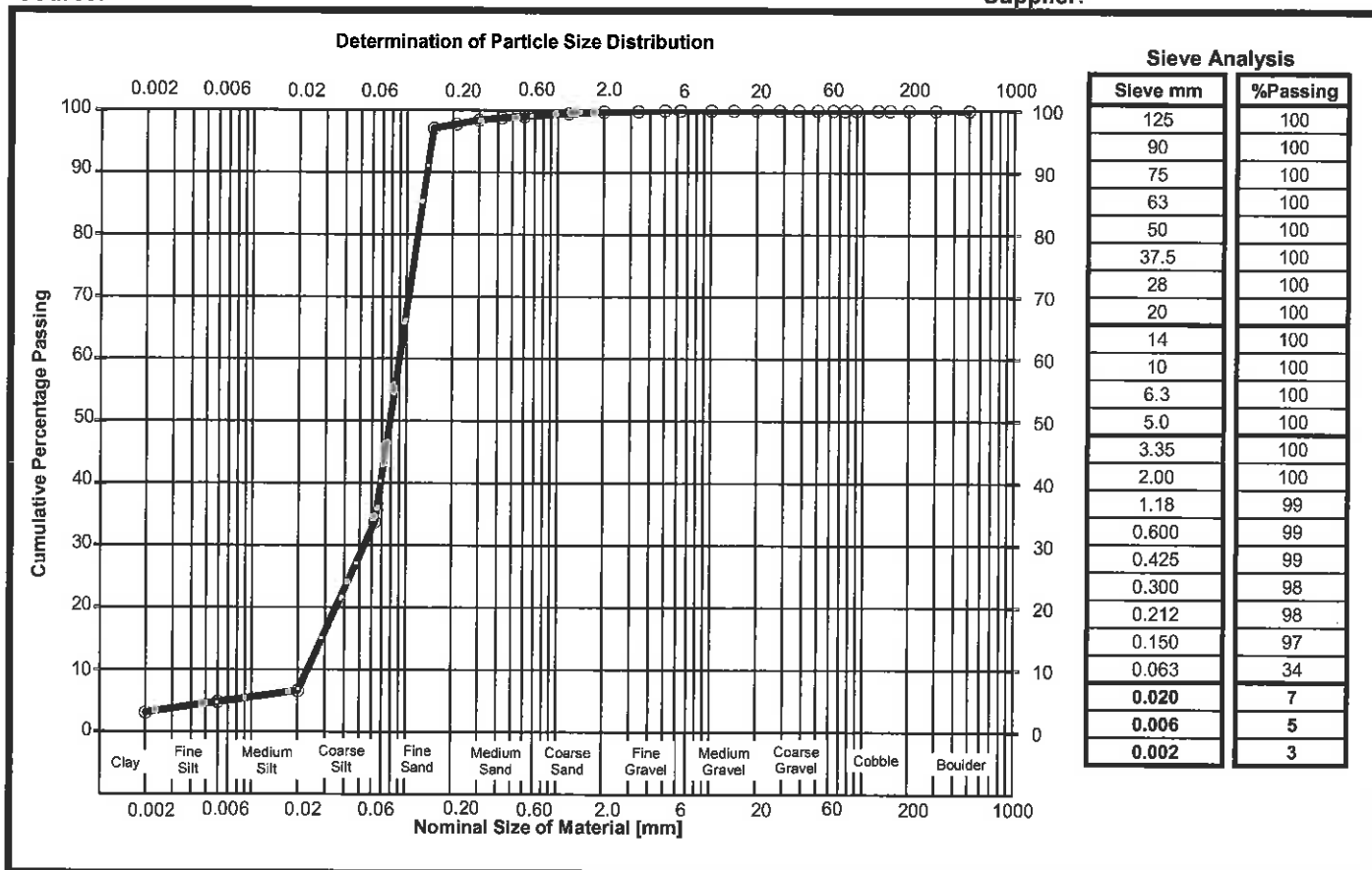
Location: TP2

Source:

Depth Top: 1.90m

Depth Base: 2.10m

Supplier:



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: 22.02.2016 Page 1 of 1

Form Number: GELab/C/709-2 Version 46

Registered in England & Wales

Registration Number: 6929574

Reg Office: Ground Engineering Ltd

Newark Rd, Peterborough PE1 5UA

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APPENDIX 1

CLASSIFICATION OF AGGRESSIVE CHEMICAL ENVIRONMENT FOR BURIED CONCRETE

TABLE C2 – AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE

(ACEC) CLASSIFICATION FOR BROWNFIELD LOCATIONS^a

Table C2 Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations^a

Sulfate and magnesium		Groundwater		Groundwater		ACEC	
Design Sulfate	2:1 water/soil extract ^b	Groundwater	Total potential sulfate ^c	Static water	Mobile water	Class for location	Class for location
1	2	3	4	5	6	7	8
Class for location	(SO ₄ mg/l)	(Mg mg/l)	(SO ₄ mg/l)	(Mg mg/l)	(SO ₄ %)	(pH) ^d	(pH) ^d
DS-1	< 500		< 400		< 0.24	≥ 2.5	> 6.5 ^d
							5.5–6.5
							4.5–5.5
							2.5–4.5
DS-2	500–1500		400–1400		0.24–0.6	> 5.5	> 6.5
						2.5–5.5	5.5–6.5
							4.5–5.5
							2.5–5.5
DS-3	1600–3000		1500–3000		0.7–1.2	> 5.5	> 6.5
						2.5–5.5	5.5–6.5
							2.5–5.5
DS-4	3100–6000	≤ 1200	3100–6000	≤ 1000	1.3–2.4	> 5.5	> 6.5
						2.5–5.5	2.5–6.5
DS-4m	3100–6000	> 1200 ^e	3100–6000	> 1000 ^e	1.3–2.4	> 5.5	> 6.5
						2.5–5.5	2.5–6.5
DS-5	> 6000	≤ 1200	> 6000	≤ 1000	> 2.4	> 5.5	> 6.5
						2.5–5.5	≥ 2.5
DS-5m	> 6000	> 1200 ^e	> 6000	> 1000 ^e	> 2.4	> 5.5	> 6.5
						2.5–5.5	≥ 2.5

Notes

- ^a Brownfield locations are those sites, or parts of sites, that might contain chemical residues produced by or associated with industrial production (Section C5.1.3).
- ^b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered from previous Digests (Box C7).
- ^c Applies only to locations where concrete will be exposed to sulfate ions (SO₄), which may result from the oxidation of sulfides such as pyrite, following ground disturbance (Appendix A1 and Box C8).
- ^d An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content (Section C5.1.3).
- ^e The limit on water-soluble magnesium does not apply to brackish groundwater (chloride content between 12 000 mg/l and 17 000 mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Seawater (chloride content about 18 000 mg/l) and stronger brines are not covered by this table.

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' have primarily to resist acid conditions and may be made with any of the cements in Table D2 on page 42.
- Suffix 'm' relates to the higher levels of magnesium in Design Sulfate Classes 4 and 5.

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