APPENDIX G – GEA Ground Investigation Factual Report

Factual Ground Investigation Report

Denmark Street South
4 Flitcroft Street
London
WC2H 8DJ

Client Consolidated Development Limited

Engineer Engenuiti

J12236

December 2012

GEA Geotechnical & Environmental Associates

Document Control

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Report checked and approved for issue by	Steve Branch BSc MSc CGeol FGS FRGS MIEnvSc		

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1	Final	23 November 2012	
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CONTENTS

EXECUTIVE SUMMARY

This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.

BRIEF

This report describes the findings of a site investigation carried out by Geotechnical and Environmental Associates Limited (GEA) on the instructions of Engenuiti, on behalf of Consolidated Developments Limited, with respect to the extension of the existing basement beneath the courtyard mews, extending to a depth of between 3.5 m and 4.0 m. The purpose of the investigation has been to determine the ground conditions and engineering properties and to establish the groundwater regime. Interpretation of the findings of the investigation by GEA was not required.

SITE DESCRIPTION

The site is located in the London Borough of Camden, approximately 160 m to the south of Tottenham Court Road London Underground station. It is irregular in shape, measuring approximately 20 m north-south by 30 m east-west and is bounded on four sides by buildings that front onto Denmark Street to the north, Flitcroft Street to the east and south and Charing Cross Road to the west. The site is gently sloping down to the southwest and is currently occupied by a mews style courtyard, covered in brick paving, surrounded by buildings that comprise predominantly three – storey to five-storey buildings with partial and single level basements, currently used as commercial space. The first floor extends over the driveway along the southern boundary of the site, allowing vehicular access to the site from Flitcroft Street. The site is devoid of vegetation.

GROUND CONDITIONS

The boreholes encountered a significant thickness of made ground, underlain by Lynch Hill Gravel, overlying the London Clay, which was proved to the full depth investigated.

The made ground extended to depths of between 2.20 m and 4.50 m and generally comprised greyish brown sandy clay with occasional fragments of brick, clinker, ash, pottery, wood and chalk. The Lynch Hill Gravel generally comprised a variable sequence of sand and gravel and extended to depths of between 4.80 m and 5.77 m. The London Clay was proved to the maximum depth investigated of 6.0 m.

Groundwater was encountered during drilling at depths of between 3.9 m and 4.8 m. Subsequent groundwater monitoring visits measured groundwater at depths of between 3.66 m and 4.40 m.

Trial Pit Nos 1, 2, 3 and 4 found that the existing buildings are bearing at depths of between 1.16 m and 2.46 m on made ground or gravelly sand of the Lynch Hill Gravel. The extent of the footings in Trial Pit Nos 5, 7 and 8 was not proved due to obstructions and Trial Pit No 6 was terminated at a depth of 0.6 m due to a significant amount of loose fill.

1.0 INTRODUCTION

Geotechnical and Environmental Associates Limited (GEA) have been commissioned by Engenuiti, on behalf of Consolidated Developments Limited, to carry out a ground investigation at Denmark Street South, 4 Flitcroft Street, London, WC2H 8DJ. Interpretation of the findings of the investigation by GEA was not required and this report therefore simply presents the factual data obtained from the investigation.

1.1 Proposed Development

It is understood that it is proposed to extend the existing basement of No 4 Flitcroft Street by constructing a single level basement beneath the courtyard mews, extending to a depth of between 3.5 m and 4.0 m.

1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

- to determine the ground conditions and their engineering properties; and
- to determine the groundwater conditions.

1.3 Scope of Work

In order to meet the above objectives, a ground investigation was carried out, which comprised, in summary, the following activities:

- three open-drive sampler boreholes advanced to depths of 6.0 m;
- standard penetration tests (SPTs), carried out at regular intervals in the boreholes, to provide quantitative data on the strength of the soils;
- the installation of three groundwater monitoring standpipes in the boreholes to depths of between 5.2 m and 6.0 m and two subsequent groundwater monitoring visits;
- eight hand-dug trial pits excavated to investigate the configuration of existing foundations;
- laboratory testing of selected soil samples for geotechnical purposes; and
- provision of a factual report presenting the above data.

1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no

independent validation of such information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site is located in the London Borough of Camden, approximately 160 m to the south of Tottenham Court Road London Underground station. It is irregular in shape, measuring approximately 20 m north-south by 30 m east-west and is bounded on four sides by buildings that front onto Denmark Street to the north, Flitcroft Street to the east and south and Charing Cross Road to the west.

The site is gently sloping down to the southwest and the courtyard varies from approximately 24.5 m OD to 24 m OD and is currently occupied by a mews style courtyard, covered in brick paving, surrounded by buildings that comprise predominantly three to five storey buildings with partial and single level basements, currently used as commercial space. The first floor extends over the driveway along the southern boundary of the site, allowing vehicular access to the site from Flitcroft Street. The site is devoid of vegetation.

2.2 Other Information

The British Geological Survey (BGS) map of the area (Sheet 256) indicates the site to be underlain by Lynch Hill Gravel overlying London Clay.

Tunnels for Crossrail will pass to the north and south of the site and once the development proposals are finalised contact should be made with Crossrail with regard to the construction method of the new basement.

London Underground Limited has confirmed that it has no assets within 50 m of the site. A copy of the correspondence is included in the appendix.

The consulting engineers provided a report (ref 36237-001, dated June 2008) undertaken by STATS for a ground investigation carried out on Denmark Place, located approximately 60 m to the north of the site. The investigation comprised two boreholes advanced to depths of 54.0 m and 63.5 m by means of a rotary rig. The boreholes encountered made ground to depths of 3.5 m and 4.4 m, underlain by River Terrace Deposits to a depth of 6.0 m, which in turn was underlain by the London Clay proved to a depth of 30.25 m, underlain by the Lambeth Group to depth of 48.8 m, underlain by the Thanet Sand to a depth of 52.8 m, overlying the Upper Chalk, proved to the maximum depth investigated. Groundwater was encountered at depths of 5.6 m and 5.0 m during drilling within the River Terrace Deposits and measured at depths of between 4.73 m and 4.88 m on subsequent groundwater monitoring visits.

3.0 EXPLORATORY WORK

The scope of the works was specified by the consulting engineers. In order to meet the objectives described in Section 1.2. Three boreholes were drilled to a depth of 6.0 m using an open-drive lined percussive sampler rig. Standard penetration tests (SPTs) were carried out in the boreholes to provide quantitative data on the strength of soils encountered.

A groundwater monitoring standpipe was installed in each of the three boreholes to depths of 5.2 m, 5.85 m and 6.0 m, and the standpipes have been monitored on two occasions to date, over a period of approximately six weeks.

In addition, eight trial pits were manually excavated to depths of between 0.47 m and 2.6 m in order to expose and to allow the inspection of the existing foundations.

A selection of the disturbed samples recovered from the boreholes and trial pits was submitted to a soil mechanics laboratory for a programme of geotechnical testing.

All of the field work was carried out under the supervision of a geotechnical engineer from GEA.

The borehole and trial pit records and results of the geotechnical laboratory testing are enclosed, together with a site plan indicating the exploratory positions.

The fieldwork was carried out in the courtyard area and at lower ground floor level of No 4 Flitcroft Street, which is approximately 1.4 m lower than the courtyard area.

3.1 Sampling Strategy

The borehole and trial pit locations were specified by the consulting engineers and positioned on site by GEA to avoid known services.

Laboratory geotechnical classification and strength tests were undertaken on samples of the natural soil.

Contamination testing did not form part of the project brief.

4.0 GROUND CONDITIONS

The investigation encountered a significant thickness of made ground, underlain by Lynch Hill Gravel, overlying the London Clay, which was proved to the full depth investigated of 6.0 m.

4.1 Made Ground

The made ground extended to depths of between 2.20 m and 4.50 m in Boreholes Nos 1 to 3 and Trial Pit Nos 3 and 4. The full thickness of the made ground was not proved at the other exploratory locations.

The made ground generally comprised greyish brown sandy clay with occasional fragments of brick, clinker, ash, pottery, wood and chalk. In Trial Pit No 6, the made ground predominantly comprised whole bricks and half bricks.

No significant evidence of contamination was noted within the soils during the fieldwork, apart from the presence of extraneous fragments of charcoal and clinker.

4.2 Lynch Hill Gravel

The Lynch Hill Gravel generally comprised a variable sequence of light orange-brown and

brown gravelly sand, sandy gravel and sand and gravel and extended to depths of between 4.80 m and 5.77 m. However, directly beneath the made ground in Borehole No 3 light greenish grey sand and gravel was encountered to a depth of 3.7 m, underlain by a layer of soft dark grey mottled black and greenish grey sandy silt which extended to a depth of 4.8 m.

SPTs indicate the Lynch Hill Gravel to be very dense and dense.

No visual or olfactory evidence of contamination was noted in these soils.

4.3 London Clay

The London Clay was proved to the full depth investigated of 6.0 m and generally comprised stiff brown mottled grey fissured silty clay with occasional partings of orange-brown fine sand and silt with rare carbonaceous material. However in Borehole No 3, the London Clay initially comprised variably soft to stiff orange-brown silty clay which extended to a depth of 5.45 m and was underlain by stiff dark grey fissured silty clay.

The results of laboratory testing indicate the clay to be of moderate and high volume change potential.

4.4 Groundwater

Groundwater was encountered during drilling at depths of between 3.9 m and 4.8 m.

Monitoring of the standpipes has subsequently been carried out on two occasions, approximately two weeks and six weeks after installation. The results of the monitoring visits are shown in the table below.

Date	Borehole No	Depth to water (m)
16/10/2012	1	4.40
	2	4.21
	3	3.72
08/11/2012	1	4.35
	2	4.20
	3	3.66

4.5 Existing Foundations

Trial Pit Nos 1, 2, 3 and 4 found that the existing buildings are founded at depths of between 1.16 m and 2.46 m on made ground or gravelly sand of the Lynch Hill Gravel.

Trial Pit No 5 was terminated at a depth of 0.47 m due to a basement ceiling. It is now known that the existing basement at that location extends outside the footprint of the building structure.

Trial Pit No 6 was excavated to a depth of 0.6 m but due to the loose nature of the fill material at this location it was not possible to continue the pit manually.

The extent of the footing encountered in Trial Pit No 7 has not been proved due to a layer of concrete at a depth of 0.7 m. Probing with a 'Hilti' drill at two locations within the trial pit indicate the concrete to extend to a depth of a least 1.2 m at which depth there appears to be a metal obstruction. Further investigations in the form of a single core, drilled using a concrete corer was carried out approximately 1.5 m from the southern elevation of No 4 Flitcroft Street. The core was terminated at a depth of 0.75 m due to snagging and it was not possible to continue the core.

Trial Pit No 8 was abandoned at a depth of 0.1 m due to the presence of a drain.

A copy of the trial pit records and photographs are included in the appendix.

APPENDIX

GEA Geotechnical & Environmental Associates

Tytherhanger House, Coursers Road, St Albans, AL4 0PG

Site: Denmark Street South, 4 Flitcroft Street, London, WC2H 8DJ

Number: BH 1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Open-drive sampler			Consolidated Developments Limited	J12236
	Location	**Dates** 05/10/2012	**Engineer** Engenuit	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.07) 0.07	Paving slab		
					(0.16) 0.23	Concrete		
					(0.77) 1.00	MADE GROUND (bricks with rare fragments of chalk and charcoal)		
1.00-1.45	CPT N=7		2,2/2,2,1,2		(0.60) 1.60	MADE GROUND (greyish brown sand with rare gravel and occasional fragments of ash, brick, charcoal, chalk and concrete)		
1.40	D1							
					(0.60) 2.20	MADE GROUND (bricks including whole bricks and fragments of brick)		
2.00-2.45	CPT N=8		3,3/1,3,3,1					
2.40	D2				(0.50) 2.70	MADE GROUND (greyish brown sand with abundant fragments of brick, charcoal and concrete)		
					(0.20) 2.90	Brown gravelly SAND. Gravel is fine to coarse subangular to subrounded and sand is medium		
3.00-3.31	CPT 54/150		10,15/24,26,4					
3.00	D3				(0.70) 3.60	Very dense brown SAND and GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded		
3.50	D4				(0.20) 3.80	Brown gravelly SAND. Gravel is fine to medium angular and sand is medium to coarse		
3.70	D5							
4.00-4.45	CPT N=44		5,7/10,10,11,13		(0.90) 4.70	Dense light orange-brown medium SAND with very rare fine angular gravel		
4.00	D6							
4.50	D7		Water strike(1) at 4.75m.					▽1
5.00	D8				(1.07) 5.77	Light orange-brown gravelly SAND. Gravel is fine to coarse subangular and sand is fine to coarse		
5.50	D9				(0.23) 6.00	Stiff brown mottled gray fissured silty CLAY with occasional partings of orange-brown fine sand and silt with rare carbonaceous material		
6.00	D10					Complete at 6.00m		

Remarks
Cased to 3.0 m
Standpipe installed to a depth of 5.2 m
Groundwater measured at a depth of 4.4 m on 16/10/2012 and 4.35 m on 08/11/2012

Scale (approx): 1:50

Logged By: HD

Figure No. J12236.BH 1

GEA Geotechnical & Environmental Associates

Tytenhanger House
Coursers Road
St Albans
AL4 0PG

Site
Denmark Street South, 4 Flitcroft Street, London, WC2H 8DJ

Number
BH 2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Open-drive sampler			Consolidated Developments Limited	J12236
Location	**Dates**		**Engineer**	**Sheet**
	05/10/2012		Engenuiti	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.07)	Paving slab		
					0.07			
					(0.20)	Concrete		
					0.27			
					(0.73)	MADE GROUND (greyish brown clayey silty fine sand with rare gravel, abundant fragments of brick and charcoal and rare glass) Poor recovery to 1.0 m		
0.90	D1				1.00			
						MADE GROUND (brickwork)		
1.50	D2				(1.10)			
					2.10			
						MADE GROUND (dark brownish grey clayey silty sand with rare gravel, occasional fragments of charcoal, glass and claypipes)		
2.50	D3				(1.30)			
3.30	D4				3.40			
						MADE GROUND (light orange-brown mottled grey sand with abundant brick and rare fragments of charcoal)		
3.70	D5				(0.50)			
4.00	D6				3.90			
						MADE GROUND (bricks including whole bricks and fragments of brick)		
4.40	D7				(0.35)			
4.50	D8				4.25			
					(0.15)	Light orange-brown fine to medium SAND with very rare fine angular gravel		
4.60	D9		Water strike(1) at 4.60m		4.40			▽1
					(0.25)			
5.00-5.45	CPT N=40		3,7/10,10,10,10		4.65	Light orange-brown gravelly SAND. Sand is fine to coarse and gravel is fine to coarse subangular		
					(1.05)			
5.50	D10					Dense light orange-brown SAND and GRAVEL with rare cobbles. Sand is fine to coarse and gravel is fine to coarse subangular		
					5.70			
5.90	D11				(0.30)			
					6.00	Stiff brown mottled grey fissured silty CLAY with occasional partings of orange-brown fine sand and silt and rare carbonaceous material		
						Complete at 6.00m		

Remarks
Cased to 4.8 m
Standpipe installed to a depth of 5.85 m
Groundwater measured at a depth of 4.21 m on 16/10/2012 and 4.20 m on 08/11/2012

Scale (approx)	Logged By
1:50	HD

Figure No.
J12236.BH 2

GEA Geotechnical & Environmental Associates

Tytenhanger House
Coursers Road
St Albans
AL4 0PG

Site
Denmark Street South, 4 Flitcroft Street, London, WC2H 8DJ

Number
BH 3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Open-drive sampler			Consolidated Developments Limited	J12236
Location	**Dates**		**Engineer**	**Sheet**
	06/10/2012		Engenuiti	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.07)	Paving slab		
					0.07			
					(0.06)	Concrete		
					0.13			
0.50	D1				(0.09)	Granite cobbles		
					0.22			
					(0.03)	Concrete		
					0.25			
					(0.15)	Sub-base (sand and gravel)		
					0.40			
					(0.30)	MADE GROUND (greyish brown slightly clayey silty sand with rare gravel and occasional fragments of brick and charcoal)		
					0.70			
					(1.20)	MADE GROUND (bricks including whole bricks and fragments of brick)		
1.95	D2							
2.00-2.45	CPT N=5		1,2/1,1,2,1		1.90	MADE GROUND (grey sandy silt with occasional partings of white fine sand with occasional fragments of brick, wood and charcoal. Layer of brick between a depth of 2.7 m and 2.8 m)		
2.50	D3							
					(2.35)			
3.50	D4							
			Water strike(1) at 3.90m					▽1
					4.25			
					(0.25)	MADE GROUND (dark grey silt with occasional fragments of fine brick) Organic odour noted		
					4.50			
					(0.20)	Light greenish grey SAND and GRAVEL. Sand is fine to coarse and gravel is fine to coarse subangular to subrounded		
4.60	D5				4.70			
4.75	D6				(0.10)			
4.85	D7				4.80	Soft dark grey mottled black and greenish grey sandy SILT		
4.95	D8				(0.65)			
5.20	D9					Variably soft to stiff orange-brown silty CLAY. Claystone encountered at a depth of 5.2 m		
					5.45			
					(0.55)	Stiff dark grey fissured silty CLAY		
5.80	D10				6.00			
						Complete at 6.00m		

Remarks
Cased to 5.0 m
Standpipe installed to a depth of 6.0 m
Groundwater measured at a depth of 3.72 m on 16/10/2012 and 3.66 m on 08/11/2012

Scale (approx)	Logged By
1:50	HD

Figure No.
J12236.BH 3

GEA Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Albans
AL4 0PG

Standard Penetration Test Results

Site : Denmark Street South, 4 Flitcroft Street, London, WC2H 8DJ

Client : Consolidated Developments Limited

Engineer: Engenuiti

Job Number J12236

Sheet 1 / 1

Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
BH 1	1.00	1.15	1.45	CPT	2	2	2	2	1	2	N=7	
BH 1	2.00	2.15	2.45	CPT	3	3	1	3	3	1	N=8	
BH 1	3.00	3.15	3.31	CPT	10	15	24	26	4		54/160mm	Refusal
BH 1	4.00	4.15	4.45	CPT	5	7	10	10	11	13	N=44	
BH 2	5.00	5.15	5.45	CPT	3	7	10	10	10	10	N=40	
BH 3	2.00	2.15	2.45	CPT	1	2	1	1	2	1	N=5	

GEA Geotechnical & Environmental Associates

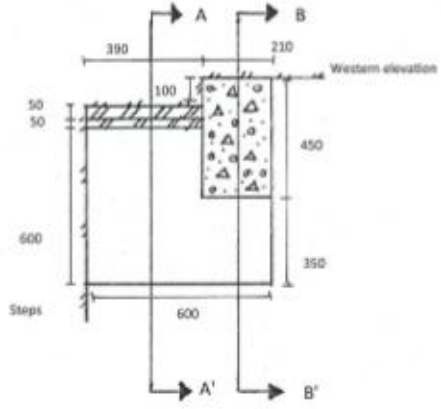
Tyttenhanger House
Coursers Road
St Albans
Herts AL4 0PG

Site Chateau Denmark, 4 Flitcroft Street, London, WC2H 8DJ

Trial Pit Number 1

Excavation Method	Dimensions (mm)	Ground Level (mOD)	Client	Job Number
Manual	800 x 600 x 1300		Consolidated Developments Limited	J12236
	Location	**Dates**	**Engineer**	**Sheet**
		05/10/2012	Engenuiti	1/22

PLAN



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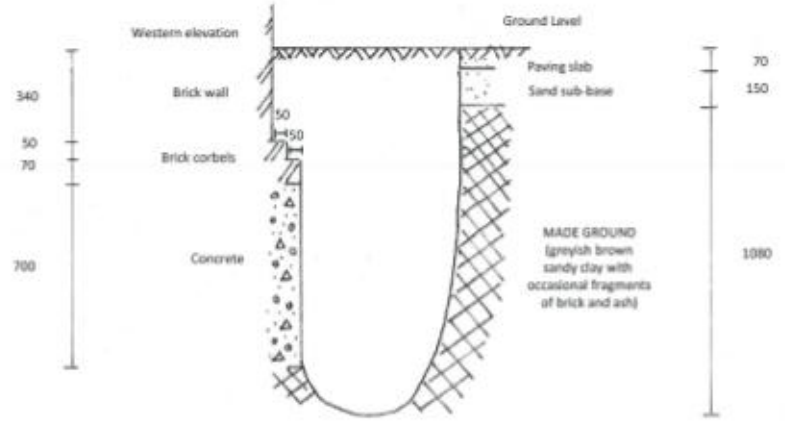


Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

Groundwater not encountered

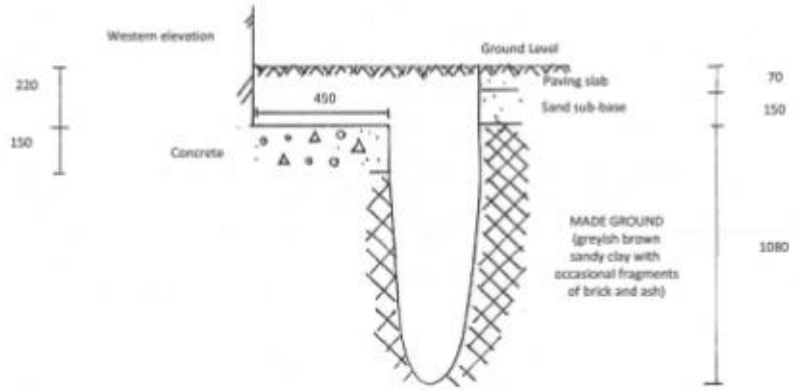
Scale: 1:20

Logged by: HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site Chateau Denmark, 4 Fitzroft Street, London, WC2H 8DJ	Trial Pit Number 1

Excavation Method	Dimensions (mm)	Ground Level (mOD)	Client	Job Number
Manual	800 x 600 x 1300		Consolidated Developments Limited	J12236
	Location	**Dates**	**Engineer**	**Sheet**
		05/10/2012	Engenuiti	2/22

SECTION B - B'



Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

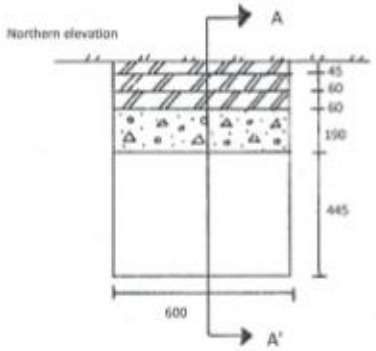
GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	Trial Pit No 1

Site	Chateau Denmark, 4 Fitzroft Street, London, WC2H 8DJ	Job Number J12236
Client	Consolidated Developments Limited	Sheet 3/22
Engineer	Engenuiti	

View of footings encountered in Trial Pit No 1, looking east

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site: Chateau Denmark, 4 Fitzroy Street, London, WC2H 8DJ	Trial Pit Number: 2
Excavation Method: Manual	Dimensions: 600 x 800 x 1500	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 04/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 4/22

PLAN



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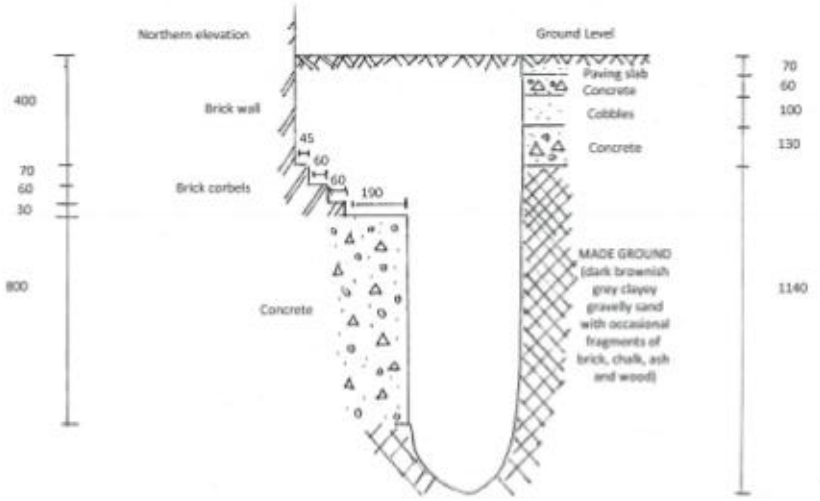


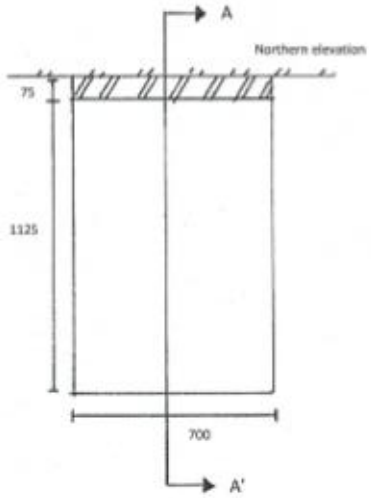
Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	Trial Pit No 2
Site: Chateau Denmark, 4 Fitzroy Street, London, WC2H 8DJ		Job Number: J12236
Client: Consolidated Developments Limited		Sheet: 5/22
Engineer: Engenuiti		

View of the footings encountered in Trial Pit No 2, looking south

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site: Chateau Denmark, 4 Fitzcroft Street, London, WC2H 8DJ	Trial Pit Number: 3
Excavation Method: Manual	Dimensions: 1200 x 700 x 2600	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 04/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 6/22

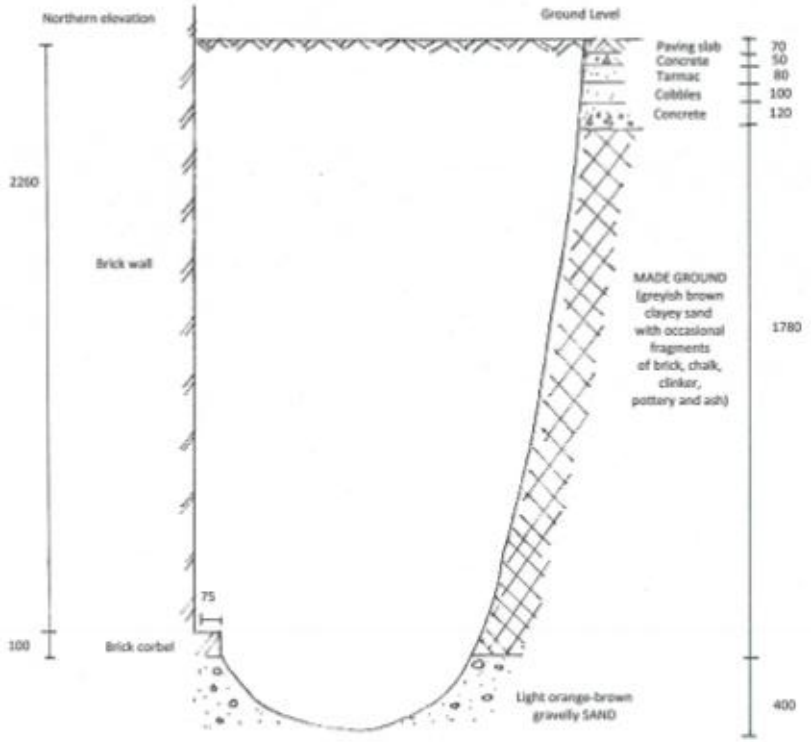
PLAN



Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site: Chateau Denmark, 4 Fitzcroft Street, London, WC2H 8DJ	Trial Pit Number: 3
Excavation Method: Manual	Dimensions (mm): 1200 x 700 x 2600	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 04/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 7/22

SECTION A - A'



Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tytenhanger House Coursers Road St Albans Herts AL4 0PG	Trial Pit No 3

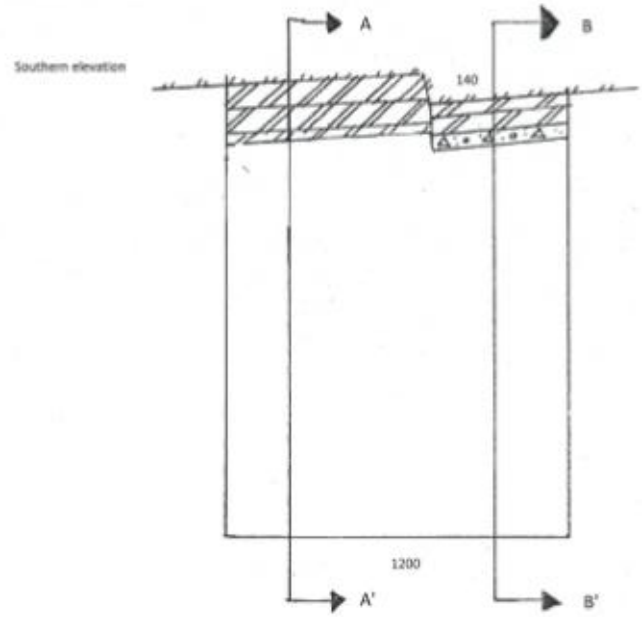
Site	Chateau Denmark, 4 Fitzroft Street, London, WC2H 8DJ	**Job Number** J12236
Client	Consolidated Developments Limited	**Sheet** 8/22
Engineer	Engenuiti	

View of the footings encountered in Trial Pit No 3, looking south

GEA Geotechnical & Environmental Associates	Tytenhanger House Coursers Road St Albans Herts AL4 0PG	**Site** Chateau Denmark, 4 Fitzroft Street, London, WC2H 8DJ	**Trial Pit Number** 4

Excavation Method Manual	**Dimensions (mm)** 1700 x 1200 x 2500	**Ground Level (mOD)**	**Client** Consolidated Developments Limited	**Job Number** J12236
	Location	**Dates** 04/10/2012	**Engineer** Engenuiti	**Sheet** 9/22

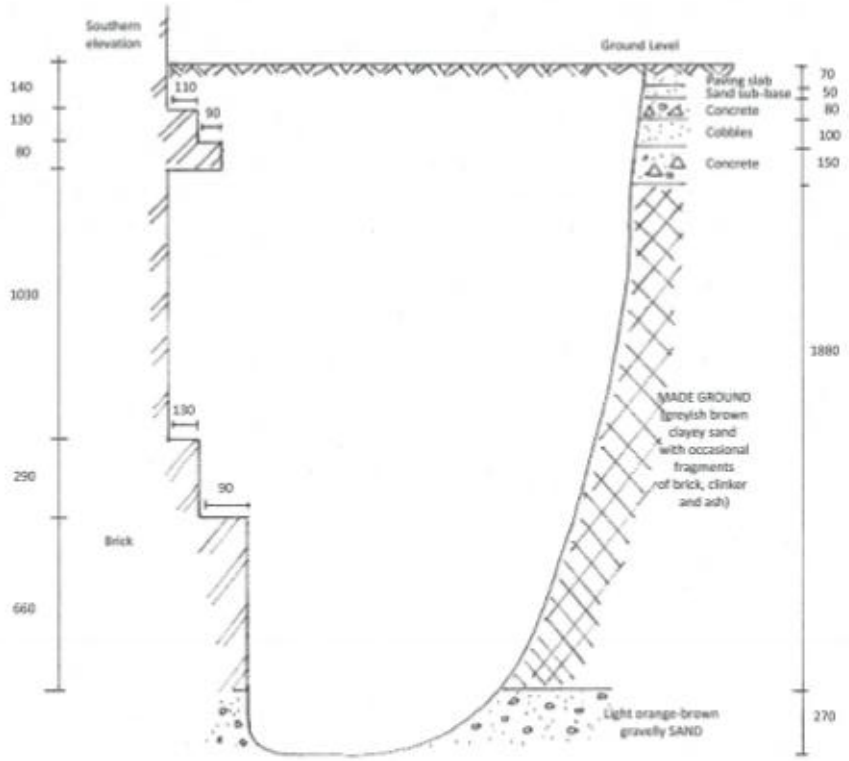
SECTION A - A'



Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site: Chateau Denmark, 4 Flitcroft Street, London, WC2H 8DJ	Trial Pit Number: 4
Excavation Method: Manual	Dimensions: 1700 x 1200 x 2600	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 04/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 10/22

SECTION A - A'



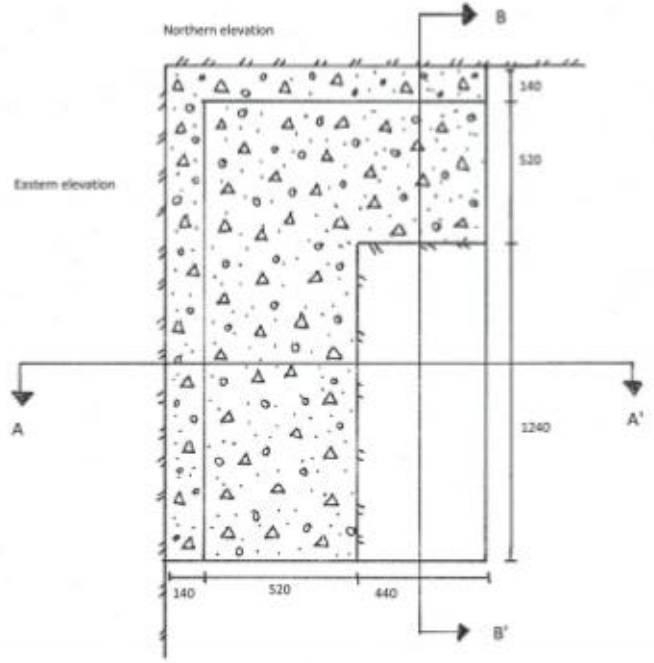
Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	Trial Pit No 4
Site: Chateau Denmark, 4 Flitcroft Street, London, WC2H 8DJ		Job Number: J12236
Client: Consolidated Developments Limited		Sheet: 12/22
Engineer: Engenuiti		

View of the footings encountered in Trial Pit No 4, looking northeast

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG	Site: Chateau Danmark, 4 Fitzcroft Street, London, WC2H 8DJ	Trial Pit Number: 5
Excavation Method: Manual	Dimensions (mm): 1900 x 1100 x 470	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 09/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 13/22

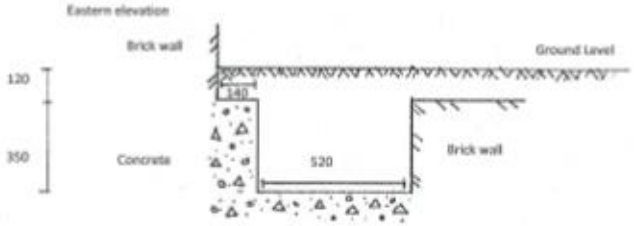
PLAN



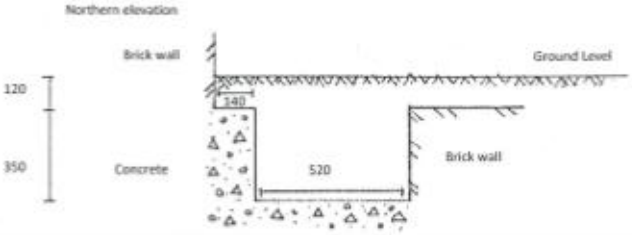
Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG	Site: Chateau Danmark, 4 Fitzcroft Street, London, WC2H 8DJ	Trial Pit Number: 5
Excavation Method: Manual	Dimensions (mm): 1900 x 1100 x 470	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 09/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 14/22

SECTION A - A'



SECTION B - B'



Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates

Tytlerhanger House
Coursers Road
St Alb

Trial Pit No 5

Site	Chateau Denmark, 4 Fitzcroft Street, London, WC2H 8DJ	Job Number J12236
Client	Consolidated Developments Limited	Sheet 15/22
Engineer	Engenuiti	

View of the findings encountered in Trial Pit No 5, looking northwest

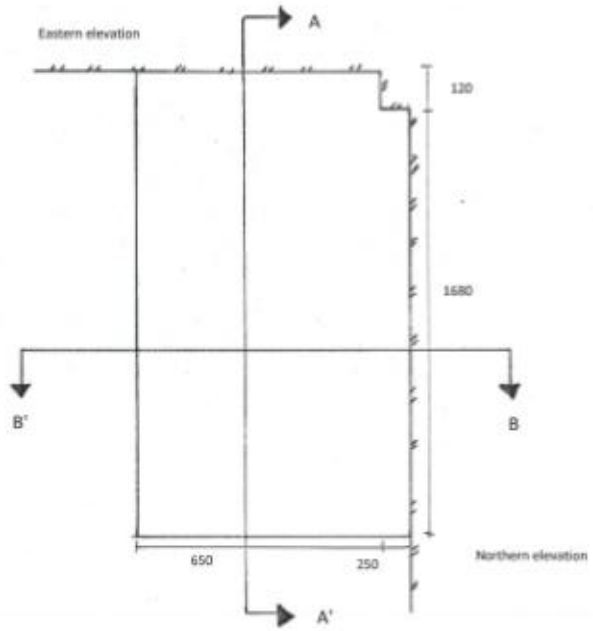
GEA Geotechnical & Environmental Associates

Tytlerhanger House
Coursers Road
St Albans
Herts AL4 0PG

Trial Pit Number 6

Excavation Method Manual	Dimensions 1800 x 900 x 600	Ground Level (mOD)	Site Chateau Denmark, 4 Fitzcroft Street, London, WC2H 8DJ	Job Number J12236
	Location	Dates 09/10/2012	Client Consolidated Developments Limited	Sheet 16/22
			Engineer Engenuiti	

PLAN



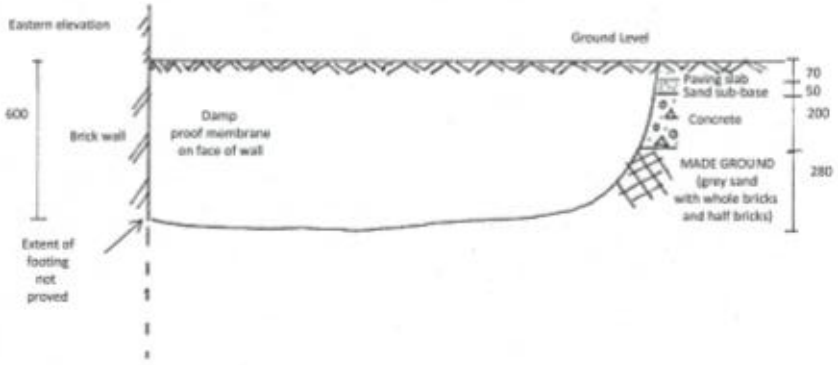
Remarks:	Scale: 1:20
All dimensions in millimetres	
Sides of trial pit did not remain stable during excavation - not possible to install shoring to continue pit	Logged by: HD
Groundwater not encountered	

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site: Chateau Denmark, 4 Fitzroft Street, London, WC2H 8DJ	Trial Pit Number: 6
Excavation Method: Manual	Dimensions: 1800 x 900 x 600	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 09/10/2012	Engineer: Engenuiti

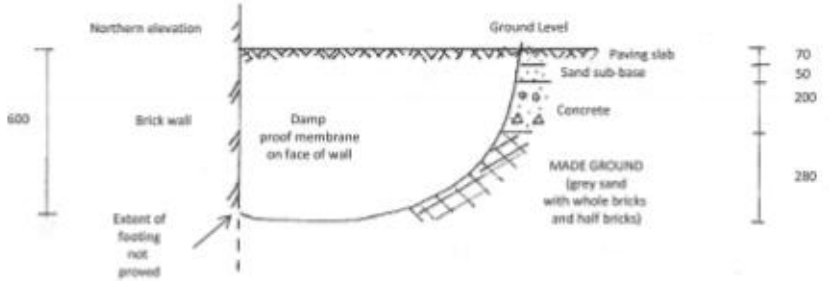
Job Number: J12236

Sheet: 17/22

SECTION A - A'



SECTION B - B'



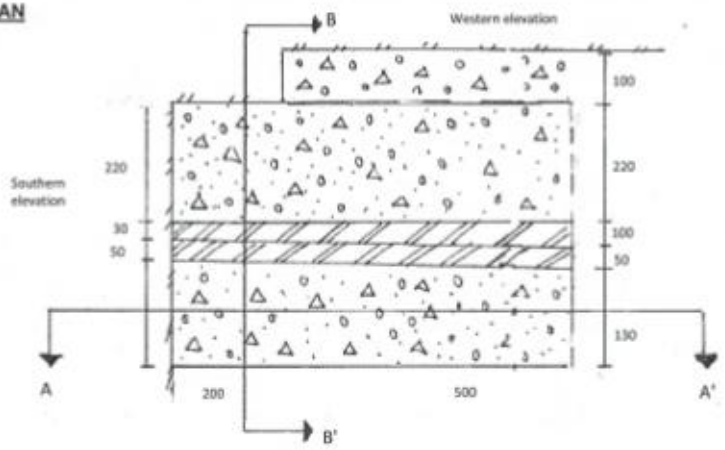
Remarks:	Scale:
All dimensions in millimetres	1:20
Sides of trial pit did not remain stable during excavation - not possible to install shoring to continue pit	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Alb	Trial Pit No 6
Site: Chateau Denmark, 4 Fitzroft Street, London, WC2H 8DJ		Job Number: J12236
Client: Consolidated Developments Limited		Sheet: 18/22
Engineer: Engenuiti		

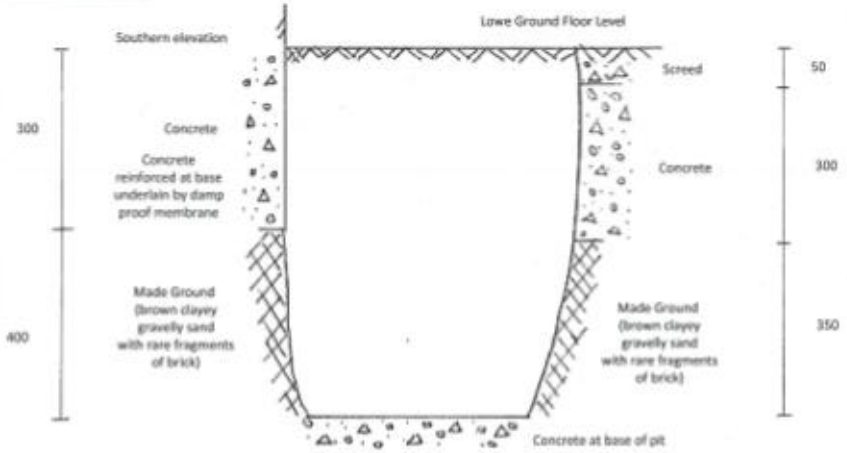
View of the findings encountered in Trial Pit No 6, looking north

GEA Geotechnical & Environmental Associates	Tytenhanger House Coursers Road St Albans Herts AL4 0PG	Site: Chateau Denmark, 4 Fitzcroft Street, London, WC2H 8DJ	Trial Pit Number: 7
Excavation Method: Manual	Dimensions (mm): 700 x 600 x 700	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 16/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 19/22

PLAN



SECTION A - A'

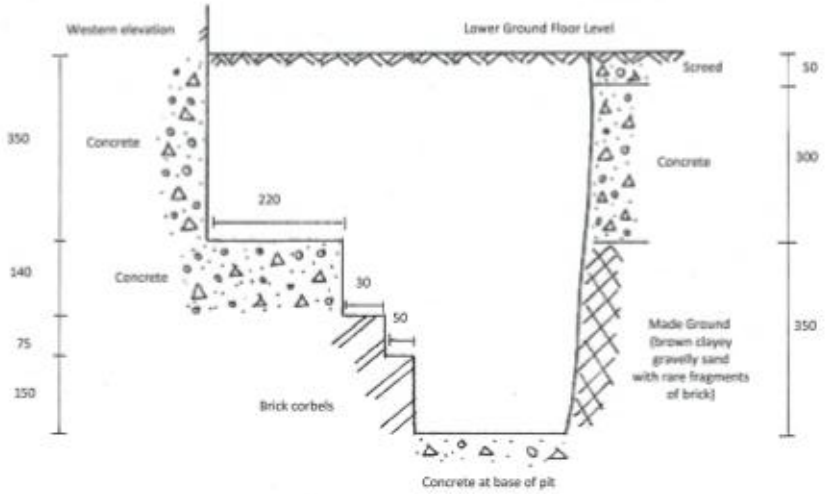


Note: Two probes through base of concrete were carried out using a hilti drill and the concrete is at least 500 mm thick, underlain by an obstruction, possibly metal

Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tytenhanger House Coursers Road St Albans Herts AL4 0PG	Site: Chateau Denmark, 4 Fitzcroft Street, London, WC2H 8DJ	Trial Pit Number: 7
Excavation Method: Manual	Dimensions (mm): 700 x 600 x 700	Ground Level (mOD):	Client: Consolidated Developments Limited
	Location:	Dates: 16/10/2012	Engineer: Engenuiti
			Job Number: J12236
			Sheet: 20/22

SECTION B - B'



Note: Two probes through base of concrete were carried out using a hilti drill and the concrete is at least 500 mm thick, underlain by an obstruction, possibly metal

Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Alb

Trial Pit No 7

Site	Chateau Denmark, 4 Flitcroft Street, London, WC2H 8DJ	Job Number J12236
Client	Consolidated Developments Limited	Sheet 21/22
Engineer	Engenuiti	

View of the findings encountered in Trial Pit No 7, looking southeast

GEA Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Alb

Trial Pit No 8

Site	Chateau Denmark, 4 Flitcroft Street, London, WC2H 8DJ	Job Number J12236
Client	Consolidated Developments Limited	Sheet 22/22
Engineer	Engenuiti	

View of the findings encountered in Trial Pit No 8, looking south

PROJECT NAME CHATEAU DENMARK. 4 FLITCROFT STREET WC2H 8DJ
Job Number: J12236
PROJECT NO: GEO / 18891

Date	01/11/2012
Approved	SB
Page	1 of 1

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression Tests			Chemical Tests			
Borehole No.	Depth (m)	No.	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	Other tests and comments
BH1	2.40	D2	D												8.3	0.89		
BH1	3.50	D4	D	Brown silty sandy GRAVEL														Particle Size Distribution
BH1	5.00	D8	D	Brown gravelly SAND														Particle Size Distribution
BH1	6.00	D10	D	Dark orange brown slightly fine sandy silty CLAY	27	65	25	40	100									
BH2	3.30	D4	D												7.8	0.64		
BH2	4.40	D7	D	Brown SAND with rare fine to medium gravel														Particle Size Distribution
BH2	5.90	D11	D	Dark greyish brown mottled orange silty CLAY	30	65	27	38	100									
BH3	3.50	D4	D												9.0	0.34		
BH3	4.75	D6	D	Brown sandy GRAVEL														Particle Size Distribution
BH3	4.95	D8	D	Orange brown slightly fine sandy silty CLAY with black staining	48	73	31	42	100									
BH3	5.20	D9	D												8.3	1.00		
BH3	5.80	D10	D	Dark greyish brown silty CLAY	28	71	26	45	100									

SUMMARY OF GEOTECHNICAL TESTING

GEOLABS

BS1377 : Part 2 : Clause 9 : 1990

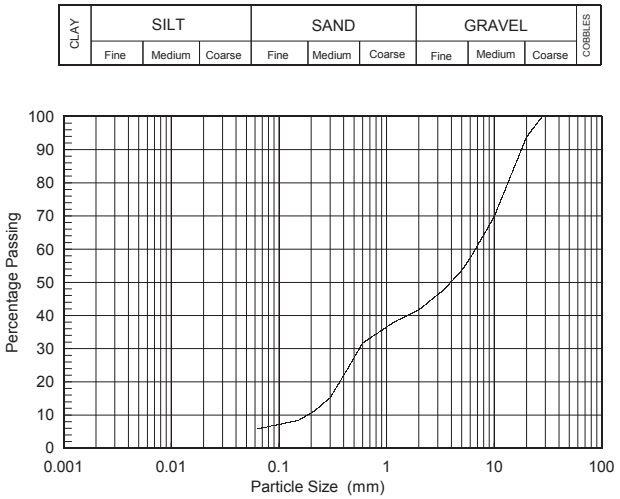
Determination of Particle Size Distribution

Borehole Number:	BH1
Sample Number:	D4
Depth (m):	3.50

Description: Brown silty sandy GRAVEL

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
28 mm	100
20 mm	94
14 mm	81
10 mm	70
6.3 mm	59
5 mm	54
3.35 mm	48
2 mm	42
1.18 mm	38
600 µm	32
425 µm	23
300 µm	15
212 µm	11
150 µm	8
63 µm	6



Particle Proportions		
Cobbles	0.0	%
Gravel	58.3	%
Sand	36.0	%
Silt & Clay	5.8	%

Checked and Approved
Initials: SB
Date: 01/11/2012

Project Number: GEO / 18891
Project Name: CHATEAU DENMARK. 4 FLITCROFT STREET WC2H 8DJ
Job Number: J12236

UKAS TESTING 1662

GEOLABS®

BS1377 : Part 2 : Clause 9 : 1990

Determination of Particle Size Distribution

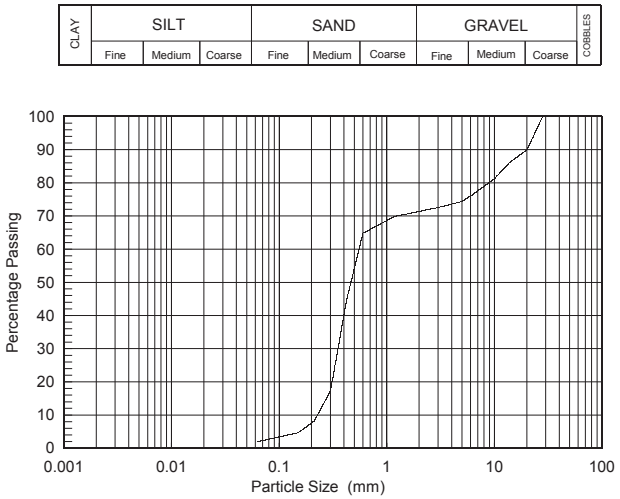
Borehole Number:	BH1
Sample Number:	D8
Depth (m):	5.00

Description:
Brown gravelly SAND

Insufficient material supplied to be representative in accordance with BS1377 requirements.

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
28 mm	100
20 mm	90
14 mm	86
10 mm	81
6.3 mm	77
5 mm	74
3.35 mm	73
2 mm	71
1.18 mm	70
600 µm	65
425 µm	45
300 µm	17
212 µm	8
150 µm	5
63 µm	2



Particle Proportions		
Cobbles	0.0	%
Gravel	28.6	%
Sand	69.4	%
Silt & Clay	2.0	%

Checked and Approved	
Initials:	SB
Date:	01/11/2012

Project Number: **GEO / 18891**

Project Name: **CHATEAU DENMARK. 4 FLITCROFT STREET WC2H 8DJ**

Job Number: J12236

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BS1377 : Part 2 : Clause 9 : 1990

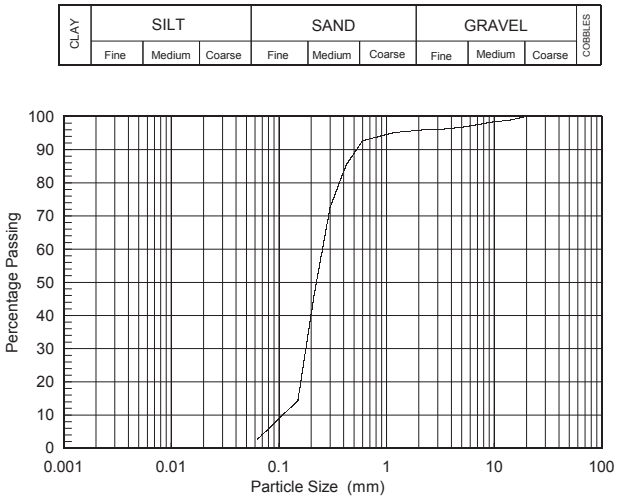
Determination of Particle Size Distribution

Borehole Number:	BH2
Sample Number:	D7
Depth (m):	4.40

Description:
Brown SAND with rare fine to medium gravel

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
28 mm	100
20 mm	100
14 mm	99
10 mm	98
6.3 mm	97
5 mm	97
3.35 mm	96
2 mm	96
1.18 mm	95
600 µm	93
425 µm	86
300 µm	73
212 µm	46
150 µm	14
63 µm	3



Particle Proportions		
Cobbles	0.0	%
Gravel	4.1	%
Sand	93.2	%
Silt & Clay	2.7	%

Checked and Approved	
Initials:	SB
Date:	01/11/2012

Project Number: **GEO / 18891**

Project Name: **CHATEAU DENMARK. 4 FLITCROFT STREET WC2H 8DJ**

Job Number: J12236

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BS1377 : Part 2 : Clause 9 : 1990

Determination of Particle Size Distribution

Borehole Number:	BH3
Sample Number:	D6
Depth (m):	4.75

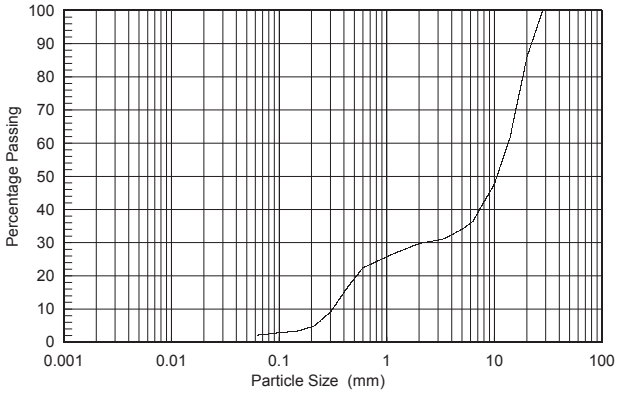
Description:
Brown sandy GRAVEL

Insufficient material supplied to be representative in accordance with BS1377 requirements.

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
28 mm	100
20 mm	86
14 mm	62
10 mm	48
6.3 mm	36
5 mm	34
3.35 mm	31
2 mm	30
1.18 mm	27
600 µm	22
425 µm	16
300 µm	9
212 µm	5
150 µm	3
63 µm	2

CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



Particle Proportions		
Cobbles	0.0	%
Gravel	70.3	%
Sand	27.6	%
Silt & Clay	2.2	%

Checked and Approved Initials: SB Date: 01/11/2012	Project Number: **GEO / 18891** Project Name: **CHATEAU DENMARK. 4 FLITCROFT STREET WC2H 8DJ** **Job Number: J12236**	GEOLABS®

Date 01 October 2012
Our Ref 20878-SI-5-011012
Your Ref
To Hannah Dashfield
Geotechnical and Environmental Associates
Hannah@gea-ltd.co.uk

London Underground Limited

Hello Hannah,

4 Flitcroft Street, London, WC2H 8DJ

Thank you for your communication of 28th September 2012.

I can confirm that London Underground has no assets within 50 metres of your site as shown on the plan you provided.

Should you have any further enquiries, please do not hesitate to contact me.

Shahina Inayathusein
Information Manager
LUL Infrastructure Protection
E-mail: Locationenquiries@tube.tfl.gov.uk
Tel: 020 7918 0016

Hannah Dashfield

From: Location Enquiries <SMBLocationEnquiries@tfl.gov.uk>
Sent: 01 October 2012 11:45
To: Hannah Dashfield
Subject: RE: London Underground asset location enquiries - Flitcroft Street
Attachments: SI-S-011012 4 Flitcroft Street, London, WC2H 8DJ.pdf

London Underground Infrastructure Protection response to your communication attached.

Kind regards

Shahina Inayathusein
Information Manager
locationenquiries@tube.tfl.gov.uk
Tel: 0207 918 0016
Auto: 40016

From: Hannah Dashfield [mailto:Hannah@gea-ltd.co.uk]
Sent: 28 September 2012 10:00
To: Location Enquiries
Cc: Steve Branch
Subject: London Underground asset location enquiries - Flitcroft Street
Importance: High

Shahina,

Our client is proposing to construct a single level basement. We understand the Northern Line to be close to the location of this site. Would you be able to provide details of the location / depth of tunnels and any exclusion zones affecting our site as we are carrying out a 10 m deep borehole next week.

Site Address: Chateau Denmark, 4 Flitcroft Street, London, WC2H 8DJ
NGR: 529929, 181233
(See attached site location plan)

Please confirm when we should expect to receive some information from you.

Let me know if you require any further information.

Regards,

Hannah Dashfield

Geotechnical & Environmental Associates
Tyttenhanger House
Coursers Road
St Albans
Herts AL4 0PG

tel 01727 824666
fax 01727 824777
email mail@gea-ltd.co.uk
web www.gea-ltd.co.uk

GEA Geotechnical & Environmental Associates

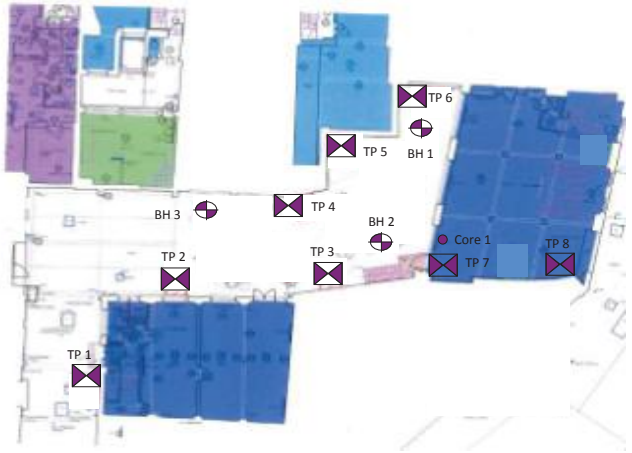
Tyttenhanger House
Coursers Road
St Albans
Herts AL4 0PG

Site Plan

Site	Chateau Denmark, 4 Flitcroft Street, London, WC2H 8DJ
Client	Consolidated Developments Limited
Engineer	Engenuiti

Job Number J12236

Sheet 1 / 1



NOTE: NOT TO SCALE

Geotechnical & Environmental Associates (GEA) is an engineer-led and client-focused independent specialist providing a complete range of geotechnical and contaminated land investigation, analytical and consultancy services to the property and construction industries.

We have offices at

Tyttenhanger House
Coursers Road
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tel 01727 824666
mail@gea-ltd.co.uk

Church Farm
Gotham Road
Kingston on Soar
Notts
NG11 0DE
tel 01509 674888
midlands@gea-ltd.co.uk

Enquiries can also be made on-line at
www.gea-ltd.co.uk
where information can be found
on all of the services that we offer.

GEA Geotechnical & Environmental Associates