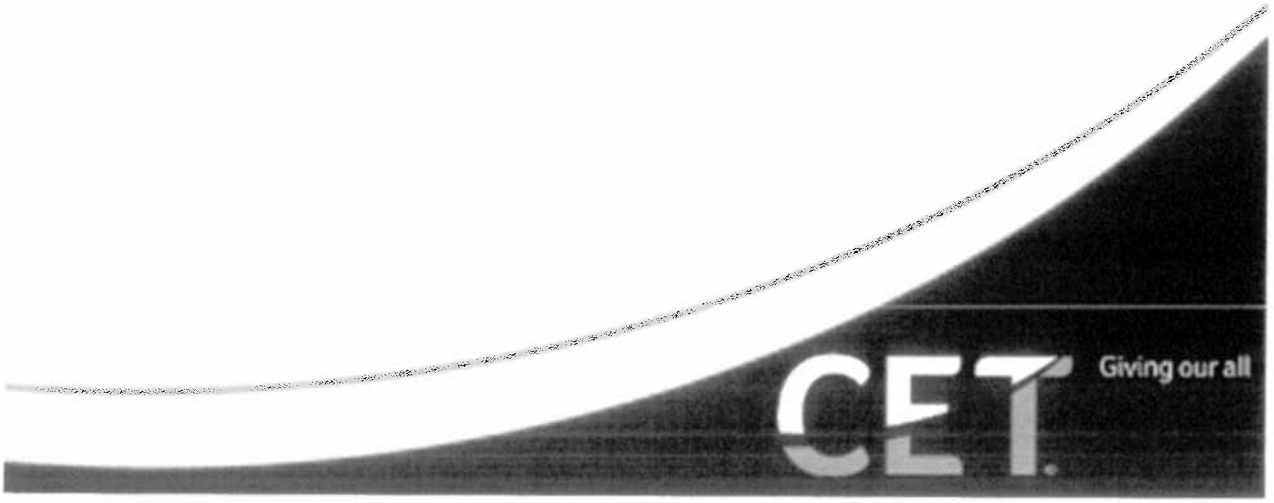
# REPORT ON
# GROUND INVESTIGATION
# AT
# 61 – 65 CHARLOTTE STREET
# FOR
# MERCHANT LAND INVESTMENTS LTD



## CONTENTS

PAGE No.



## FIGURES



## APPENDICES

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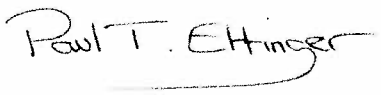
## APPROVAL & DISTRIBUTION SHEET

| PROJECT DETAILS | |
|---|---|
| CET LEAD NO. | 240524 |
| JOB NAME | 61 – 65 Charlotte Street |
| CLIENT | Merchant Land Investments Ltd |
| STATUS | Final |
| VERSION | REV0 |

| DISTRIBUTION | | | |
|---|---|---|---|
| Date: | Issued to: | Name: | No: |
| Dec 2015 | Michael Barclay Partnership LLP | Rob Manning | 1 |
| Dec 2015 | CET Infrastructure | File | 1 |

**PREPARED BY:**



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## FOREWORD

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## 1. INTRODUCTION

This report has been prepared upon the instruction of Merchant Land Investments Ltd, email dated 13 November 2015.

It is proposed to construct a two storey building to the rear of 61 to 65 Charlotte Street, London W1T 4PG. The scheme is to comprise internal modification of the terraced properties and locally reducing the level of the ground floor. A nominated ground investigation comprising two driven window sampler boreholes was carried out in November 2015 to provide parameters for the design of the geotechnical aspects of the proposed scheme.

A waste classification Hazard Assessment has been carried out upon samples recovered during the ground investigation. Whilst reference may be made to this the related letter report (reference 240524/HA dated 8th December 2015) the document has not been reproduced herein.

Attention is drawn to the fact that whilst every effort has been made to ensure the accuracy of the data supplied and any analysis derived from it, there is a potential for variations in ground conditions between and beyond the specific locations investigated. No liability can be accepted for any such variations. Furthermore, any recommendations are specific to the client's requirements as detailed herein and no liability will be accepted should these be used by third parties without prior consultation with CET Structures Ltd.

A Desk Study as outlined in BS5930 "Code of practice for site investigations" was not requested and therefore has not been carried out.

## 2. SITE SETTINGS

The subject site is situated on the west side of Charlotte Street, London, W1T 4PG at approximate Ordnance Survey Grid Reference TQ293817, as shown on Figure 1.

The site comprises three terraced, four storey buildings, numbers 61, 63 and 65, with retail units at ground level. The properties are bounded to the north, south and west by further retail units. Reference to the publications of the British Geological Survey indicates that the site is underlain by the London Clay Formation, which is mantled by superficial deposits of the Lynch Hill Gravel Member. These deposits may be described as follows:

| | |
|---|---|
| London Clay Formation | Generally stiff, fissured grey clay that weathers to a brown colour near the surface. Characteristics of the London Clay Formation are layers of septarian nodules, commonly termed claystone, and selenite crystals, which is a form of sulphate. |
| Lynch Hill Gravel Member | Predominantly flint gravel derived from the destruction of older gravel horizons and/or the chalk. |

The ground investigation established that the site is underlain Made Ground overlying the Lynch Hill Gravel and the London Clay Formation successively with depth.

## 3. GROUND INVESTIGATION

The ground investigation comprised two driven window sampler boreholes carried out on 23rd November 2015, at the approximate locations shown on Figure 2.

Details of the ground conditions encountered in the exploratory holes are presented on the exploratory hole logs included in Appendix A. Reference should be made to these logs for detailed descriptions of the strata encountered, the depths and type of recovered samples and the results of any in situ testing. A summary only is presented below.

Below a mantle of concrete, Made Ground was encountered in both window sampler boreholes to a maximum depth of 6m below ground level in WS01. The Made Ground predominantly comprised a series of silt horizons that locally contained organic material. WS02 was terminated within the Made Ground at 5.2m below ground due to a possible obstruction that may have been the "density" of the GRAVEL horizon at this depth.

Beneath the Made Ground in WS01 possible deposits of the Lynch Hill Gravel Member were encountered as slightly silty, sandy GRAVEL of flint to a depth of 7.2m below ground level.

Below this granular horizon, the Weathered London Clay Formation was encountered to the base of the borehole at 7.7m below ground level. This horizon comprised slightly fine sandy CLAY with fine sand sized selenite crystals.

Groundwater seepages were not observed in either borehole although the soils between 2.6m and 2.9m and 6m to 7.2m in WS01 and below 5m in WS02 were noted to be wet. The absence of seepages into the borehole does not preclude the possibility of a groundwater table being present. The water table may not have been expressed as seepages due to either the relatively low permeability of the soils encountered or the short period of time that the boreholes were open. A standpipe was installed at 5.1m in WS01 for the long term monitoring of the groundwater table.

## 4 LABORATORY TESTING

A geotechnical laboratory testing programme was carried out to provide further information on the engineering properties of the subsoil. Unless stated otherwise, these tests were carried out in accordance with BS 1377 "Methods of Test for Soils for Civil Engineering Purposes". CET Structures Limited has been accredited for specific tests as indicated below, by the United Kingdom Accreditation Service (U.K.A.S.). Individual full format reports for tests are available, if required. Other tests indicated ** have been carried out by UKAS accredited suppliers to CET Structures Limited. The following tests were carried out and the results are presented in Appendix B:

| No. | Test | UKAS Accreditation |
|---|---|---|
| 5 | Moisture content determinations | CET |
| 3 | Atterberg Limits Determinations | CET |
| 4 | pH and water soluble sulphate determinations | CET Supplier |
| | | |

## 5 DISCUSSION

It is proposed to construct a two storey building behind the existing terraced retail units on Charlotte Street, London, W1T 4PG with modification works being carried out internally. The internal works will comprise the localised lowering of the floor level to accommodate an increased ceiling height.

The nominated ground investigation has established that the site is underlain by a substantial thickness of Made Ground that was proved to a maximum depth of 6m below ground level in WS01. Below the Made Ground, superficial deposits of the Lynch Hill Gravel Member were observed to 7.2m below ground level with the borehole terminating within the Weathered London Clay Formation at 7.7m below ground level. WS02 was terminated in the Made Ground at 5.2m due to the possible "dense" nature of the granular material encountered.

Groundwater seepages were not observed in either borehole but samples were locally noted to be "wet" in both boreholes however the comments made in Section 3 of this report should be borne in mind. A piezometer was installed in WS01 to facilitate the long term monitoring of any groundwater.

### FOUNDATIONS

Foundations bearing within Made Ground are not recommended due to the unpredictable settlement and strength characteristics of this material and the inherent risk of collapse settlement.

Reference to the engineer's logs indicates that the Made Ground was encountered to 6m below ground level therefore piled foundations are likely to be required as part of the proposed scheme. In light of this, a cable percussion borehole to a depth of 20m to 25m below ground level will be required to prove the soils to sufficient depth and provide parameters for the subsequent pile design.

### GROUND FLOOR SLABS

Ground bearing floor slabs constructed on Made Ground are not recommended because of the risk of differential and collapse settlement and suspended floor slabs would have to be adopted.

### CONCRETE BELOW GROUND

A single sample of the Weathered London Clay Formation was subjected to sulphate analysis.

The results of the water soluble sulphate and pH determination indicate that in accordance with BRE Special Digest 1, **"Concrete in Aggressive Ground"**, Table C2, the Weathered London Clay Formation conforms with ACEC Class AC-1s and Design Sulphate Class DS-1. However, in light of the presence of selenite crystals, the Weathered London Clay Formation should be assumed to be DS-3 and ACEC Class AC-3.

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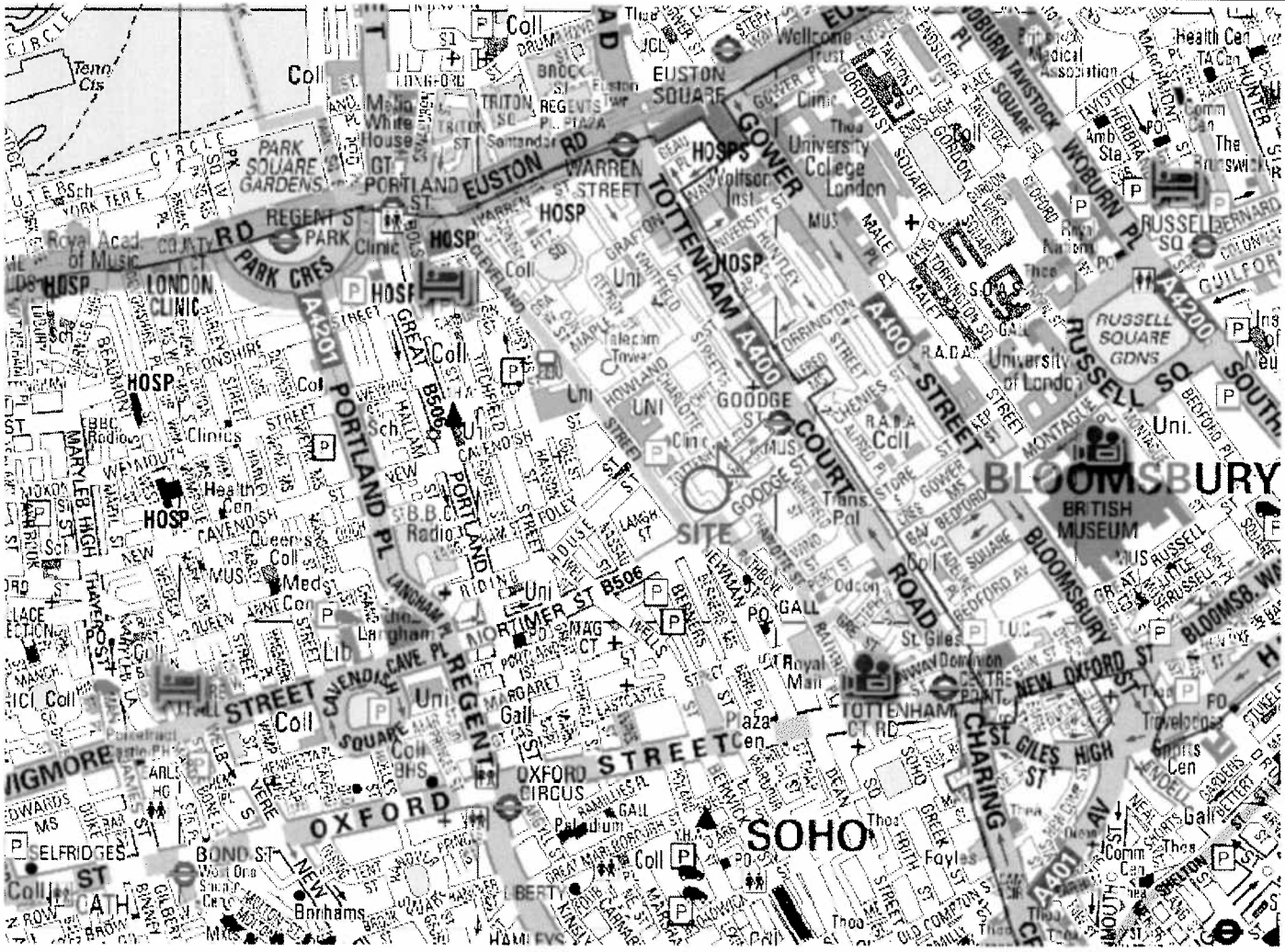
# FIGURE 1

## SITE LOCATION PLAN

61 – 65 Charlotte Street, Fitzrovia, London

240524

N



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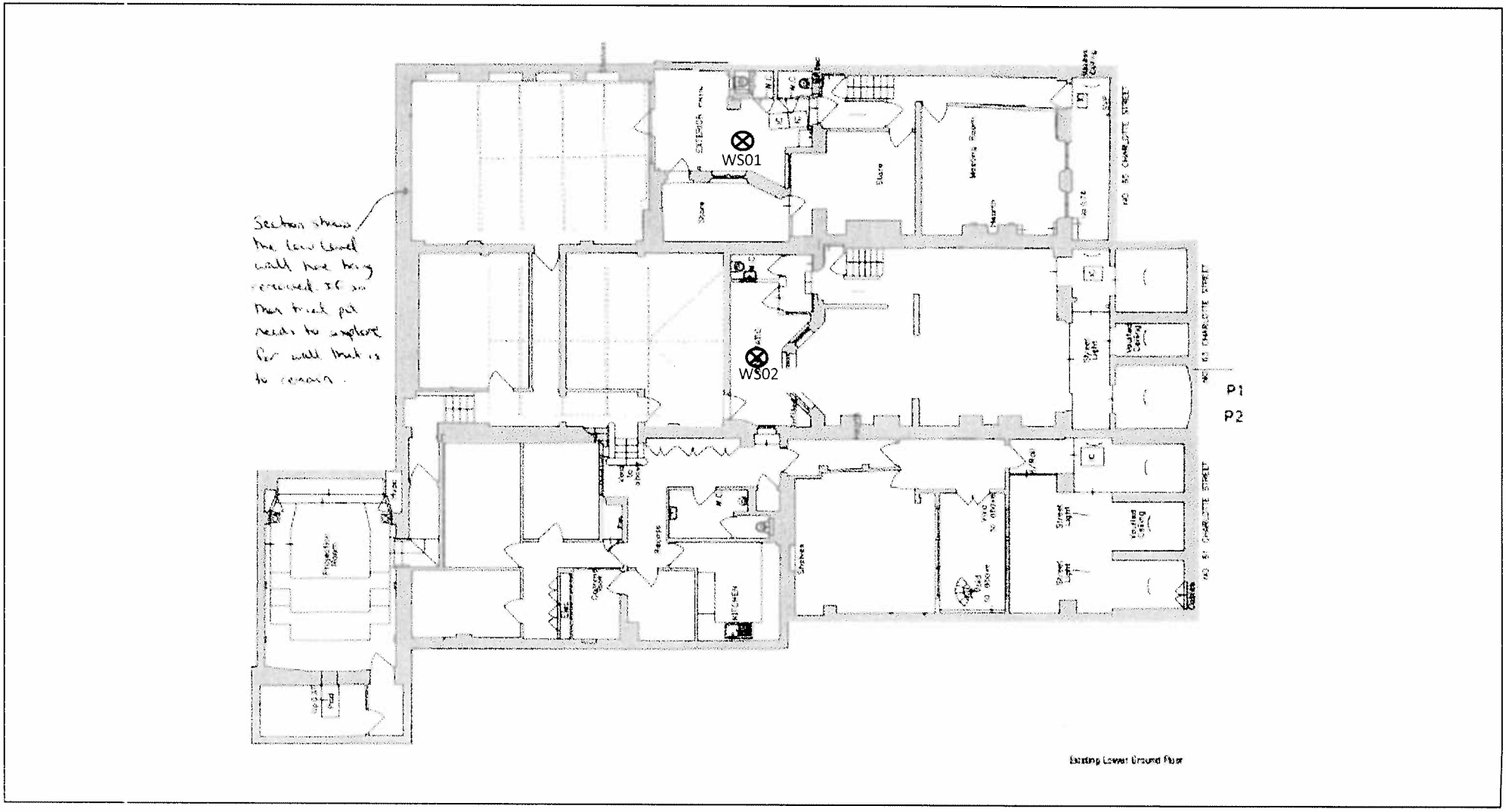
# FIGURE 2

## APPROXIMATE EXPLORATORY HOLE LOCATION PLAN

61 – 65 Charlotte Street, Fitzrovia, London

240524



# APPENDIX A

Fieldwork

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# KEY TO BOREHOLE AND TRIAL PIT LOGS

## Samples

| | |
|---|---|
| D | Small disturbed sample |
| U | Undisturbed sample, 100mm nominal diameter |
| B | Bulk disturbed samples (bar indicates sample range) |
| U38 | Hand driven 'undisturbed' sample, 38mm nominal diameter |
| P | Undisturbed piston sample (bar indicates sample range) |
| W | Water sample |
| ICBR | In-situ California Bearing Ratio sample |
| * | No recovery sample |
| T | Tub sample |
| V | Vial sample |
| J | Jar sample |

### Tests

| | |
|---|---|
| S | Standard penetration test |
| C | Cone penetration tests |
| N = | SPT/CPT 'N' Value (number of blows for 300mm full penetration) |
| 80/150 | Number of blows/total penetration (mm) for SPT/CPT test |
| 25/25SP | As above for seating drive only |
| * | N value obtained over 450mm penetration |
| U = | Blows to achieve 450mm penetration for a U sample |
| $V_h$ = | In-situ hand vane test in $kN/m^2$ |
| m | In-situ CBR test by Mexe probe |
| V = | In-situ field vane test in $kN/m^2$ |
| ppm = | Parts per million of flammable gas as methane equivalents |
| pp = | Pocket Penetrometer in $kg/cm^2$ |

### Observations

| | |
|---|---|
| ▼ ----- | Water strike – depth shown in metres below ground level. |

| Client: **Merchant Land Investments Ltd** | Hole Diameter (mm): 75 tapering with depth to 7.70m | **BOREHOLE NUMBER** **WS01** Sheet 1 of 2 |
|---|---|---|
| Method: Window Sampler | | |
| Date: 23/11/15 Co-ordinates E N | Ground Level (m AOD) | Ref. No: 240524 |

| Backfill/Well Legend (m) | Water Depth (m) | Samples Depth (m) | Samples Type | In Situ Tests Results | Reduced Level (m AOD) | Depth & (Thickness) (m) | Description of Strata | Legend |
|---|---|---|---|---|---|---|---|---|
| | | | | | | (0.05) 0.05 | Concrete slab | |
| | | | | | | (0.25) 0.30 | Reinforced concrete | |
| | | 0.40 - 0.60 | D | | | (1.00) 1.30 | Dark brown, fine to coarse sandy, silty GRAVEL of angular to sub-rounded, fine to coarse, brick, flint, concrete, oyster shells and clinker. (Made Ground) | |
| | | 1.30 - 1.90 | D | | | | | |
| 1.70 | | | | | | | | |
| 2.00 | | 2.20 - 3.00 | D | | | (1.70) 3.00 | Soft, black and dark brown, fine to coarse sandy, slightly gravelly SILT. Gravel is angular and sub-angular, fine to coarse brick, flint and clinker. (Made Ground) | |
| | | 3.00 - 3.80 | D | | | (0.80) 3.80 | Soft, greyish brown, fine and medium sandy, slightly gravelly SILT. Gravel is angular to sub-rounded, fine to coarse flint and brick. (Made Ground) | |
| | | 3.80 - 4.50 | D | | | (0.90) 4.70 | Soft, black, amorphous peaty, slightly gravelly, slightly fine sandy SILT. Gravel is sub-angular, fine to coarse brick and flint (black and brown). Brick cobble observed at 4.5m to 4.7m below ground level. Organic odour noted. (Made Ground) | |
| | | 4.70 - 5.00 | D | | | | Orange brown, silty, slightly gravelly, fine to coarse SAND. Gravel is | |

*Continued on next sheet*

General Remarks:
1. Service inspection pit hand excavated prior to the commencement of borehole.
2. No water ingress was observed whilst borehole remained open.
3. Samples were recovered as wet at 2.7m to 2.9m and at 6m to 7.2m below ground level.
4. Borehole collapsed to 5.2m below ground level upon removal of window sampling equipment.

| Driller: | CB | BOREHOLE RECORD Scale 1:25 See Key Sheet for explanation of symbols, etc. | CET INFRASTRUCTURE Giving our all! |
|---|---|---|---|
| Logged: | MIW | | |
| Chked: | | Charlotte Street, London | FIG A1 |
| Appr'd: | | | |

| Client: **Merchant Land Investments Ltd** | Hole Diameter (mm): 75 tapering with depth to 7.70m | **BOREHOLE NUMBER** |
|---|---|---|
| Method: Window Sampler | | **WS01** |
| Date: 23/11/15 | Co-ordinates E N / Ground Level (m AOD) / Ref. No: 240524 | Sheet 2 of 2 |

| Backfill/Well | | Water | Samples | | In Situ Tests | Reduced | Depth & | | |
|---|---|---|---|---|---|---|---|---|---|
| (m) | Legend | Depth (m) | Depth (m) | Type | Results | Level (m AOD) | (Thickness) (m) | Description of Strata | Legend |
| 5.10 | | | | | | | (0.60) | sub-angular to well rounded, fine to coarse brown flint, brick and shell fragments. | |
| 5.20 | | | | | | | 5.30 | Detail 4.70m - 5.30m : (Made Ground) | |
| | | | 5.30 - 5.70 | D | | | (0.40) | Brown, silty, slightly gravelly, fine to coarse SAND. Gravel is angular to rounded, fine to coarse brown flint and brick. | |
| | | | | | | | 5.70 | (Made Ground) | |
| | | | | | | | (0.30) | | |
| | | | 6.00 - 6.50 | D | | | 6.00 | Soft, black, slightly fine and medium sandy, slightly gravelly SILT. Gravel is angular to rounded, fine to coarse brick and black flint. | |
| | | | | | | | | (Made Ground) | |
| | | | | | | | (1.20) | Orange brown, slightly silty, fine to coarse sandy GRAVEL of angular to well rounded, fine to coarse grey, brown and orange brown flint. | |
| | | | | | | | | (Lynch Hill Gravel Member?) | |
| | | | 7.20 - 7.50 | D | Vh = 110 | | 7.20 | Very stiff, brown, locally slightly fine sandy CLAY. Occassional fine sand size selenite crystals observed. | |
| | | | 7.25 | | pp = 5.0 | | (0.50) | (Weathered London Clay Formation) | |
| | | | 7.50 | | Vh = 120 pp = 4.8 | | 7.70 | *End of Borehole at 7.70 m* | |

General Remarks:
1. Service inspection pit hand excavated prior to the commencement of borehole.
2. No water ingress was observed whilst borehole remained open.
3. Samples were recovered as wet at 2.7m to 2.9m and at 6m to 7.2m below ground level.
4. Borehole collapsed to 5.2m below ground level upon removal of window sampling equipment.

| | | | |
|---|---|---|---|
| Driller: | CB | BOREHOLE RECORD Scale 1:25 See Key Sheet for explanation of symbols, etc. | CET INFRASTRUCTURE Giving our all |
| Logged: | MIW | | |
| Chked: | | Charlotte Street, London | FIG A1 |
| Appr'd: | | | |

| Client: **Merchant Land Investments Ltd** | Hole Diameter (mm): 75 tapering with depth to 5.20m | **BOREHOLE NUMBER** **WS02** Sheet 1 of 2 |
|---|---|---|
| Method: Window Sampler | | |
| Date: 23/11/15 Co-ordinates E N | Ground Level (m AOD) | Ref. No: 240524 |

| Backfill/Well | | Water | Samples | | In Situ Tests | Reduced | Depth & (Thickness) | Description of Strata | Legend |
|---|---|---|---|---|---|---|---|---|---|
| (m) | Legend | Depth (m) | Depth (m) | Type | Results | Level (m AOD) | (m) | | |
| | | | | | | | (0.10) 0.10 | Concrete slab | |
| | | | 0.20 - 0.50 | D | | | | Dark brown and locally red, silty, fine to coarse sandy GRAVEL of angular to rounded, fine to coarse brick, flint and clinker. (Made Ground) | |
| | | | | | | | (1.20) | | |
| | | | | | | | 1.30 | | |
| | | | 1.40 - 2.00 | D | | | | Soft, dark brown, locally light brown, fine to coarse sandy, slightly gravelly SILT. Gravel is angular to sub-rounded, fine to coarse brick, flint, concrete and clinker. (Made Ground) | |
| | | | 2.20 - 2.70 | D | | | (2.70) | | |
| | | | 3.50 - 4.00 | D | | | | | |
| | | | 4.00 - 5.00 | D | | | 4.00 | | |
| | | | | | | | | Soft, black, amorphous peaty, slightly fine and medium sandy, slightly gravelly SILT. Gravel is angular to sub-rounded, fine to coarse flint, brick and clinker. Organic odour noted. (Made Ground) | |
| | | | | | | | (1.00) | | |
| | | | | | | | | *Continued on next sheet* | |

General Remarks:
1. Service inspection pit hand excavated prior to the commencement of borehole.
2. Borehole remained relatively stable whilst open.
3. Samples were recovered as wet 5m below ground level.
4. Borehole terminated at 5.2m below ground level due to an obstruction, possible due to the density of the gravel encountered at depth.

| Driller: | CB | BOREHOLE RECORD Scale 1:25 See Key Sheet for explanation of symbols, etc. | CET INFRASTRUCTURE Giving our all |
|---|---|---|---|
| Logged: | MIW | | |
| Chked: | | Charlotte Street, London | FIG A2 |
| Appr'd: | | | |

| Client: **Merchant Land Investments Ltd** | Hole Diameter (mm): 75 tapering with depth to 5.20m | **BOREHOLE NUMBER** |
|---|---|---|
| Method: Window Sampler | | **WS02** |
| Date: 23/11/15 | Co-ordinates E N / Ground Level (m AOD) | Ref. No: 240524 / Sheet 2 of 2 |

| Backfill/Well | | Water | Samples | | In Situ Tests | Reduced | Depth & | | |
|---|---|---|---|---|---|---|---|---|---|
| (m) | Legend | Depth (m) | Depth (m) | Type | Results | Level (m AOD) | *(Thickness)* (m) | Description of Strata | Legend |
| | | | 5.00 - 5.20 | D | | | 5.00 *(0.20)* | Dark grey, fine to coarse sandy, silty GRAVEL of angular to sub-rounded, fine to coarse brown and grey flint and brick. (Made Ground) | |
| 5.20 | | | | | | | 5.20 | *End of Borehole at 5.20 m* | |

General Remarks:
1. Service inspection pit hand excavated prior to the commencement of borehole.
2. Borehole remained relatively stable whilst open.
3. Samples were recovered as wet 5m below ground level.
4. Borehole terminated at 5.2m below ground level due to an obstruction, possible due to the density of the gravel encountered at depth.

| | |
|---|---|
| Driller: | CB |
| Logged: | MIW |
| Chked: | |
| Appr'd: | |

BOREHOLE RECORD
Scale 1:25
See Key Sheet for explanation of symbols, etc.

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Charlotte Street, London

FIG A2

# APPENDIX B

Laboratory Testing

## Summary of Lab Test Results:

| Moisture Content and Atterberg Limits Tests | | | | | | |
|---|---|---|---|---|---|---|
| Borehole No. | Depth (m bgl) | Moisture Content % | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Material |
| WS01 | 1.3 – 1.9 | 35 | 34 | Non plastic | | Made Ground |
| WS01 | 2.2 – 3.0 | 21 | | | | Made Ground |
| WS01 | 3.0 – 3.8 | 21 | | | | Made Ground |
| WS01 | 3.8 – 4.5 | 19 | 32 | Non plastic | | Made Ground |
| WS02 | 4.0 – 5.0 | 26 | 33 | Non plastic | | Made Ground |

| Water Soluble Sulphate and pH determinations | | | | | |
|---|---|---|---|---|---|
| Borehole | Depth (m bgl) | Water Soluble Sulphate (g/l) | pH | Design Sulphate Class for Location | ACEC Class for Location |
| WS01 | 0.4 - 0.6 | 0.07 | 8.4 | DS-1 | AC-1d |
| WS01 | 7.2 – 7.5 | 0.11 | 7.7 | DS-1 | AC-1d |
| WS02 | 0.2 – 0.5 | 0.03 | 8.2 | DS-1 | AC-1d |
| WS02 | 1.4 – 2.7 | 0.02 | 7.8 | DS-1 | AC-1d |