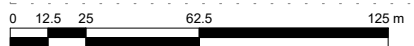


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- 1 BED
- 1 BED (L)
- 1 BED (S)
- 2 BED
- 2 BED (L)
- 2 BED (M)
- 2 BED (S)
- 3 BED
- 3 BED (L)
- 3 BED (S)
- 4 BED (7P)
- ASSISTED LIVING
- CARE HOME
- CINEMA
- CORE
- HOTEL
- KE
- OFFICE
- PLANT
- SCHOOL
- SMOKE



FINAL DRAFT PLANNING APPLICATION	18/01/18	BJ
Revision description	Date	Check Rev

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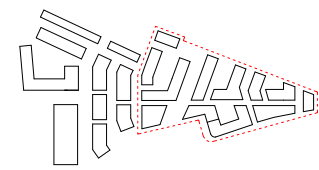
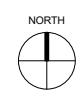
Project
Stag Brewery
 Richmond

Drawing
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Job Number	Drawing number	Revision
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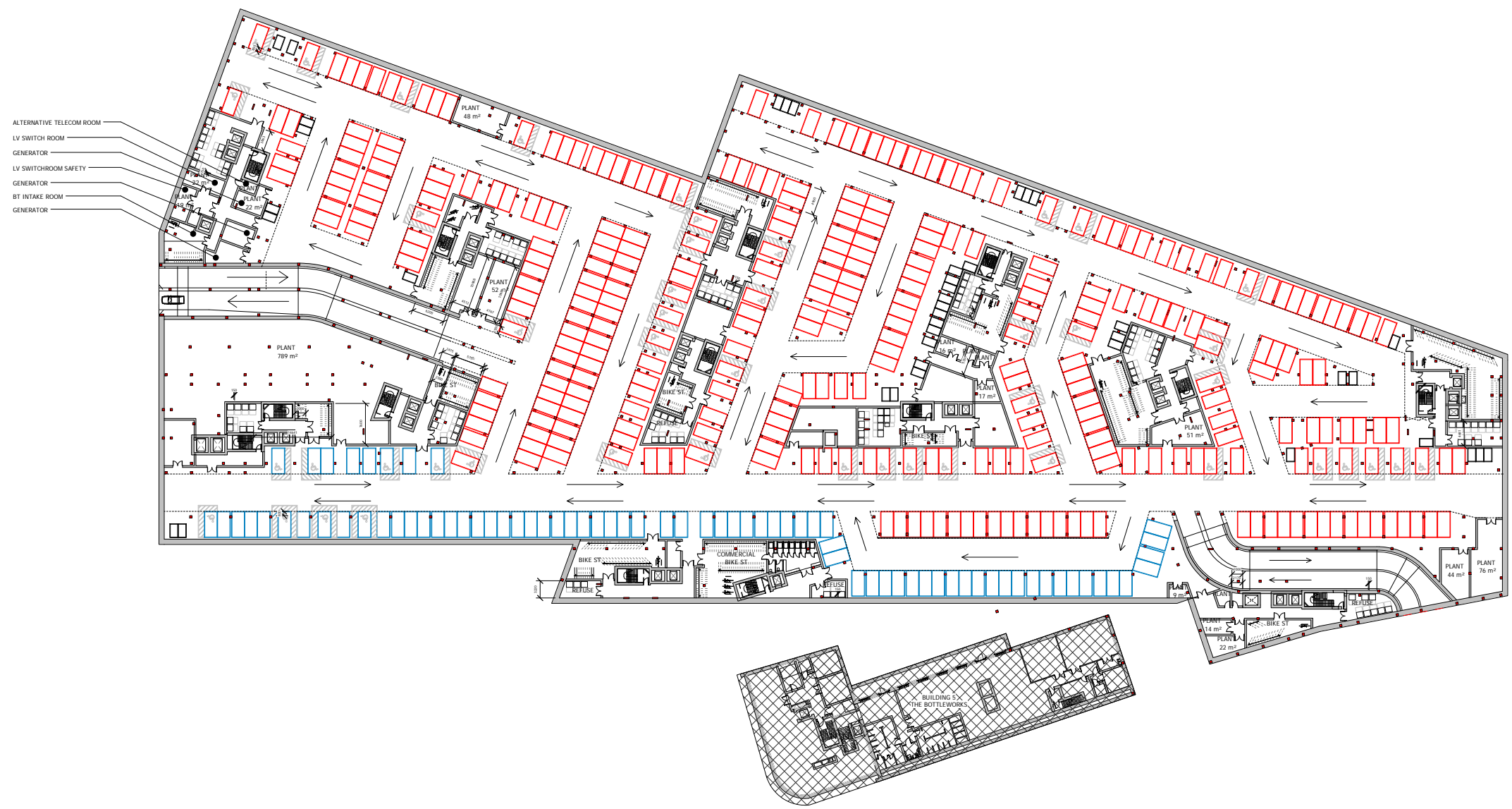
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KEY

- ▭ 331 Residential Spaces
- ▭ 77 Commercial Spaces
- 42 Motorbike Spaces
- 1014 Cycle Spaces



Revision description	Date	Check	Rev
FINAL DRAFT PLANNING APPLICATION	18/01/18	BJ	-

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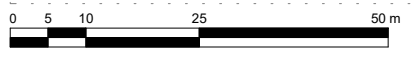
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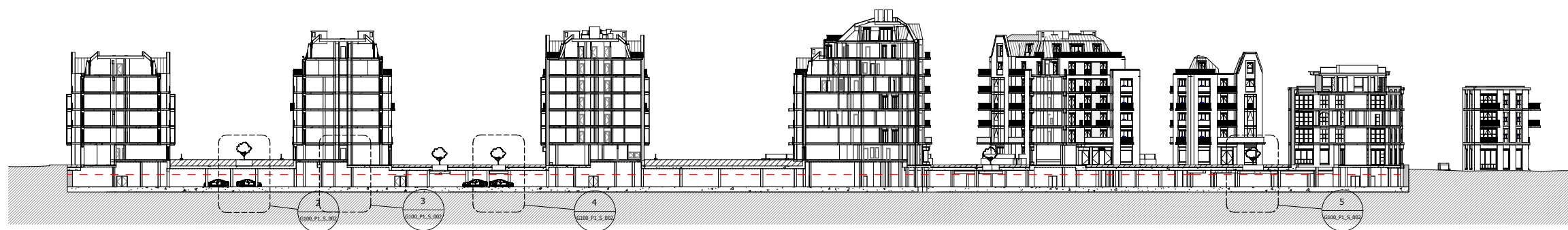
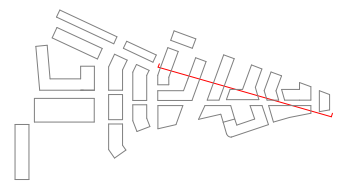
Project
Stag Brewery
Richmond

Drawing
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BASEMENT PLAN

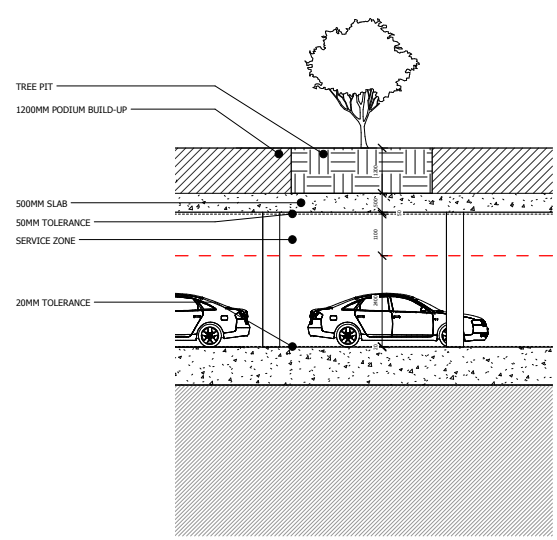
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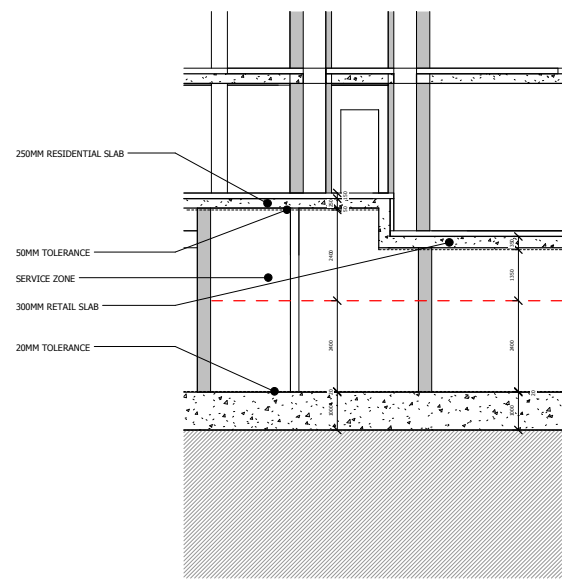
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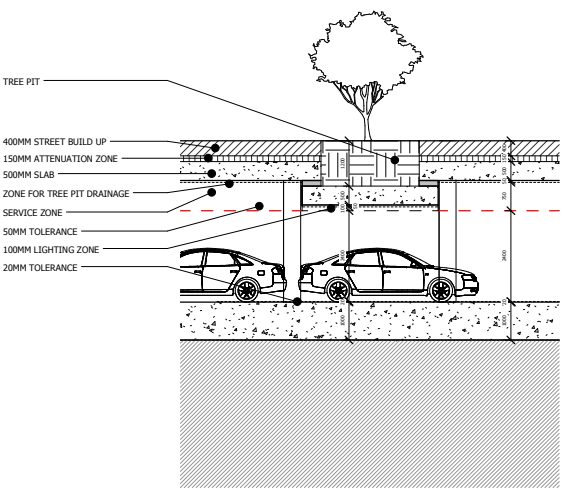
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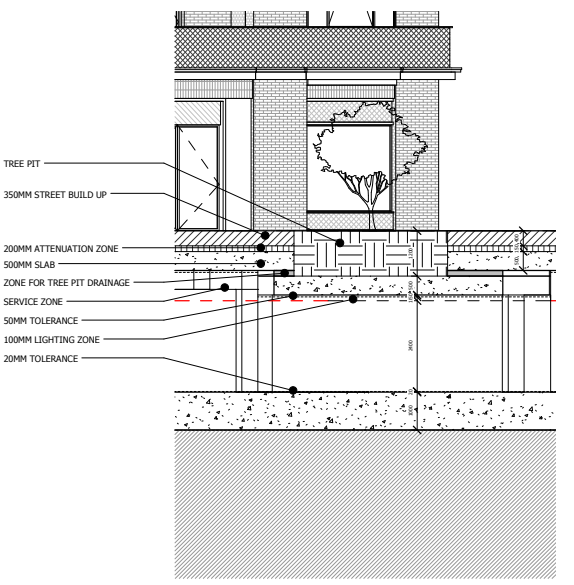
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 1 : 100



3 Basement Section_Phase 01_Slab Step
 1 : 100



4 Basement Section_Phase 01_Boulevard
 1 : 100



5 Basement Section_Phase 01_Main Street
 1 : 100

Revision description	Date	Check	Rev
ISSUE TO DESIGN TEAM	25/10/17	BJ	A
SCENARIO 2 DESIGN FREEZE	11/08/17	BJ	-

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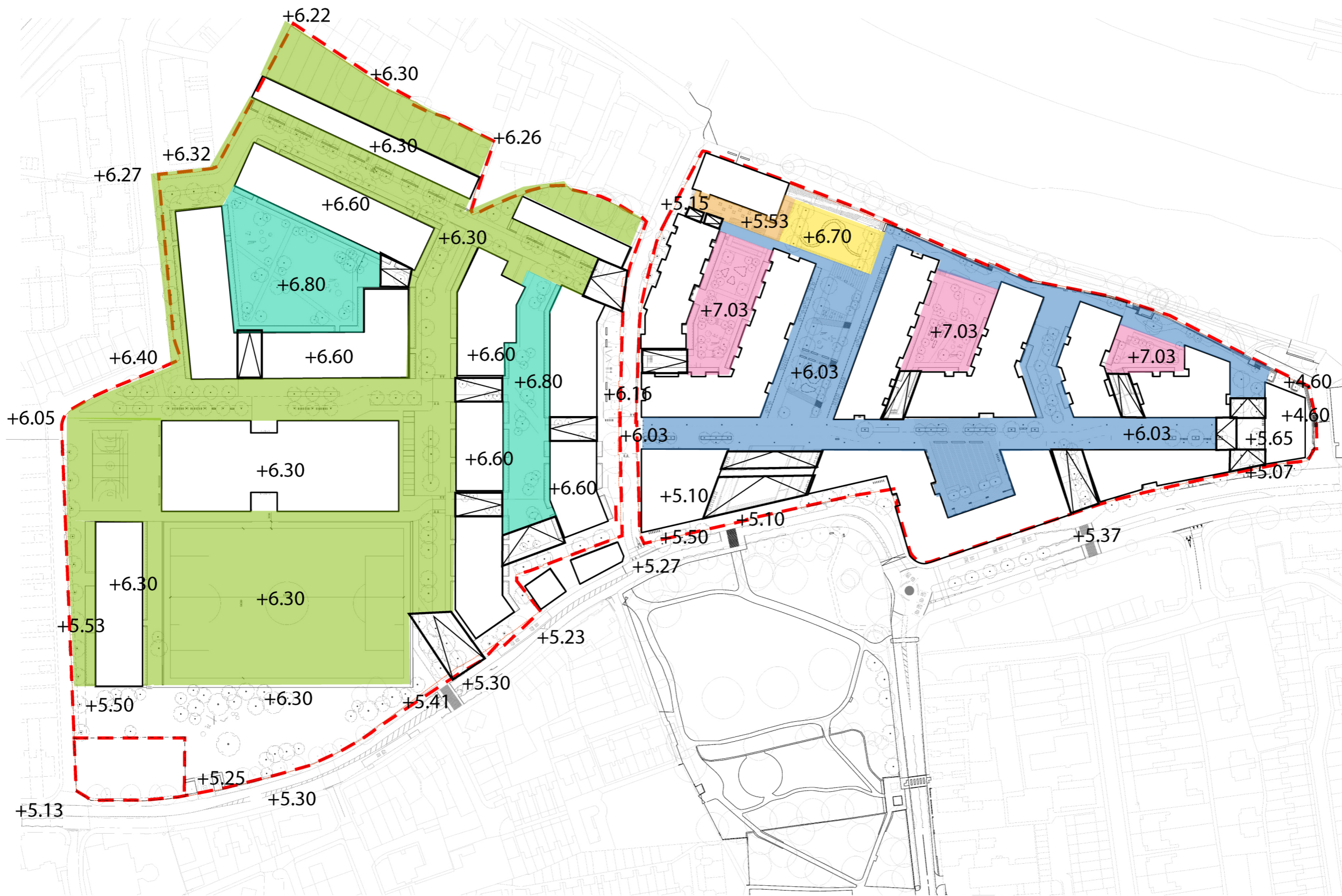
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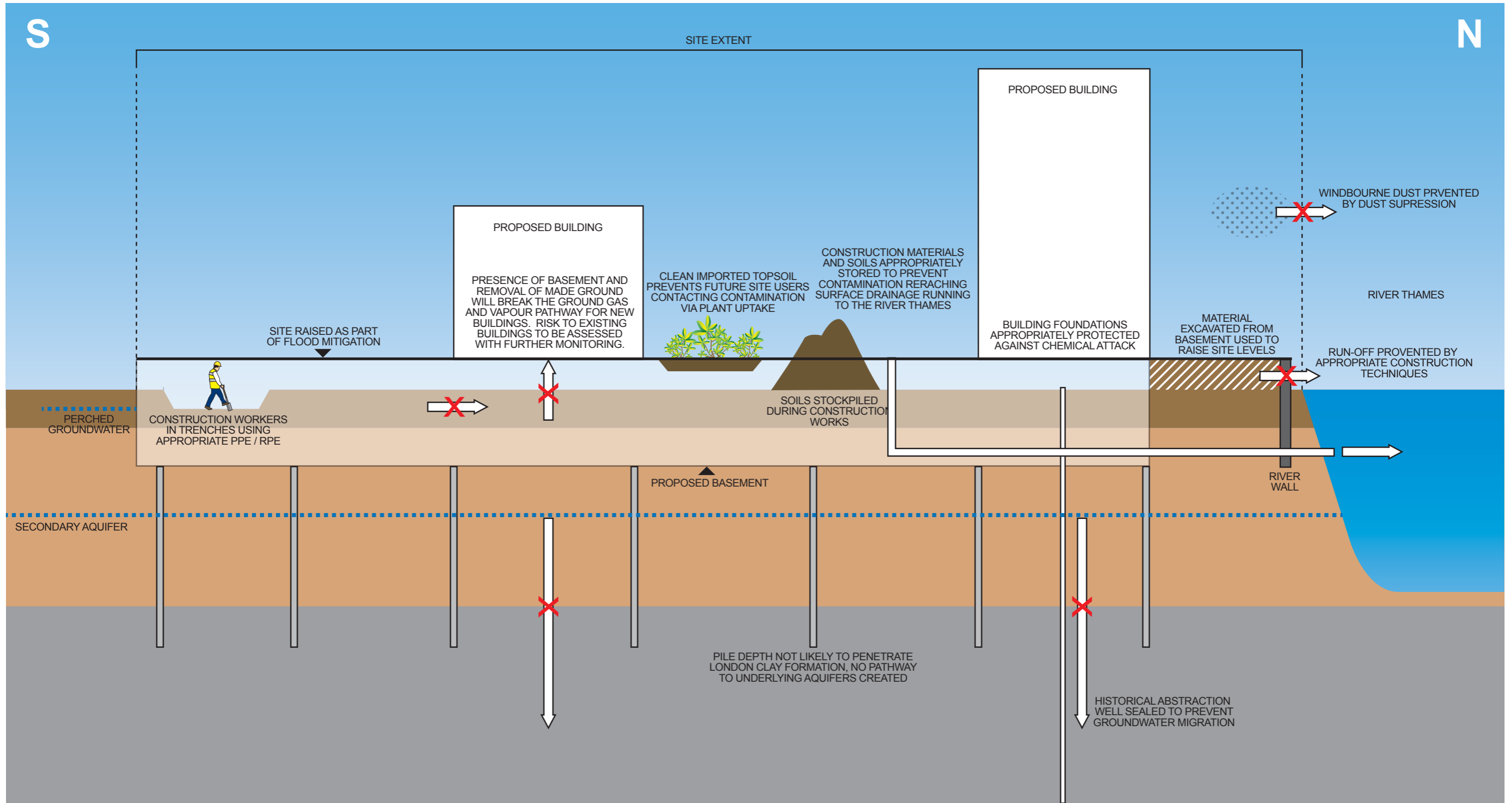
Project
Stag Brewery
 Richmond

Drawing
PHASE 01 - BASEMENT SECTIONS 02

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16019	G100_P1_S_002	A



- +7.03M
- +6.70M
- +6.60M
- +6.30M
- +6.03M
- +5.53M
- /
 GRADING
- SITE BOUNDARY



- MADE GROUND
- ALLUVIUM AND RIVER TERRACE DEPOSITS
- LONDON CLAY FORMATION

Project Details	WIE10667-101: Stag Brewery, Mortlake
Figure Title	Figure A6: Conceptual Site Model
Figure Ref	WIE10667-101_GR_PERA_A6B
Date	2017
File Location	\\s-inc\wiel\projects\wie10667\101\graphics\pera\issued figures



Appendix B

Site Photographs

- Plates 1-12



Photograph 1. Entrance to the East Site



Photograph 2. General conditions at East Site



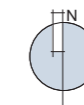
Photograph 3. Interior of packaging warehouse



Photograph 4. General conditions at East Site



Photograph 5. General conditions at East Site



Project Details	WIE10667-101: Stag Brewery, Mortlake
Figure Title	Figure B1: Site Photographs
Figure Ref	WIE10667-101_GR_GERA_B1A
Date	2017
File Location	\\s-inc\wiel\projects\wie10667\101\graphics\gera\issued figures



Photograph 6. General condition of River Wall adjacent to the Site



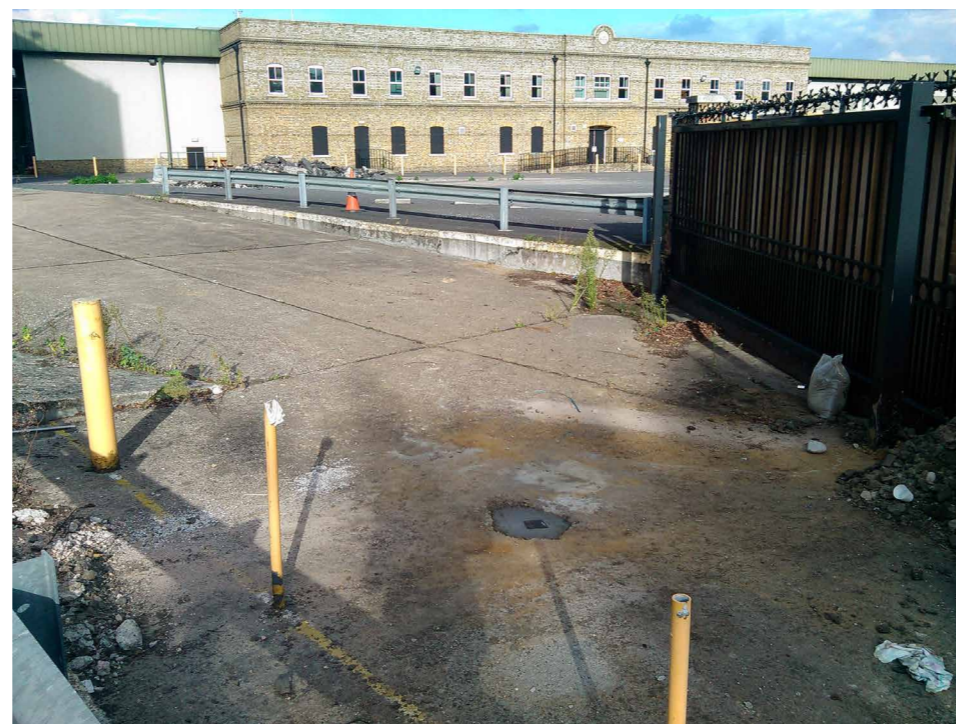
Photograph 7. Ground investigation works in progress



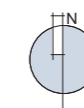
Photograph 8. Typical completed borehole



Photograph 9. Follow-up groundwater monitoring works



Photograph 10. Typical completed borehole



Project Details	WIE10667-101: Stag Brewery, Mortlake
Figure Title	Figure B2: Site Photographs
Figure Ref	WIE10667-101_GR_GERA_B2A
Date	2017
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Appendix C

Soil Consultants Geotechnical Report

- **Soil Consultants - Report On Preliminary Ground Investigation: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET. November 2016 (*report ref. 10022/OT/JRCB*)**

REPORT ON PRELIMINARY GROUND INVESTIGATION

PROPOSED REDEVELOPMENT:

STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON SW14 7ET



Client: RESELTON PROPERTIES LIMITED

Agent: DARTMOUTH CAPITAL ADVISORS LIMITED

Engineers: WATERMAN STRUCTURES LIMITED
Pickfords Wharf, Clink Street
London SE1 9DG

Report reference: 10022/OT/JRCB

Date: 08 November 2016 (Rev.0)

REPORT ON PRELIMINARY GROUND INVESTIGATION

PROPOSED REDEVELOPMENT:

STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON SW14 7ET

DOCUMENT ISSUE STATUS:

Issue	Date	Description	Author	Checked/approved
Rev 0	08 November 2016	First issue	Opher Tolkovsky BSc, MSc, DIC, CGeol, FGS	John Bartley BSc, MSc, FGS, CGeol

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TABLE OF CONTENTS

1.0	Introduction	1
2.0	Site Description	1
3.0	Previous Investigations	2
4.0	Current SCL Exploratory Work	4
5.0	Geology and Ground Conditions	6
5.1	Made ground.....	7
5.2	Alluvium.....	7
5.3	Kempton Park Gravel	7
5.4	London Clay Formation.....	8
5.5	Groundwater.....	9
5.6	Environmental observations	10
6.0	Preliminary Geotechnical Assessment	10
6.1	Basement excavation and retaining wall	10
6.2	Basement raft design	12
6.3	Piled foundations	12
6.4	Foundation concrete	14
6.5	Further geotechnical investigations	15

General Information, Limitations and Exceptions

APPENDIX

Fieldwork, in-situ testing

- ✚ Cable percussion borehole records
- ✚ Dynamic sample borehole records
- ✚ Standard Penetration Test (SPT) results
- ✚ SPT hammer energy certificates

Laboratory testing and monitoring

- ✚ Summary of classification test results
- ✚ Plasticity charts
- ✚ Particle size distribution results
- ✚ Summary of undrained shear strength test results
- ✚ Soluble Sulphate/pH results (QTS Environmental)

Ground model/summary plots

- ✚ SPT and c_u vs depth
- ✚ Depth to top – River Terrace Deposits
- ✚ Depth to top – London Clay Formation
- ✚ Schematic geological cross sections

Plans & drawings

- ✚ Architectural drawings
- ✚ Topographical survey drawings
- ✚ Site Plan
- ✚ Location Maps

1.0 INTRODUCTION

Consideration is being given to the redevelopment of the former Stag Brewery site, Mortlake, which is to be demolished and replaced with educational, commercial, retail, leisure and residential apartment blocks (3-8 storeys) with a single storey basement to provide car parking facilities and plant rooms.

The redevelopment is to be carried out in three phases. The current preliminary exploratory work was restricted to Phases 1 and 2 (east of Ship lane) and this report specifically relates to those areas. However the review of available data does include some historical information within the Phase 3 area which we also comment on for completeness.

In connection with the proposed works, Soil Consultants Ltd (SCL) were commissioned by Dartmouth Capital Advisors Ltd, on behalf of Reselton Properties Ltd (the Client) to carry out a ground investigation to include the following elements:

- ✚ Review of existing geological/geotechnical information
- ✚ Limited intrusive work (eastern part of the site only) to identify the ground sequence
- ✚ Geotechnical and contamination sampling
- ✚ Geotechnical laboratory testing
- ✚ Factual and interpretative reporting of geotechnical results

This report reviews the existing information available, describes the investigation undertaken and then provides the exploratory and field/laboratory testing records together with preliminary geotechnical recommendations. Contamination/environmental assessment is being undertaken separately by Waterman Infrastructure & Environment (WIE), who have also undertaken the Desk Study of the site.

2.0 SITE DESCRIPTION

The site is located in Mortlake in the London Borough of Richmond upon Thames and is centred at approximate National Grid reference of 520410E, 176030N. The overall site is bound to the north by River Thames, to the south by Lower Richmond Road/Mortlake High Street, to the west by Williams Lane and to the east by Bulls Alley. The overall site is divided into two by Ship Lane.

The site is a triangular-shaped plot of land which covers an area of approximately 9 hectares (22 acres). The existing site level (shown on APR Services, 'Land Survey', Drawing No. 915213-7, July 2015 - see copy in the Appendix), lies at approximately +4.5m to +6.5mOD with the highest ground to the west falling down to the east. We understand that the proposed site levels will be similar to the existing.

The site contains many disused buildings with the majority of the remaining areas comprising access roads, loading bays and hardstanding. The bottling plant dominates the eastern half of the site whilst the south-western corner of the site comprises a grassed sports ground. The site is almost totally devoid of vegetation with the exception of a row of large trees (Sycamore or London Plane?) along the western side of Ship Lane, and on the periphery of the sports ground.

The current proposal is to carry out the majority of the development in three phases (Phases 1 to 3) as shown below. Phases 1 and 2 comprise the eastern half of the site, east of Ship Lane and Phase 3 comprises the western half of the site.

Whilst we discuss some elements of previous investigations and historical borehole information which fall into the Phase 3 area, at this stage the exploratory work carried out for this preliminary investigation was restricted to Phases 1 and 2.



3.0 PREVIOUS INVESTIGATIONS

Three previous investigation reports (within the site) have been obtained, which are summarised below.

1. *Soil Consultants Ltd - Project Stabilise, Budweiser Stag Brewing Company Ltd, Ref. 3665/JAD/TSR, January 2004*
 - This investigation comprised 3no boreholes, up to 12.5m deep located in the western site area between the sports ground and Ship Lane.
 - The boreholes proved a succession of made ground followed by localised superficial soils, River Terrace Deposits and the London Clay Formation
 - The made ground was highly variable, including soft clay, attaining a thickness of between 0.8m to 1.7m. At one location this overlay soft sandy clay with scattered gravel extending to about 2.2m depth. Generally dense sand and gravel to between about 5.5m and 6m depth was present in all boreholes. The London Clay Formation was then met, described as firm to stiff becoming stiff grey fissured clay, slightly silty in part and with local brown staining at top, which continued

to the base of the boreholes. Groundwater was recorded within the sand and gravel layer, at between 5.1m and 5.6m depth.

2. *Ground Explorations Ltd – Report on Exploration of ground conditions, Report No. 8320/RSW/vw, June 1980*

- This investigation comprised 3no boreholes, up to 15.0m deep, located in the eastern part of the site
- The boreholes proved a succession of made ground followed by River Terrace Deposits (two boreholes) and the London Clay Formation (all three boreholes)
- The made ground was variable, including granular and cohesive deposits, attaining a thickness of between 1.5m to 4.6m. Generally dense or very dense sand and gravel was present in two of the boreholes to about 5.5m depth. The London Clay Formation was then present, directly beneath the made ground in one borehole, comprising stiff brown fissured clay becoming stiff to very stiff grey fissured silty clay with depth. Groundwater was recorded within the boreholes at between 3.0m and 4.0m depth, with standing water level recorded at 2.6m bgl in BH2
- The eastern side of the site is indicated in the report to contain infilled basements

3. *AECOM – Phase 2 Environmental Site Assessment Report – Report Ref. 47075502, September 2015*

- 31no shallow boreholes were drilled to a maximum depth of 6.0m
- Where penetrated made ground was generally proven across the site to between 1.2m and 2.6m depth; buried obstructions (relict concrete slabs) were encountered at eleven locations, at a maximum depth of 3.6m in one of the boreholes (where the base of the made ground was not proven)
- Superficial deposits were present beneath the made ground (where penetrated) comprising both soft cohesive soils, extending to a maximum of 2.6m bgl, followed by sands and gravels. The full thickness of the gravel was only recorded in one borehole at about 5m depth
- The top of London Clay Formation was only proven in one borehole at about 5m depth. AECOM refer to an earlier investigation (2003) which investigated the western half of the site plus the south-western corner of the eastern site area, and this recorded the top of the London Clay at between 6.5m and 6.9m bgl, and at one position it was not present to the base of the BH at 7.2m depth. The report notes, however, that the use of auger drilling techniques means that the depths recorded may not be very accurate.

- Groundwater monitoring indicated water depths range between 3.57m and 5.14m bgl. A small tidal influence of 60mm was measured over a short period of 2.5 days – although it is not stated whether this reflects a spring tide condition where the water range differences between low and high tide are at their highest
4. In addition to the above investigations, several historical BGS borehole records are also available, the most recent and detailed of which are summarised below:
- TQ27NW/393 – Cementation Ground Engineering borehole from 1972: located in the western part of the site, close to the SCL boreholes described above. Encountered made ground to 1.2m depth followed by soft to firm sandy clay to 1.5m, sand and gravel to 6.4m and stiff London Clay to the base of the borehole at 10.05m. Water strike at 6.1m
 - TQ27NW/394 – Cementation Ground Engineering borehole from 1972: located in the central area of the western part of the site. Encountered made ground to 0.9m depth followed by sand and gravel to 6.85m and stiff London Clay to the base of the borehole at 20.0m. Water strike at 6.1m
 - TQ27NW/398 – Cementation Ground Engineering borehole from 1972: located near Ship Lane in the western part of the site. Encountered made ground to 1.5m depth followed by firm silty clay to 1.85m, sand and gravel to 7.6m and stiff London Clay to the base of the borehole at 15.0m. Water at 4.9m and seepage at 4.55m
 - TQ27NW/924 – Exploration Associates borehole from 1995: located beneath the current bottling plant in the eastern part of the site. Encountered made ground to 1.4m depth followed by sand and gravel to 4.8m and very stiff London Clay to the base of the borehole at 15.0m. Groundwater not encountered during drilling

4.0 CURRENT SCL EXPLORATORY WORK

The SCL fieldwork was carried out in October 2016 and comprised the elements detailed below. The exploratory positions were determined following discussions with Waterman Structures Ltd. Sampling procedure for the environmental samples was in accordance with BS10175 and WI&E requirements. UXO specialist site attendance provided detection/clearance during the works.

Cable percussion boreholes

4no cable percussion boreholes (BH1 and BH2, 2A, 2B) were constructed using a cable percussion drilling rig. A summary of depths and inferred ground levels is given in the table below.

BH	Ground Elevation*	BH depth (below ground level)
1	+5.15m OD	30.00m
2	+4.81m OD	3.60m
2A*	+4.80m OD	3.50m
2B	+4.96m OD	30.00m

(Levels from GPS survey except for 2A whose level was inferred from the site survey drawing)

BH2 and BH2A were terminated due to encountering impenetrable concrete obstructions.

In situ Standard Penetration Tests (SPTs) were undertaken at regular intervals and representative soil samples, both disturbed and relatively undisturbed, collected for description and for testing.

The calibration certificate for the cable percussive drilling rig SPT equipment used indicates that Energy Ratio, E_r , of 66% should be used to provide corrected N_{60} values in line with the recommendations given in BS EN 22476-3, 2005, National Annex A.

Dynamic sampler boreholes and dynamic probe tests

15no dynamic (windowless) sampler boreholes (WS1 to WS7, WS7A, WS8, WS8A, WS9, WS9A, WS10, WS10A and WS11) were completed using a small tracked rig, under the supervision of SCL, to depths of up to 5.5m bgl. SPTs were carried out in the natural strata and disturbed samples were taken for subsequent laboratory testing. Several of the boreholes were refused on obstructions within the made ground – WS6 at 0.5m, WS7 at 0.8m, WS7A at 1.4m, WS8 at 1.0m, BH10 at 1.6m, and WS11 at 0.7m depth.

The calibration certificate for the dynamic sampler drilling rig SPT equipment used indicates that Energy Ratio, E_r , of 79% should be used to provide corrected N_{60} values in line with the recommendations given in BS EN 22476-3, 2005, National Annex A.

PID testing

PID (photo-ionisation detector) headspace testing was undertaken during the fieldwork on all made ground and shallow natural soil samples, and the results are shown on the relevant exploratory records in the Appendix.

Groundwater and gas installations

50mm ID HDPE monitoring standpipes were installed in most of the boreholes (with the exception of WS3, 6 & 11) into the London Clay Formation, with a filter/response zone generally within the Made Ground, to facilitate water/gas monitoring by Waterman Infrastructure & Environment.

A summary of the borehole installations is provided below:

Summary of pipe installation			
Installation reference (and nominal internal pipe diameter)	Pipe tip		Response zone
	Depth (m bgl)	Approx. elevation (m OD)	Depth (m bgl)
BH1	6.00	-0.85	1.00 to 6.00
BH2B	5.00	-0.05	1.00 to 5.00
WS1	5.00	+1.12	1.00 to 5.00
WS2	2.00	+4.10	1.00 to 2.00
WS4	5.00	+0.85	2.00 to 5.00
WS5	5.00	+0.76	2.00 to 5.00
WS7A	1.40	+3.83	0.50 to 1.40
WS8A	2.50	+2.65	1.00 to 2.50
WS9A	3.70	+1.20	1.00 to 3.70
WS10A	4.00	+0.90	1.00 to 4.00

Geotechnical laboratory testing

The following geotechnical laboratory testing was completed:

- ✚ Natural moisture content and index properties tests (Atterberg Limits)
- ✚ Undrained triaxial testing
- ✚ Particle size distribution
- ✚ Soluble sulphate/pH analyses (tested by QTS Environmental Ltd)

The borehole records are included in the Appendix, together with a Site Plan which shows the exploratory locations.

5.0 GEOLOGY AND GROUND CONDITIONS

Reference to published 1:50,000 scale BGS map indicates that the site is underlain by Kempton Park Gravel Formation, overlying the London Clay Formation, shown to extend to at least 45m depth in nearby historical boreholes. Alluvium, associated with The River Thames, is shown along the southern bank of The Thames, immediately to the north of the site. Historical BGS borehole from the 19th and early 20th centuries at the brewery site indicate that the London Clay Formation is about 60m thick and the chalk is present (below the Lambeth Group and Thanet Beds) at about 81m to 83m depth below ground level.

The various ground investigations (as discussed in Section 3.0) at the site confirmed the anticipated upper sequence as summarised below. The appended strength/depth graph and cross sections through boreholes should also be referred to as they readily illustrate the sequence.

It must be understood that the following summary is based on generally widely spaced boreholes (up to about 100m) and hence there can be expected to be further variation between these positions.

5.1 Made ground

Hard surfacing across the site comprised concrete (some reinforced) and/or asphalt. The underlying made ground typically ranged in thickness between about 1.0m and 3.0m, but locally, at the west of the site was <1.0m thick. In the extreme east, thicknesses of up to 4.6m of made ground were recorded.

The made ground varied in composition both laterally and vertically over short distances. It generally comprised variable, non-engineered mixtures of grey or brown silty sand, locally clay, and gravel size pieces of mostly concrete, flint and brick but also stone, asphalt, clinker, glass, metal, wood and occasional cobble to boulder size concrete and brick pieces. Obstructions from former structures were commonplace in the eastern part of the site, where made ground thicknesses were the greatest, with likely buried/infilled basements being present. The backfill to numerous service runs can also be expected. Several of the boreholes were terminated within concrete obstructions at this part of the site, between about 3.0m and 3.6m depth bgl.

5.2 Alluvium

Alluvium was recorded beneath the made ground in fourteen of the fifty one borehole records we have reviewed, which includes the current boreholes. Where present, the stratum was 0.35m to 1.5m thick (averaging about 0.9m), reaching depths of between 1.5m and 2.8m bgl, and approximate levels ranging between +3.0mOD and +4.9mOD. The stratum generally comprised brown/dark brown, locally grey/orange mottled clay/sandy clay, with occasional to some flint gravel. Occasional roots were also noted. The consistency of the clay was assessed as generally being soft, locally firm.

The distribution of the alluvium across the site has no discernible trend, being recorded in several boreholes in the southern area of the eastern part of the site, and, more frequently, at various locations across the western half. It is thus likely that this natural stratum has been removed from much of the site by the previous development and is now replaced by made ground.

Plasticity Indices (PI) of 14% and 19% and Liquid Limits of <40% were measured on two samples, indicating the alluvium to be low to intermediate plasticity (BS classification) and a low volume change potential (NHBC classification).

5.3 Kempton Park Gravel

The Kempton Park Gravel was present in almost all boreholes where the made ground was fully penetrated and described as brown or light brown, locally greyish or orange brown mixture of slightly silty/silty sand and gravel, locally clayey or very clayey. The gravel comprised fine to coarse flint.

The stratum attained a thickness of between 1.2m and 5.95m (averaging 3.67m), and where proven, extended to depths of between 3.7m and 7.6m bgl (average of 5.3m). We do not have information on the ground levels at the time of the historical investigations, however, assuming these were similar to the current ground levels these depths correspond to an elevation of approximately +1.2mOD to -0.65mOD across the site, generally rising from west to east. A single borehole record (BGS borehole 398), constructed in the southern central area of the site, identified that the base of the gravel possibly occurs

at about -1.7mOD. This is greater localised depth than recorded elsewhere may be due to either a) a higher ground level being present when the borehole was drilled or b) deeper geological scouring by the gravel.

An indicative plan in the Appendix gives approximate depth zones to the top of the stratum, based on all available boreholes. The top of the gravel stratum beneath the vast majority of the western site, and the central area of the eastern half of the site, are indicated to be in the range of 1m to 2m depth bgl, whilst the western and south-eastern corner of the western half of the site, and both the northern and southern zones of the eastern half are indicated to have a thicker made ground/alluvium, with the top of the gravel stratum occurring at 2m to 3m bgl. Local areas of either shallower or deeper occurrences are also recorded in part of the west and the extreme east of the overall site. In the east (BH GE03) the gravel was absent with the made ground resting upon the London Clay at 4.6m depth.

SPT N_{60} values of between 13 and >50 blows were measured by SCL, indicating a variable medium dense to very dense state of compaction. A few results from the historical boreholes are also available giving a similar range of values, although there is no SPT hammer energy information available to produce a 'corrected' N_{60} values, thus direct comparison with the current results is not possible.

Particle size distribution tests from the SCL boreholes indicated a predominance of sand (between 32% and 93%) with gravel (generally between 5% and 68%), together with low fines (clay and silt) content ranging between 1% and 13%. It should be noted that the drilling through the granular strata necessitated the addition of water which may have washed out some of the fines from the samples with the results that fine particles may be under-represented in the tests.

5.4 London Clay Formation

The London Clay Formation was encountered beneath the Kempton Park Gravel (where penetrated), and at one of the historical boreholes in the east of the site, directly beneath made ground at 4.6m depth. It generally comprised brown/dark brown (weathered) with depth becoming dark greyish brown/grey fissured clay with occasional partings/pockets of silt/fine sand, occasional silty/slightly sandy zones, small infilled burrows, shell fragments and claystone nodules. It was necessary to undertake chiselling techniques to bypass these claystones.

The top of the London Clay was present at between 3.7m and 7.6m bgl (average of 5.3m) depth bgl (about +1.2mOD and -1.7mOD across the site) and a thin layer of reworked clay, up to 0.3m thick, containing flint gravel, was recorded locally. Whilst some of the boreholes recorded the upper zone of the clay to be brown, others did not, which indicates a variable weathered profile. The depth to the top of the London Clay across the site is shown in the indicative zone plan in the Appendix, indicating a deepening from 3m to 4m bgl in the south-east to a depth of 5m to 6m in the north-west across the eastern half of the site. Only limited data are available for the western half of the site (only covering the south-eastern corner), and these indicate depths to the top of the clay to from 5m to 6m range to 7m to 8m depth from south to north.

Plasticity Indices (PI) of >40% and Liquid Limits of >70% were measured, indicating the London Clay to be very high plasticity (BS classification) and a high volume change potential (NHBC classification).

In situ SPTs and triaxial testing indicate that the clay strength increases with depth, from an initially medium to high strength (minimum c_u of around 60kPa) at the top of the stratum, becoming very high strength below about 10m to 15m depth. The strength vs depth profile is shown in the Appendix.

The London Clay was present to the full depth investigated, maximum of 30m bgl in our boreholes at the eastern half of the site (about -25mOD minimum); historical BGS boreholes indicate a thickness of around 60m beneath the site.

5.5 Groundwater

Groundwater inflows were noted within the Kempton Park Gravel in SCL BH1 (at 4.3m sealed out by the casing at 5.0m) and in BH2B (at 3.20m sealed out at 4.15m). In the deeper dynamic sampler boreholes water was recorded at between about 2.9m and 4.5m depth, whilst several of the boreholes remained dry throughout.

The historical BGS boreholes recorded groundwater depths at about 4.5m and 6.1m bgl. The Ground Explorations 1980 investigation reported water at between about 2.6m and 4.0m, and the SCL boreholes of 2004 recorded groundwater within the superficial deposits at between 5.1m and 5.6m depth. More recently, groundwater monitoring by AECOM indicated water depths ranging between 3.57m and 5.14m bgl. A small tidal influence (of 60mm) was measured over a short period of 2.5 days – although it is not stated whether this reflects a Spring tide condition where the water range differences between low and high tide are at their highest.

Standpipe monitoring was undertaken by Waterman following the current investigation fieldwork and the results at the time of writing are summarised below:

Summary of available groundwater monitoring by WIE				
Installation reference (all pipe 50mm ID)	Approximate pipe base		Water depth/level 27 October 2016	
	Depth (m bgl)	Elevation (m OD)	Depth (m bgl)	Elevation (m OD)
BH1	5.87	-0.72	3.82	+1.33
BH2B	4.90	+0.06	3.51	+1.45
WS1	4.70	+1.42	4.48	+1.64
WS2	2.07	+4.01	Dry	N/A
WS4	4.49	+1.36	4.10	+1.75
WS5	3.18	+2.58	3.09	+2.67
WS7A	4.52	+0.71	4.42	+0.81
WS8A	2.42	+2.73	Dry	N/A
WS9A	0.85	+4.05	Dry	N/A
WS10A	3.90	+1.00	2.30	+2.62

Notes:

- 1) Ground levels from GPS survey
- 2) Pipe base shown is as measured during monitoring – reflecting some silting up of the installation

There is no current information available for the western half of the site, however, the recorded levels in the eastern half are similar to those recorded historically and we do not anticipate significant variations between the eastern and western halves of the site. Some variability should, however, be expected due

to former structures and geological variations. Seasonal variations and some tidal influence should also be anticipated.

5.6 Environmental observations

No visual or olfactory signs of gross contamination were observed in any of the strata and all PID headspace measurement indicated nil or very low concentrations of volatile hydrocarbons (all <5ppm with the exception of three results, maximum 16.3ppm) within the made ground and upper natural soils. Asbestos containing materials (ACMs) were not visually observed in our boreholes but these are common in made ground and in buildings constructed before 2000. Reference should be made to the WIE report in this regard.

6.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

The overall scheme proposal (Phases 1, 2 and 3) is to demolish the existing buildings and infrastructure, and redevelop the site with educational, commercial, retail, leisure and residential apartment blocks, with a single storey basement to provide car parking facilities and plant rooms to the development. A minimum headroom height in the proposed basement is to be approx. 4.0m to 4.5m and a raft thickness of approx. 850mm thick is proposed. The total excavation depth is expected to be up to about 7m, equating to an elevation of approximately -2.0mOD.

There will be a mix of building heights across the site of between 3-8 storeys. The residential blocks are likely to be concrete framed buildings utilising flat slab construction on in situ reinforced concrete columns. The proposed structure for the retail/leisure buildings is envisaged to be steel framed with composite beams and floors.

Available architectural drawings showing the proposed construction are appended.

6.1 Basement excavation and retaining wall

Based on the available borehole records, the excavation for the proposed basement, which is expected to be about 7.0m deep, will generally encounter a sequence of variable made ground, locally followed by alluvium, and then the Kempton Park Gravel. The available borehole records indicate that the London Clay Formation would be encountered at the lower part of the basement excavation, in some areas towards/at the base of the excavation, but at this stage we have insufficient deep borehole information to fully assess the geological sequence at the western half (Phase 3) of the overall site in particular.

Based on limited/partial available information depth to the London Clay Formation appears to deepen (and be at a lower elevation) from east to west within the Phase 1 and 2 area, and within the Phase 3 area it appears to be slightly deeper.

From the historical information and recent monitoring in 2016 (by Waterman), steady-state groundwater levels are expected to be around 1.5m to 3.5m above the formation level, within the superficial deposits and made ground, although this must be verified by further monitoring as levels may rise during wet periods. Limited information available at the time of writing, from a previous investigation by AECOM,

indicates that tidal influences are not thought to be significant, however, we would recommend additional monitoring work is undertaken to verify these results, as the monitoring period undertaken previously was only for 2.5 days and it is not clear whether it coincided with the highest tidal range.

As a relatively high groundwater is present we consider that an embedded water-tight retaining wall construction will be required to permit basement excavation and stop any water ingress; a sheet pile or secant bored pile wall will probably be the optimum type. Where the excavation is likely to adversely affect any remaining structures/infrastructure, a robust arrangement of temporary internal bracings/props, including support elements near the top of the basement wall, will be required to maintain wall stability and assist in controlling ground movements. The presence of reported previous basements and deep concrete obstructions, particularly in the eastern half (Phase 1 and 2) of the site, must be considered in the choice of retaining wall and measures to remove the obstructions will have to be carefully considered to avoid installation difficulties.

Careful selection of the appropriate temporary design parameters will be needed, incorporating allowances for factors such as the presence of groundwater and the possibility of soil softening – CIRIA Report C580 provides more detail.

In the permanent case the lateral earth pressures will be supported directly by the piled retaining wall or by a reinforced concrete lining wall cast within the piles. In either case horizontal support to the wall will be provided by the new ground and basement floor slabs.

The following table of coefficients may be used for the preliminary design of the basement retaining wall:

Stratum	Bulk density (Mg/m³)	Effective cohesion, c' (kN/m²)	Effective friction angle, ϕ' (degrees)
Made ground and alluvium	1.80	0	25
Kempton Park Gravel	2.00	0	36
London Clay:			
<5m below basement level	2.00	0	22
>5m below basement level	2.00	5	22

The wall designer should use these parameters to derive the active and passive earth pressure coefficients, K_a and K_p . The determination of appropriate earth pressure coefficients, together with factors such as the pattern of earth pressure distribution, will depend upon the type/geometry of the wall and the overall design approach. Piled walls may of course also be used to provide vertical load capacity if required subject to the necessary allowance being made for interaction effects.

A specialist contractor/structural engineer must be consulted to confirm the most appropriate type of wall and to provide the final wall design.

6.2 Basement raft design

The current proposals are for a very large basement extending beneath the vast majority of the site. We understand that current proposals envisage the use of a reinforced concrete basement raft and consider that this should provide an eminently suitable foundation solution. We recommend that a detailed ground movement analysis is undertaken in due course to provide the design/performance information based on the findings of the ground investigations; such an analysis is outside the scope of this current report.

The basement excavation will involve the removal of approximately 7m of soil, resulting in unloading of about 130kN/m². This stress reduction will theoretically result in an element of heave in the London Clay beneath the site. The potential long term effect of this heave in the London Clay as it recovers should be considered during raft design and the raft must clearly be designed to withstand potential forces/movements. The stresses within a large raft will be complex and will be highly dependent on the column spacing and the relative soil and structure stiffnesses. There may be areas of net unload where some heave would be expected, with other areas of net loading where downward settlements will occur. As discussed above, these raft movements should be analysed in due course by a specialist ground movement analysis.

It will also be necessary to consider uplift of the raft due to potential hydrostatic pressures and in this respect the guidelines incorporated in BS8102:2009 should be followed. The raft design will need to take account of potential seasonal fluctuations and/or accidental/tidal and flood conditions. At this stage, subject to further monitoring and detailed hydrogeological assessment (outside our current scope) we consider that a design water level of say 2m below ground level could be used for preliminary design. Based on this water level we consider that a theoretical hydrostatic uplift pressure of 50kN/m² should be used for raft design (for a 7m deep excavation). This preliminary value can be regarded as the minimum design uplift pressure for the basement raft. This design water level may need to be agreed with the local building control in due course.

We understand that the site is within Flood Zones 2 & 3 and the potential effects from flooding should also be carefully considered in the design.

6.3 Piled foundations

Piles are envisaged to form the basement retaining walls and may also be required to carry structural loads as part of the retaining wall structure or within other areas of the site. For the ground conditions encountered, with groundwater being present within the superficial soils, we consider that CFA piles are likely to present the optimum type for load-bearing. Obstructions must be expected, some at depth within the made ground and these will require removal prior to piling.

The following table of coefficients may be used for the design of CFA piles, based upon the measured strength/level profile included in the Appendix.

Shaft adhesion

Stratum	Depth/level	Undrained cohesion (from strength profile)	Ultimate unit shaft adhesion 'q _s '
All made ground and natural strata (above basement excavation)	Above 7.0m depth (about -2.0mOD)	Ignore	Ignore
London Clay Formation	Below 7.0 depth (about -2.0mOD)	Increases linearly from 90kN/m ² at a rate of 9.44kN/m ² /m	Increases linearly from 45kN/m ² at a rate of 4.72kN/m ² /m (incorporates α = 0.50)

Notes:

- Unit shaft adhesion 'q_s' = α × c_u (where α = 0.50 and c_u is the undrained cohesion from the design line)
- The α value of 0.5 is based upon 102mm diameter triaxial tests and this should not be varied
- The average shaft adhesion over the pile length should be limited to 110kN/m²
- The maximum value for unit shaft adhesion should be limited to 140kN/m²

End bearing

Stratum	Depth/level	Undrained cohesion (from strength profile)	Ultimate unit base resistance 'q _b '
London Clay	Below say 15m depth (-10.0m OD approx)	Increases linearly from 165.5kN/m ² at a rate of 9.44kN/m ² /m	Increases linearly from 1,489.5kN/m ² at a rate of 85kN/m ² /m (incorporates N _c = 9)

Notes:

- Unit base resistance in clay 'q_b' = N_c × c_u (where N_c = 9 and c_u is the equivalent undrained cohesion from the design line)

Using the traditional UK approach, an overall Factor of Safety of 2.6 should be appropriate when applied to these ultimate parameters, in accordance with the LDSA guidelines. Example working loads are provided below:

Pile diameter (mm)	Pile toe depth (m bgl)	Ultimate load (kN)	Working load (kN)
450	15	960	370
	20	1695	650
	25	2600	1000
600	15	1385	530
	20	2395	920
	25	3630	1395
750	15	1860	715
	20	3165	1215
	25	4745	1825
900	15	2395	920
	20	4000	1540
	25	5940	2285

Notes:

- Working load is calculated using F_{shaft} and F_{base} = 2.6
- Concrete stress should be considered in the final design
- Pile length assumes top of pile at 7m depth (approximately -2.0mOD)
- Pile capacities are given as a guide and are not constituted as design recommendations

Although groundwater inflows were not observed within the London Clay, it is noted that groundwater seepages may occur within the stratum, especially in silty/sandy zones or where claystones are present. Some modification of the pile parameters or downgrading of the pile capacities may be warranted to mitigate the possible risk of clay softening, although this should be minimal with well-installed CFA piles.

Any piles within the heave zone may be subject to an element of uplift as the clay responds to the excavation unloading, with tensile forces being generated within the shaft. The maximum tensile forces will occur if the piles are installed prior to the excavation (for example single piles with plunge columns), but even if installed following the basement excavation they could still be subjected to some tension until the axial loads are applied by the new structure. The final pile design should address the potential tensile forces and appropriate reinforcement should be incorporated.

Eurocode 7 adopts a slightly different approach, applying partial factors to the ultimate pile capacity in accordance with EC7 (BS EN 1997-1:2004 and UK National Annex) for the ultimate limit state GEO Design Approach 1, Combinations 1 and 2. The following partial factors, as recommended in the UK National Annex, are applied:

- a] Model Factor, γ_{Rd} = 1.4 (Combinations 1 and 2)
- b] Factor on shaft resistance, γ_s = 1.6 (Combination 2)
- c] Factor on base resistance, γ_b = 2.0 (Combination 2)

When designing to EC7, the engineer must ensure that the correct comparisons are made between the Design Actions and Design Resistances. Whilst the partial factors address ULS design, serviceability checks should also be carried out.

We recommend that a specialist piling contractor is consulted at an early stage to advise on the most appropriate pile type and to ultimately provide the final pile design. If pile testing is undertaken it is probable that a lower overall factor of safety could be adopted.

6.4 Foundation concrete

Concentrations of soluble sulphates were measured in selected soil and groundwater samples as follows:

- ✚ SCL (10no samples): water soluble sulphate range <10 to 251mg/kg and pH 7.4 to 9.3
- ✚ Waterman IE (5no samples): water soluble sulphate range 23 to 472mg/kg and pH 8.5 to 11.2
- ✚ AECOM (14no groundwater samples): soluble sulphate <2 to 457mg/kg and pH of 7.1 to 8.1

The older results from the previous investigations have not been included in this assessment as there is no reliance on these results.

The above values result in an overall Site Design Class DS-1/AC-1, as provided in BRE Special Digest 1 (2005), Table C2 for cases where soil oxidation is not anticipated (for example for piling). However, the results suggest that the London Clay is probably pyritic at this site, with many of the oxidisable sulphide levels significantly exceeding 0.3%. Our preliminary recommendation is that that buried concrete which is in contact with soils that have been disturbed/potentially oxidised is designed in accordance with ACEC Site Class AC-4.

Further testing (on both water and soil samples) is being undertaken by WIE as part of the environmental assessment which must be reviewed for final design.

6.5 Further geotechnical investigations

Further comprehensive ground investigations and monitoring of water levels will be required prior to final scheme design.

The current preliminary exploratory work was restricted to Phase 1 and 2 (the eastern half of the global site) and within this area there are significant distances of up to 100m between exploratory positions. In addition contractual reliance may not be available upon some information we have reviewed; particularly the Ground Explorations report of 1980; this information will certainly be outside any warranty period. The BGS Borehole data similarly is provided publicly for information purposes only. The majority of the dynamic sampler boreholes are also of insufficient depth to provide much useful geotechnical design information. Therefore, further investigations should comprise a series of deep boreholes to confirm the levels of the various strata and the groundwater regime, in order to provide sufficient pile and basement design information.

In the Phase 3 (western half of the global site) there are very little data which can be relied upon. Presumably the Client can obtain reliance on the data in the SCL 2004 report; we would have no objection to this but again the information will be outside any warranty period. The BGS information should be used for general background information only. Therefore, in this phase a comprehensive geotechnical investigation will be required, essentially across the whole of the area, again comprising a series of deep boreholes to confirm the levels of the various strata and groundwater regime to provide pile and basement construction design information.

Of course these additional investigations can be undertaken in tandem with WIE to efficiently provide the necessary environmental coverage.

As we have discussed above, a detailed ground movement analysis will be required to assess the performance of the proposed raft. In addition, a hydrogeological assessment is likely to be required for final scheme design.



GENERAL INFORMATION, LIMITATIONS AND EXCEPTIONS

Unless otherwise stated, our Report should be construed as being a Ground Investigation Report (GIR) as defined in BS EN1997-2. Our Report is not intended to be and should not be viewed or treated as a Geotechnical Design Report (GDR) as defined in EN1997-2. Any 'design' recommendations which are provided are for guidance only and are intended to allow the designer to assess the results and implications of our investigation/testing and to permit preliminary design of relevant elements of the proposed scheme.

The methods of investigation used have been chosen taking into account the constraints of the site including but not limited to access and space limitations. Where it has not been possible to reasonably use an EC7 compliant investigation technique we have adopted a practical technique to obtain indicative soil parameters and any interpretation is based upon our engineering experience and relevant published information.

The Report is issued on the condition that Soil Consultants Ltd will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the exploratory points which differ from those identified during our investigation. In addition Soil Consultants Ltd will not be liable for any loss arising directly or indirectly from any opinion given on the possible configuration of strata both between the exploratory points and/or below the maximum depth of the investigation; such opinions, where given, are for guidance only and no liability can be accepted as to their accuracy. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

Comments made relating to ground-water or ground-gas are based upon observations made during our investigation unless otherwise stated. Ground-water and ground-gas conditions may vary with time from those reported due to factors such as seasonal effects, atmospheric effects and and/or tidal conditions. We recommend that if monitoring installations have been included as part of our investigation, continued monitoring should be carried out to maximise the information gained.

Specific geotechnical features/hazards such as (but not limited to) areas of root-related desiccation and dissolution features in chalk/soluble rock can exist in discrete localised areas - there can be no certainty that any or all of such features/hazards have been located, sampled or identified. Where a risk is identified the designer should provide appropriate contingencies to mitigate the risk through additional exploratory work and/or an engineered solution.

Where a specific risk of ground dissolution features has been identified in our Report (anything above a 'low' risk rating), reference should be made to the local building control to establish whether there are any specific local requirements for foundation design and appropriate allowances should be incorporated into the design. If such a risk assessment was not within the scope of our investigation and where it is deemed that the ground sequence may give rise to such a risk (for example near-surface chalk strata) it is recommended that an appropriate assessment should be undertaken prior to design of foundations.

Where spread foundations are used, we recommend that all excavations are inspected and approved by suitably experienced personnel; appropriate inspection records should be kept. This should also apply to any structures which are in direct contact with the soil where the soil could have a detrimental effect on performance or integrity of the structure.

Ground contamination often exists in small discrete areas - there can be no certainty that any or all such areas have been located, sampled or identified.

The findings and opinions conveyed in this Report may be based on information from a variety of sources such as previous desk studies, investigations or chemical analyses. Soil Consultants Limited cannot and does not provide any guarantee as to the authenticity, accuracy or reliability of such information from third parties; such information has not been independently verified unless stated in our Report.

Our Report is written in the context of an agreed scope of work between Soil Consultants Ltd and the Client and should not be used in any different context. In light of additional information becoming available, improved practices and changes in legislation, amendment or re-interpretation of the assessment or the Report in part or in whole may be necessary after its original publication.

Unless otherwise stated our investigation does not include an arboricultural survey, asbestos survey, ecological survey or flood risk assessment and these should be deemed to be outside the scope of our investigation.

APPENDIX

Fieldwork, in-situ testing

- ✚ Cable percussion borehole records
- ✚ Dynamic sample borehole records
- ✚ Standard Penetration Test (SPT) results
- ✚ SPT hammer energy certificates

Laboratory testing and monitoring

- ✚ Summary of classification test results
- ✚ Plasticity charts
- ✚ Particle size distribution results
- ✚ Summary of undrained shear strength test results
- ✚ Soluble Sulphate/pH results (QTS Environmental)

Ground model/summary plots

- ✚ SPT and c_u vs depth
- ✚ Depth to top – River Terrace Deposits
- ✚ Depth to top – London Clay Formation
- ✚ Schematic geological cross sections

Plans & drawings

- ✚ Architectural drawings
- ✚ Topographical survey drawings
- ✚ Site Plan
- ✚ Location Maps

FOREWORD/GUIDANCE NOTES - CABLE PERCUSSION BORING

GENERAL

The Borehole Records are compiled from the driller's description of the strata encountered, an examination of the samples by our Geotechnical Engineer and the results of in-situ and laboratory tests. Based on this data, the report presents an opinion on the configuration of strata within the site. However, such reasonable assumptions are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes.

BORING METHODS

The Cable Percussion technique of boring is normally employed and allows the ground conditions to be reasonably well established. However, some disturbance of the ground is inevitable, particularly some "softening" of the upper zone of clay immediately beneath a granular soil. The presence of thin layers of different soils within a stratum may not always be detected.

GROUND WATER

The depth at which ground water was struck is entered on the Borehole Records. However, this observation may not indicate the true water level at that period. Due to the speed of boring and the relatively small diameter of the borehole, natural ground water may be present at a depth slightly higher than the water strike. Moreover, ground water levels are subject to variations caused by changes in the local drainage conditions and by seasonal effects. When a moderate inflow of water does take place, boring is suspended for at least 10 minutes to enable a more accurate short term water level to be achieved. An estimate of the rate of inflow is also given. This is a relative term and serves only as a guide to the probable flow of water into an excavation.

Further observations of the water level made during the progress of the borehole are shown including end of shift and overnight readings and the depth at which water was sealed off by the borehole casing, if applicable.

Whilst drilling through granular soils, it is usually necessary to introduce water into the borehole to permit their extraction. When additional water has been used a remark is made on the Borehole Record and the implications are discussed in the text.

SAMPLES

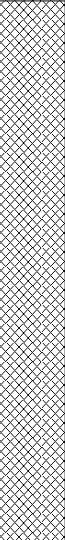

Undisturbed samples of the predominantly cohesive soils are obtained using a 100mm diameter open-drive sampler. In granular soils, disturbed bulk samples are taken and placed in polythene bags. Small jar samples are taken at frequent intervals in all soils for subsequent visual examination. Where ground water is encountered in sufficient quantity, a sample of the ground water is also taken.

IN-SITU STANDARD PENETRATION TESTS

This test is performed in accordance with the procedure given in B.S.1377: 1990. The individual blow count record for each test is given on a separate table. The 'N' value is normally the number of blows to achieve a penetration of 0.3m following a seating distance of 0.15m and is quoted at the mid-depth of the test zone. However if a change of stratum occurs within the test zone then a revised 'N' value is calculated to assess one layer in particular. In hard strata full penetration may not be obtained. In such cases the suffix + indicates that the result has been extrapolated from the limited penetration achieved. Where ground water has affected the measured values, the resultant 'N' value has been placed in brackets since it is unlikely to represent the true in-situ density of the soil.

Site & Location:		Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET				Borehole No: BH1		
Client: Reselton Properties Ltd			Coordinates: 520384E, 175949N		Sheet 1 of 3			
Engineer: Waterman Structures Ltd			Ground Level: +5.15mOD		Report No: 10022/OT			
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH commenced: 04/10/2016 BH/casing dia: 150mm BH casing depth: 5.0m	ES PID	0.50 0.50	0.5				MADE GROUND: concrete [250mm] over compact concrete and brick - driller's description	
Hand excavated inspection pit to 1.20m	ES PID D	1.00 1.00 1.30	0.7	1.20	3.95		Soft brown mottled sandy CLAY - driller's description	1
Water added between 2.0m and 4.50m to assist drilling	ES PID U	1.50 1.50 1.55	0.1	1.85	3.30		Light brown slightly silty gravelly fine to medium SAND. Gravel is subangular to rounded, fine to coarse flint	2
	ES PID B SPT/C	2.00 2.50 2.50 2.55 2.55	0.3 N=39 N ₆₀ =43				<i>at 2.55m; becoming dense</i>	3
Groundwater strike at 4.30m [fast flow]; sealed out at 5.0m	ES PID B SPT/C	3.50 3.50 3.55 3.55	0.3 N=25 N ₆₀ =28	3.15	2.00		Dense light brown slightly silty very sandy GRAVEL. Gravel is subangular to rounded, fine to coarse flint <i>at 3.55m; becoming medium dense</i>	4
	ES PID D D D SPT/S	4.50 4.50 4.70 4.90 5.05 5.05	0.4 N=15 N ₆₀ =16	4.70 4.90 5.05	0.45 0.25 0.10		Firm dark brown, locally mottled dark grey and reddish brown, CLAY with rare subangular to rounded, fine to medium flint gravel Firm dark brown, fissured, CLAY. Occasional light grey staining on fissured surfaces Stiff, fissured, dark greyish brown CLAY	5
	PID	5.50	0.4				<i>at 6.0m; with rare foram fossils</i>	6
	U	6.55					<i>at 6.55m; locally firm</i>	7
End of shift 04/10/2016 BH depth: 7.0m Groundwater depth: dry	D SPT/S	7.50 8.05 8.05	N=24 N ₆₀ =26	7.50	-2.35		Stiff, fissured, dark greyish brown CLAY with frequent pockets and partings of dark grey fine sand and grey silt infilled burrows. Rare white foram fossils	8
	D	9.00						9
	U	9.55						10
				10.00	-4.85		Continued on next sheet	
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Cable Percussion
Remarks: 50mm ID standpipe installed to 6.0m								Borehole No: BH1

Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET							Borehole No: BH1	
Client: Reselton Properties Ltd					Coordinates: 520384E, 175949N		Sheet 2 of 3	
Engineer: Waterman Structures Ltd					Ground Level: +5.15mOD		Report No: 10022/OT	
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
	D	10.50					Very stiff, fissured, dark greyish brown CLAY with frequent pockets and partings of dark grey fine sand and grey silt infilled burrows. Rare white foram fossils	
	D SPT/S	11.05 11.05	N=34 N ₆₀ =37	11.05	-5.90		Very stiff, fissured, dark greyish brown CLAY	11
	D	12.00					<u>at 12.0m; with rare foram fossils and grey silt infilled burrows</u>	12
	U	12.55					<u>at 12.55m; locally stiff</u>	13
	D	13.50		13.50	-8.35		Very stiff dark greyish brown slightly sandy silty CLAY. Occasional foram fossils and grey silt infilled burrows <u>between 13.70m and 13.80m; claystone</u>	14
	D SPT/S	14.05 14.05	N=35 N ₆₀ =38					15
	D	15.00						16
	U	15.55						17
	D	16.50		16.50	-11.35		Very stiff dark greyish brown silty CLAY. Occasional foram fossils and grey silt infilled burrows	18
	D SPT/S	17.05 17.05	N=41 N ₆₀ =45					19
	D	18.00						20
	U	18.55						
	D	19.50		19.50	-14.35		Very stiff dark greyish brown slightly sandy silty CLAY. Occasional foram fossils and grey silt infilled burrows	
				20.00	-14.85		Continued on next sheet	
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Cable Percussion
Remarks: 50mm ID standpipe installed to 6.0m								Borehole No: BH1

Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET							Borehole No: BH2			
Client: Reselton Properties Ltd					Coordinates: 520410E, 175962N		Sheet 1 of 1			
Engineer: Waterman Structures Ltd					Ground Level: +4.81mOD		Report No: 10022/OT			
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation		
	Type	Depth (m)		Depth (m)	Level (m)					
BH commenced: 03/10/2016 BH/casing dia: 150mm BH casing depth: 3.45m	ES PID	0.50 0.50	0.7				MADE GROUND: asphalt (300mm) over crushed concrete with brick, steel and concrete boulders - driller's description			
Hand excavated inspection pit to 1.20m	ES PID D SPT/S	1.00 1.00 1.25 1.25	0.9						1	
1.5hr chiselling at 1.80m [possible concrete slab]	ES PID	1.50 1.50	N=71 N ₆₀ =78 0.8						2	
1.5hr chiselling at 2.25m [concrete boulder] Groundwater strike at 2.30m [fast inflow]; not sealed out	ES PID D SPT/C	2.00 2.00 2.25 2.25	0.6						3	
2hr chiselling between 3.40m and 3.60m [possible concrete slab] Borehole terminated on impenetrable concrete slab at 3.60m	ES PID	2.50 2.50	N>50* 1.0	3.60	1.21				4	
End of hole at 3.60m									5	
									6	
									7	
									8	
									9	
							10			
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Cable Percussion		
Remarks: BH backfilled upon completion								Borehole No: BH2		

Stag Brewery, Site & Location: Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: BH2A		
Client: Reselton Properties Ltd				Coordinates: 520651E, 176003N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +4.80mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH commenced 06/10/2016 BH/casing dia: 150mm BH casing depth: 2.0m Hand excavated inspection pit to 1.20m Groundwater strike at 2.30m [fast inflow]; not sealed out 2hr chiselling between 3.45m and 3.50m [possible concrete slab]							MADE GROUND: asphalt (250mm) over pea shingle, plastic pipe fragments and crushed concrete - driller's description	
				2.00	2.80		MADE GROUND: pea shingle and crushed concrete - driller's description	
				3.45 3.50	1.35 1.30		MADE GROUND: concrete slab - driller's description End of hole at 3.50m	
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Cable Percussion
Remarks: BH backfilled upon completion								Borehole No: BH2A

Site & Location:		Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET				Borehole No: BH2B		
Client: Reselton Properties Ltd		Coordinates: 520598E, 175976N		Sheet 1 of 3				
Engineer: Waterman Structures Ltd		Ground Level: +4.96mOD		Report No: 10022/OT				
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH commenced: 07/10/2016 BH/casing dia: 150mm BH casing depth: 4.15m							MADE GROUND: asphalt [200mm] over compact crushed concrete and brick	
Hand excavated inspection pit to 1.20m	ES PID	1.50 1.50	0.1	1.25	3.71		Firm orangish brown, mottled dark brown, sandy CLAY with frequent black flecks and rare rounded, fine to medium flint gravel	1
	B ES SPT/C	2.00 2.00 2.00	N=36 N ₆₀ =40	1.80	3.16		Dense orangish brown slightly silty very gravelly SAND. Gravel is subangular to rounded, fine to coarse flint	2
Groundwater strike at 3.20m [fast flow]; sealed out at 4.15m	PID	2.00	0.1				<i>at 3.0m; becoming medium dense slightly silty very sandy gravel</i>	3
	B ES SPT/C	3.00 3.00 3.00	N=14 N ₆₀ =15					3
	PID	3.00	0.1					4
End of shift 07/10/2016 BH depth: 4.50m Groundwater level: dry	D	3.90		3.75	1.21		Soft to firm dark greyish brown CLAY with occasional subrounded, fine to medium gravel	4
	D SPT/S	4.05 4.05	N=15 N ₆₀ =16	4.05	0.91		Stiff, fissured, dark greyish brown CLAY. Rare grey silt infilled burrows	5
	D	4.75						5
	U	5.05						6
	D	6.00		6.00	-1.04		Stiff, fissured, dark greyish brown CLAY with occasional pockets and partings of dark grey fine sand. Rare foram fossils and grey silt infilled burrows	6
	D SPT/S	6.55 6.55	N=23 N ₆₀ =25					7
	D	7.50						8
0.5hr chiselling between 8.60m and 8.75m [claystone]	U	8.05						8
	D	9.00					<i>between 8.60m and 8.75m; claystone</i>	9
	D SPT/S	9.55 9.55	N=25 N ₆₀ =28					9
				10.00	-5.04			10
Continued on next sheet								
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Cable Percussion
Remarks: 50mm ID standpipe installed to 5.0m								Borehole No: BH2B

Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET							Borehole No: BH2B				
Client: Reselton Properties Ltd					Coordinates: 520598E, 175976N		Sheet 2 of 3				
Engineer: Waterman Structures Ltd					Ground Level: +4.96mOD		Report No: 10022/OT				
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation			
	Type	Depth (m)		Depth (m)	Level (m)						
0.5hr chiselling between 18.20m and 18.35m [claystone]	D	10.50	N=34 N ₆₀ =37	10.20	-5.24		Stiff, fissured, dark greyish brown CLAY with occasional pockets and partings of dark grey fine sand. Rare foram fossils and grey silt infilled burrows		11		
	U	11.50								Very stiff dark greyish brown slightly sandy silty CLAY with occasional to frequent foram fossils and grey silt infilled lenses. Occasional pockets and partings of fine dark grey sand	
	D	12.00									
	D SPT/S	12.55 12.55								<u>between 12.55m and 13.55m; locally silty clay</u>	13
	D	13.50	N=35 N ₆₀ =38	13.50	-8.54		Very stiff dark greyish brown slightly sandy silty CLAY. Occasional foram fossils and grey silt infilled burrows			14	
	U	14.05									
	D	15.00								<u>at 15.0m; with rare fossil shell debris and frequent foram fossils</u>	15
	D SPT/S	15.55 15.55									16
	D	16.50	N=39 N ₆₀ =43	16.50	-11.54		Very stiff dark greyish brown silty CLAY. Occasional foram fossils and grey silt infilled burrows			17	
	U	17.05									
	D	18.00								<u>at 18.0m; pocket of pyrite/pyritic sand</u> <u>between 18.20m and 18.35m; claystone</u>	18
	D SPT/S	18.55 18.55									19
	D	19.50		19.50	-14.54		Very stiff dark greyish brown slightly sandy silty CLAY. Frequent foram fossils and grey silt infilled burrows			20	
			20.00	-15.04		Continued on next sheet					

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²]
 HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Remarks: 50mm ID standpipe installed to 5.0m

Borehole type: Cable Percussion

Borehole No: **BH2B**



Site & Location:		Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET					Borehole No: BH2B					
Client: Reselton Properties Ltd			Coordinates: 520598E, 175976N			Sheet 3 of 3						
Engineer: Waterman Structures Ltd			Ground Level: +4.96mOD			Report No: 10022/OT						
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation				
	Type	Depth (m)		Depth (m)	Level (m)							
End of shift 10/10/2016 BH depth: 25.0m Groundwater depth: dry	U	20.05	N=44 N ₆₀ =48				Very stiff dark greyish brown slightly sandy silty CLAY. Frequent foram fossils and grey silt infilled burrows					
	D	21.00							21			
	D	21.55										
	SPT/S	21.55							22			
	D	22.50										
	U	23.05	N=47 N ₆₀ =52									23
	D	24.00									24	
	D	24.55										
	SPT/S	24.55									25	
	D	25.50										
0.5hr chiselling between 28.00m and 28.15m [claystone]	U	26.05		26.00	-21.04		Very stiff dark greyish brown CLAY with occasional white shell fragments		26			
	D	27.00								27		
	D	27.55	N=49 N ₆₀ =54									
	SPT/S	27.55								28		
	D	28.75									29	
BH completed: 11/10/2016 Groundwater depth on removal of casing: 3.50m	U	29.55					End of hole at 30.00m		30			
				30.00	-25.04							

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²]
 HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Remarks: 50mm ID standpipe installed to 5.0m

Borehole type: Cable Percussion
 Borehole No: **BH2B**



Site & Location:		Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET				Borehole No: WS4		
Client: Reselton Properties Ltd		Coordinates: 520431E, 176031N		Sheet 1 of 1				
Engineer: Waterman Structures Ltd		Ground Level: +5.85mOD		Report No: 10022/OT				
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed: 04/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth	ES PID	0.50 0.50	0.8	0.80	5.05		MADE GROUND: asphalt (200mm) over dark brown silty very sandy gravel. Gravel is limestone, brick and rare flint	
	ES PID	1.00 1.00	0.3				MADE GROUND: dark brown and black slightly sandy slightly gravelly clay. Gravel is fine to coarse clinker, brick and flint at 0.90m; becoming light greyish brown	
	ES PID	1.50 1.50	0.3	1.70	4.15		MADE GROUND: dark brown grey slightly sandy slightly gravelly clay. Gravel is fine to medium clinker, brick and rare concrete fragments	
	ES PID	2.00 2.00	0.5	2.00	3.85		Light brown slightly, locally very, gravelly SAND. Gravel is subangular to angular, fine to coarse flint	
	D	2.30						
	ES PID	2.60 2.60	1.3				at 2.60m; locally stained black	
	D SPT/S	3.00 3.00	N=38 N ₆₀ =50				at 3.0m; becoming very dense	
	ES PID	3.50 3.50	4.2					
	SPT/S	4.00	N=17 N ₆₀ =22				at 4.0m; becoming medium dense	
	ES PID D	4.50 4.50 4.70	3.4					
	SPT/S	5.00	N=9 N ₆₀ =12	5.00	0.85		Firm dark brown CLAY	
	BH dry upon completion	D	5.50	5.50	0.35		End of hole at 5.50m	

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²]
 HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Remarks: 50mm ID standpipe installed to 5.0m

Borehole type: Dynamic Sampler
 Borehole No: **WS4**





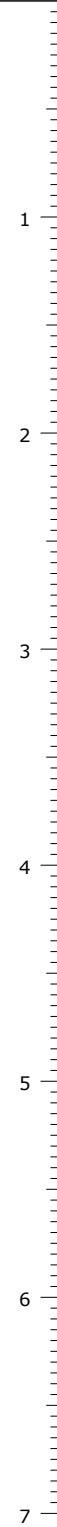
Site & Location:		Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET				Borehole No: WS5			
Client: Reselton Properties Ltd		Coordinates: 520429E, 175972N		Sheet 1 of 1					
Engineer: Waterman Structures Ltd		Ground Level: +5.76mOD		Report No: 10022/OT					
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation	
	Type	Depth (m)		Depth (m)	Level (m)				
BH constructed: 03/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth	ES PID	0.50	2.0	0.50	5.26		MADE GROUND: asphalt (100mm) over greyish brown sandy gravel of concrete		
		0.50							
	ES PID	1.00	0.4	1.20	4.56				MADE GROUND: light grey and pinkish grey clayey sandy gravel. Gravel is fine to coarse limestone and occasional brick
		1.00							
	ES PID	1.50	0.5	2.20	3.56				MADE GROUND: dark brown slightly sandy slightly gravelly clay. Gravel is fine to coarse brick
		1.50							
	ES PID	2.00	0.5	2.20	3.56				Firm brownish grey slightly gravelly slightly sandy CLAY. Gravel is subangular to rounded, fine to coarse flint. Occasional root traces
		2.00							
	D	2.30	0.8	2.80	2.96				Medium dense orangish brown, becoming yellowish brown, slightly silty SAND with rare subangular to rounded, fine to coarse flint gravel
		2.30							
ES PID	2.50	1.1	2.80	2.96	at 4.0m; becoming very dense				
	2.50								
SPT/S D	3.00	N=16 N ₆₀ =21	2.80	2.96	at 4.50m; becoming slightly silty very gravelly sand				
	3.10								
ES PID	3.50	1.1	2.80	2.96	at 4.50m; becoming slightly silty very gravelly sand				
	3.50								
SPT/S	4.00	N=40 N ₆₀ =53	2.80	2.96	at 4.50m; becoming slightly silty very gravelly sand				
	4.00								
Groundwater strike at about 4.50m	ES PID D	4.50	16.3	5.00	0.76	End of hole at 5.00m			
		4.50							
		4.60							


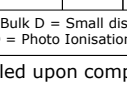

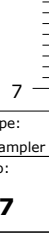
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²]
 HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Remarks: 50mm ID standpipe installed to 5.0m

Borehole type: Dynamic Sampler
 Borehole No: **WS5**



Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: WS6		
Client: Reselton Properties Ltd				Coordinates: 520477E, 176066N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +5.22mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 05/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth BH refused at 0.50m				0.50	4.72		MADE GROUND: concrete	
							End of hole at 0.50m	
								
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Dynamic Sampler
Remarks: BH backfilled upon completion								Borehole No: WS6

Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: WS7		
Client: Reselton Properties Ltd				Coordinates: 520486E, 176003N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +5.23mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 05/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth BH refused at 0.80m	ES PID	0.70	0.1	0.60	4.63		MADE GROUND: reinforced concrete slab	
		0.70		0.80	4.43		MADE GROUND: dark greyish brown very sandy gravel. Gravel is fine to coarse brick and flint. Locally clayey to very clayey	
End of hole at 0.80m								
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Dynamic Sampler
Remarks: BH backfilled upon completion								Borehole No: WS7
								

Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: WS7A		
Client: Reselton Properties Ltd				Coordinates: 520486E, 176003N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +5.23mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 05/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth				0.25	4.98		MADE GROUND: concrete	
	ES PID	1.00 1.00	0.3				MADE GROUND: dark grey clayey sandy gravel. Gravel is fine to coarse concrete, metal and clinker	
BH refused at 1.40m				1.40	3.83		End of hole at 1.40m	
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								
Remarks: 50mm ID standpipe installed to 1.40m								Borehole type: Dynamic Sampler Borehole No: WS7A

Stag Brewery, Site & Location: Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: WS8		
Client: Reselton Properties Ltd				Coordinates: 520583E, 176026N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +5.15mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 03/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth Bh refused at 1.0m				0.70	4.45		MADE GROUND: concrete	
				1.00	4.15		MADE GROUND: orangish brown slightly silty sandy gravel. Gravel is fine to coarse flint	
	ES SPT/S PID	1.00 1.00 1.00	N>50* 0.7				End of hole at 1.00m	
								1
								2
								3
								4
								5
								6
								7
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Dynamic Sampler
Remarks: BH backfilled upon completion								Borehole No: WS8

Site & Location:		Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET				Borehole No: WS8A		
Client: Reselton Properties Ltd		Coordinates: 520583E, 176026N		Sheet 1 of 1				
Engineer: Waterman Structures Ltd		Ground Level: +5.15mOD		Report No: 10022/OT				
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 12/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth	ES PID	1.50	0.4	0.70	4.45	[Cross-hatched pattern]	MADE GROUND: concrete	[Black vertical bar]
		1.50		1.00	4.15		MADE GROUND: brown silty sandy gravel. Gravel is fine to coarse concrete and rare flint	
BH refused at 2.50m	ES PID	2.00	0.2	2.40	2.75	[Dotted pattern]	MADE GROUND: brown and orangish brown sandy gravel. Gravel is fine to coarse flint and occasional concrete	[Dotted pattern]
		2.00					at 2.0m; becoming brownish grey very clayey sandy gravel	
	2.50	at 2.30m: recovered as fine to coarse brick fragments - possible buried structure	[Dotted pattern]					
	2.50	0.3		2.50	2.65		Orangish brown sandy GRAVEL. Gravel is subangular to subrounded, fine to coarse flint	
End of hole at 2.50m								
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								
Remarks: 50mm ID standpipe installed to 2.50m								
Borehole type: Dynamic Sampler								
Borehole No: WS8A								



Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: WS9A		
Client: Reselton Properties Ltd				Coordinates: 520517E, 175966N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +4.89mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 12/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth							MADE GROUND: dark brown clayey very sandy gravel. Gravel is fine to coarse flint, brick and clinker	
							<i>at 1.60m; becoming orangish brown, grey, brown mottled slightly sandy slightly gravelly clay. Gravel is fine to coarse flint and rare brick</i>	
Groundwater standing at about 2.90m upon completion	ES	2.00	N=10 N ₆₀ =13 0.4	2.00	2.89		Medium dense light brown silty slightly gravelly, locally very clayey, SAND. Gravel is subrounded to rounded, fine to coarse flint	
	SPT/S	2.00						
	PID	2.00						
	D	2.50						
	ES	3.00	N=34 N ₆₀ =45 2.9				<i>at 2.90m; becoming orangish brown sandy gravel</i> <i>at 3.0m; becoming dense</i>	
	SPT/S	3.00						
	PID	3.00						
	D	3.50						
	HV	3.80	70	3.85	1.04		Firm dark grey, orangish grey and reddish grey mottled CLAY <i>at 3.90m; becoming dark grey clay</i> End of hole at 4.00m	
	D	3.90						
	HV	3.90	60	4.00	0.89			



Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Borehole type: Dynamic Sampler

Remarks: 50mm ID standpipe installed to 3.70m

Borehole No: **WS9A**



Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: WS10		
Client: Reselton Properties Ltd				Coordinates: 520615E, 176024N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +4.92mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 03/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth				0.25	4.67		MADE GROUND: reinforced concrete	
	ES PID	0.50 0.50	1.1				MADE GROUND: dark grey sandy gravel. Gravel is fine to coarse concrete, brick and flint. Locally slightly clayey	
	ES PID	1.00 1.00	0.5					
BH refused at 1.60m	ES PID	1.50 1.50	0.5	1.60	3.32		End of hole at 1.60m	
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm ²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								
Remarks: BH backfilled upon completion								Borehole type: Dynamic Sampler Borehole No: WS10



Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET							Borehole No: WS10A	
Client: Reselton Properties Ltd					Coordinates: 520615E, 176024N		Sheet 1 of 1	
Engineer: Waterman Structures Ltd					Ground Level: +4.92mOD		Report No: 10022/OT	
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 12/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth							MADE GROUND: grey sandy gravel. Gravel is fine to coarse concrete and rare brick	
	ES PID	2.50 2.50	0.3	2.50	2.42			1
	D SPT/S	3.00 3.00	N=37 N ₆₀ =49				Light brown silty SAND and GRAVEL. Gravel is subangular to rounded, fine to coarse flint <i>at 3.0m; becoming dense</i>	3
	ES PID	3.50 3.50	3.5	3.70	1.22		Stiff, locally firm, dark brownish grey CLAY	4
	D HV HV	3.80 3.80 3.90	75 70					
Groundwater standing at about 4.50m upon completion	D HV HV	4.50 4.50 4.70	75 88					
	HV D	4.90 5.00	94	5.00	-0.08		End of hole at 5.00m	5
								6
								7

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²]
 HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Remarks: 50mm ID standpipe installed to 4.0m

Borehole type: Dynamic Sampler
 Borehole No: **WS10A**



Site & Location: Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET						Borehole No: WS11		
Client: Reselton Properties Ltd				Coordinates: 520598E, 175976N		Sheet 1 of 1		
Engineer: Waterman Structures Ltd				Ground Level: +4.96mOD		Report No: 10022/OT		
Progress & Observations	Samples & Tests		Field Test Results	Strata		Legend	Strata Descriptions	Backfill / Installation
	Type	Depth (m)		Depth (m)	Level (m)			
BH constructed 03/10/2016 BH dia: 100mm from GL to 1.0m, reducing with depth	ES PID	0.50	0.3	0.70	4.26		MADE GROUND: asphalt (300mm) over dark greyish brown sandy gravel. Gravel is fine to coarse concrete, and rare brick and clinker	
BH refused at 0.70m		0.50						
								1
								2
								3
								4
								5
								6
								7
Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet								Borehole type: Dynamic Sampler
Remarks: BH backfilled upon completion								Borehole No: WS11

SPT Calibration Report



Hammer Energy Measurement Report

Type of Hammer: SPT HAMMER
 Client: GEH GROUNDWORKS
 Test No: EQU1367_5
 Test Depth (m): 7.59
 Date of Test: 16 October 2015
 Valid until: 15 October 2016
 Hammer ID: GEH2

Mass of the hammer: $m = 63.5\text{kg}$
 Falling height: $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

Diameter: $d_r = 0.052\text{m}$
 Length of the instrumented rod: 0.558m
 Area: $A = 11.61\text{cm}^2$
 Modulus: $E_o = 206843\text{MPa}$

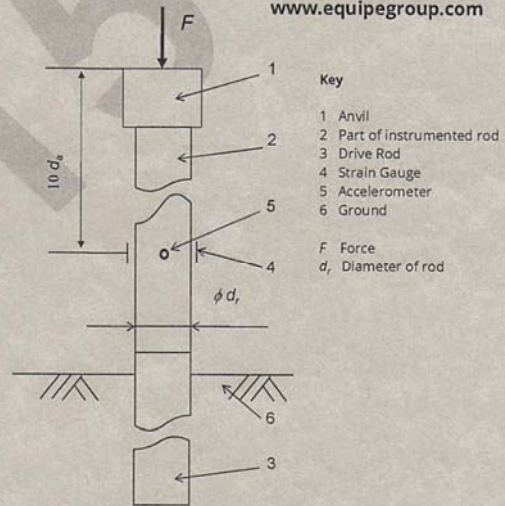
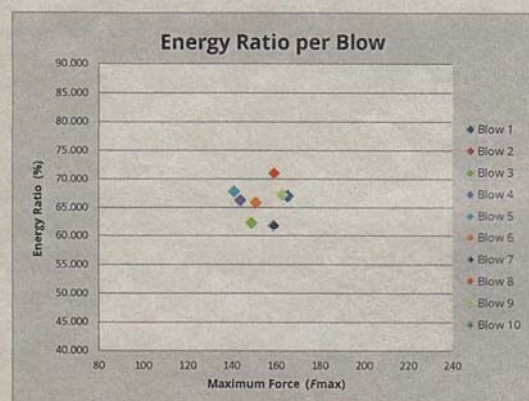
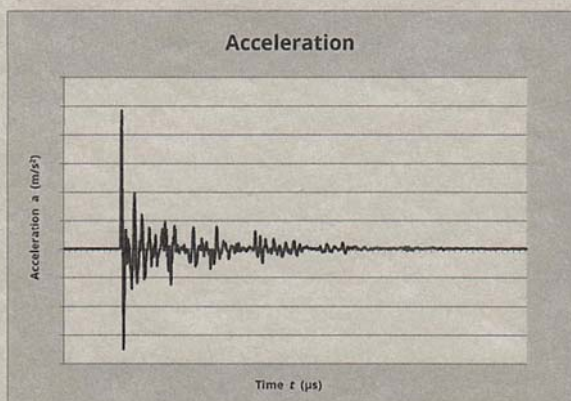
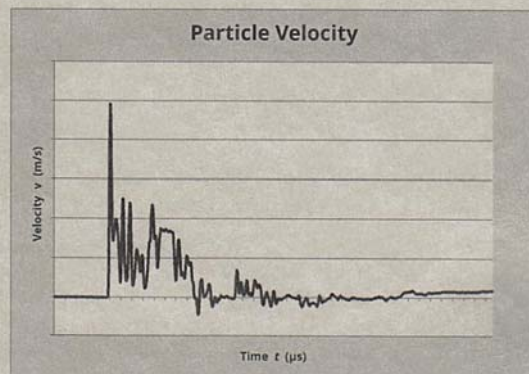


Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011



Observations:
1.

$E_{\text{meas}} = 0.312\text{ kN-m}$
 $E_{\text{theor}} = 0.473\text{ kN-m}$

Energy Ratio = $\frac{E_{\text{meas}}}{E_{\text{theor}}}$ = 65.96%

Equipe SPT Analyzer Operators:

MH

Prepared by:

Checked by:

Date

21/10/2015



Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling uk ltd
6-8 victory parkway
victory road
Derby
DE24 8ZF

Hammer Ref: SS01
Test Date: 27/06/2016
Report Date:
File Name: SS01.spt
Test Operator: TP

Instrumented Rod Data

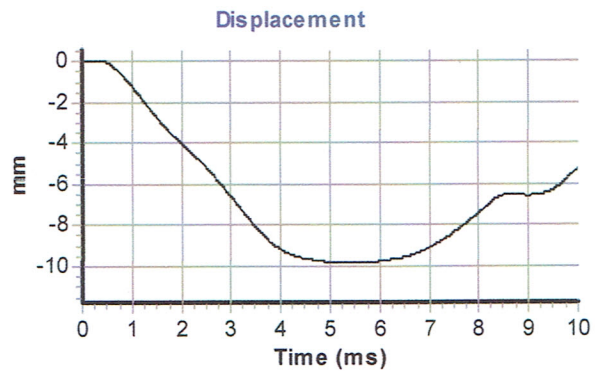
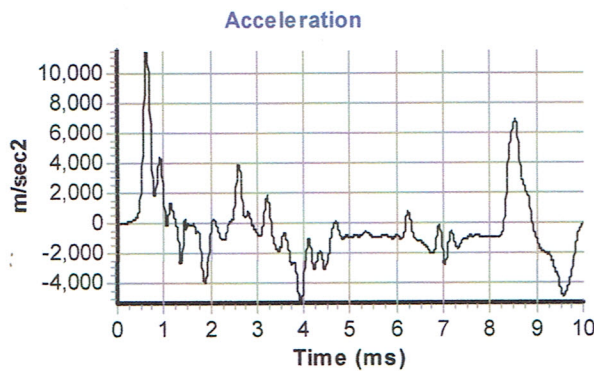
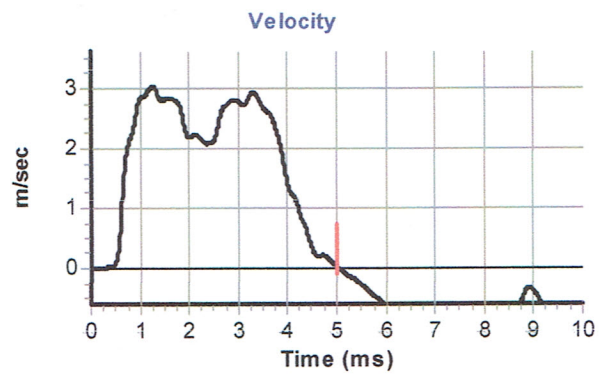
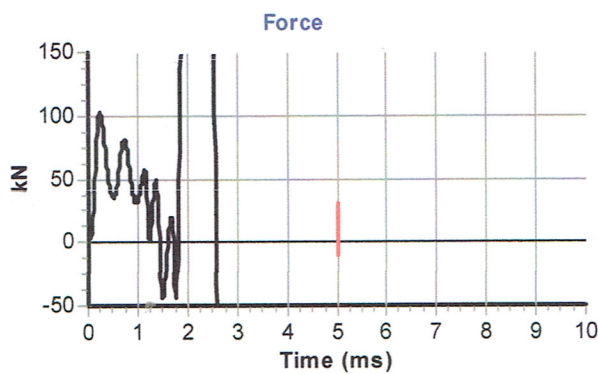
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.9
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 6455
Accelerometer No.2: 6457

Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
String Length L (m): 15.0

Comments / Location


Hammer tested at Dynamic samplings yard.



Calculations

Area of Rod A (mm^2): 1021
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 374

Energy Ratio E_r (%): **79**


Signed: A.parker
Title: Manager

The recommended calibration interval is 12 months

STANDARD PENETRATION TEST SUMMARY

BH ID	Depth [m]	Test type	'N' value and blow-counts [Seating blows/Test blows]	N ₆₀	Casing depth [m]	Water depth [m]	Remarks
BH1	2.55	C	N = 39 :5 5/ 8 10 10 11	44	2.55	DRY	
	3.55	C	N = 25 :4 4/ 6 6 6 7	28	3.55	DRY	
	5.05	S	N = 15 :2 3/ 3 4 4 4	17	5.00	DRY	
	8.05	S	N = 24 :3 3/ 5 6 6 7	27	5.00	DRY	
	11.05	S	N = 34 :4 4/ 7 9 9 9	38	5.00	DRY	
	14.05	S	N = 35 :3 4/ 7 8 10 10	39	5.00	DRY	
	17.05	S	N = 41 :4 4/ 8 10 11 12	46	5.00	DRY	
	20.05	S	N = 46 :5 5/ 9 11 13 13	51	5.00	DRY	
	23.05	S	N = 46 :5 5/ 9 12 12 13	51	5.00	DRY	
	26.05	S	N = 51 :5 6/ 10 13 13 15	57	5.00	DRY	
	29.55	S	N = 46 :5 5/ 8 11 13 14	51	5.00	DRY	
BH2	1.25	S	N = 71 :15 15/ 13 14 20 24	79	1.25	DRY	Refusal
	2.25	C	50 :50 /	>56*	0.00	DRY	
BH2B	2.00	C	N = 36 :4 5/ 7 9 10 10	40	2.00	DRY	
	3.00	C	N = 14 :3 3/ 3 3 4 4	16	3.00	DRY	
	4.05	S	N = 15 :2 3/ 3 4 4 4	17	4.05	DRY	
	6.55	S	N = 23 :3 3/ 5 6 6 6	26	4.15	DRY	
	9.55	S	N = 25 :3 3/ 5 6 7 7	28	4.15	DRY	
	12.55	S	N = 34 :4 4/ 8 8 9 9	38	4.15	DRY	
	15.55	S	N = 35 :5 5/ 7 9 9 10	39	4.15	DRY	
	18.55	S	N = 39 :5 5/ 8 10 10 11	44	4.15	DRY	
WS1	3.00	S	N = 28 :3 4/ 7 7 8 6	37	0.00	DRY	
	4.00	S	N = 35 :9 10/ 11 9 8 7	46	0.00	DRY	
	5.00	S	N = 21 :3 5/ 6 7 4 4	28	0.00	DRY	
	WS10A	3.00	S	N = 37 :9 11/ 10 10 10 7	49	0.00	DRY
		WS2	2.00	S	N = 28 :7 6/ 7 7 7 7	37	0.00
	WS2	3.00	S	N = 34 :8 8/ 7 9 8 10	45	0.00	DRY
		4.00	S	N = 44 :9 12/ 12 11 11 10	58	0.00	DRY
5.00		S	N = 22 :2 3/ 4 6 7 5	29	0.00	DRY	
WS3		2.00	S	N = 23 :3 5/ 5 6 6 6	30	0.00	DRY
	3.00	S	N = 32 :7 8/ 8 8 8 8	42	0.00	DRY	
	4.00	S	N = 9 :1 1/ 1 2 3 3	12	0.00	DRY	
WS3	5.00	S	N = 35 :4 8/ 7 8 10 10	46	0.00	DRY	
	WS4	3.00	S	N = 38 :10 9/ 8 10 10 10	50	0.00	DRY
		4.00	S	N = 17 :7 6/ 5 5 3 4	22	0.00	DRY
5.00		S	N = 9 :3 2/ 2 2 2 3	12	0.00	DRY	
WS5	3.00	S	N = 16 :3 3/ 4 4 4 4	21	0.00	DRY	
	4.00	S	N = 40 :7 7/ 8 12 10 10	53	0.00	DRY	
WS8	1.00	S	50 :25 / 50	>66*	0.00	DRY	
WS9A	2.00	S	N = 10 :3 2/ 2 3 2 3	13	0.00	DRY	

Standard Penetration Test : BS EN ISO 22476:2005 Part 3

Hammer Energy Ratio, Er = 66% [CP boreholes] 79% [WS boreholes]

* where full penetration not achieved, the reported N₆₀ is based on maximum uncorrected blow-counts of 50

** extrapolated N₆₀ value where full penetration not achieved - this is indicative only and should be used with caution



Site & Location	Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET	Report No:	10022/CH
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STANDARD PENETRATION TEST SUMMARY

BH ID	Depth [m]	Test type	'N' value and blow-counts [Seating blows/Test blows]	N ₆₀	Casing depth [m]	Water depth [m]	Remarks
WS9A	3.00	S	N = 34 : 7 7/ 7 8 10 9	45	0.00	DRY	

Standard Penetration Test : BS EN ISO 22476:2005 Part 3 Hammer Energy Ratio, Er = 66% [CP boreholes] 79% [WS boreholes]
 * where full penetration not achieved, the reported N₆₀ is based on maximum uncorrected blow-counts of 50
 ** extrapolated N₆₀ value where full penetration not achieved - this is indicative only and should be used with caution [SPT Sheet 2 of 2]

SUMMARY OF CLASSIFICATION TEST RESULTS

BH ID	Depth (m)	Type	w (%)	wL (%)	wP (%)	Pass 425 (%)	IP (%)	Mod IP (%)	IL (%)	LOI (%)	Description
BH1	1.55	U	10	38	19	>95	19		-0.48		Brown sandy CLAY
	4.90	D	33	79	32	>95	47		0.03		Dark brown CLAY
	6.55	U	27								Dark greyish brown CLAY
	9.55	U	26	73	31	>95	42		-0.14		Dark greyish brown CLAY
	12.55	U	26	78	30	>95	48		-0.09		Dark greyish brown CLAY
	15.55	U	20								Dark greyish brown slightly sandy silty CLAY
	18.55	U	26								Dark greyish brown silty CLAY
	21.55	U	25	77	33	>95	44		-0.18		Dark greyish brown slightly sandy silty CLAY
	24.55	U	25	81	33	>95	48		-0.18		Dark greyish brown slightly sandy silty CLAY
	27.55	U	20								CLAYSTONE
BH2B	5.05	U	28	76	32	>95	44		-0.09		Dark greyish brown CLAY
	8.05	U	26								Dark greyish brown CLAY
	11.50	U	25	79	30	>95	49		-0.11		Dark greyish brown slightly sandy silty CLAY
	14.05	U	27								Dark greyish brown slightly sandy silty CLAY
	17.05	U	26	82	31	>95	51		-0.10		Dark greyish brown silty CLAY
	20.05	U	25								Dark greyish brown slightly sandy silty CLAY
	23.05	U	23	79	33	>95	46		-0.23		Dark greyish brown slightly sandy silty CLAY
	26.05	U	25								Dark greyish brown CLAY
29.55	U	25	78	32	>95	46		-0.16		Dark greyish brown CLAY	

Testing in accordance with BS EN ISO 17892 unless specified otherwise Modified Plasticity Index calculated in accordance with NHBC Standards Chapter 4.2 (reported if %passing 425mm <95%) Percent passing 425µm: by estimation, by hand* or by sieving**	Date: 01 Nov 16 (Classification Sheet 1 of 2)
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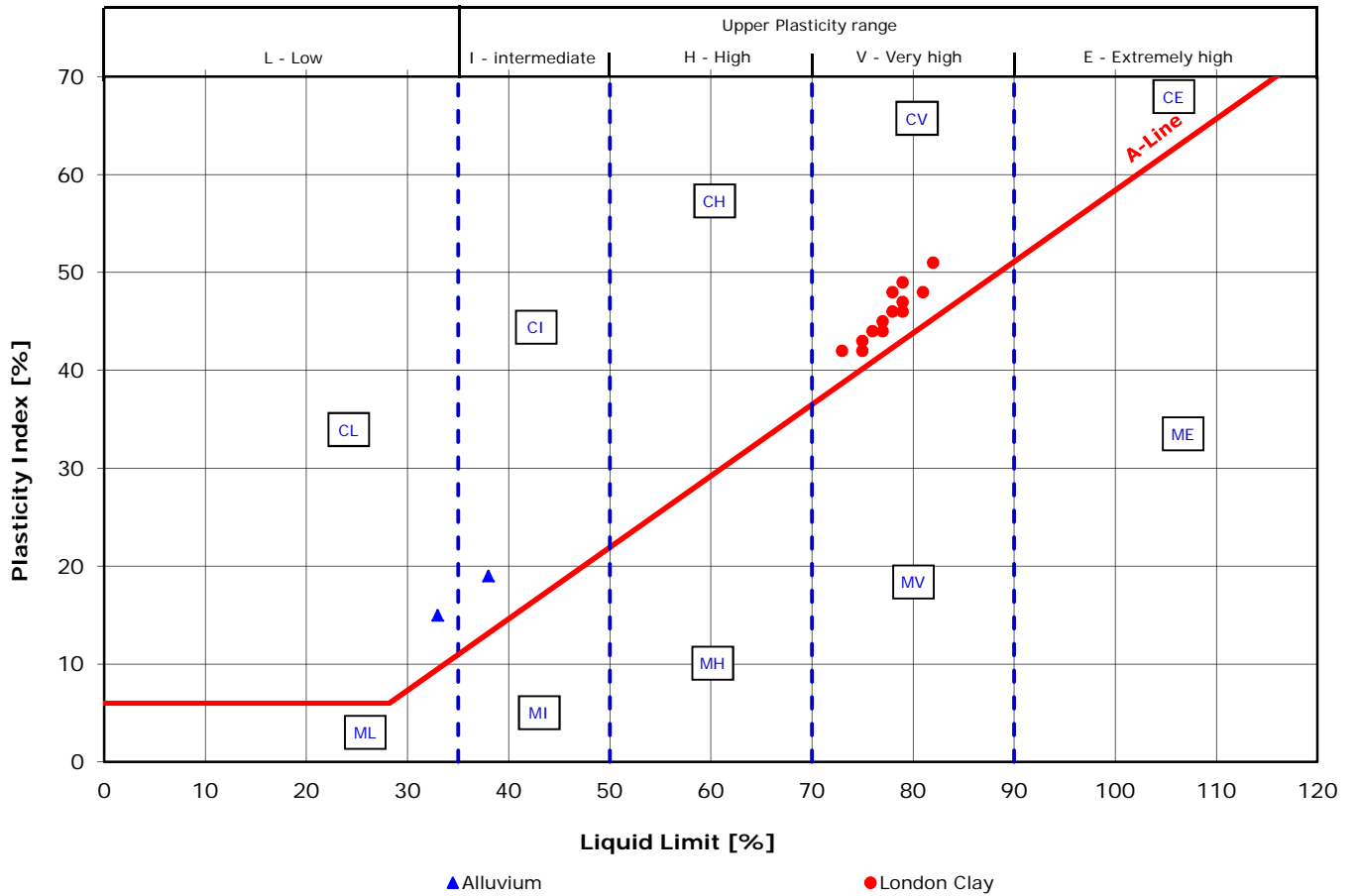
SUMMARY OF CLASSIFICATION TEST RESULTS

BH ID	Depth (m)	Type	w (%)	wL (%)	wP (%)	Pass 425 (%)	IP (%)	Mod IP (%)	IL (%)	LOI (%)	Description
WS10A	3.80	D	31	75	32	>95	43		-0.03		Dark brownish grey CLAY
	5.00	D	28	77	32	>95	45		-0.09		Dark brownish grey CLAY
WS5	2.30	D	20	33	18	93	15	14	0.11		Brownish grey slightly gravelly slightly sandy CLAY
WS9A	3.90	D	32	75	33	>95	42		-0.02		Dark grey, orangish grey and reddish grey mottled CLAY

Testing in accordance with BS EN ISO 17892 unless specified otherwise Date: 01 Nov 16
 Modified Plasticity Index calculated in accordance with NHBC Standards Chapter 4.2 (reported if %passing 425mm <95%)
 Percent passing 425µm: by estimation, by hand* or by sieving** (Classification Sheet 2 of 2)



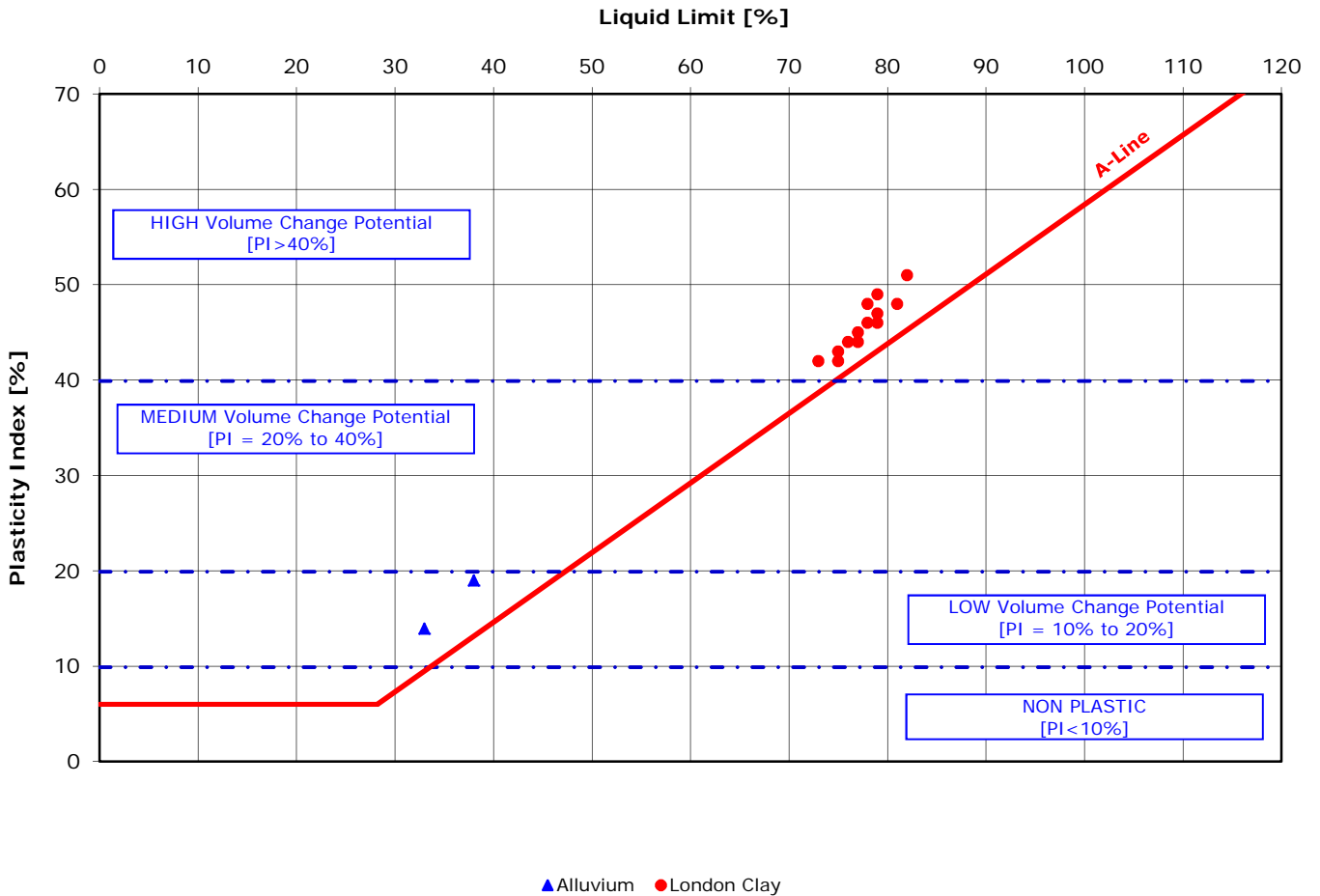
Plasticity Chart



M - SILT [plots below the A-Line]
C - CLAY [plots above the A-Line]

Classification in accordance with BS5930:1999+A2:2010 "Code of practice for site investigations"

Plasticity Chart



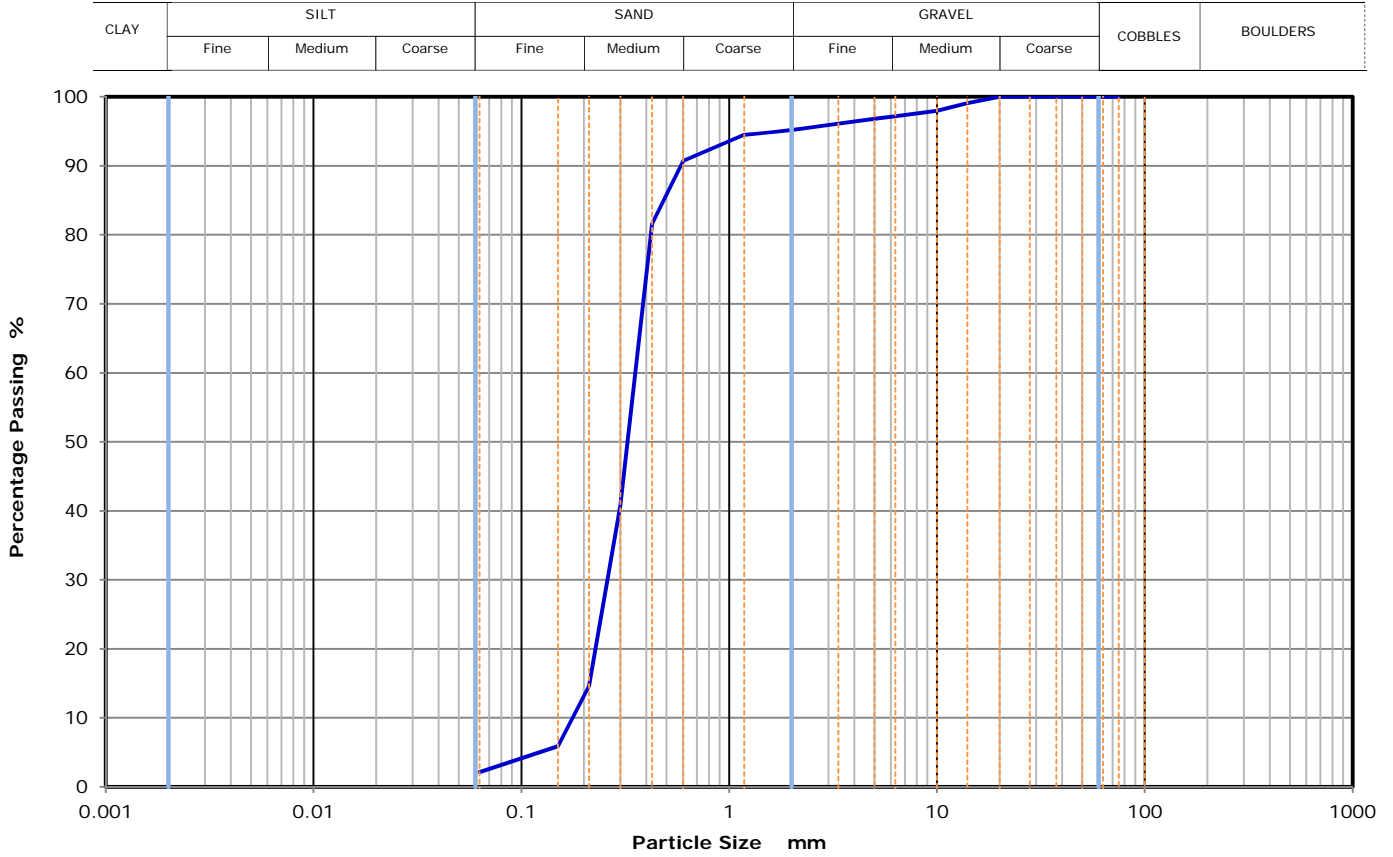
Modified Plasticity Index, I'p:

$$I'p = \frac{I_p \times (\% \text{ passing } 425\text{mm})}{100\%} \quad [\text{where } I_p = \text{Plasticity Index}]$$

Classification in accordance with NHBC Standards, Part 4 'Foundations', Chapter 4.2 'Building near trees'

PARTICLE SIZE DISTRIBUTION

Hole ID: BH1 Depth [m]: 2.55	Description: Light brown slightly silty gravelly SAND
---	--



Sieving	
Size [mm]	% passing
75	100
63	100
50	100
37.5	100
28	100
20	100
14	99.1
10	98
6.3	97.2
5	96.8
3.35	96.1
2	95.2
1.18	94.5
0.6	90.7
0.425	81.6
0.3	40.8
0.212	14.6
0.15	5.9
0.063	2.1

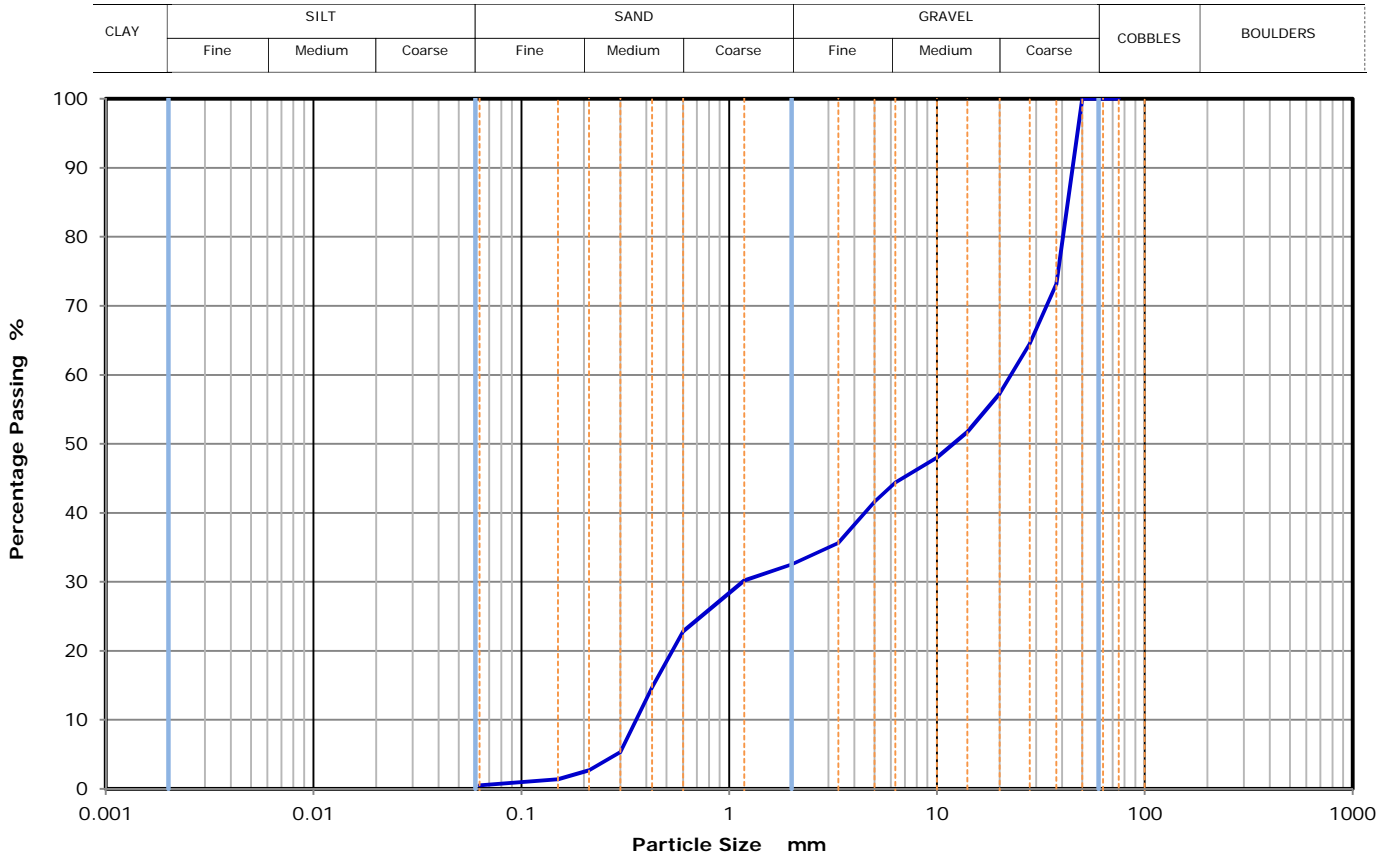
Sample proportions	%
Cobbles	0
Gravel	5
Sand	93
Fines <0.063mm	2

Grading analysis		
D60	mm	0.4
D30	mm	0.3
D10	mm	0.2
Uniformity Coefficient		2.0
Curvature Coefficient		1.1

Test method and date	
Testing in accordance with BS EN ISO 17892:	
Wet sieving method	
Reporting date:	08 Nov 16

PARTICLE SIZE DISTRIBUTION

Hole ID: BH1 Depth [m]: 3.55	Description: Light brown slightly silty very sandy GRAVEL
---	--



Sieving	
Size [mm]	% passing
75	100
63	100
50	100
37.5	73.1
28	64.5
20	57.3
14	51.7
10	48
6.3	44.4
5	41.6
3.35	35.6
2	32.5
1.18	30.2
0.6	22.8
0.425	14.7
0.3	5.3
0.212	2.7
0.15	1.4
0.063	0.5

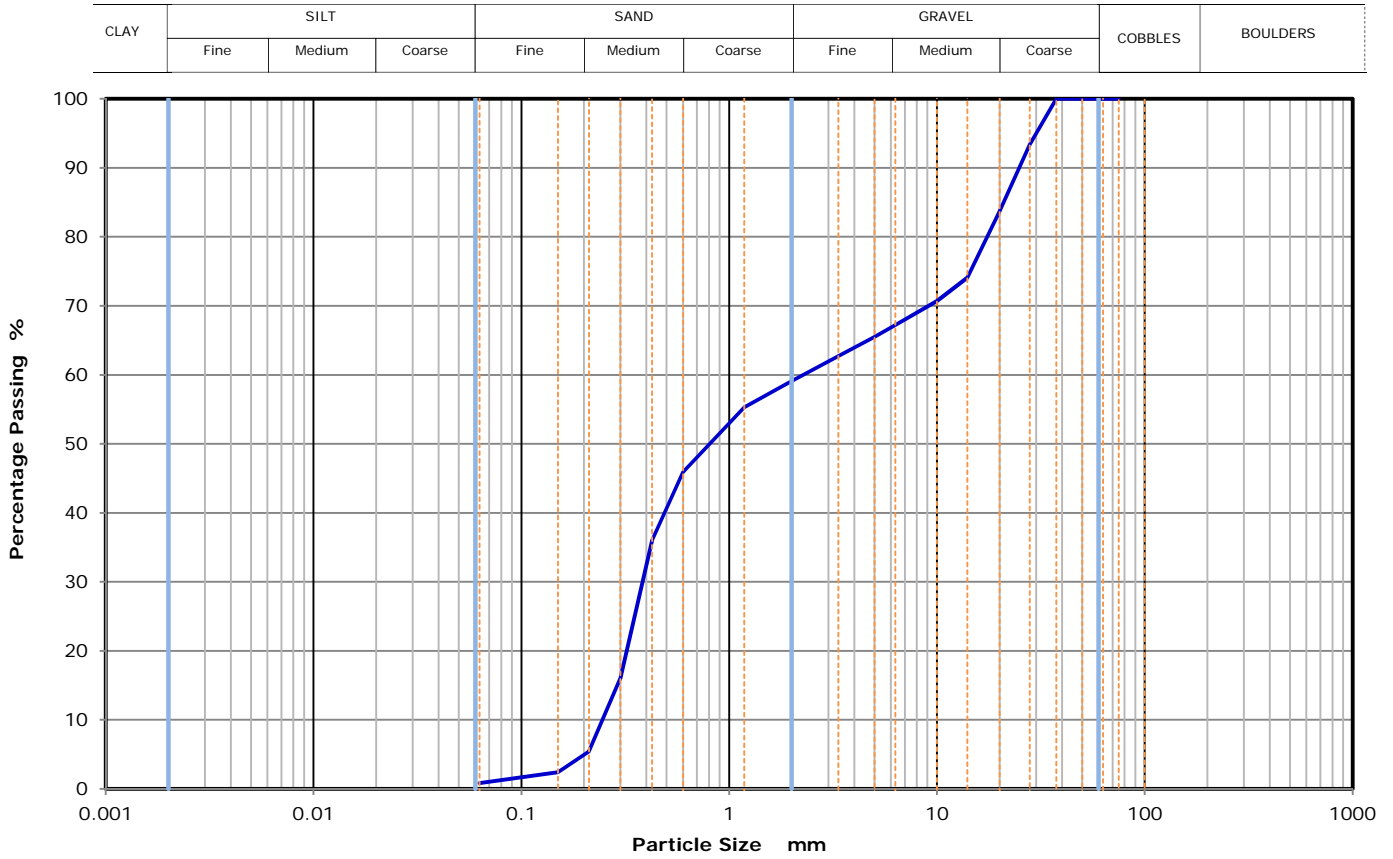
Sample proportions	%
Cobbles	0
Gravel	68
Sand	32
Fines <math><0.063\text{mm}</math>	1

Grading analysis		
D60	mm	22.7
D30	mm	1.2
D10	mm	0.4
Uniformity Coefficient		63.5
Curvature Coefficient		0.2

Test method and date	
Testing in accordance with BS EN ISO 17892:	
Wet sieving method	
Reporting date:	08 Nov 16

PARTICLE SIZE DISTRIBUTION

Hole ID: BH2B Depth [m]: 2.00	Description: Orangish brown slightly silty very gravelly SAND
--	--



Sieving	
Size [mm]	% passing
75	100
63	100
50	100
37.5	100
28	93.4
20	83.7
14	74.1
10	70.7
6.3	67.2
5	65.5
3.35	62.7
2	59.1
1.18	55.3
0.6	45.9
0.425	36
0.3	16
0.212	5.4
0.15	2.4
0.063	0.8

Sample proportions	%
Cobbles	0
Gravel	41
Sand	58
Fines <0.063mm	1

Grading analysis		
D60	mm	2.3
D30	mm	0.4
D10	mm	0.2
Uniformity Coefficient		9.2
Curvature Coefficient		0.3

Test method and date	
Testing in accordance with BS EN ISO 17892:	
Wet sieving method	
Reporting date:	08 Nov 16