Shoreham Rugby Football Club
Buckingham Park
Shoreham-by-Sea
West Sussex

Geotechnical Assessment Report

Report No. R16-11420

June 2016

Report prepared for the benefit of:

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EXECUTIVE SUMMARY

The following presents a summary of the main findings of the ground investigation. It is emphasised that no reliance should be placed on any individual point until the whole of the report has been read as other sections of the report may put into context the information contained herein.

It is proposed to redevelop the existing Shoreham Rugby Football Club (RFC) building at Buckingham Park, Shoreham-by-Sea, West Sussex. The development proposals comprise the demolition of the existing structure and the construction of a new two storey club house.

Reference to geological datasets indicates that the site is expected to be underlain by Head deposits overlying the White Chalk Subgroup. The ground investigation confirmed the underlying soils to comprise a shallow thickness of made ground, overlying Head deposits, White Chalk Subgroup deposits not having been encountered within the depth of the exploratory holes that extended to a depth of 5.0m below ground level.

The Head and White Chalk Subgroup deposits are classed as Secondary Undifferentiated and Principal aquifers, respectively. The site lies within an Environment Agency Source Protection Zone III (Total Catchment Area) with regard to the protection of the quality of groundwater that is abstracted for potable supply. Groundwater was not encountered during the period of the works or during subsequent monitoring of a standpipe installed at the site.

Precautions against shrinkage and heave for any new foundation system should assume a low volume change potential for the fine grained Head soils and take into account current guidance such as that given by the Building Research Establishment (BRE) or the National House Builders Council (NHBC).

A net allowable bearing capacity of no greater than 150kN/m^2 may be assumed for spread (pad or strip) foundations up to 2.0m across bearing within the Head deposits of at least stiff consistency. The quoted bearing capacity is expected to limit settlement to less than 25mm.

A DS-1 Design Sulfate Class and an AC-1s ACEC classification may be assumed for the design of concrete in contact with the ground.

In view of the variable thickness of made ground and the presence of soils of low volume change potential, it is recommended that ground floors should be suspended. Ground bearing floors may be considered where the conditions outlined in the report are met.

The results from the infiltration tests indicate that the gravelly clay horizons of the Head deposits are likely to be capable of disposing of storm runoff to the ground using infiltration systems. However it is noted that these gravelly clay soils were of limited extent and the clays soils that predominate within the Head deposits are likely to have a very low infiltration rate.

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1. INTRODUCTION

It is proposed to redevelop the existing Shoreham Rugby Football Club (RFC) building at Buckingham Park, Shoreham-by-Sea, West Sussex. The development proposals comprise the demolition of the existing structure and the construction of a new two storey club house.

Ashdown Site Investigation Limited was commissioned to carry out a ground investigation and geotechnical assessment of the site by Mr Elliot Flynn of Hemsley Orrell Partnership, HOP House, 41 Church Road, Hove BN3 2BE.

The scope of the commission and the terms and conditions under which the work was undertaken are set out within the offer letter Q16-4774 dated 28th April 2016. The instruction to proceed was received on behalf of the client, Shoreham RFC, in an email dated 9th May 2016.

The objectives of the works were to:

a) Establish the expected geology and hydrogeology at the site;
b) Investigate the shallow ground and groundwater conditions in the area of the proposed development;
c) Investigate the form of foundations to existing structures; and
d) Provide advice to assist others in undertaking design of spread foundations, ground floors, and soakaways.

2. SITE CONTEXT

2.1 Site Description

The site is located within Buckingham Park, Shoreham-by-Sea, West Sussex, and is centred on the approximate Ordnance Survey national grid reference TQ 2212 0595. A site location plan and exploratory hole location plan are presented as Figure 1 and Figure 2, respectively.

The area under investigation is located within the southern part of Buckingham Park and comprises the area immediately to the north of an existing single storey club house building. A children's playground area was located further to the south of the subject site with tennis courts to the north west. To the north and east, open playing fields were present.

Mature trees were present to the south and south east of the existing club house building. To the north west of the building was an existing soakaway chamber that was some 1.0m deep and recorded to be dry during the period of the works. The topography of the area sloped gently downwards towards the south.

2.2 Expected Geology

Reference has been made to the British Geological Survey lexicon of named rock units and British Geological Survey mapping data. The stratigraphic unit that may be expected to underlie the site is presented in the following table.

Table 1. Expected Geological Strata

Type	Stratum
Superficial Deposits	Head
Bedrock Deposits	White Chalk Subgroup

2.2.1 Head

The superficial Head is a polymict deposit generally comprising clay and sandy clay with variable amounts of gravel and cobbles. The lithology of the Head reflects the nature of the parent solid strata; the gravel and cobble fraction comprising chalk and flint. The material is likely to have been disturbed by intense frost action in a periglacial environment. It is usually poorly sorted but may be stratified where it has been subject to solifluction and/or hillwash and soil creep. It may form infill to solution features within the underlying chalk deposits.

2.2.2 White Chalk Subgroup

The White Chalk Subgroup comprises a weak, white chalk locally with flint bands together with scattered nodular flints. It may be expected to have a deeply convoluted upper surface as a result of solution weathering. The presence of natural cavities in the chalk is very rare and solution features, if present, can be expected to be infilled with Quaternary deposits such as the Head.

The infill material may be significantly weaker than the surrounding chalk. Solution features can comprise pipes extending to several metres deep into the chalk or conical depressions and basin shaped structures.

Historically, chalk deposits were often mined locally. Most commonly historical mines characteristically comprise a narrow shaft with a number of chambers radiating from the base. These structures are colloquially known as "deneholes", "chalk-wells" or "chalkangles". The depth of the features reflects the depth to the underlying chalk bedrock. The shaft width was commonly in the order of 2m to 3m, widening out into galleries at depth. The chalk was extracted for soil improvement and was usually applied directly to fields though sometimes the chalk was processed, typically by burning in kilns where the chalk was used to produce quicklime (calcium oxide). Once they had reached their limits the mines were commonly capped. Various capping techniques were used; examples include the use of upturned trees or brick arching. Records pertaining to the distribution of these localised mines are incomplete, usually being limited to features marked as shafts or the occurrence of circular depressions on historic Ordnance Survey maps. In the field they are most likely to be visible as shallow depressions, if at all.

Inspection of historical mapping dating back to 1874 and site inspection does not reveal the presence of any significant features at the site though, for reasons given above, their presence cannot be fully discounted. It is therefore recommended that all stripped formation levels should be inspected for evidence of historical backfilled shafts as a precaution.

2.3 Hydrogeology

2.3.1 Aquifer Classification

The Environment Agency designates aquifers in accordance with the Water Framework Directive. These designations reflect not only the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

The Head deposits expected beneath the site are classified as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifer designation is usually given in cases where it has not been possible to attribute either Secondary A or B status to a stratum.

The White Chalk Subgroup is classed as a Principal Aquifer. Principal Aquifers comprise deposits that have high intergranular and/or fracture permeability, usually providing a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

2.3.2 Groundwater Source Protection Zones

The site lies within an Environment Agency Source Protection Zone III (Total Catchment Area) with regard to the protection of the quality of groundwater that is abstracted for potable supply.

3. GROUND INVESTIGATION

3.1 Introduction

The ground investigation comprised the excavation of a series of dynamic sampler boreholes and hand dug trial pits with accompanying in situ geotechnical testing. A single groundwater monitoring standpipe was installed in one of the exploratory holes and monitored for a period of three weeks. The fieldwork was carried out on 17th May 2016. The locations of the exploratory holes, specified by Hemsley Orrell Partnership, are shown on Figure 2.

Descriptions of the strata encountered and comments on groundwater conditions are shown in the exploratory hole records given in Appendix A, together with notes to assist in their interpretation.

3.2 Exploratory Holes

3.2.1 Dynamic Sampler Boreholes

Five boreholes (designated WS1 to WS5) were drilled to depths of between 2.0m and 5.0m below ground level.

The boreholes were formed by a series of 1.0m long, open ended, hollow steel tubes of up to 100mm diameter, each containing a removable plastic liner. The tubes, progressively reducing in diameter, were driven into the ground by means of a track-mounted drop weight. Each tube was extracted from the ground using a hydraulically operated jack and the enclosed sample was recovered in its plastic liner.

The system enables sub-samples to be taken for detailed examination and laboratory testing.

3.2.2 Trial Pits

Two pits (designated FP1 and FP2) were excavated using hand-tools to depths of 1.1m and 1.2m below ground level, respectively, to enable inspection of the foundations to the existing building.

In addition a single trial pit (designated TP1) was dug using hand tools to a depth of 0.8m below ground level to enable in situ testing to be carried out.

3.3 Sampling

Disturbed samples of soil were taken at the depths shown in the exploratory hole records and were collected in plastic bags, plastic tubs or amber jars fitted with gas tight lids.

On collection the amber jars were stored in cool boxes with cooling blocks to maintain temperatures below 4°C until transferred to refrigerators upon return to the office and subsequently forwarded to the external accredited chemical testing laboratory.

3.4 In Situ Testing

The depths of in situ testing, together with the test results, are either given on the exploratory hole records or are summarised separately in Appendix A. Notes providing additional information on the tests performed are included in the appendix.

3.4.1 DPSH Dynamic Probe (Super Heavy) Testing

Continuous dynamic probe tests were undertaken adjacent to boreholes WS2, WS3, WS4 and WS5 and at the locations of DP1 and DP2 to depths of between 5.0m and 10.0m below ground level. Probing was undertaken in accordance with BS EN ISO 22476-2:2005 using a super heavy DPSH-B probing geometry.

The DPSH-B configuration is similar to that of the standard penetration test (SPT); the main differences being that the tip comprises a 90° cone, the driving rods are lighter than those used for SPT testing and the blow counts are recorded over 100mm increments rather than 300mm, as is the case for the SPT.

The blow counts recorded and the calculated dynamic point resistances, which account for inertia of the anvil and driving rods, are presented on the borehole records and separately in Appendix A.

3.4.2 Perth Penetrometer Tests

Perth penetrometer tests were undertaken in the soils encountered in the trial pits FP1 and FP2. Testing was carried out in accordance with Australian Standard AS 1289:6.3.3-1997, Method of Testing Soils for Engineering Purposes; no equivalent European or British Standard having been published to date.

3.4.3 Undrained Shear Strength

Undrained shear strength determinations were made in situ within the fine grained soils using a Geonor hand shear vane. Additionally undrained shear strength determinations were made within samples of the fine grained soils held in the dynamic sampler liners using a hand penetrometer.

3.4.4 Soakage Testing

Falling head soakage tests were undertaken within the Head deposits encountered in borehole WS4 with the hole at a depth of 2.0m. The tests were carried out in general accordance with The Soakaway Design Guide published by Kent County Council (2000).

In addition a shallow soakage test was carried out in trial pit TP1 in general accordance with Building Research Establishment (BRE) Digest 365 (1991), other than the pit was filled only once rather than the three times suggested by the digest.

3.5 Installations

A single groundwater monitoring standpipe was installed to a depth of 3m within borehole WS5. A description of the installation is shown on the exploratory hole record in Appendix A.

A groundwater data logger together with a barometric logger was installed within the standpipe on the 17th May and collected on the 8th June 2016. The data loggers were programmed to collect readings at 15 minute intervals. The results of the groundwater monitoring are included within Appendix A.

3.6 Laboratory Testing

Geotechnical testing was undertaken by Ashdown Site Investigation Ltd in accordance with the methods given in BS1377:1990 Parts 1 to 8 'Methods of test for soils for civil engineering purposes'. Chemical testing to enable classification of the chemical environment of soils in accordance with BRE SD1 was undertaken by an external UKAS accredited laboratory. Results from the laboratory tests are provided in Appendix B. Notes to assist with the interpretation of the tests are also contained within appendix.

4. GROUND CONDITIONS

4.1 Stratigraphy

4.1.1 Surface Covering

With the exception of trial pit FP1, each of the exploratory holes was excavated through a surface cover of topsoil some 50mm to 150mm in thickness.

At the location of trial pit FP1 a paving slab overlying sand sub base was recorded.

4.1.2 Made Ground

Made ground, generally comprising gravelly sandy silty clay was recorded to depths of between 0.3m and 0.6m below ground level within each of the exploratory holes. The gravel fraction comprised variable quantities of flint, chalk, concrete, brick, ceramics, breeze block, plastic, ash-like material, charcoal-like material and clinker-like material.

4.1.3 Head

Underlying the made ground, the investigation progressed into undisturbed generally stiff to locally very stiff, slightly sandy, slightly gravelly, silty clay soils with subordinate horizons of gravelly clay soils. These gravelly clay horizons were typically encountered at depths of between 0.7m and 2.0m below ground level. Locally firm clay deposits were recorded in the uppermost part of borehole WS1.

These clay deposits were recorded to a depth of 4.0m below ground level within borehole WS1 and to the full depth of the remaining exploratory holes.

Beneath the clay deposits within boreholes WS1 dense sandy gravel soils were encountered to the full depth of the borehole.

These soils are considered to represent the Head deposits indicated on the published geological map.

4.2 Stability

Each of the exploratory holes was recorded to be stable during the course of excavation.

4.3 Groundwater Conditions

Each of the exploratory holes was recorded to remain dry during drilling / excavation. The data logger installed within the standpipe in borehole WS5 also did not record groundwater during the monitoring period.

4.4 Existing Foundations

Details of the foundations exposed within the foundation inspection pits are included as Figure 3 of this report.

The foundations appeared to comprise mass concrete spread foundations bearing within the Head deposits at depths of 1.0m and 1.1m below ground level in FP1 and FP2, respectively.

5. GEOTECHNICAL ASSESSMENT

The geotechnical assessment has been prepared in connection with the development proposals shown in the Ground Investigation Works Tender Document produced by Hemsley Orrell Partnership (Reference 14806.01.SIT dated April 2016).

In summary the document indicates the proposed development to comprise demolition of the existing building and the construction of a new two storey club house.

At the time of writing, no details were available concerning the specific loads likely to be applied to the foundations.

5.1 Foundations

5.1.1 Soil Shrinkage/Heave Potential

The fine grained soils of the Head have been classified as clays of low to high plasticity and with modified plasticity indices in the range of 2% to 19% the soils may be expected to exhibit a non plastic to low volume change potential.

It is recommended that the design of precautions against shrinkage and heave for any new foundation system should assume a low volume change potential for the fine grained Head soils and take into account current guidance such as that given by the Building Research Establishment (BRE) or the National House Builders Council (NHBC).

Whilst this report has been prepared to provide advice to assist designers in undertaking detailed design, the report itself does not represent a detailed design statement. It is recommended that an arboricultural survey of the site should be conducted to establish the species and maturity of the existing trees in the areas of the proposed new buildings. The survey should be extended to include a review of historical photographs and detailed site plans (if available) to establish the species and location of any felled trees that may affect foundation design. The information obtained from the arboricultural survey, information on proposed planting schemes and the findings of this report should be provided to the structural engineer responsible for the detailed design of foundation systems, including assessment of minimum founding depths for spread foundations, requirements for sleeving or reinforcing of piled foundations and requirements for placement of void formers et cetera.

5.1.2 Spread Foundations

Unless evidence exists to the contrary, all made ground and any soils disturbed by the construction or removal of any previously existing foundations or services should be regarded as being variable in nature and state of compaction and, as such, unsuitable as a founding medium for shallow footings. New footings should be constructed so as to bear below such soils and onto undisturbed, competent, natural deposits.

For design purposes, a net allowable bearing capacity of no greater than 150kN/m^2 may be assumed for spread (pad or strip) foundations up to 2.0m across bearing within the Head deposits. In the event that firm soils are encountered and are to remain beneath foundations a reduced bearing capacity of no greater than 100kN/m^2 should be adopted for foundations limited to 1.0m width. The quoted bearing capacities are expected to limit settlement to less than 25mm. In general a minimum depth to formation of 0.75m should be adopted, although

foundations should be deepened where made ground is found to extend below the advised minimum foundation depth or where there is a requirement to deepen foundations to comply with NHBC / BRE guidance to protect foundations against seasonal soil volume changes induced by trees.

5.2 Groundwater

Groundwater was not encountered during the period of the intrusive works or during the subsequent monitoring period.

It is possible that heavy precipitation during construction could lead to the ingress of perched groundwater or surface water run-off into excavations. In such circumstances it would be expected that water entering into excavations would be adequately managed by pumping from sumps.

5.3 Stability of Excavations

All made ground or coarse grained natural soils exposed in excavations should be assumed to be unstable, even in the short term. Whilst fine grained natural soils may remain stable for a short period of time if not subjected to surcharge loads (such as may be imposed by existing foundations, traffic or storage of materials), the stability of these soils if left unsupported should be assumed to have the potential to deteriorate. Where stable excavations are required excavations should either be suitably supported or side slopes should be battered back to a safe angle of repose.

All excavations requiring human entry must be shored or battered as necessary to conform to current best practice, as accepted by the Health and Safety Executive (HSE); relevant guidance is given on the HSE website (www.hse.gov.uk). Current legislation requires that where personnel access is required into any excavation a competent person must inspect excavation supports or battering of slopes at the start of the working shift and at other specified times. No work should take place until the excavation is safe. Excavations should also be inspected after any event that may have affected their stability, such as a significant weather event, changes in surcharge loadings imposed by temporary storage of materials or changes in site traffic plans or alteration of support systems. Inspections should be formally recorded and any faults that are found should be corrected immediately.

5.4 Aggressivity to Concrete

In view of the soils encountered beneath the site it is considered that 'natural ground conditions' may be assumed for the purpose of assessing the aggressivity of the chemical environment for concrete classification (ACEC class). Given that groundwater was not encountered, 'static groundwater' conditions may be assumed.

Assessment of the chemical analysis of the soil indicates a sulphate content falling into Design Sulfate Class DS-1 of Table C1 of the Building Research Establishment Special Digest No 1 "Concrete in aggressive ground", 2005. The results of the pH tests indicate that the underlying soils are slightly alkaline.

In accordance with the digest, a DS-1 Design Sulfate Class and an AC-1s ACEC classification may be assumed for the design of concrete in contact with the ground.

5.5 Ground Floors

In view of the variable thickness of made ground and the presence of soils of low volume change potential, it is recommended that ground floors should be suspended.

Current guidance suggests that ground bearing floor slabs may, however, be considered where made ground soils are not present or are to be removed from beneath building footprints and the depth of foundations required to protect against seasonal soil volume changes close to trees is less than 1.5m. In such circumstances further works should be undertaken to demonstrate, that close to the time of construction, no significant soil desiccation is present. If ground bearing floors are adopted it is recommended that the potential for differential movement, both between the floor slab and walls and across the floor slab itself, should be anticipated. Such floors should be fully debonded from walls. Formations should be adequately proof rolled and any excessively soft materials excavated and replaced with a suitable, well graded granular fill. The depth of any fill should be limited to a maximum of 600mm unless placed to an engineering specification designed to limit internal settlement of the fill materials to a tolerance to be advised by the designer.

The detailing of services through, or under, ground-bearing floors should incorporate flexible connections and, where appropriate, enhanced falls.

5.6 Stormwater Infiltration Systems

In situ infiltration testing was undertaken within borehole WS4 in accordance with 'The Soakaway Design Guide' published by Kent County Council (July 2000). From the test results, calculations were made to estimate the infiltration rate that could be expected for soakaways constructed to discharge into the underlying soils within the test zone.

In addition a shallow in situ infiltration testing was carried out within trial pit TP1 in general accordance with the requirements of BRE 365 'Soakaway Design'. During the test performed, the water level within the test pit did not fall below 25% of the initial test depth and calculation of the soil infiltration rate in accordance with the BRE digest was not possible. The soil infiltration rate has therefore been calculated by dividing the volume of water lost during the test by the product of the average surface area of the trial pit in contact with water during the test period and the test duration in seconds.

The infiltration rates derived from the tests are summarised in the following table.

Table 2. Calculated Infiltration Rates

Exploratory Hole	Test Response Zone Depth (m)		Stratum	Infiltration Rate (f) (m/sec)	Driving Head of Water (m)
	Top	Bottom			
WS4 Test 1	1.00	2.00	Head – Gravelly Clay	1.25×10^{-4}	1.0
WS4 Test 2	1.00	2.00	Head – Gravelly Clay	1.50×10^{-4}	1.0
WS4 Test 3	1.00	2.00	Head – Gravelly Clay	1.20×10^{-4}	1.0
TP1	0.34	0.80	Head – Clay and Gravelly Clay	2.50×10^{-6}	-

The value 'f' is equivalent to the soil infiltration coefficient 'q' quoted in the Construction Industry Research and Information Association (CIRIA) Report 156.

The results of the infiltration tests indicate that the gravelly clay horizons of the Head deposits are likely to be capable of disposing of storm runoff to the ground using infiltration systems. However it is noted these gravelly clay soils were of limited extent and the clay soils that predominate at the site are likely to have a very low infiltration rate. In view of the above and that storage of water may be limited it may be prudent to carry out larger scale soakage testing at the proposed soakaway location in advance of finalising the design.

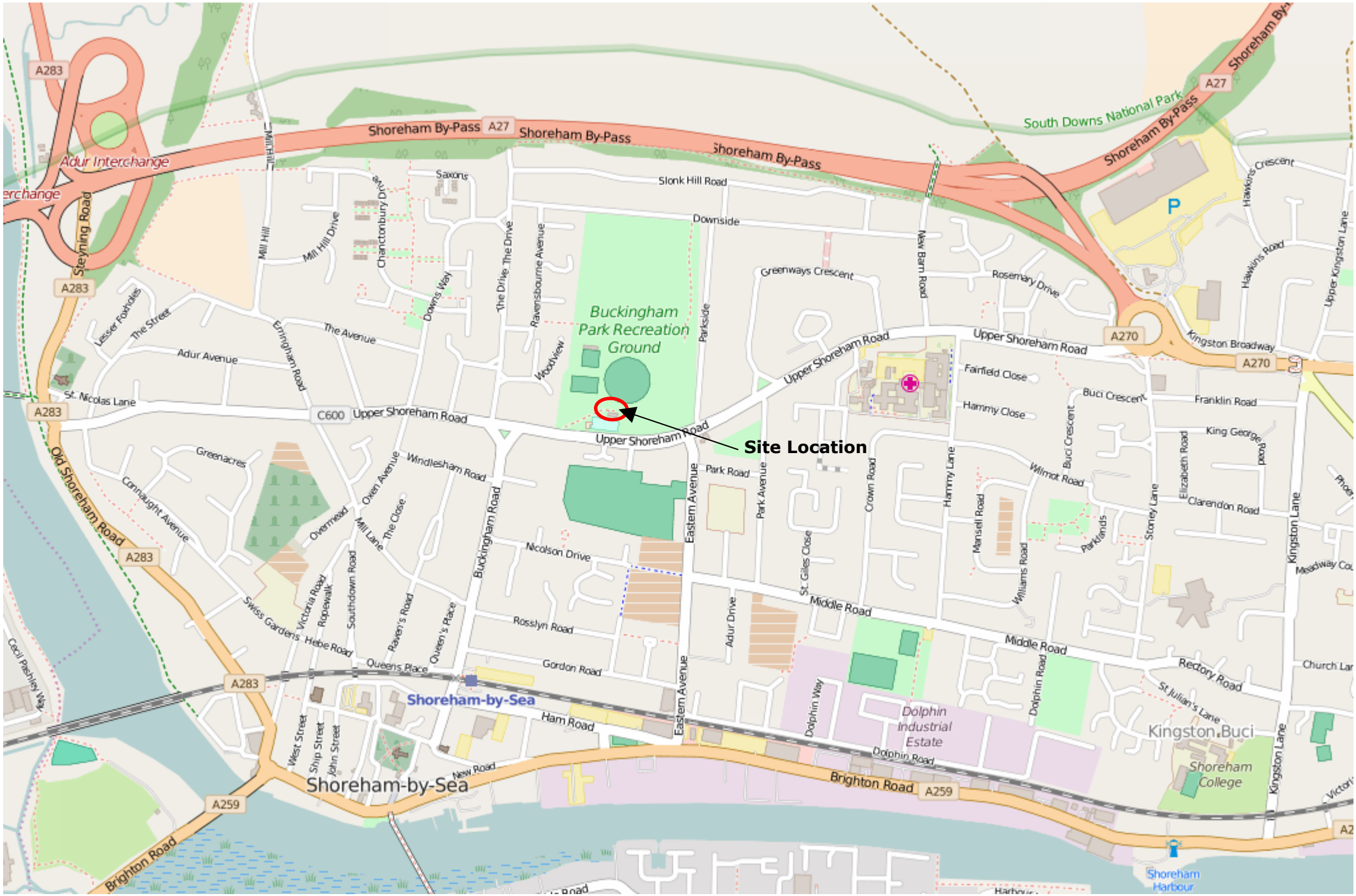
To minimise the risk of subsidence, and in view of the presence of underlying chalk strata, point discharging infiltration systems (conventional ring or trench soakaways) should be constructed a minimum of 10.0m away from proposed or existing buildings.

In the event that discharge to ground via infiltration systems is proposed, it is recommended that designers the system provides for the prevention of pollution of groundwater. In this regard appropriate consideration should be given to whether there is a need for inclusion of interceptors and oil separators. The Local Authority and/or relevant water company should be consulted in relation to consent for discharge of water from rooftops, areas of hardstanding and roadways to drains.

Ashdown Site Investigation Ltd.
June 2016

FIGURES

Figure 1 Site Location Plan
Figure 2 Exploratory Hole Location Plan
Figure 3 Foundation Details



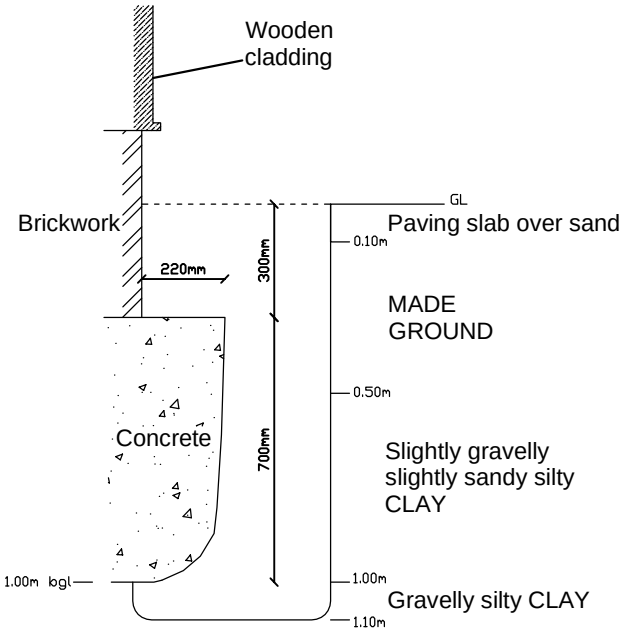
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ASHDOWN SITE INVESTIGATION LIMITED	Site: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex	Site Location Plan. Not To Scale	Figure 1 R16-11420

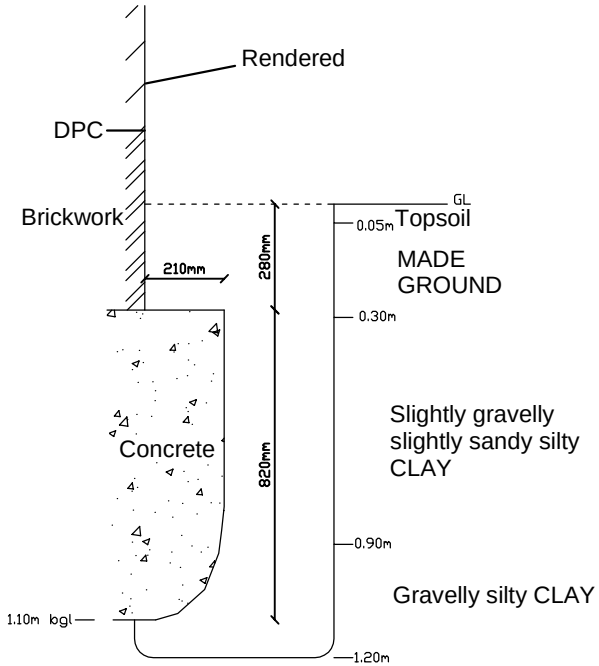


ASHDOWN SITE INVESTIGATION LIMITED	Site: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex	Exploratory Hole Location Plan. Not To Scale	Figure 2 R16-11420

FP1



FP2



ASHDOWN SITE INVESTIGATION LIMITED

The Old Dairy,
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Lewes,
East Sussex
BN7 3PF
Tel: 01273 483119 Fax: 01273 483104
email: contact@ashdownsi.co.uk

DRAWN BY:	DATE:	SCALE (at A4):
TSH	June 2016	1:20

SITE:
Shoreham RFC
Buckingham Park
Shoreham-by-Sea
West Sussex

REPORT REF.:	FIGURE NO.:
R16-11420	3

DRAWING TITLE:
Foundation Details

APPENDIX A

Exploratory Hole Notes
In Situ Testing Notes
Exploratory Hole Records
DPSH-B Dynamic Probe Records
Summary of Borehole Falling Head Soakage Test Results
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NOTES FOR THE INTERPRETATION OF EXPLORATORY HOLE RECORDS

1 Symbols and abbreviations

Samples

U 'Undisturbed' Sample: - also known as 'U100' or 'U4' - 100mm diameter by 450mm long. The number of blows to drive in the sampling tube is shown after the test index letter in the SPT column.
Uo Sample not obtained.
U* Full penetration of sample not obtained.
Pi Piston Sample: 'Undisturbed' sample 100mm diameter by 600mm long.
D Disturbed Sample.
R Root Sample.
B Bulk Disturbed Sample.
W Water Sample.
J Jar Sample (sample taken in amber glass jar fitted with gas tight lid)
T Tub Sample
Vi Vial Sample

In situ Testing

S Standard penetration test (SPT): In the borehole record the depth of the test is that at the start of the normal 450mm penetration. The number of blows per 75mm penetration is recorded, with the initial 150mm for seating blows being recorded followed by the blows recorded for the remaining 300mm of the test. The total blows to achieve the standard penetration of 300mm, discounting the seating blows, is noted as the N value on the log. Where the full penetration of the test cannot be achieved (a refusal) the number of blows achieved and the penetration achieved will be reported.

C Standard Penetration Test (SPT) conducted usually in coarse grained soils or weak rocks using the same procedure as for the SPT but with a 50mm diameter, 60º apex solid cone fitted in place of the sampler. Variations in test results are indicated by the same symbols as for the SPT (above).

V Shear Vane Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.

H Hand penetrometer Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.

P Perth Penetrometer Test: See "In Situ Testing Notes" for full description. Number of blows for 300mm penetration shown under Vane/Pen Test and N Value column. In sand the number of blows is approximately equivalent to the SPT "N" value.

Excavation Method

CP Cable Percussion Borehole
WLS Dynamic Sampler Borehole using windowless sampler tubes
WS Dynamic Sampler Borehole using window sampler tubes
TP Trial Pit excavated using mechanic excavator
HDP Trial Pit excavated using hand tools

2 Soil Description

Description and classification of soils has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of soil, Part 1 Identification and description (BS EN ISO 14688-1:2002+A1:2013) and Part 2 Principles of classification (BS EN 14688-2:2004+A1:2013) as well as the BS5930:2015 code of Practice for Ground Investigations.

Fine Grained Soils

The consistency of fine grained soils given in the report is based on visual inspection of the samples and the strength is based on results of in situ and/or laboratory undrained shear strength tests when carried out.

The consistency is determined on the following basis:

Consistency	**Manual Test**
Very Soft	Soil exudes between fingers when squeezed in hand
Soft	Soils can be moulded by light finger pressure
Firm	Cannot be moulded by finger but rolled to 3mm threads without breaking/crumbling
Stiff	Crumbles/breaks when rolled to 3mm thick threads but can be moulded into a lump again
Very Stiff	Cannot be moulded and crumbles under pressure, can be indented by thumbnail

The terms used for the designation of the undrained shear strength are as follows:

Undrained Shear Strength	
Extremely to Very Low	<20 kPa
Low	20-40 kPa
Medium	40-75 kPa
High	75-150 kPa
Very High	150-300 kPa
Extremely high	300-600 kPa

Note: The undrained shear strength of the soils is measured either by laboratory testing or in the field using hand shear vane.

It is recognised that any coarse grained soil that has in excess of approximately 35% fine grained soil (clay and silt) can often be expected to behave as a fine grained soil despite the dominance of coarse grained material within the soil mass. To reflect this, it is the soil type that dominates the behaviour of the soil mass that appears on the exploratory hole records.

Coarse Grained Soils

The relative densities of coarse grained soils (sand and gravel) given in the report are based on field estimations and the results of the Standard Penetration Test (SPT) and equivalent correlation from other testing. The classification in terms of "N" Values is as follows:

SPT 'N' Value	**Relative Density**
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Greater than 50	Very Dense

3 Rock Description

Description and classification of rocks has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of rock, Part 1 Identification and classification (BS EN ISO 14689-1:2003) as well as the BS5930:2015 code of Practice for Ground Investigations.

The description of rock mass includes the type of rock, structure, discontinuities and weathering.

The unconfined compressive strength of rock material is determined on the following basis:

Term	**Field Identification**	**Unconfined Compressive Strength (MPa)**
Extremely Weak	Indented by thumbnail	Less than 1
Very Weak	Crumbles under firm blows with point of geological hammer, peeled by pocket knife	1 to 5
Weak	Peeled by pocket knife with difficulty, shallow indentations made by firm blow with geological hammer	5 to 25
Medium Strong	Cannot be peeled or scraped with knife, can be fractured with single firm blow of geological hammer	25 to 50
Strong	Requires more than one blow of geological hammer to fracture	50 to 100
Very Strong	Requires may blows of geological hammer to fracture it	100 to 250
Extremely Strong	Can only be chipped with geological hammer	Greater and 250

The terms describing discontinuity and bedding spacing are as follows:

Bedding Thickness	
Very Thick	>2000mm
Thick	2000-600mm
Medium	600-200mm
Thin	200-60mm
Very Thin	60-20mm
Thickly Laminated	20-6mm
Thinly Laminated	<6mm

Discontinuity Spacing	
Very Wide	>2000mm
Wide	2000-600mm
Medium	600-200mm
Close	200-60mm
Very Close	60-20mm
Extremely Close	<20mm

Chalk

Chalk description is based on BS EN ISO 14688, BS EN ISO 14689 and BS5930. The classification of chalk generally follows the guidance offered by the Construction Industry Research and Information Association (CIRIA) C574, 'Engineering in Chalk'. This is based on assessment of chalk density, discontinuity and aperture spacing, and the proportion of intact chalk to silt of chalk. See additional chalk classification notes.

IN SITU TESTING NOTES

1 Standard Penetration Testing

Standard penetration testing (SPT) is carried out within a cased cable percussion borehole. The test is performed using a either a split spoon (barrel) sampler in finer grained deposits, or, in coarser grained soils or weak rocks, using a 50mm diameter, 60º apex solid cone fitted in place of the sampler.

The sampler is driven into the deposits at the base of the borehole by means of a 63.5kg hammer falling freely through 760mm.

In the borehole record the depth of the test is that at the start of the normal 450mm penetration, the number of blows to achieve the standard penetration of 300mm (the "N" value) is shown after the test index letter, but the seating blows through the initial 150mm penetration are not reported unless the full penetration of 450mm cannot be achieved.

(BS EN ISO 22476-3:2005+A1:2011, Geotechnical investigation and testing – Field Testing, Part 3 and BS5930:2015 code of practice of for ground investigations)

2 Dynamic Probe Testing

The DPH (heavy) dynamic probing rig drives a 32mm diameter rod with a 15cm^2 area, 90º end cone into the ground by means of a 50kg hammer which falls freely through a distance of 0.5m. The number of blows per 100mm penetration (N_{100}) is recorded.

The DPSH (super heavy) dynamic probing rig drives a 35mm diameter rod with a 20cm^2 area, 90º end cone into the ground by means of a 63.5kg hammer that falls freely through a distance of 0.75m. The number of blows per 100mm penetration (N_{100}) is recorded. The results can provide a useful indication of the relative strength of the material. The dynamic probing is carried out in accordance with BS EN ISO 22476-2:2005+A1:2011 and BS5930.

3 Perth Penetrometer Test

In this test a hardened stainless steel rod is driven into the deposit by a 9.5kg sliding hammer falling freely through 600mm. After an initial penetration of 150mm the number of blows required to drive the rod a further 300mm is recorded. In sand the Perth blow count gives a close correlation to the "N-value" that could be expected from a standard penetration test (SPT) made in similar materials. The results are less reliable in coarser grained materials but can give an indication of their engineering properties. The perth penetrometer test is carried out in accordance with the Australian Standard AS 1289:6.3.3-1997, Method of Testing Soils for Engineering Purposes, there is no European equivalent code.

4 Undrained Shear Strength

Undrained shear strength determinations are made in situ within the fine grained soils using a Geonor hand shear vane or (usually in the case of window sampler boreholes) a hand penetrometer. The test records the undrained shear strength (cohesion) in kN/m^2. The shear vane records a maximum shear strength of 130kN/m^2 and the hand penetrometer records a maximum shear strength of 250kN/m^2.

3 California Bearing Ratio Test

In this test a hand held Farnell cone penetrometer apparatus is pushed into the deposits for the estimation of the California bearing ratio of the subgrade (for use in pavement design). The test equipment is design for the estimation of the bearing ratio of fine grained soils (clay and silt) only and is unsuitable for use in coarse grained soils and rock.

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Site Name: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex

Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Borehole Number: **WS1** Sheet 1 of 1

Standpipe	Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Dynamic Probe Blows/100mm 0 5 10 15 20 25 30	Legend	Depth	Stratum Description
							0.00	Topsoil.
	J T	0.20					0.10	MADE GROUND: Brown slightly gravelly silty clay. Gravel is angular to subrounded fine to coarse flint and plastic.
	D	0.50					0.30	Firm brown slightly gravelly CLAY. Gravel is angular to subangular fine to coarse flint.
	J T	1.10					0.70	Stiff light brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint and chalk. (Head)
	D	1.30						
	D	1.80						becoming very clayey GRAVEL towards base.
	J T	2.00					2.00	Stiff to very stiff orange brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint and chalk. (Head)
	D	2.50						
	H	2.80		170				
	V	3.00		90			3.00	Stiff light orange and yellow brown slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to medium chalk and rare flint. (Head)
	H	3.20		115				
	D	3.50						with much gravel of chalk below 3.50m depth.
	H	3.50		115				
	D	4.50					4.00	Dense grey brown sandy angular to rounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (Head) limited sample recovery below 4.00m depth.
							5.00	End of borehole at 5.00m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: WLS

Borehole Diameter: Various

Made By: SA

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Site Name: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex

Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Borehole Number: **WS2** Sheet 1 of 1

Standpipe	Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Dynamic Probe Blows/100mm 0 5 10 15 20 25 30	Legend	Depth	Stratum Description
							0.00	Topsoil.
	J T	0.20					0.05	MADE GROUND: Brown slightly gravelly silty clay. Gravel is subangular to subrounded fine to coarse flint with a trace of brick.
	J T	0.60					0.40	Stiff light brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse flint and chalk. (Head)
	D	0.90						
	D	1.20						
	J T	1.50						
	D	1.90					1.90	
	V	2.00		>130				Stiff orange brown slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to medium flint and chalk. (Head)
	H	2.20		115				
	D	2.50						
	H	2.50		115				
	H	2.80		195				
								becoming firm below 3.00m depth.
	D	3.50						
	H	3.50		60				
	H	3.80		60				
							4.00	End of borehole at 4.00m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: WLS

Borehole Diameter: Various

Made By: SA

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Site Name: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex

Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Borehole Number: **WS3**

Standpipe	Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Dynamic Probe Blows/100mm 0 5 10 15 20 25 30	Legend	Depth	Stratum Description
							0.00	Topsoil.
	J T	0.20					0.10	MADE GROUND: Brown slightly gravelly silty clay. Gravel is angular to subrounded fine to coarse flint and brick.
	D	0.60					0.40	Stiff brown slightly sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint and chalk. (Head)
	J T	0.80						
	V	1.00		>130				
	D	1.20					1.10	Stiff light brown slightly sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint, chalk and sandstone. (Head)
	J T	1.50						
	D	1.80						
							2.00	Stiff orange brown slightly gravelly silty CLAY. Gravel is angular to subrounded fine to coarse flint and chalk. (Head)
	D	2.50						
							3.00	End of borehole at 3.00m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: WLS

Borehole Diameter: Various

Made By: SA

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Site Name: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex

Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Borehole Number: **WS4** Sheet 1 of 1

Standpipe	Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Dynamic Probe Blows/100mm 0 5 10 15 20 25 30	Legend	Depth	Stratum Description
							0.00	Topsoil.
	J T	0.20					0.10	MADE GROUND: Brown slightly gravelly silty clay. Gravel is angular to subangular fine to coarse flint and charcoal-like material with a trace of brick.
	J T	0.40					0.30	
	H	0.50		115				Stiff dark brown slightly gravelly silty CLAY. Gravel is angular to subrounded fine to coarse flint. (Head)
	D	0.70					0.80	
	J T	1.00						Stiff light brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint, chalk and sandstone. (Head)
	V	1.00		90				
	D	1.20						
	D	2.00					2.00	
	V	2.00		100				End of borehole at 2.00m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: WLS

Borehole Diameter: Various

Made By: SA

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Site Name: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex

Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Borehole Number: **WS5**

Standpipe	Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Dynamic Probe Blows/100mm 0 5 10 15 20 25 30	Legend	Depth	Stratum Description
							0.00	Topsoil.
							0.15	MADE GROUND: Dark brown slightly gravelly silty clay. Gravel is subangular to subrounded fine to coarse flint, concrete and breeze block.
	J T	0.30						
	D	0.40						
							0.60	Very stiff brown gravelly silty CLAY. Gravel is angular to subrounded fine to coarse flint. (Head)
	D	0.80						
	H	0.80		170				
							1.00	Very stiff light brown sandy gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded fine to coarse flint and chalk. (Head)
	J T	1.10						
	H	1.20		225				
	D	1.50						
	H	1.50		195				
	H	1.80		115				becoming stiff below 1.80m depth.
	D	1.90						
							2.00	Stiff orange brown slightly gravelly silty CLAY. Gravel is angular to subrounded fine to coarse flint. (Head)
	H	2.20		115				
	D	2.50						
	H	2.80		170				becoming stiff towards base.
							3.00	End of borehole at 3.00m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: Standpipe installed to 3.00m depth; 3.00m to 1.00m slotted pipe with gravel surround; 1.00m to ground level plain pipe with bentonite seal; completed with end cap and security cover concreted flush with ground surface.

Excavation Method: WLS

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Trial Pit Number: **TP1**

Samples and In Situ Testing				Legend	Depth/ Reduced Level	Stratum Description
Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result			
					0.00	Topsoil.
J T	0.20				0.10	MADE GROUND: Brown slightly gravelly silty clay. Gravel is angular to subrounded fine to coarse flint and brick.
					0.30	Stiff brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint and chalk. (Head)
D	0.60					
D	0.75				0.70	Stiff light brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint, chalk and sandstone. (Head)
J T	0.75				0.80	End of trial pit at 0.80m

Remarks

Groundwater: Trial pit dry on completion.

Stability: Trial pit stable on completion.

Notes: n/a

Excavation Method: HDP

Pit Length: 0.27m

Pit Width: 0.24m

Made By: SA

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Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Trial Pit Number: **FP1**

Sample/ Test Type	Samples and In Situ Testing: Depth From (m)	Depth To (m)	Test Result	Legend	Depth/ Reduced Level	Stratum Description
					0.00	Paving slab (50mm) over,
					0.10	Sand.
J T	0.20					MADE GROUND: Brown slightly sandy gravelly silty clay with a trace of rootlets. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse flint ,concrete, ash-like material, charcoal-like material, brick, ceramic, clinker-like material and chalk with cobbles of concrete.
					0.50	
D	0.60					Stiff orange brown slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to coarse flint. (Head)
P	0.80	1.25	24			
					1.00	
D	1.10				1.10	Stiff yellow brown gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse flint and chalk. (Head)
P	1.25	1.55	19			End of trial pit at 1.10m
P	1.55	1.60	10			

Remarks

Groundwater: Trial pit dry on completion.

Stability: Trial pit stable on completion.

Notes: Perth at 1.55m depth - blow count for 50mm penetration only.

Excavation Method:	HDP
Pit Length:	n/a
Pit Width:	n/a
Made By:	SA

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Job Number: R16-11420

Start Date: 17/05/2016

End Date: 17/05/2016

Trial Pit Number: **FP2**

Sample/ Test Type	Samples and In Situ Testing: Depth From (m)	Depth To (m)	Test Result	Legend	Depth/ Reduced Level	Stratum Description
					0.00	Topsoil.
J T	0.20				0.05	MADE GROUND: Brown slightly sandy gravelly silty clay. Gravel is subangular to subrounded fine to coarse flint, chalk, ash-like material, clinker-like material, plastic, bitumen and brick.
					0.30	Stiff oange brown slightly gravelly slightly sandy silty CLAY. Gravel is fine to coarse flint. (Head)
D	0.60					
P	0.80	1.25	20			
					0.90	
D	1.00					Stiff yellow brown gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse flint and chalk. (Head)
P	1.25	1.55	21		1.20	End of trial pit at 1.20m
P	1.55	1.60	5			

Remarks

Groundwater: Trial pit dry on completion.

Stability: Trial pit stable on completion.

Notes: Perth at 1.55m depth - blow count for 50mm penetration only.

Excavation Method:	HDP
Pit Length:	n/a
Pit Width:	n/a
Made By:	SA

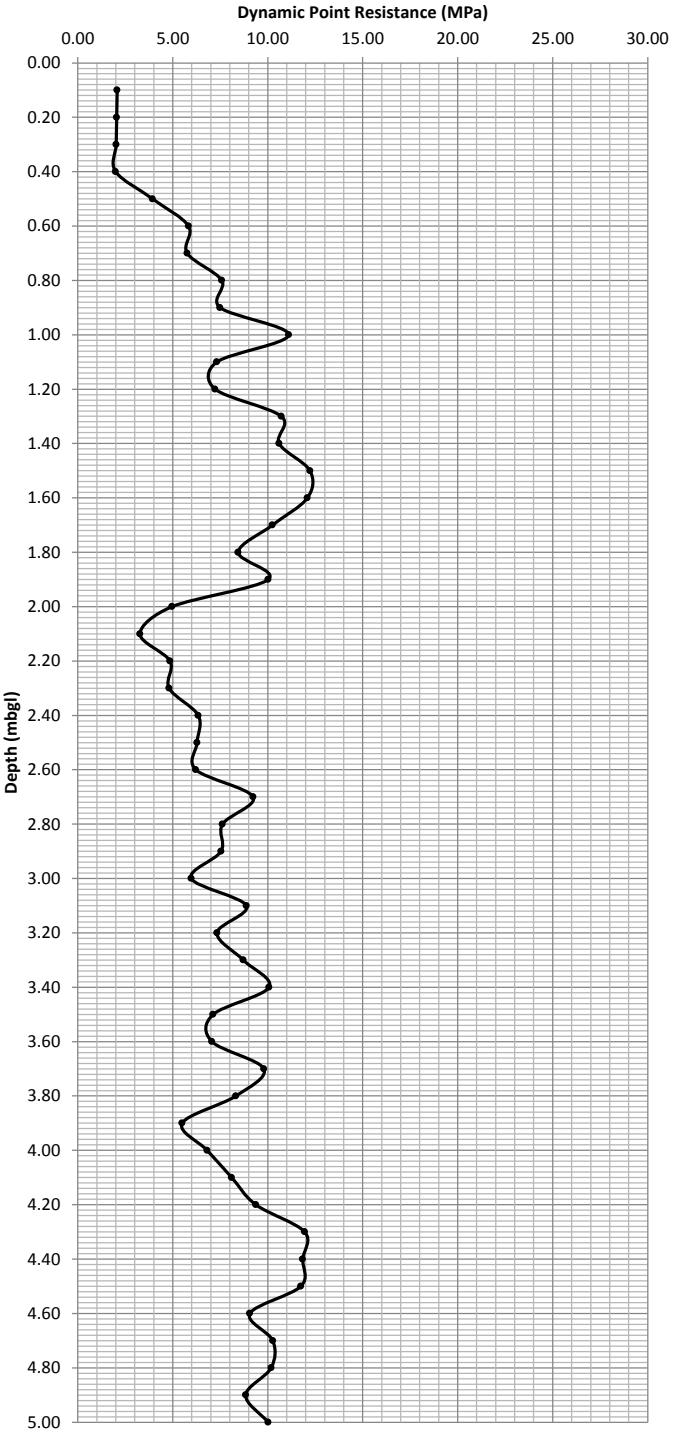
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Dynamic Probe Record

SITE Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex **Report Ref.** R16-11420

Test Location Reference	DP1

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10	1	0.10	2.14	2.07
0.20	1	0.10	2.14	2.05
0.30	1	0.10	2.14	2.02
0.40	1	0.10	2.14	1.99
0.50	2	0.05	4.29	3.94
0.60	3	0.03	6.43	5.83
0.70	3	0.03	6.43	5.76
0.80	4	0.03	8.57	7.58
0.90	4	0.03	8.57	7.49
1.00	6	0.02	12.86	11.10
1.10	4	0.03	8.57	7.31
1.20	4	0.03	8.57	7.23
1.30	6	0.02	12.86	10.72
1.40	6	0.02	12.86	10.60
1.50	7	0.01	15.00	12.22
1.60	7	0.01	15.00	12.09
1.70	6	0.02	12.86	10.25
1.80	5	0.02	10.71	8.45
1.90	6	0.02	12.86	10.02
2.00	3	0.03	6.43	4.96
2.10	2	0.05	4.29	3.27
2.20	3	0.03	6.43	4.86
2.30	3	0.03	6.43	4.81
2.40	4	0.03	8.57	6.34
2.50	4	0.03	8.57	6.28
2.60	4	0.03	8.57	6.21
2.70	6	0.02	12.86	9.23
2.80	5	0.02	10.71	7.61
2.90	5	0.02	10.71	7.54
3.00	4	0.03	8.57	5.97
3.10	6	0.02	12.86	8.88
3.20	5	0.02	10.71	7.33
3.30	6	0.02	12.86	8.71
3.40	7	0.01	15.00	10.07
3.50	5	0.02	10.71	7.12
3.60	5	0.02	10.71	7.06
3.70	7	0.01	15.00	9.79
3.80	6	0.02	12.86	8.32
3.90	4	0.03	8.57	5.50
4.00	5	0.02	10.71	6.81
4.10	6	0.02	12.86	8.10
4.20	7	0.01	15.00	9.37
4.30	9	0.01	19.29	11.94
4.40	9	0.01	19.29	11.84
4.50	9	0.01	19.29	11.74
4.60	7	0.01	15.00	9.06
4.70	8	0.01	17.14	10.27
4.80	8	0.01	17.14	10.18
4.90	7	0.01	15.00	8.84
5.00	8	0.01	17.14	10.02



Notes:

Hammer Mass	63.5	kg
Fall Height	0.76	m
Cone Area	0.0019	m^2
E_{theor}	473	J
Energy Ratio	0.86	
Anvil Mass	1.25	kg
Rod Mass	8.79	kg/m

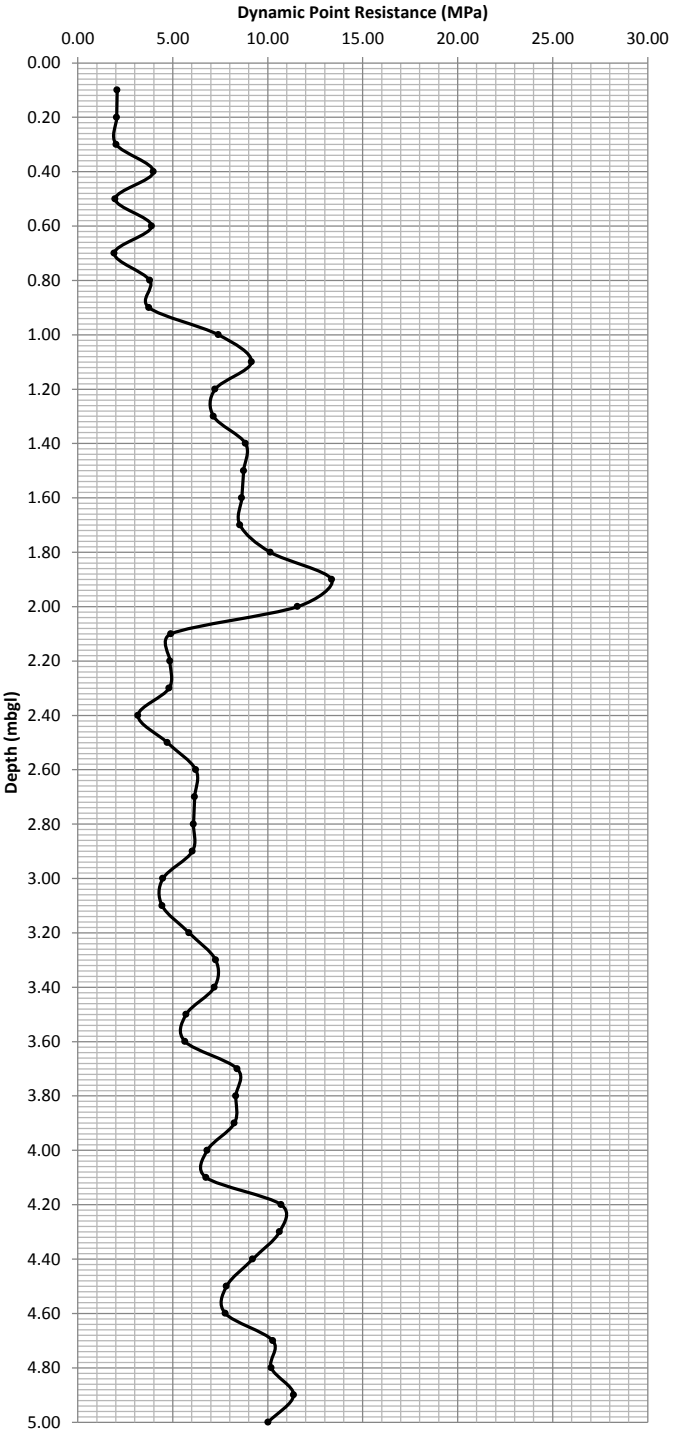
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Dynamic Probe Record

SITE Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex **Report Ref.** R16-11420

Test Location Reference	DP2

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10	1	0.10	2.14	2.07
0.20	1	0.10	2.14	2.05
0.30	1	0.10	2.14	2.02
0.40	2	0.05	4.29	3.99
0.50	1	0.10	2.14	1.97
0.60	2	0.05	4.29	3.89
0.70	1	0.10	2.14	1.92
0.80	2	0.05	4.29	3.79
0.90	2	0.05	4.29	3.75
1.00	4	0.03	8.57	7.40
1.10	5	0.02	10.71	9.14
1.20	4	0.03	8.57	7.23
1.30	4	0.03	8.57	7.15
1.40	5	0.02	10.71	8.83
1.50	5	0.02	10.71	8.73
1.60	5	0.02	10.71	8.63
1.70	5	0.02	10.71	8.54
1.80	6	0.02	12.86	10.13
1.90	8	0.01	17.14	13.37
2.00	7	0.01	15.00	11.57
2.10	3	0.03	6.43	4.91
2.20	3	0.03	6.43	4.86
2.30	3	0.03	6.43	4.81
2.40	2	0.05	4.29	3.17
2.50	3	0.03	6.43	4.71
2.60	4	0.03	8.57	6.21
2.70	4	0.03	8.57	6.15
2.80	4	0.03	8.57	6.09
2.90	4	0.03	8.57	6.03
3.00	3	0.03	6.43	4.48
3.10	3	0.03	6.43	4.44
3.20	4	0.03	8.57	5.86
3.30	5	0.02	10.71	7.26
3.40	5	0.02	10.71	7.19
3.50	4	0.03	8.57	5.70
3.60	4	0.03	8.57	5.65
3.70	6	0.02	12.86	8.39
3.80	6	0.02	12.86	8.32
3.90	6	0.02	12.86	8.25
4.00	5	0.02	10.71	6.81
4.10	5	0.02	10.71	6.75
4.20	8	0.01	17.14	10.71
4.30	8	0.01	17.14	10.62
4.40	7	0.01	15.00	9.21
4.50	6	0.02	12.86	7.83
4.60	6	0.02	12.86	7.76
4.70	8	0.01	17.14	10.27
4.80	8	0.01	17.14	10.18
4.90	9	0.01	19.29	11.36
5.00	8	0.01	17.14	10.02



Notes:

Hammer Mass	63.5	kg
Fall Height	0.76	m
Cone Area	0.0019	m^2
E_{theor}	473	J
Energy Ratio	0.86	
Anvil Mass	1.25	kg
Rod Mass	8.79	kg/m

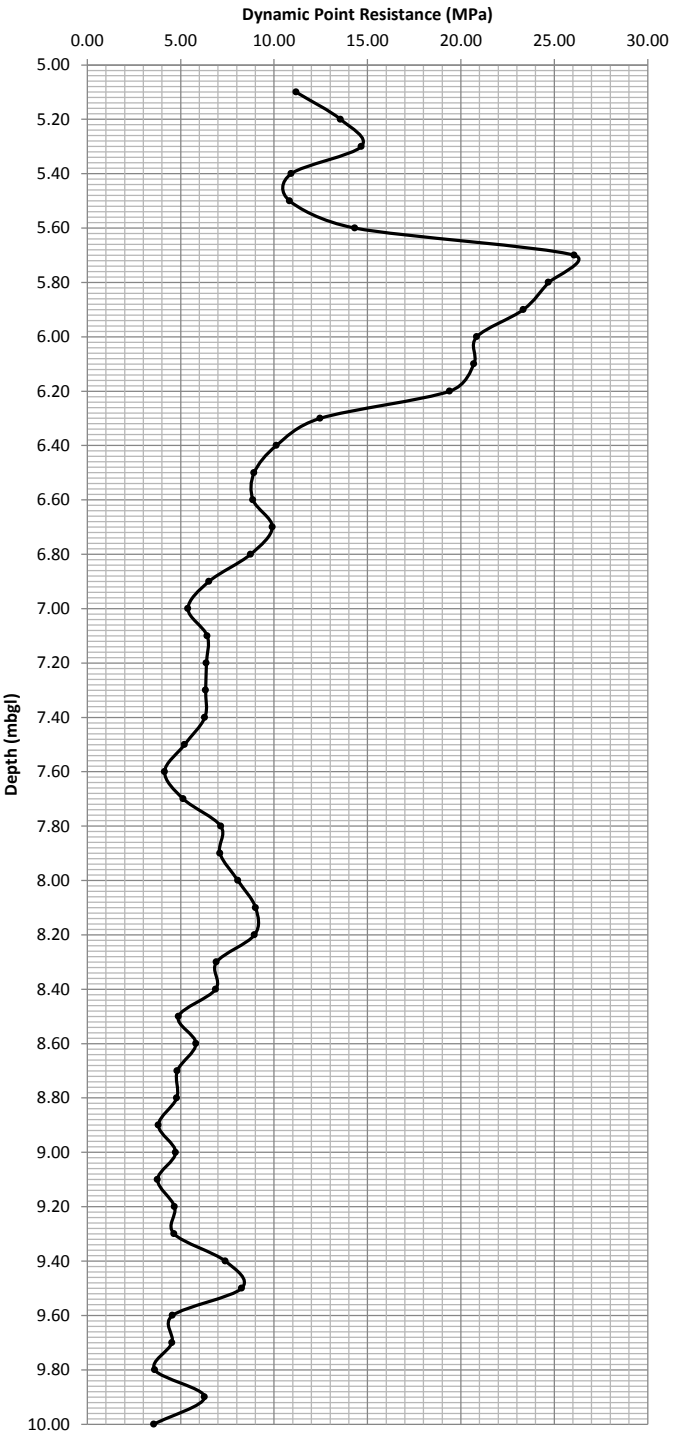
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Dynamic Probe Record

SITE Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex **Report Ref.** R16-11420

Test Location Reference	DP2

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
5.10	9	0.01	19.29	11.18
5.20	11	0.01	23.57	13.55
5.30	12	0.01	25.71	14.67
5.40	9	0.01	19.29	10.92
5.50	9	0.01	19.29	10.83
5.60	12	0.01	25.71	14.33
5.70	22	0.00	47.14	26.07
5.80	21	0.00	45.00	24.70
5.90	20	0.01	42.86	23.34
6.00	18	0.01	38.57	20.85
6.10	18	0.01	38.57	20.70
6.20	17	0.01	36.43	19.40
6.30	11	0.01	23.57	12.46
6.40	9	0.01	19.29	10.12
6.50	8	0.01	17.14	8.93
6.60	8	0.01	17.14	8.87
6.70	9	0.01	19.29	9.91
6.80	8	0.01	17.14	8.74
6.90	6	0.02	12.86	6.51
7.00	5	0.02	10.71	5.39
7.10	6	0.02	12.86	6.42
7.20	6	0.02	12.86	6.38
7.30	6	0.02	12.86	6.33
7.40	6	0.02	12.86	6.29
7.50	5	0.02	10.71	5.21
7.60	4	0.03	8.57	4.14
7.70	5	0.02	10.71	5.14
7.80	7	0.01	15.00	7.15
7.90	7	0.01	15.00	7.10
8.00	8	0.01	17.14	8.06
8.10	9	0.01	19.29	9.01
8.20	9	0.01	19.29	8.95
8.30	7	0.01	15.00	6.92
8.40	7	0.01	15.00	6.88
8.50	5	0.02	10.71	4.88
8.60	6	0.02	12.86	5.82
8.70	5	0.02	10.71	4.82
8.80	5	0.02	10.71	4.79
8.90	4	0.03	8.57	3.81
9.00	5	0.02	10.71	4.73
9.10	4	0.03	8.57	3.76
9.20	5	0.02	10.71	4.67
9.30	5	0.02	10.71	4.65
9.40	8	0.01	17.14	7.39
9.50	9	0.01	19.29	8.26
9.60	5	0.02	10.71	4.56
9.70	5	0.02	10.71	4.54
9.80	4	0.03	8.57	3.61
9.90	7	0.01	15.00	6.28
10.00	4	0.03	8.57	3.57



Notes:

Hammer Mass	63.5	kg
Fall Height	0.76	m
Cone Area	0.0019	m^2
E_{theor}	473	J
Energy Ratio	0.86	
Anvil Mass	1.25	kg
Rod Mass	8.79	kg/m

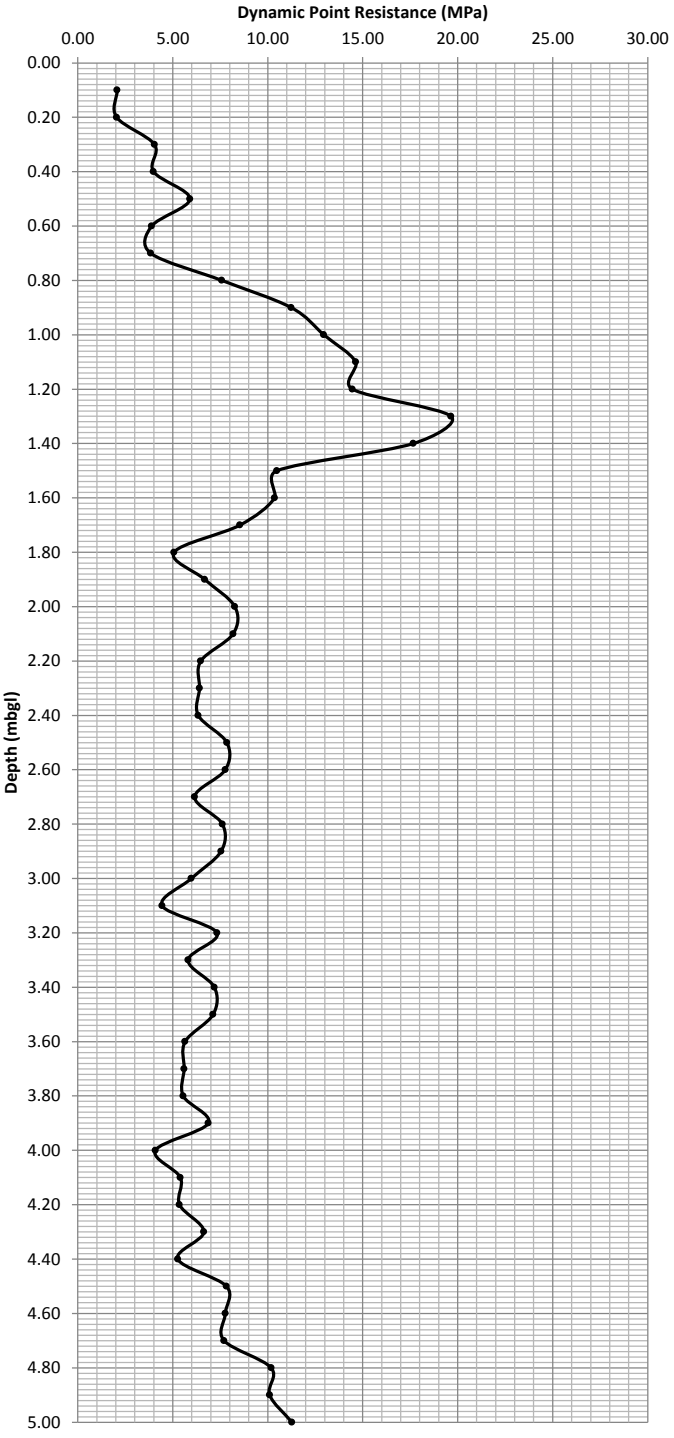
ASHDOWN SITE INVESTIGATION LTD

Dynamic Probe Record

SITE Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex **Report Ref.** R16-11420

Test Location Reference	WS2

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10	1	0.10	2.14	2.07
0.20	1	0.10	2.14	2.05
0.30	2	0.05	4.29	4.04
0.40	2	0.05	4.29	3.99
0.50	3	0.03	6.43	5.90
0.60	2	0.05	4.29	3.89
0.70	2	0.05	4.29	3.84
0.80	4	0.03	8.57	7.58
0.90	6	0.02	12.86	11.24
1.00	7	0.01	15.00	12.95
1.10	8	0.01	17.14	14.63
1.20	8	0.01	17.14	14.46
1.30	11	0.01	23.57	19.65
1.40	10	0.01	21.43	17.66
1.50	6	0.02	12.86	10.48
1.60	6	0.02	12.86	10.36
1.70	5	0.02	10.71	8.54
1.80	3	0.03	6.43	5.07
1.90	4	0.03	8.57	6.68
2.00	5	0.02	10.71	8.26
2.10	5	0.02	10.71	8.18
2.20	4	0.03	8.57	6.47
2.30	4	0.03	8.57	6.41
2.40	4	0.03	8.57	6.34
2.50	5	0.02	10.71	7.85
2.60	5	0.02	10.71	7.77
2.70	4	0.03	8.57	6.15
2.80	5	0.02	10.71	7.61
2.90	5	0.02	10.71	7.54
3.00	4	0.03	8.57	5.97
3.10	3	0.03	6.43	4.44
3.20	5	0.02	10.71	7.33
3.30	4	0.03	8.57	5.81
3.40	5	0.02	10.71	7.19
3.50	5	0.02	10.71	7.12
3.60	4	0.03	8.57	5.65
3.70	4	0.03	8.57	5.60
3.80	4	0.03	8.57	5.55
3.90	5	0.02	10.71	6.87
4.00	3	0.03	6.43	4.09
4.10	4	0.03	8.57	5.40
4.20	4	0.03	8.57	5.35
4.30	5	0.02	10.71	6.64
4.40	4	0.03	8.57	5.26
4.50	6	0.02	12.86	7.83
4.60	6	0.02	12.86	7.76
4.70	6	0.02	12.86	7.70
4.80	8	0.01	17.14	10.18
4.90	8	0.01	17.14	10.10
5.00	9	0.01	19.29	11.27



Notes:

Hammer Mass	63.5	kg
Fall Height	0.76	m
Cone Area	0.0019	m^2
E_{theor}	473	J
Energy Ratio	0.86	
Anvil Mass	1.25	kg
Rod Mass	8.79	kg/m

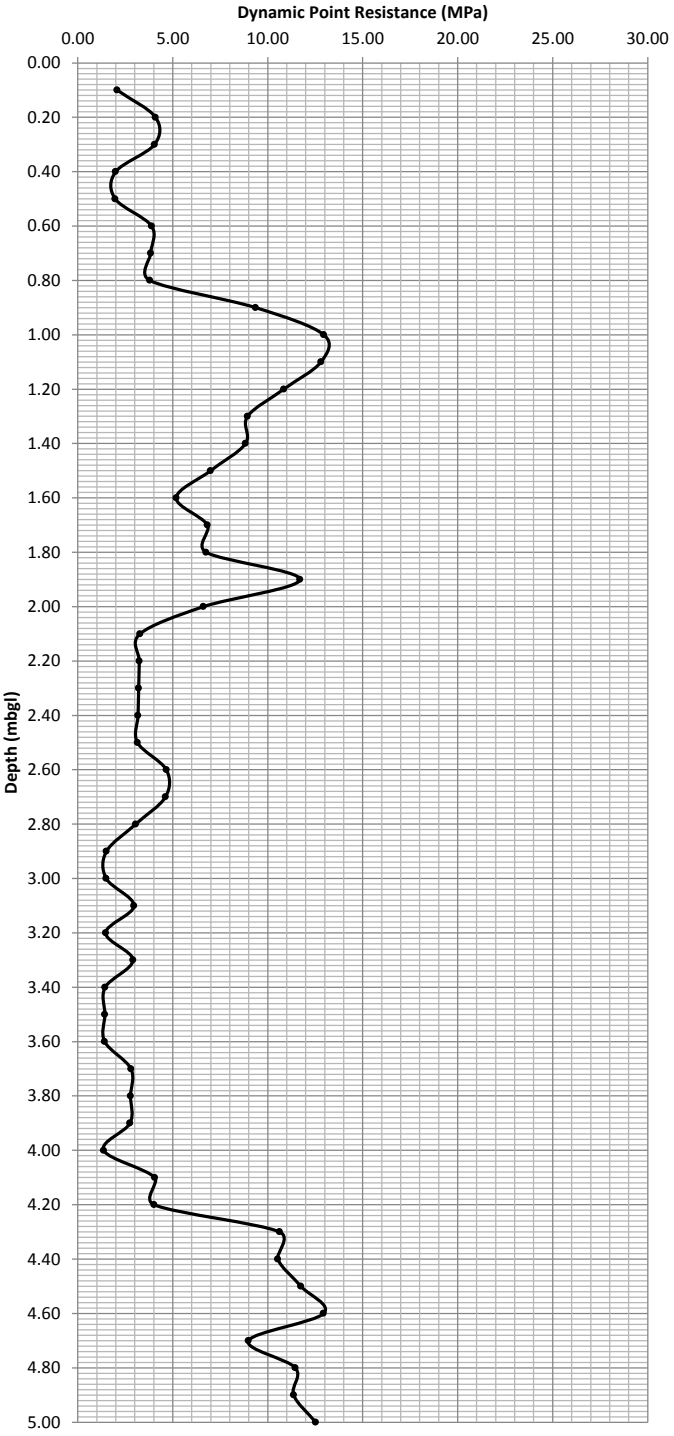
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Dynamic Probe Record

SITE Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex **Report Ref.** R16-11420

Test Location Reference	WS3

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10	1	0.10	2.14	2.07
0.20	2	0.05	4.29	4.09
0.30	2	0.05	4.29	4.04
0.40	1	0.10	2.14	1.99
0.50	1	0.10	2.14	1.97
0.60	2	0.05	4.29	3.89
0.70	2	0.05	4.29	3.84
0.80	2	0.05	4.29	3.79
0.90	5	0.02	10.71	9.36
1.00	7	0.01	15.00	12.95
1.10	7	0.01	15.00	12.80
1.20	6	0.02	12.86	10.84
1.30	5	0.02	10.71	8.93
1.40	5	0.02	10.71	8.83
1.50	4	0.03	8.57	6.98
1.60	3	0.03	6.43	5.18
1.70	4	0.03	8.57	6.83
1.80	4	0.03	8.57	6.76
1.90	7	0.01	15.00	11.70
2.00	4	0.03	8.57	6.61
2.10	2	0.05	4.29	3.27
2.20	2	0.05	4.29	3.24
2.30	2	0.05	4.29	3.20
2.40	2	0.05	4.29	3.17
2.50	2	0.05	4.29	3.14
2.60	3	0.03	6.43	4.66
2.70	3	0.03	6.43	4.61
2.80	2	0.05	4.29	3.05
2.90	1	0.10	2.14	1.51
3.00	1	0.10	2.14	1.49
3.10	2	0.05	4.29	2.96
3.20	1	0.10	2.14	1.47
3.30	2	0.05	4.29	2.90
3.40	1	0.10	2.14	1.44
3.50	1	0.10	2.14	1.42
3.60	1	0.10	2.14	1.41
3.70	2	0.05	4.29	2.80
3.80	2	0.05	4.29	2.77
3.90	2	0.05	4.29	2.75
4.00	1	0.10	2.14	1.36
4.10	3	0.03	6.43	4.05
4.20	3	0.03	6.43	4.02
4.30	8	0.01	17.14	10.62
4.40	8	0.01	17.14	10.53
4.50	9	0.01	19.29	11.74
4.60	10	0.01	21.43	12.94
4.70	7	0.01	15.00	8.98
4.80	9	0.01	19.29	11.45
4.90	9	0.01	19.29	11.36
5.00	10	0.01	21.43	12.52



Notes:

Hammer Mass	63.5	kg
Fall Height	0.76	m
Cone Area	0.0019	m^2
E_{theor}	473	J
Energy Ratio	0.86	
Anvil Mass	1.25	kg
Rod Mass	8.79	kg/m

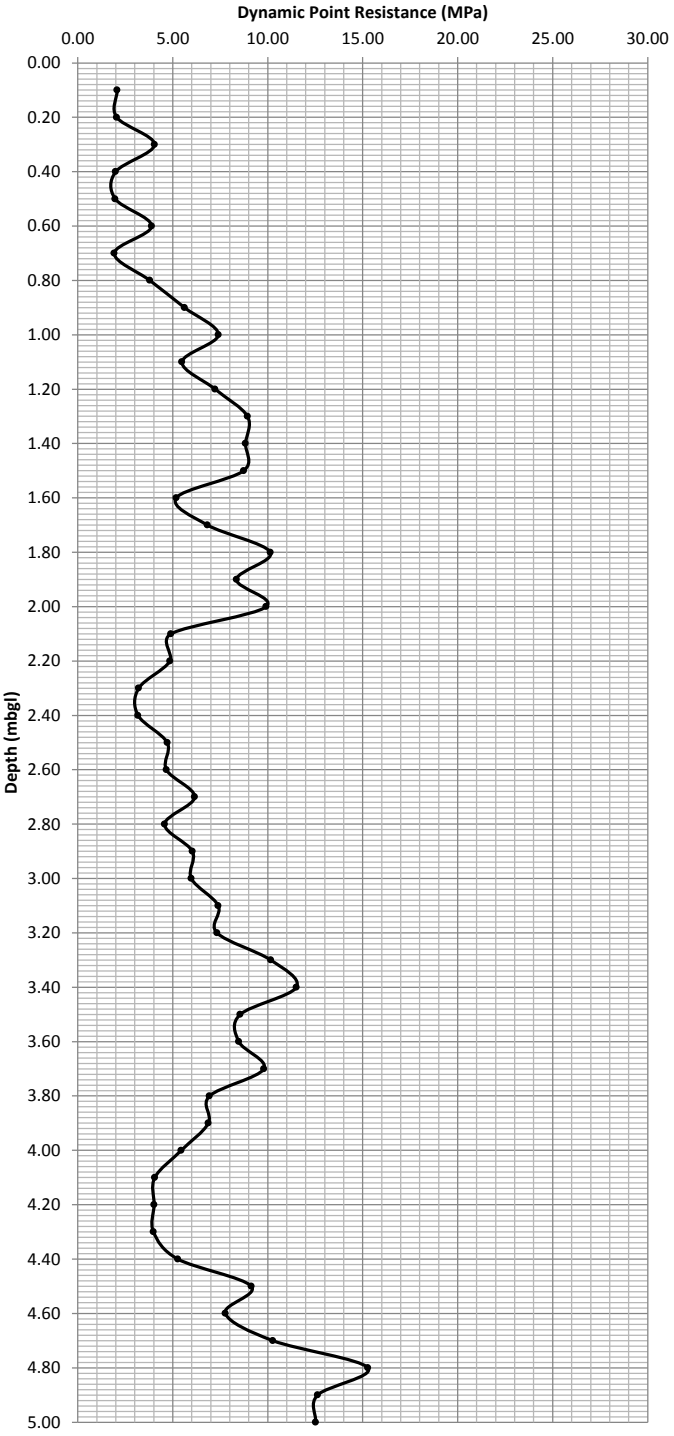
ASHDOWN SITE INVESTIGATION LTD

Dynamic Probe Record

SITE Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex **Report Ref.** R16-11420

Test Location Reference	WS4

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10	1	0.10	2.14	2.07
0.20	1	0.10	2.14	2.05
0.30	2	0.05	4.29	4.04
0.40	1	0.10	2.14	1.99
0.50	1	0.10	2.14	1.97
0.60	2	0.05	4.29	3.89
0.70	1	0.10	2.14	1.92
0.80	2	0.05	4.29	3.79
0.90	3	0.03	6.43	5.62
1.00	4	0.03	8.57	7.40
1.10	3	0.03	6.43	5.49
1.20	4	0.03	8.57	7.23
1.30	5	0.02	10.71	8.93
1.40	5	0.02	10.71	8.83
1.50	5	0.02	10.71	8.73
1.60	3	0.03	6.43	5.18
1.70	4	0.03	8.57	6.83
1.80	6	0.02	12.86	10.13
1.90	5	0.02	10.71	8.35
2.00	6	0.02	12.86	9.92
2.10	3	0.03	6.43	4.91
2.20	3	0.03	6.43	4.86
2.30	2	0.05	4.29	3.20
2.40	2	0.05	4.29	3.17
2.50	3	0.03	6.43	4.71
2.60	3	0.03	6.43	4.66
2.70	4	0.03	8.57	6.15
2.80	3	0.03	6.43	4.57
2.90	4	0.03	8.57	6.03
3.00	4	0.03	8.57	5.97
3.10	5	0.02	10.71	7.40
3.20	5	0.02	10.71	7.33
3.30	7	0.01	15.00	10.16
3.40	8	0.01	17.14	11.50
3.50	6	0.02	12.86	8.55
3.60	6	0.02	12.86	8.47
3.70	7	0.01	15.00	9.79
3.80	5	0.02	10.71	6.93
3.90	5	0.02	10.71	6.87
4.00	4	0.03	8.57	5.45
4.10	3	0.03	6.43	4.05
4.20	3	0.03	6.43	4.02
4.30	3	0.03	6.43	3.98
4.40	4	0.03	8.57	5.26
4.50	7	0.01	15.00	9.13
4.60	6	0.02	12.86	7.76
4.70	8	0.01	17.14	10.27
4.80	12	0.01	25.71	15.27
4.90	10	0.01	21.43	12.62
5.00	10	0.01	21.43	12.52



Notes:

Hammer Mass	63.5	kg
Fall Height	0.76	m
Cone Area	0.0019	m^2
E_{theor}	473	J
Energy Ratio	0.86	
Anvil Mass	1.25	kg
Rod Mass	8.79	kg/m

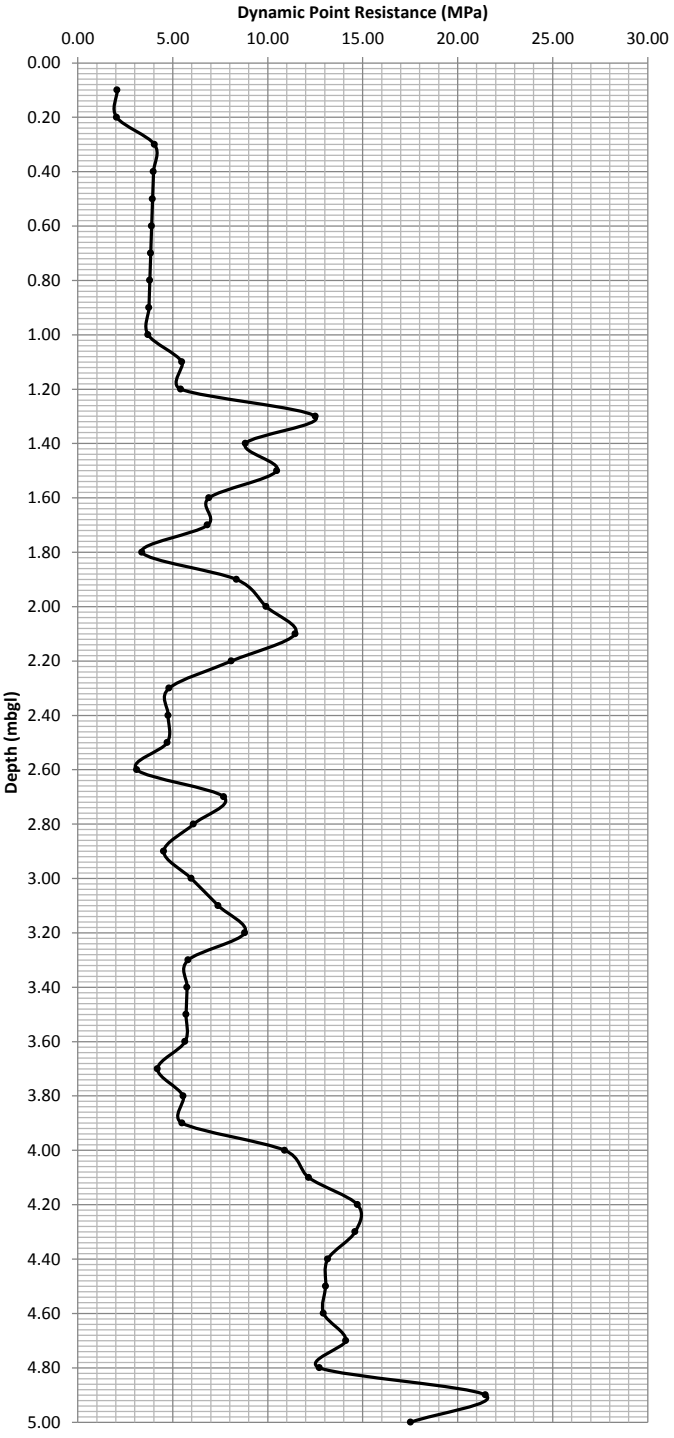
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Dynamic Probe Record

SITE Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex **Report Ref.** R16-11420

Test Location Reference	WS5

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10	1	0.10	2.14	2.07
0.20	1	0.10	2.14	2.05
0.30	2	0.05	4.29	4.04
0.40	2	0.05	4.29	3.99
0.50	2	0.05	4.29	3.94
0.60	2	0.05	4.29	3.89
0.70	2	0.05	4.29	3.84
0.80	2	0.05	4.29	3.79
0.90	2	0.05	4.29	3.75
1.00	2	0.05	4.29	3.70
1.10	3	0.03	6.43	5.49
1.20	3	0.03	6.43	5.42
1.30	7	0.01	15.00	12.51
1.40	5	0.02	10.71	8.83
1.50	6	0.02	12.86	10.48
1.60	4	0.03	8.57	6.91
1.70	4	0.03	8.57	6.83
1.80	2	0.05	4.29	3.38
1.90	5	0.02	10.71	8.35
2.00	6	0.02	12.86	9.92
2.10	7	0.01	15.00	11.45
2.20	5	0.02	10.71	8.09
2.30	3	0.03	6.43	4.81
2.40	3	0.03	6.43	4.76
2.50	3	0.03	6.43	4.71
2.60	2	0.05	4.29	3.11
2.70	5	0.02	10.71	7.69
2.80	4	0.03	8.57	6.09
2.90	3	0.03	6.43	4.52
3.00	4	0.03	8.57	5.97
3.10	5	0.02	10.71	7.40
3.20	6	0.02	12.86	8.79
3.30	4	0.03	8.57	5.81
3.40	4	0.03	8.57	5.75
3.50	4	0.03	8.57	5.70
3.60	4	0.03	8.57	5.65
3.70	3	0.03	6.43	4.20
3.80	4	0.03	8.57	5.55
3.90	4	0.03	8.57	5.50
4.00	8	0.01	17.14	10.90
4.10	9	0.01	19.29	12.15
4.20	11	0.01	23.57	14.73
4.30	11	0.01	23.57	14.60
4.40	10	0.01	21.43	13.16
4.50	10	0.01	21.43	13.05
4.60	10	0.01	21.43	12.94
4.70	11	0.01	23.57	14.12
4.80	10	0.01	21.43	12.73
4.90	17	0.01	36.43	21.46
5.00	14	0.01	30.00	17.53



Notes:

Hammer Mass	63.5	kg
Fall Height	0.76	m
Cone Area	0.0019	m^2
E_{theor}	473	J
Energy Ratio	0.86	
Anvil Mass	1.25	kg
Rod Mass	8.79	kg/m

ASHDOWN SITE INVESTIGATION LIMITED

Site: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex	Report No.: R16-11420 Sheet No.: 1 of 1

SUMMARY OF BOREHOLE FALLING HEAD SOAKAGE TEST RESULTS

Borehole **WS4 (Test 1)**	
Time (mins)	Depth to water (m bgl)
0	0.00
1	0.79
2	1.20
3	1.85
Borehole Depth (m bgl)	2.00
Casing Depth (m bgl)	1.00
Borehole Diameter (mm)	92.00
Casing Diameter (mm)	105.00

Borehole **WS4 (Test 2)**	
Time (mins)	Depth to water (m bgl)
0	0.00
1	0.67
2	1.10
3	1.26
Borehole Depth (m bgl)	2.00
Casing Depth (m bgl)	1.00
Borehole Diameter (mm)	92.00
Casing Diameter (mm)	105.00

Borehole **WS4 (Test 3)**	
Time (mins)	Depth to water (m bgl)
0	0.00
1	0.56
2	0.83
3	1.07
4	1.20
Borehole Depth (m bgl)	2.00
Casing Depth (m bgl)	1.00
Borehole Diameter (mm)	92.00
Casing Diameter (mm)	105.00

Notes: bgl – below ground level.

ASHDOWN SITE INVESTIGATION LIMITED

Site: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex	Report No.: R16-11420 Sheet No.: 1 of 1

SUMMARY OF TRIAL PIT FALLING HEAD SOAKAGE TEST RESULTS

Trial Pit **TP1**	
Time (mins)	Depth to water (m bgl)
0	0.34
1	0.34
2	0.35
4	0.36
15	0.38
30	0.42
66	0.46
88	0.49
193	0.55
223	0.56
Pit Length - 0.27m Pit Width - 0.24m Pit Depth - 0.80m bgl	

Remarks: bgl - below ground level.

Ashdown Site Investigation Limted

Site: Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex	Report No. R16-11420

Summary of Standing Groundwater Depths - WS5



APPENDIX B

Geotechnical Laboratory Testing Notes
Geotechnical Test Results

GEOTECHNICAL LABORATORY TESTING NOTES

1 Soil Description

Description and classification of soils has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of soil, Part 1 Identification and description (BS EN ISO 14688-1:2002+A1:2013) and Part 2 Principles of classification (BS EN 14688-2:2004 +A1:2013) as well as the BS5930:2015 code of Practice for Ground Investigations.

2 Index Tests

Index (Atterberg Limit) tests are undertaken on samples of fine grained soils provide the primary information for the classification of fine grained soils.

Fine grained soil is tested to determine its liquid and plastic limits, which are moisture contents that define boundaries between material consistency states. These tests are used to evaluate indices used for soil identification and to help determine the shrinkage and swelling characteristics of the soil under conditions of changing moisture content. The tests are carried out in accordance with BS1377: Part 2: 1990 + A1:1996 Classification tests.

The consistency index is derived from the Index Tests and is summarized in the following table. These divisions may be approximate, particularly for low plasticity soils. The consistency recorded on the soil classification summary is derived from the consistency index.

Consistency	Consistency Index
Very Soft	<0.25
Soft	0.25 to 0.50
Firm	0.50 to 0.75
Stiff	0.75 to 1.00
Very Stiff	>1.00

3 Particle Size Distribution Tests

Sieve analyses are carried out soil samples to establish their particle size distribution that can assist in the assessment of the permeability and classification of granular soils.

The tests are carried out in accordance with BS1377: Part 2: 1990 + A1:1996 Classification tests.

4 Natural Moisture/ Saturated Moisture Content Determination of Chalk

The results of natural moisture or saturated moisture content tests of disturbed samples of chalk are used to assist in the classification of the chalk to determine key geotechnical parameters of strength, density and crushing properties.

The tests are carried out in accordance with BS1377: Part 2: 1990 + A1:1996 Classification tests.

5 Soil Suction Testing

Soil suction tests are undertaken for the determination of the state of desiccation in clay soils.

The testing is carried out in accordance with the Building Research Establishment Information Paper IP4/93, dated February 1993.

6 Triaxial Compression Tests

Undrained triaxial compression tests are carried out on undisturbed samples of cohesive soil in order to assist in the determination of the undrained shear strength of the soil. The results of moisture content and density determinations are also included.

The tests are carried out in accordance with BS1377: Part 7: 1990 + A1:1994 Shear strength tests (total stress).

7 Shear Vane and Hand Penetrometer Testing

Undisturbed samples are tested in the laboratory using a Geonor Hand Shear Vane for the determination of their undrained shear strength.

The vane tests are carried out in general accordance with BS1377: Part 7: 1990 + A1:1994 Shear strength tests (total stress).

8 One Dimensional Consolidation Tests

One-dimensional consolidation tests are performed on undisturbed soil samples to ascertain their settlement characteristics.

The tests are carried out in accordance with BS1377: Part 5: 1990 + A1:1994 Compressibility, Permeability and Durability tests.

9 Dry Density / Moisture Content Relationship (Compaction) Testing

Compaction testing for the determination of the dry density / moisture content relationship is carried out on using either a 2.5kg, 4.5kg hammer or a vibrating hammer.

The tests are carried out in accordance with the British Standard BS1377: Part 4: 1990 + A1 & A2:2002 Compaction-related tests.

10 California Bearing Ratio

The soil is usually compacted at the as dug “natural” moisture content and often at moisture contents around the natural moisture content.

The California bearing ratio is determined in accordance with the British Standard BS1377: Part 4: 1990 + A1 & A2:2002 Compaction related tests.

11 Chemical Testing

Soil samples are tested for their concentration of water soluble sulphate and pH for use in concrete mix design.

Water samples are tested for total sulphate concentration and pH value.

Where a water soluble sulphate content in soils or a total sulphate content in groundwater exceeds 3000mg/l SO_4 the magnesium sulphate content of the samples is required to be determined (BRE Special Digest 1:2005).

Swanborough Farm Swanborough Lewes, East Sussex BN73PF	**ASHDOWN SITE INVESTIGATION LTD** **Geotechnical and Geoenvironmental Engineers**	ASHDOWN SITE INVESTIGATION L·I·M·I·T·E·D

Site:	Shoreham RFC, Buckingham Park, Shoreham-by-Sea, West Sussex.	Job No: Sheet No:	R16-11420 1

SOIL CLASSIFICATION SUMMARY

BH/TP No.	Depth (m)	Nat. Moist. Cont. (w %)	Equiv. Moist. Cont. (w_a %)	Atterberg Limits			Class'n	Cons. Index (I_c)	% passing 425 µm sieve	Visual Description of Sample
				W_l %	W_p %	I_p %				
WS1	2.50	14		37	20	17	CI	1.35*	75	Very stiff brown slightly gravelly CLAY. Gravel is fine to coarse flint.
WS2	3.50	21		32	16	16	CL	0.69*	95	Firm brown slightly gravelly slightly sandy silty CLAY. Gravel is fine to medium chalk and flint.
WS3	1.20	12		23	15	8	CL	1.38*	58	Very stiff light brown gravelly CLAY. Gravel is fine to medium chalk, flint and rare fine sandstone.
WS4	2.00	13		25	17	8	CL	1.50*	30	Very stiff light brown gravelly CLAY. Gravel is fine to coarse flint and fine to medium ferruginous sandstone.
WS5	0.80	18		52	19	33	CH	1.03*	57	Very stiff brown gravelly CLAY. Gravel is fine to coarse flint.

Test Method: Classification Tests BS1377: Part 2: 1990: Method 4.4, 5.3 and 5.4

* Consistency index based on natural moisture content and not the equivalent moisture content.

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QTS Environmental Report No: 16-44656

Site Reference:	Shoreham RFC, Shoreham-by-Sea, West Sussex
Project / Job Ref:	R16-11420
Order No:	3600
Sample Receipt Date:	24/05/2016
Sample Scheduled Date:	25/05/2016
Report Issue Number:	1
Reporting Date:	01/06/2016

Authorised by: [redacted]

Russell Jarvis
Associate Director of Client Services
On behalf of QTS Environmental Ltd

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Kevin Old
Associate Director of Laboratory
On behalf of QTS Environmental Ltd

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Soil Analysis Certificate						
QTS Environmental Report No: 16-44656	**Date Sampled**	17/05/16	17/05/16	17/05/16	17/05/16	17/05/16
Ashdown Site Investigations Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Shoreham RFC, Shoreham-by-Sea, West Sussex	**TP / BH No**	WS1	WS2	WS3	WS4	WS5
Project / Job Ref: R16-11420	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3600	**Depth (m)**	1.30	0.90	1.80	0.70	2.50
Reporting Date: 01/06/2016	**QTSE Sample No**	208646	208647	208648	208649	208650

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.9	7.7	7.5	7.3	7.4
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	15	16	37	37	36
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.02	0.02	0.04	0.04	0.04

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis $^{(S)}$

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-44656	
Ashdown Site Investigations Ltd	
Site Reference: Shoreham RFC, Shoreham-by-Sea, West Sussex	
Project / Job Ref: R16-11420	
Order No: 3600	
Reporting Date: 01/06/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
208646	WS1	None Supplied	1.30	9.5	Light brown clay with stones
208647	WS2	None Supplied	0.90	9.2	Light brown clay with stones
208648	WS3	None Supplied	1.80	6.9	Light brown clay with stones
208649	WS4	None Supplied	0.70	15.9	Light brown clay with stones
208650	WS5	None Supplied	2.50	13	Light brown clay with stones

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information

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Ashdown Site Investigations Ltd
Site Reference: Shoreham RFC, Shoreham-by-Sea, West Sussex
Project / Job Ref: R16-11420
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Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received