



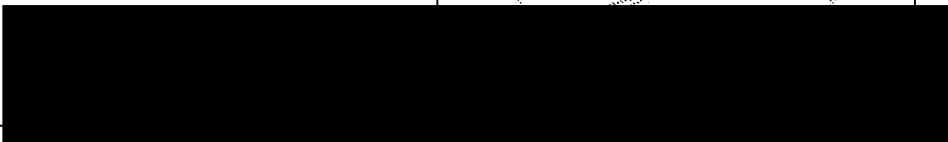
GROUND INVESTIGATION REPORT

for the site at

**KINGSTON CORNER ANNEX, BROKSID ROAD, EAST PRESTON,
WEST SUSSEX BN16 1SE**

on behalf of

DAVID STATION C/O NICO WARR ARCHITECTS

Report Reference: GWPR2607/GIR/July 2018		Status: FINAL
Issue:	Prepared By:	Verified By:
V1.01 July 2018		
	Roger Foord BA (Hons) MSc DIC FGS Senior Geotechnical Engineer	Francis Williams M.Geol. (Hons) FGS CGeol. CEnv AGS Director
File Reference: Ground and Water/Project Files/ GWPR2607 Kingston Corner Annex, Broadside Road, East Preston		

CONTENTS

1.0 INTRODUCTION

- 1.1 General
- 1.2 Aims of Investigation
- 1.3 Conditions and Limitations

2.0 SITE SETTING

- 2.1 Site Location
- 2.2 Site Description
- 2.3 Proposed Development
- 2.4 Geology
- 2.5 Hydrogeology and Hydrology
- 2.6 Radon

3.0 FIELDWORK

- 3.1 Scope of Works
- 3.2 Sampling Procedure

4.0 ENCOUNTERED GROUND CONDITIONS

- 4.1 Soil Conditions
- 4.2 Roots Encountered
- 4.3 Groundwater Conditions
- 4.4 Obstructions

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

- 5.1 In-situ Geotechnical Testing
- 5.2 Laboratory Geotechnical Testing
 - 5.2.1 Atterberg Limit Tests
 - 5.2.2 Comparison of Soil's Moisture Content with Index Properties
 - 5.2.2.1 Liquidity Index Analyses
 - 5.2.2.2 Liquid Limit
 - 5.2.3 Sulphate and pH Tests
 - 5.2.4 BRE Special Digest Tests

6.0 ENGINEERING CONSIDERATIONS

- 6.1 Soil Characteristics and Geotechnical Parameters
- 6.2 Spread Foundations
- 6.3 Piled Foundations
- 6.4 Excavations and Stability
- 6.5 Sub-Surface Concrete
- 6.6 Road and Hardstanding
- 6.7 Surface Water Disposal
- 6.8 Discovery Strategy
- 6.9 Waste Disposal
- 6.10 Imported Material
- 6.11 Duty of Care

FIGURES

Figure 1	Site Location Plan
Figure 2	Site Development Area
Figure 3	Aerial View of Site
Figure 4	Trial Hole Location Plan

APPENDICES

Appendix A	Conditions and Limitations
Appendix B	Fieldwork Logs
Appendix C	Geotechnical Laboratory Test Results

1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by David Station c/o Nico Warr Architects on the 3rd May 2018 to conduct a Ground Investigation at Kingston Corner Annex, Brookside Road, East Preston, West Sussex BN16 1SE. The scope of the investigation was detailed within the Ground and Water Limited email fee proposal Ref: GWQ3853 dated 30th April 2018.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes.

A Desk Study and full scale contamination assessment were not part of the remit of this report.

The techniques adopted for the investigation were chosen considering the anticipated ground conditions and development proposals on-site, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

2.0 SITE SETTING

2.1 Site Location

The site comprised 0.50ha rectangular shaped plot of land orientated in an east to west direction and located on the eastern side of Brookside Road. The site was located in the private estate of Kingston Gorse, to the west of Ferring in West Sussex.

The approximate O.S. National Grid Reference for the centre of the site was TQ 08924 01754. A site location plan can be seen in Figure 1 with a plan showing the site area presented in Figure 2.

2.2 Site Description

The site was occupied by an existing two storey detached residential property and areas of front, side and rear gardens. A tennis court was located in the rear garden. Numerous mature trees (apple, beech, poplar and cedar) and bushes were located across and around the boundaries of the site.

The southerly flowing Ferring Rife was located ~125m east of the site.

An aerial view of the site showing the site and approximate site boundary is given within Figure 3.

2.3 Proposed Development

At the time of reporting, July 2018, the proposed development was understood to comprise the construction of a single storey guest house with a mezzanine floor. Whilst no basement is to be excavated, it is proposed to sink the building into the ground by about 0.80m (~2.80 m AOD). French drains are proposed to be installed around the perimeter of the new building. A plan of the proposed development is given in Figure 5 and a section is given in Figure 6.

2.4 Geology

The BGS Geological Map for the East Preston area (Chichester and Bognor Sheet No. 317/332) revealed that the site was located on Brickearth and Undifferentiated River Terrace Deposits overlying the Lewes Nodular Chalk Formation.

There were no areas of Made Ground or Worked Ground within a 250m radius of the site.

Brickearth

Brickearth comprises a geologically recent deposit of brown structureless sandy clay of limited thickness that usually overlies Marine Gravels in the area of the site. Its name is derived from its former use in the manufacture of bricks.

Undifferentiated River Terrace Deposits

In the south, flanking the rivers draining into the Solent, these deposits consist of gravels and sandy gravels, commonly clayey in the higher terraces. In places, clayey and sandy silty and silty clay overlie the aggregate, perhaps an indication of the preservation of overbank or Aeolian deposits at the top of each fluvial cycle. In general the terrace deposits are up to 6m thick.

Lewes Nodular Chalk Formation

The Lewes Nodular Chalk Formation comprises hard to very nodular chalks and hardgrounds with interbedded soft to medium hard chalks (some grainy) and marls. The softer chalks become more abundant towards the top. Nodular chalks are typically lumpy and iron stained (usually marking sponges). Brash is rough and flaggy or rubbly and tends to be dirty. The first regular seams of nodular flint, some large, commence near the base and continue throughout.

Occasional erosional features, such as pipes, swallow holes and solution cavities, usually in-filled with drift deposits; can be found in the chalk deposits. These features sometimes manifest themselves at the surface as shallow circular depressions. Solution features may be reactivated by the concentrated ingress of water from leaking drains or soakaways. Reactivation may lead to surface collapse.

There were no BGS borehole records in a close proximity to the site.

2.5 Hydrogeology and Hydrology

An examination of the DEFRA website revealed the site to be located on a **Secondary A Aquifer** relating to the superficial deposits of the Undifferentiated River Terrace Deposits, overlying a **Principal Aquifer** corresponding to the bedrock deposits of the Lewes Nodular Chalk Formation.

Superficial (Drift) deposits are permeable unconsolidated (loose) deposits, for example, sands and gravels. The bedrock is described as solid permeable formations e.g. sandstone, chalk and limestone.

Secondary aquifers include a wide range of drift deposits with an equally wide range of water permeability and storage capacities. Secondary (A) Aquifers consist of deposits with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

A Principal Aquifer is a layer of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Examination of the Environment Agency records showed that the site was not located within a Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

The nearest surface water features was the southerly flowing Ferring Rife located ~125m east of the site. The coast was located ~350m to the south.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered at shallow depth (<3m bgl) and it was considered that the groundwater was flowing in an easterly direction towards the Ferring Rife and in a southerly direction in alignment with local topography towards the coast, ~300m to the south.

Examination of the Environment Agency data showed the area of the proposed structure, in the western portion of the site, was located within a Flood Zone 1 (an area with a low probability of river or sea flooding). The eastern portion of the total site area, away from the proposed development, fell within a Flood Zone 2. **Environment Agency Zone 2** floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. The extreme eastern boundary of the total site area, close to the Ferring Rife, fell within a Flood Zone 3. **Environment Agency Zone 3** shows the extent of a river flood with a 1 in 100 (1% or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year.

2.6 Radon

BRE 211 (2007) Map 5 of London, Sussex and West Kent revealed the site **was not** located within an area where mandatory protection measures against the ingress of Radon were required. The site

was not located within an area where a risk assessment was required.

3.0 FIELDWORK

3.1 Scope of Works

Fieldwork was undertaken on the 10th May 2018 and comprised the drilling of 2No. Dart Windowless Sampler Boreholes, one to 10.00m bgl (BH1) and one to 5.00m bgl (BH2). SPTs were undertaken at 1m intervals during the drilling of the boreholes.

The approximate locations of the trial holes can be seen within Figure 5.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, exploratory positions were relocated away from these areas.

As a further precautionary measure, the borehole was hand excavated to 1.20m bgl and all trial holes were scanned with a Cable Avoidance Tool (CAT scanner) to minimise the risk to services.

Upon completion of the site works, the trial holes were backfilled and made good/reinstated in relation to the surrounding area.

3.2 Sampling Procedures

Small disturbed samples were recovered from the borehole at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A selection of samples were despatched for geotechnical testing purposes.

4.0 ENCOUNTERED GROUND CONDITIONS

4.1 Soil Conditions

The borehole was logged by Roger Foord of Ground and Water Limited generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the boreholes drilled generally conformed to that anticipated from examination of the geology map. Topsoil and Made Ground was noted to overlie Brickearth, which in turn rested upon soils of the Undifferentiated River Terrace Deposits and then the Lewes Nodular Chalk Formation.

The ground conditions encountered during the investigation are described in this section. For more complete information about the soils encountered, reference must be made to the trial hole logs within Appendix B.

The trial hole location plan can be viewed in Figure 4.

For the purposes of discussion, the succession of conditions encountered within the borehole in descending order can be summarised as follows:

Topsoil (BH2 only)
Made Ground (BH1 only)
Brickearth
Undifferentiated River Terrace Deposits
Lewes Nodular Chalk Formation

Topsoil

Topsoil was encountered from ground level to a depth of 0.15m bgl in BH2 and comprised a dark brown sandy clay. The sand was fine grained.

Made Ground

Made Ground was encountered underlying a 0.15m thickness of shingle over a Type I sub-base in BH1 and comprised a dark brown gravelly sandy silty clay to a depth of 0.40m bgl. The sand was fine grained and the gravel was occasional to abundant, fine to coarse, sub-angular to sub-rounded flint and brick.

Brickearth

Soils described as Brickearth were encountered underlying the Made Ground between 0.60 – 2.30m bgl in BH1 and between 0.15 – 1.20m bgl in BH2. The deposits were noted to comprise a dark brown to brown slightly gravelly slightly sandy silty clay. The sand was fine grained and the gravel was rare, fine, sub-angular to sub-rounded flint.

Undifferentiated River Terrace Deposits

Soils of the Undifferentiated River Terrace Deposits were encountered underlying the Brickearth between 1.40 – 2.30m bgl in BH1 and between 1.20 – 4.20m bgl in BH2. The soils generally comprised a pale brown, locally slightly grey mottled slightly gravelly to gravelly, slightly sandy to sandy, locally silty clay. The sand was fine to medium grained and the gravel was occasional to abundant, fine to medium, sub-angular to sub-rounded flint and chalk.

In BH2, a grey and dark brown mottled gravelly silty clay was encountered between 3.70 – 4.20m

bgl. The gravel was occasional to abundant, fine to medium, sub-angular to sub-rounded chalk.

Lewes Nodular Chalk Formation

Soils of the Lewes Nodular Chalk Formation were encountered underlying the Undifferentiated River Terrace Deposits for the remaining depth of BH1 at 10.45m bgl and BH2 at 5.45m bgl. As a result of sample disturbance caused by the drilling process, the chalk was generally recovered as a structureless chalk composed of off white slightly gravelly sandy silt clay. The gravel was very weak to weak, low density and sub-angular. (CIRIA C574: Grade Dm).

Between 5.40 – 10.45m bgl in BH1 the chalk was recovered as a structureless chalk composed of slightly silty sub-rounded gravel. The clasts were weak, low and medium density, sub-angular and white. (CIRIA C574: Grade Dc).

For details of the composition of the soils encountered at particular points, reference must be made to the individual trial hole logs within Appendix B.

4.2 Roots Encountered

Roots were noted to 1.80m bgl in BH1 and 0.60m bgl in BH2.

It must be noted that the chance of determining actual depth of root penetration through a narrow diameter borehole is low. Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.3 Groundwater Conditions

Groundwater encountered at depths of 1.40m, 4.20m and 7.50m bgl in BH1. Groundwater encountered at depth of 1.60m and 3.60m bgl in BH2.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site. The investigation was undertaken in May 2018, when groundwater levels are likely to be falling towards their annual minimum (i.e. lowest level).

Isolated pockets of groundwater may be perched within any Made Ground found at other locations around the site.

4.4 Obstructions

No natural or artificial obstructions were encountered during the drilling of the boreholes.

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

5.1 In-Situ Geotechnical Testing

Standard Penetration Testing (SPT) was undertaken within the boreholes at 1.00m intervals. The results of the SPT's have not been amended to take into account hammer efficiency, rod lengths and overburden pressure in accordance with Eurocode 7.

Cable Percussion Boreholes provide samples of the ground for assessment but they do not give any engineering data. The Standard Penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50 mm and an inside diameter of 35 mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5 kg falling through a distance of 760 mm. The sample tube is driven 150 mm into the ground and then the number of blows needed for the tube to penetrate each 150 mm up to a depth of 450 mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

The cohesive soils of the Brickearth and the Undifferentiated River Terrace Deposits were classified based on the table below.

Undrained Shear Strength from Field Inspection/ SPT blow counts (N_1) ₆₀ Cohesive Soils (EN ISO 14688-2:2004 & Stroud (1974))		
Classification	Undrained Shear Strength (kPa)	Field Indications
Extremely High	>300	-
Very High	150 – 300	Brittle or very tough
High	75 – 150	Cannot be moulded in the fingers
Medium	40 – 75	Can be moulded in the fingers by strong pressure
Low	20 – 40	Easily moulded in the fingers
Very Low	10 – 20	Exudes between fingers when squeezed in the fist
Extremely Low	<10	-

An interpretation of the in-situ geotechnical testing results is given in the table below.

Interpretation of In-situ Geotechnical Testing Results					
Strata	SPT "N" Blow Counts	Equivalent Undrained Shear Strength (kPa) Cohesive Soils	Soil Type		Trial Hole/s
			Cohesive	Granular	
Brickearth	4	20	Very Low/Low	-	BH1 (0.60 – 1.40m bgl)
Undifferentiated River Terrace Deposits (cohesive soils)	11 3 – 12	55 15 – 60	Medium Very Low - Medium	-	BH1 (1.40 – 2.30m bgl) BH2 (1.20 – 4.20m bgl)
Lewes Nodular Chalk Formation	16 – 45 14 – 24	-	-	-	BH1 (2.30 – 10.45m bgl) BH2 (4.20 – 5.45m bgl)

It must be noted that field measurements of undrained shear strength are dependent on a number of

variables including disturbance of sample, method of investigation and also the size of specimen or test zone etc.

5.2 Laboratory Geotechnical Testing

A programme of geotechnical laboratory testing, scheduled by Ground and Water Limited and carried out by K4 Soils Laboratory and QTS Environmental Limited, was undertaken on samples recovered from the Brickearth and the Undifferentiated River Terrace Deposits. The results of the tests are presented in Appendix C.

The test procedures used were generally in accordance with the methods described in BS1377:1990. Details of the specific tests used in each case are given below:

Standard Methodology for Laboratory Geotechnical Testing		
Test	Standard	Number of Tests
Atterberg Limit Tests	BS1377:1990:Part 2:Clauses 3.2, 4.3 & 5	4
Water Soluble Sulphate & pH Tests	BS1377:1990:Part 3:Clause 5	1
BRE Special Digest 1 (incl. Ph, Electrical Conductivity, Total Sulphate, W/S Sulphate, Total Chlorine, W/S Chlorine, Total Sulphur, Ammonium as NH ₄ , W/S Nitrate, W/S Magnesium)	BRE Special Digest 1 "Concrete in Aggressive Ground (BRE, 2005).	2

5.2.1 Atterberg Limit Tests

A précis of the results of Atterberg Limit Tests undertaken on one sample of the Brickearth and three samples of the Undifferentiated River Terrace Deposits can be seen tabulated below.

Atterberg Limit Tests Results Summary							
Stratum	Moisture Content (%)	Passing 425 µm sieve (%)	Modified PI (%)	Soil Class Range	Consistency Index (I _c)	Volume Change Potential Range	
						NHBC	BRE
Brickearth	21	100	35.0	CH	Very Stiff (1.00)	Medium	Medium
Undifferentiated River Terrace Deposits	16 – 22	70	9.1 – 17.5	CI, ML	Very Stiff (1.20 – 1.43)	No - Low	Low

NB: NP – Non-plastic

BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)

Soil Classification based on British Soil Classification System.

Consistency Index (I_c) based on BS EN ISO 14688-2:2004.

5.2.2 Comparison of Soil's Moisture Content with Index Properties

5.2.2.1 Liquidity Index Analyses

The results of the Atterberg Limit tests undertaken on one sample of the Brickearth and three samples of the Undifferentiated River Terrace Deposits were analysed to determine the Liquidity Index of the samples. This gives an indication as to whether the samples recovered showed a moisture deficit and their degree of consolidation. The results are tabulated overpage.

Liquidity Index Calculations Summary					
Strata/Trial Hole/Depth/Soil Description	Moisture Content (%)	Plastic Limit (%)	Modified Plasticity Index (%)	Liquidity Index	Result
Undifferentiated River Terrace Deposits (BH1/1.50m bgl) (Brown mottled bluish grey slightly sandy silty CLAY with traces of fine rootlets and rare fine gravel).	22	18	17.5	0.23	Overconsolidated
Brickearth BH2/1.00m bgl (Brown silty CLAY with traces of fine rootlets and scattered black flecks).	21	21	35.0	0.00	Heavily Overconsolidated
Undifferentiated River Terrace Deposits (BH2/2.00m bgl) (Light brown slightly gravelly slightly sandy silty CLAY with rare fine to medium chalk fragments (gravel is fine to coarse and sub-angular)).	21	20	14.7	0.07	Heavily Overconsolidated
Undifferentiated River Terrace Deposits (BH2/3.50m bgl) (Light brown slightly gravelly slightly sandy silty CLAY with rare fine to medium chalk fragments (gravel is fine to coarse and sub-angular)).	16	16	9.1	0.00	Heavily Overconsolidated

The results in the table above indicated no potential moisture deficit was present within the heavily overconsolidated sample of the Brickearth and the overconsolidated to heavily overconsolidated samples of the Undifferentiated River Terrace Deposits tested.

5.2.2.2 Liquid Limit

A comparison of the soil moisture content and the liquid limit can be seen tabulated below.

Moisture Content vs. Liquid Limit				
Strata/Trial Hole/Depth/Soil Description	Moisture Content (MC) (%)	Liquid Limit (LL) (%)	40% Liquid Limit (LL)	Result
Undifferentiated River Terrace Deposits (BH1/1.50m bgl) (Brown mottled bluish grey slightly sandy silty CLAY with traces of fine rootlets and rare fine gravel).	22	43	17.2	MC > 0.4 x LL (No Significant Moisture Deficit)
Brickearth BH2/1.00m bgl (Brown silty CLAY with traces of fine rootlets and scattered black flecks).	21	56	22.4	MC < 0.4 x LL (Potential Significant Moisture Deficit)
Undifferentiated River Terrace Deposits (BH2/2.00m bgl) (Light brown slightly gravelly slightly sandy silty CLAY with rare fine to medium chalk fragments (gravel is fine to coarse and sub-angular)).	21	41	16.4	MC > 0.4 x LL (No Significant Moisture Deficit)
Undifferentiated River Terrace Deposits (BH2/3.50m bgl) (Light brown slightly gravelly slightly sandy silty CLAY with rare fine to medium chalk fragments (gravel is fine to coarse and sub-angular)).	16	29	11.6	MC > 0.4 x LL (No Significant Moisture Deficit)

The results in the table above indicated that a potential significant moisture deficit was present within the sample of the Brickearth tested (BH2/1.00m bgl). The moisture content value was below 40% of the liquid limit. The sample was described as a brown silty clay with traces of fine rootlets and scattered black flecks. Consequently the apparent moisture deficit was likely to be related to a combination of the lithology of the soil (heavily overconsolidated soils) and the water demand of roots from nearby trees.

The results in the table above indicated no potential significant moisture deficit was present within the overconsolidated to heavily overconsolidated samples of the Undifferentiated River Terrace Deposits tested.

5.2.3 Sulphate and pH Tests

A Sulphate and pH test was undertaken on one sample from the Undifferentiated River Terrace Deposits (BH2/2.00m bgl). A sulphate concentration of 250mg/l was determined with a pH of 7.9.

5.2.4 BRE Special Digest 1

In accordance with BRE Special Digest 1 'Concrete in Aggressive Ground' (BRE, 2005) one sample of Brickearth (BH1/1.00m bgl) and one sample of the Undifferentiated River Terrace Deposits (BH2/3.00m bgl) were scheduled for laboratory analysis to determine parameters for concrete specification.

The results are given within Appendix C and a summary is tabulated below.

Summary of Results of BRE Special Digest Testing			
Determinand	Unit	Minimum	Maximum
pH	-	8.1	8.2
Ammonium as NH ₄	mg/kg	<0.5	3.4
Sulphur	%	<0.02	<0.02
Chloride (water soluble)	mg/l	13.5	17.2
Magnesium (water soluble)	mg/l	1.5	2.2
Nitrate (water soluble)	mg/l	<1.5	3.1
Sulphate (water soluble)	mg/l	17	18
Sulphate (total)	%	<0.02	0.05

6.0 ENGINEERING CONSIDERATIONS

6.1 Soil Characteristics and Geotechnical Parameters

Based on the results of the intrusive investigation and geotechnical laboratory testing the following interpretations have been made with respect to engineering considerations.

- Topsoil and Made Ground was encountered to a depth of between 0.15m to 0.40m bgl in the boreholes.

As a result of the inherent variability of Made Ground it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Made Ground may be found to deeper depth at other locations on the site.

- Soils described as Brickearth were encountered underlying the Made Ground between 0.60 – 2.30m bgl in BH1 and between 0.15 – 1.20m bgl in BH2. The deposits were noted to comprise a dark brown to brown slightly gravelly slightly sandy silty clay. The sand was fine grained and the gravel was rare, fine, sub-angular to sub-rounded flint.

In-situ testing revealed the soils of Brickearth had a very low/low undrained shear strength (20kPa).

The cohesive soils were shown to have a **medium volume change potential** in accordance with NHBC Standards Chapter 4.2 and BRE240. Geotechnical analyses indicated these soils to be very stiff, heavily overconsolidated with a potential moisture deficit as a result of a combination of the lithology of the soil (heavily overconsolidated soils) and the water demand of roots from nearby trees.

Whilst the soils of the Brickearth were heavily overconsolidated cohesive soils, given the very low/low bearing value and likely high settlements induced on loading, they were therefore considered to be an unsuitable bearing stratum for the proposed development and should be bypassed in favour of the underlying Undifferentiated River Terrace Deposits.

- Soils of the Undifferentiated River Terrace Deposits were encountered underlying the Brickearth between 1.40 – 2.30m bgl in BH1 and between 1.20 – 4.20m bgl in BH2. The soils generally comprised a pale brown, locally slightly grey mottled slightly gravelly to gravelly, slightly sandy to sandy, locally silty clay. The sand was fine to medium grained and the gravel was occasional to abundant, fine to medium, sub-angular to sub-rounded flint and chalk.

In BH2, a grey and dark brown mottled gravelly silty clay was encountered between 3.70 – 4.20m bgl. The gravel was occasional to abundant, fine to medium, sub-angular to sub-rounded chalk.

The cohesive soils were shown to have a **no to low volume change potential** in accordance with NHBC Standards Chapter 4.2 and a **low volume change potential** in accordance with BRE240. Geotechnical analyses indicated these soils to be very stiff, overconsolidated to heavily overconsolidated with no potential moisture deficits.

The soils of the Undifferentiated River Terrace Deposits were overconsolidated to heavily overconsolidated cohesive soils of very low to medium undrained shear strength and were therefore likely to be a suitable stratum for moderately loaded spread or piled foundations. The settlements induced on loading were likely to be moderate to high.

- Soils of the Lewes Nodular Chalk Formation were encountered underlying the Undifferentiated River Terrace Deposits for the remaining depth of BH1 and BH2, a depth of 5.45 - 10.45m bgl. As a result of sample disturbance caused by the drilling process, the chalk was generally recovered as a structureless chalk composed of off white slightly gravelly sandy silt clay. The gravel was very weak to weak, low density and sub-angular. (CIRIA C574: Grade Dm).

Between 5.40 – 10.45m bgl in BH1 the chalk was recovered as a structureless chalk composed of slightly silty sub-rounded gravel. The clasts were weak, low and medium density, sub-angular and white. (CIRIA C574: Grade Dc).

The deposits of the Lewes Nodular Chalk Formation were a weak rock and as such were suitable as a bearing stratum for the proposed development. The depth to the Lewes Nodular Chalk Formation would prevent it being used as a bearing stratum for pad or strip foundations, but would be suitable as a founding stratum for a piled foundation scheme. The settlements induced on loading are likely to be low to moderate.

The final design of foundations will need to take into account the volume change potential of the soil, the depth of root penetration and/or desiccation and the likely serviceability and settlement requirements of the proposed structure. These parameters for design are discussed in the next section of this report.

- Roots were noted to 1.80m bgl in BH1 and 0.60m bgl in BH2.
- Groundwater encountered at depths of 1.40m, 4.20m and 7.50m bgl in BH1. Groundwater encountered at depth of 1.60m and 3.60m bgl in BH2.

6.2 Spread Foundations

The foundation design must be suitable for the conditions present at the site.

At the time of reporting, July 2018, the proposed development was understood to comprise the construction of a single storey guest house with a mezzanine floor. Whilst no basement is to be excavated, it is proposed to sink the building into the ground by about 0.80m (~2.80 m AOD). French drains are proposed to be installed around the perimeter of the new building. A plan of the proposed development is given in Figure 5 and a section is given in Figure 6.

The proposed development fell within Geotechnical Design Category 2 in accordance with Eurocode 7. The anticipated foundation loads were unknown to Ground and Water Limited at the time of the preparation of this report, but are thought to range between 75 – 150kN/m² based on experience.

The cohesive soils were shown to have a **no to low volume change potential** in accordance with NHBC Standards Chapter 4.2 and a **low volume change potential** in accordance with BRE240. Geotechnical analyses indicated these soils to be very stiff, overconsolidated to heavily overconsolidated with no potential moisture deficits.

Due to the cohesive soils having the potential for volume change foundations must not be placed within cohesive root penetrated and/or desiccated soils and the influence of the trees surrounding the site must be taken into account. The base of foundation excavations must extend at least 300mm into non-root penetrated soils. Should trees be removed from footprint of proposed development then a piled foundation should be considered.

Roots were noted to 1.80m bgl in BH1 and 0.60m bgl in BH2. Fine rootlets were noted in the sample from 1.00m bgl in BH2 during the geotechnical laboratory testing. Soils described as Brickearth with a very low/low undrained shear strength (20kPa) were encountered to a depth of between 1.20 – 1.40m bgl. A soft spot with a very low undrained shear strength (15kPa) within the soils of the Undifferentiated River Terrace Deposits was encountered at a depth of 1.20-1.40m bgl in BH2.

Based on the above, minimum foundation depths are likely to be ~2.00 – 2.10m bgl (1.20 – 1.30m below the lowered floor level). It was considered that foundations should be taken through any Made Ground/Topsoil, Brickearth, disturbed and/or desiccated ground, below any roots and into or onto the soils of the Undifferentiated River Terrace Deposits and/or Lewes Nodular Chalk Formation. The following bearing capacities could be adopted for 5.0m long by 0.75m and 1.0m wide footings and a 1.5m by 1.5m pad constructed at 2.00m and 2.50m bgl.

Limit State: Bearing Capacities Calculated (Based on BH2)		
Depth (m BGL)	Foundation System	Limit Bearing Capacity (kN/m ²)
2.00	5.00m by 0.75m Strip	84.42
	5.00m by 1.00m Strip	85.14
	1.50m by 1.50m Pad	96.26
2.50	5.00m by 0.75m Strip	105.18
	5.00m by 1.00m Strip	106.06
	1.50m by 1.50m Pad	116.73

Serviceability State: Settlement Parameters Calculated (Based on BH2)			
Depth (m BGL)	Foundation System	Limit Bearing Capacity (kN/m ²)	Settlement (mm)
2.00	5.00m by 0.75m Strip	80	<11
	5.00m by 1.00m Strip	85	<13
	1.50m by 1.50m Pad	95	<15
2.50	5.00m by 0.75m Strip	100	<11
	5.00m by 1.00m Strip	105	<14
	1.50m by 1.50m Pad	115	<15

Differential settlement between foundations cast into the cohesive soils of the Undifferentiated River Terrace Deposits and the Lewes Nodular Chalk Formation was anticipated and foundations must be reinforced to allow for such potential differential movement. Note should be made that differential settlement may also occur between strip and isolated pad foundations.

Excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate on the formation level for even a short time not only would an increase in heave occur resulting from the soil increasing in volume by taking up water, but also the shear strength and hence the bearing capacity would also be reduced.

Groundwater encountered at depths of 1.40m, 4.20m and 7.50m bgl in BH1. Groundwater encountered at depth of 1.60m and 3.60m bgl in BH2.

Based on the ground investigation results, it was considered likely that groundwater would be encountered during foundation excavation, based on the founding depths for spread foundations. Dewatering is likely to be required, and the advice of a reputable dewatering contractor, familiar with the type of ground and groundwater conditions encountered on this site, should be sought prior to finalising the foundation design regarding the suitability and cost of dewatering to facilitate the excavation of shallow foundations.

Perched water may also be encountered within the Made Ground especially after period of prolonged rainfall.

Additionally, based on Figure 4 it would appear that trees are likely to be removed to enable construction. **Should this be the case then an alternative foundation solution like isolated deep pads, a raft or piled foundations should be considered.** Piled foundations would be taken through the Made Ground, the Undifferentiated River Terrace Deposits and into the underlying Lewes Nodular Chalk Formation

General Recommendations for Spread Foundations:

- Foundation excavations must be carefully bottomed out and any loose soil or soft spots removed prior to the foundation concrete or blinding being placed. Failure to ensure that foundation excavations are suitably bottomed out could result in additional settlements.
- Inspection of foundation excavations, prior to concreting, must be made by a competent and suitably qualified person to check for any soft spots and to check for the presence of roots.
- The excavation must be kept dry as accumulation of water could result in increased settlements.
- Foundations must not be cast over foundations of former structures and/or other hard spots.
- Any groundwater or surface water ingress must be prevented from entering foundation trenches.
- Isolated Pad Foundations must be at least 1.5 times the width of the widest pad apart to keep to the anticipated settlements.
- Given that the medium volume change potential of the cohesive soils of the Brickearth, a suspended slab should be considered. The volume change potential of the shallow surface soils must be taken into account in final design (underfloor void diameter/compressible material/void formers etc.).
- Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the structure, volume change potential of the soils encountered and the developments proximity to former, present and proposed trees.

6.3 Piled Foundations

Should the bearing capacities provided not be suitable for the proposed development and given the potential need for dewatering during foundation excavation and the likely removal of trees to facilitate construction, a piled foundation may be more cost effective with piles taken through the Topsoil/Made Ground, Brickearth, Undifferentiated River Terrace Deposits and into the underlying Lewes Nodular Chalk Formation.

The construction and design of a piled foundation is a specialist job, and the advice of a reputable contractor, familiar with the type of ground and groundwater conditions encountered on this site, should be sought prior to finalising the foundation design, as the actual pile working load will depend on the particular type of pile and method of installation adopted. The pile design should be undertaken based upon the results obtained from BH1.

6.4 Excavations and Stability

Shallow excavations in the Topsoil/Made Ground, Brickearth and the Undifferentiated River Terrace Deposits are likely to be marginally stable at best. Long, deep excavations, through these strata are likely to become unstable, especially where groundwater strikes are noted.

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

6.5 Sub-Surface Concrete

Sulphate concentrations measured in 2:1 water/soil extracts, from both the geotechnical and chemical laboratory testing, fell into Class DS-1 of the BRE Special Digest 1, 2005, *'Concrete in Aggressive Ground'*.

Table C2 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) site classification AC-1 for foundations on the site. For the classification given, the "mobile" and "natural ground" case was adopted given the geology (granular soils over chalk) and the history of the site.

The sulphate concentrations ranged in the samples from 17 - 250 mg/l with a pH range of 7.9 – 8.2. Total sulphate concentrations were <0.02 – 0.05%. Total potential sulfate (3x Total Sulphur) was <0.06%

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, *'Concrete in Aggressive Ground'* taking into account the pH of the soils.

6.6 Road and Hardstanding

Topsoil and Made Ground was encountered to a depth of between 0.15m to 0.40m bgl in the boreholes. Where roads and hardstanding are to be founded in Made Ground, consideration should be given to adopting a CBR value of 1%. Given that the Made Ground soils encountered beneath the site are a mixture of sand, gravel and clay-based soils, these deposits are likely to be **frost susceptible**.

Where shallow Made Ground was noted, roads and hardstanding constructed on the medium volume change potential soils of the Brickearth and or/Undifferentiated River Terrace Deposits should be designed based on a CBR value of 3.0%. This is based on reference to Table C1 of TRL1132 and average construction conditions. Based on wet conditions a CBR of 1.5% should be adopted, with dry conditions a CBR of 3.5% being applicable. Given that the soils encountered beneath the site are

mainly clay-based soils (poorly drained) with plasticity indexes greater than 20%, **these deposits are likely to be non-frost susceptible.**

All formation levels for roads and hardstanding should be proof rolled to highlight any soft areas which should then be dug out and replaced with selected granular material compacted in thin layers to a suitable specification.

6.7 Surface Water Disposal

Infiltration tests were beyond the scope of the investigation.

The principles of a sustainable urban drainage system (SUDS) should be applied to reduce the risk of flooding from surface water ponding.

It was considered that the Undifferentiated River Terrace Deposits may provide a suitable medium for the disposal of storm water. Soakaway tests to BRE365 should be undertaken to confirm this since the cohesive soils may restrict the design infiltration rate.

Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources.

6.8 Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation. For example, there may have been underground storage tanks (UST's) not identified during the Ground Investigation for which there is no historical or contemporary evidence.

Such occurrences may be discovered during the construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.

6.9 Waste Disposal

The excavation of foundations is likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all waste must be classified as;

- Inert;
- Non-hazardous, or;
- Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM2) document outlines the methodology for classifying wastes.

Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

6.10 Imported Material

Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

The Topsoil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, either prior to placing (ideally) or after placing, to ensure that the human receptor cannot come into contact with compounds that could be detrimental to human health.

6.11 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust were generated as a result of construction activities.

The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:

Kingston Corner Annex, Brookside Road, East Preston, West Sussex BN16 1SE

Client:

David Station c/o Nico Warr Architects

Date:

July 2018

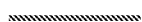
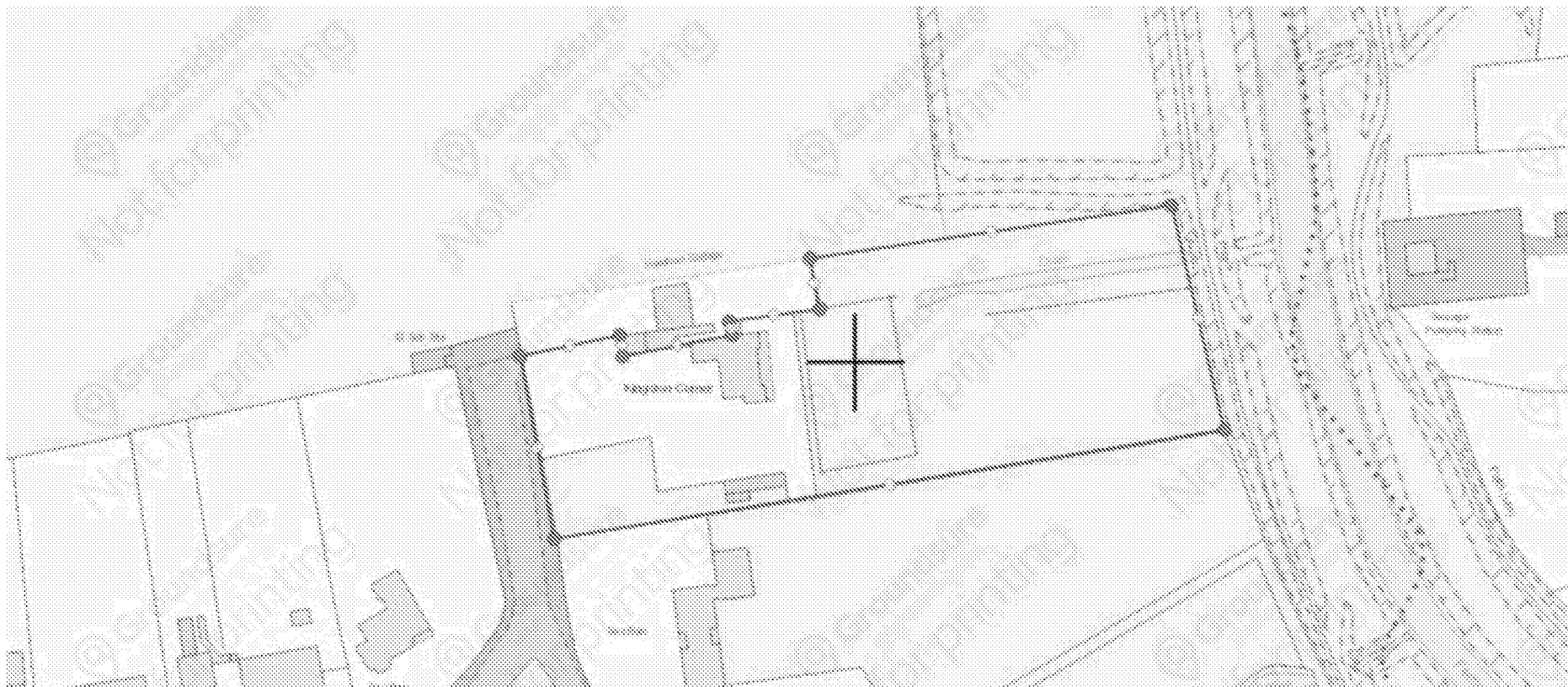
Site Location Plan

Ref:

GWPR2607

Figure 1

ground&water



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:

Kingston Corner Annex, Brookside Road, East Preston, West Sussex BN16 1SE

Client:

David Station c/o Nico Warr Architects

Date:

July 2018

Site Development Area

Ref:

GWPR2607

Figure 2

ground&water



----- APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:

Kingston Corner Annex, Brookside Road, East Preston, West Sussex BN16 1SE

Client:

David Station c/o Nico Warr Architects

Date:

July 2018

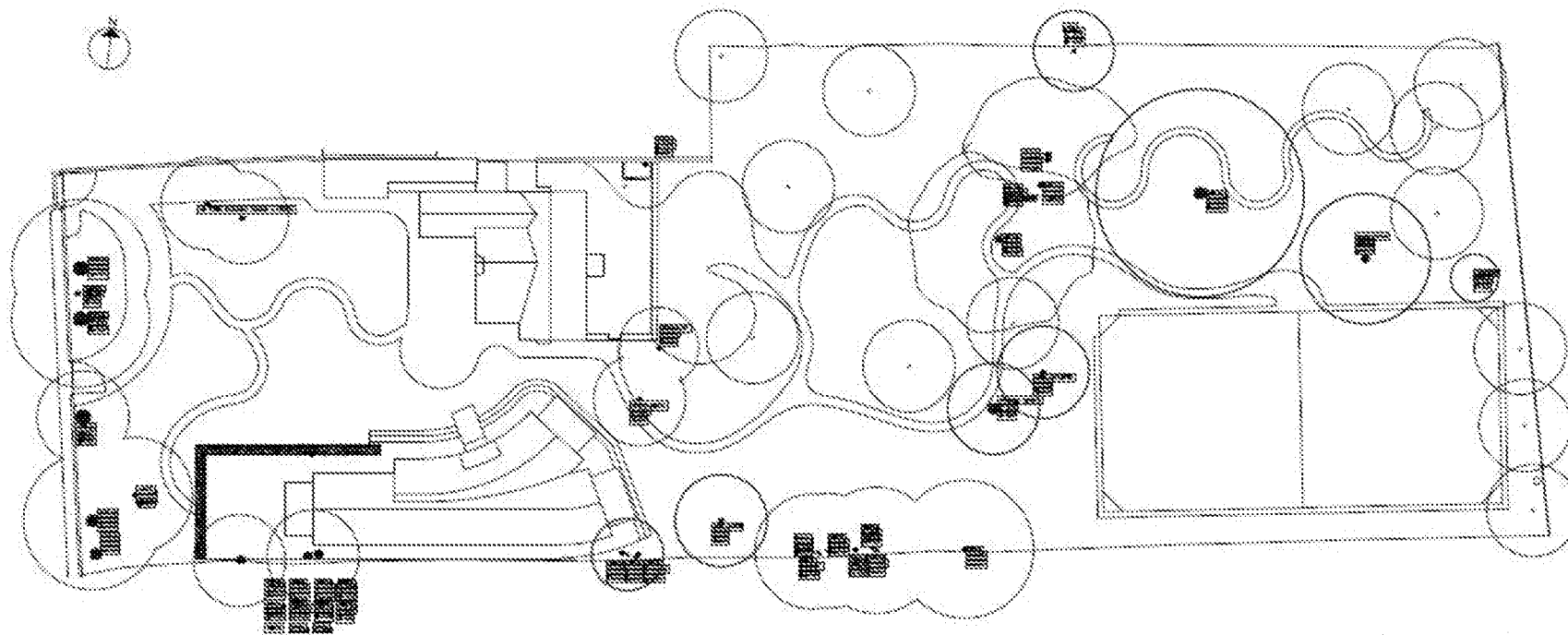
Aerial View of the Site

Ref:

GWPR2607

Figure 3

ground&water



① GA Plan - Ground Floor
1/1/2018

----- APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:
Kingston Corner Annex, Brookside Road, East Preston, West Sussex BN16 1SE

Client:
David Station c/o Nico Warr Architects

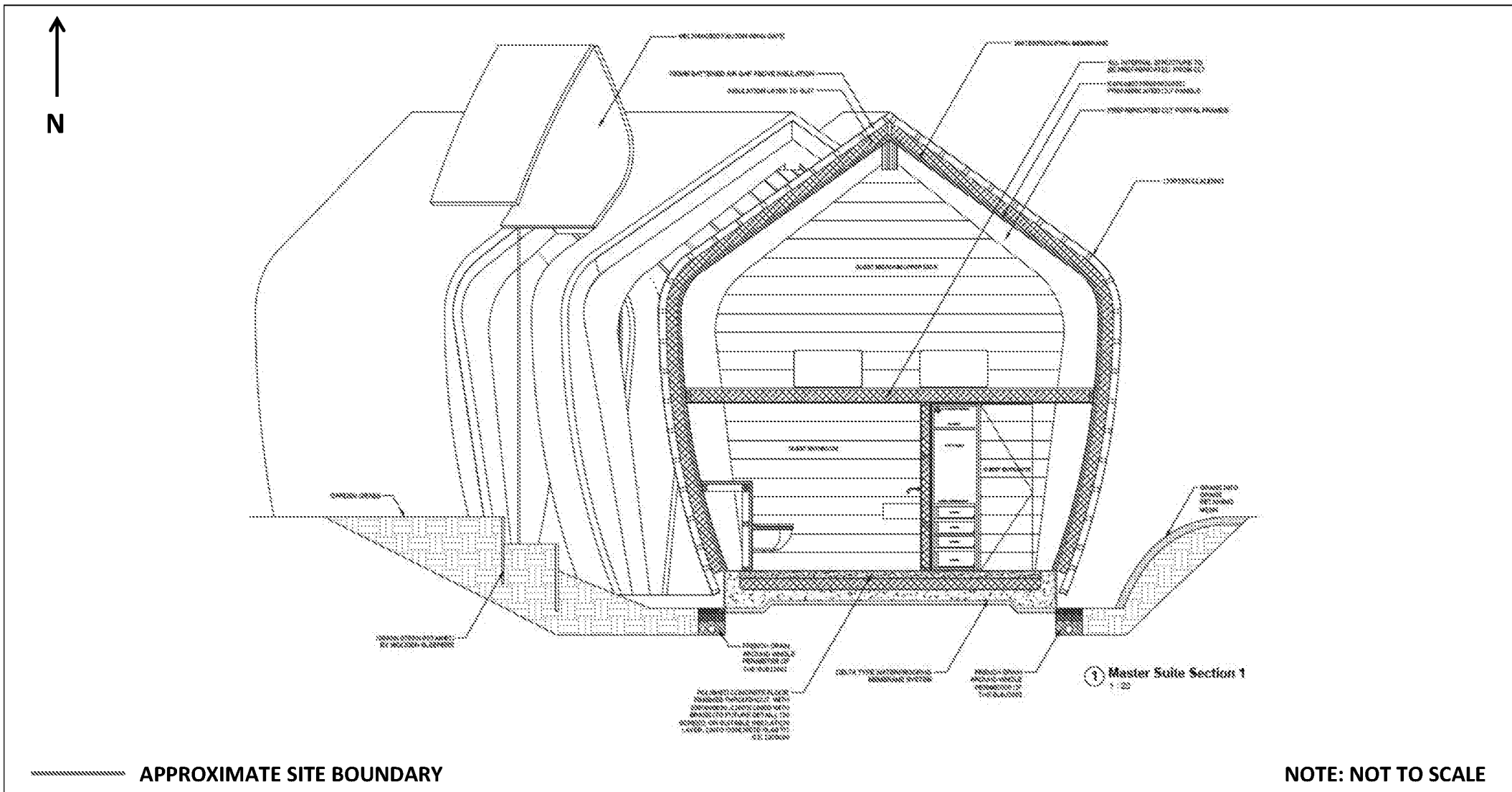
Date:
July 2018

Proposed Development - Plan View

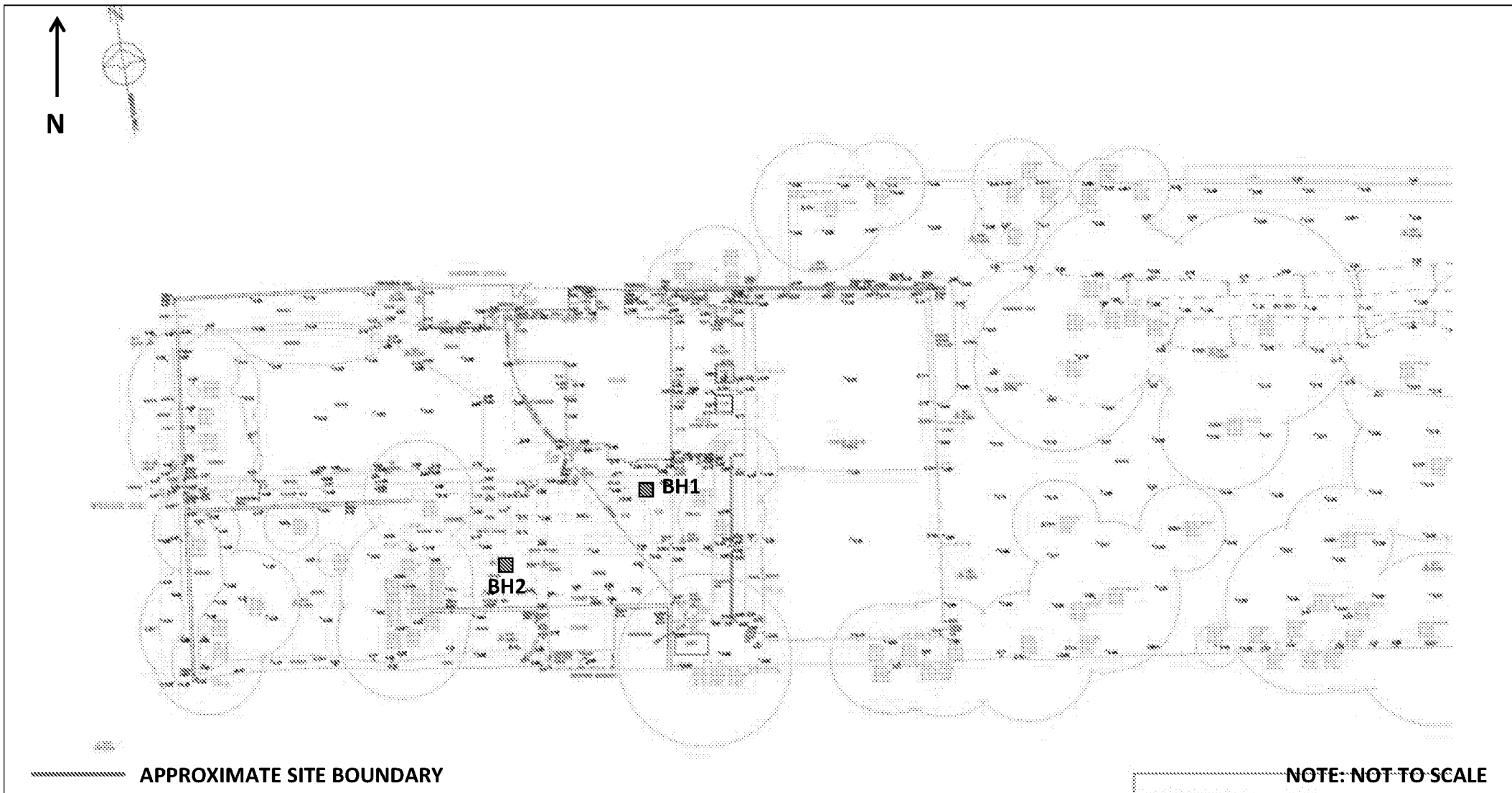
Ref:
GWPR2607

Figure 4

ground&water



Project:		Kingston Corner Annex, Brookside Road, East Preston, West Sussex BN16 1SE		Figure 5 ground&water
Client:	David Station c/o Nico Warr Architects	Date:	July 2018	
Proposed Development - Section View		Ref:	GWPR2607	



Project: Kingston Corner Annex, Brookside Road, East Preston, West Sussex BN16 1SE		Figure 6 ground&water
Client: David Station c/o Nico Warr Architects	Date: July 2018	
Trial Hole Location Plan	Ref: GWPR2607	

APPENDIX A

Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to Kingston Corner Annex, Brookside Road, West Sussex BN12 5NH.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Only our client may rely on this report and should this report or any information contained in it be provided to any third party we accept no responsibility to the third party for the contents of this report save to the extent expressly outlined by us in writing in a reliance letter addressed from us to the third party.

Recipients are not permitted to publish this report outside of their organisation without our express written consent.

APPENDIX B
Fieldwork Logs

Project Name
Kingston Corner Annex

Project No.
GWPR2607

Co-ords: -

Hole Type
WLS

Location: Brookside Road, East Preston, West Sussex BN16 1SE

Level: -

Scale
1:50

Client: David Station c/o Nico Warr Architects

Dates: 10/05/2018

Logged By
RF

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.03			0.03			MADE GROUND: Shingle.	
		0.15			0.15			MADE GROUND: Type 1 sub-base.	
		0.50	D		0.60			MADE GROUND: Dark brown gravelly sandy silty clay. The sand was fine grained and the gravel was occasional to abundant, fine to coarse, sub-angular to sub-rounded flint and brick.	
		0.80	D						
		1.00	SPT	N=4					
		1.00	D	(1,1/ 1,1,1,1)					1
		1.50	D		1.40			BRICKEARTH: Dark brown slightly gravelly sandy silty clay. The sand was fine grained and the gravel was rare to occasional, fine to medium, sub-angular to sub-rounded flint.	
		2.00	SPT	N=11					
		2.00	D	(2,3/ 2,3,3,3)					2
		2.50	D		2.30			UNDIFFERENTIATED RIVER TERRACE DEPOSITS: Pale brown slightly grey mottled slightly gravelly sandy very silty CLAY. The sand was fine grained and the gravel was rare to occasional, fine to medium, sub-angular to sub-rounded flint.	
		3.00	SPT	N=17					
		3.00	D	(3,3/ 4,4,5,4)					3
		3.50	D						
		4.00	SPT	N=24					
		4.00	D	(5,6/ 6,6,6,6)					4
		4.50	D						
		5.00	SPT	N=32					
		5.00	D	(5,6/ 5,10,8,9)					5
		5.50	D		5.40				
		6.00	SPT	N=45					
		6.00	D	(9,10/ 10,11,12,12)					6
		6.50	D						
		7.00	SPT	N=22					
		7.00	D	(10,9/ 5,5,6,6)					7
		7.50	D						
		8.00	SPT	N=16					
		8.00	D	(6,5/ 4,4,4,4)					8
		8.50	D						
		9.00	SPT	N=23					
		9.00	D	(5,5/ 8,7,4,4)					9
		9.50	D						

Continued next sheet

Remarks: Groundwater strikes at 1.40m, 4.20m and 7.50mbgl.
Roots noted to 1.80m bgl.



Project Name
Kingston Corner Annex

Project No.
GWPR2607

Co-ords: -

Hole Type
WLS

Location: Brookside Road, East Preston, West Sussex BN16 1SE

Level: -

Scale
1:50

Client: David Station c/o Nico Warr Architects

Dates: 10/05/2018

Logged By
RF

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.00	SPT	N=32	10.45			LEWES NODULAR CHALK FORMATION: Structureless CHALK composed of slightly silty sub-rounded GRAVEL. The clasts were weak, low and medium density, sub-angular and white. (CIRIA C574: Grade Dc)	
		10.00	D	(7,9/10,8,7,7)					
								End of Borehole at 10.45 m	
									11
									12
									13
									14
									15
									16
									17
									18
									19
			Type	Results					

Remarks: Groundwater strikes at 1.40m, 4.20m and 7.50mbgl.
Roots noted to 1.80m bgl.



Project Name
Kingston Corner Annex

Project No.
GWPR2607

Co-ords: -

Hole Type
WLS

Location: Brookside Road, East Preston, West Sussex BN16 1SE

Level: -

Scale
1:50

Client: David Station c/o Nico Warr Architects

Dates: 10/05/2018

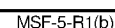
Logged By
RF

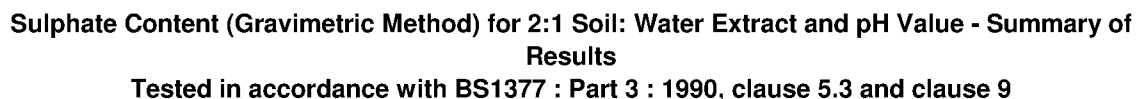
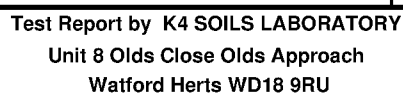
Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	 <								

Remarks: Groundwater strike at 1.60m and 3.40m bgl.
Roots noted to 0.60m bgl.



APPENDIX C
Geotechnical Laboratory Test Results

[illegible]

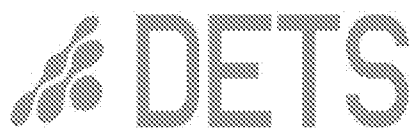
[illegible]

Checked and Approved	
Initials	kp
Date:	14/06/2018

2519

Approved Signatories: K. F. Naure (Tech.Mgr) J. F. Naure (Lab.Mgr)

MSF-5-R29



Roger Foord
Ground & Water Ltd
2 The Long Barn
Norton Farm
Selborne Road
Alton
Hampshire
GU34 3NB

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN



DETS Report No: 18-76036

Site Reference: Kingston Corner Annex, Brookside Road, East Preston, West Sussex, BH16 1SE

Project / Job Ref: GWPR2607

Order No: None Supplied

Sample Receipt Date: 31/05/2018

Sample Scheduled Date: 31/05/2018

Report Issue Number: 1

Reporting Date: 06/06/2018

Authorised by:



Russell Jarvis
Associate Director of Client Services

Authorised by:

Dave Ashworth
Deputy Quality Manager



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone



Soil Analysis Certificate						
DETS Report No: 18-76036	Date Sampled	10/05/18	10/05/18			
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Kingston Corner Annex, Brookside Road, East Preston, West Sussex, BH16 1SE	TP / BH No	BH1	BH2			
Project / Job Ref: GWPR2607	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	1.00	3.00			
Reporting Date: 06/06/2018	QTSE Sample No	337309	337310			

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	8.1	8.2			
Total Sulphate as SO ₄	mg/kg	< 200	NONE	< 200	481			
Total Sulphate as SO ₄	%	< 0.02	NONE	< 0.02	0.05			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	17	18			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.02			
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02			
Ammonium as NH ₄	mg/kg	< 0.5	NONE	< 0.5	3.4			
Ammonium as NH ₄	mg/l	< 0.05	NONE	< 0.05	0.34			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	27	34			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	13.5	17.2			
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	6	< 3			
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	3.1	< 1.5			
W/S Magnesium	mg/l	< 0.1	NONE	2.2	1.5			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 18-76036	
Ground & Water Ltd	
Site Reference: Kingston Corner Annex, Brookside Road, East Preston, West Sussex, BH16 1SE	
Project / Job Ref: GWPR2607	
Order No: None Supplied	
Reporting Date: 06/06/2018	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
\$ 337309	BH1	None Supplied	1.00	12.8	Brown sandy clay with vegetation
\$ 337310	BH2	None Supplied	3.00	13.2	Light grey sandy clay with chalk

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{U/5}

\$ samples exceeded recommended holding times



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No: 18-76036	
Ground & Water Ltd	
Site Reference: Kingston Corner Annex, Brookside Road, East Preston, West Sussex, BH16 1SE	
Project / Job Ref: GWPR2607	
Order No: None Supplied	
Reporting Date: 06/06/2018	

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