



Ground Condition Consultants

YEOMANS HONDA, LITTLEHAMPTON RD, WORTHING

GROUND CONDITION ASSESSMENT

AUGUST 2018

Prepared for
AKS Ward
116 High Street
The French Quarter
Southampton SO14 2AA

Prepared by
Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
Hampshire
SO19 9RY



VERSION CONTROL

Project Name Yeomans Honda, Worthing – GCA

Project No. J18-035

Report No. J18-035-R02

Desk Study Assessment	
Prepared by: Antony Platt - Director	Reviewed by: Rasmus Palmgren - Director
Site Investigation Factual Report	
Prepared by: Antony Platt - Director	Reviewed by: Rasmus Palmgren - Director
Generic Quantitative Risk Assessment	
Prepared by: Antony Platt - Director	Reviewed by: Rasmus Palmgren - Director
Geotechnical Design Report	
Prepared by: David Fall – Geotechnical and Environmental Consulting Ltd	Reviewed by: Rasmus Palmgren - Director

Version	Date	Description
1.0	08.08.18	Final

Contents

0.	EXECUTIVE SUMMARY	7
1.	INTRODUCTION	9
1.1	INSTRUCTION	9
1.2	LEGAL CONTEXT	9
1.3	METHODOLOGY	10
1.4	PROPOSED USE	12
1.5	REPORT SCOPE AND LIMITATIONS	12
2.	PRELIMINARY RISK ASSESSMENT	13
2.1	SITE LOCATION AND DESCRIPTION	13
2.2	SITE HISTORY	13
2.3	DOCUMENTATED GROUND CONDITIONS	14
2.4	ENVIRONMENTAL DATA SEARCH	15
2.5	MINING AND NATURAL GROUND HAZARDS	16
2.6	DEPARTMENT OF ENVIRONMENT – INDUSTRY PROFILES	17
2.7	CONCLUSIONS OF PRELIMINARY RISK ASSESSMENT	18
3.	FIELDWORK SUMMARY OF SCOPE AND RATIONALE	19
3.1	RATIONALE AND SUMMARY OF SCOPE	19
3.2	SAMPLING	19
3.3	SITE INVESTIGATION STANDARDS	20
4.	GROUND CONDITIONS ENCOUNTERED	21
4.1	SOIL CONDITIONS	21
4.2	TOPSOIL/MADE GROUND	21
4.3	UNDIFFERENTIATED SUPERFICIAL DEPOSITS	22
4.4	UNDIFFERENTIATED WHITE CHALK	22
4.5	EXCAVATION STABILITY	22
4.6	OBSTRUCTIONS	22

4.7	GROUNDWATER CONDITIONS.....	22
4.8	VISUAL/OLFACTORY EVIDENCE OF CONTAMINATION	23
4.9	INFILTRATION TESTING	23
5.	GENERIC RISK ASSESSMENT	25
5.1	CONTAMINATION ASSESSMENT METHODOLOGY	25
5.2	SOIL ASSESSMENT	27
5.3	STATISTICAL ANALYSIS	30
5.4	WASTE ACCEPTANCE CRITERIA.....	30
5.5	GROUND GAS ASSESSMENT	31
6.	CONCEPTUAL SITE MODEL	32
6.1	SOURCES.....	32
6.2	PATHWAYS	32
6.3	RECEPTORS	32
7.	RISK ASSESSMENT.....	33
7.1	RISK ASSESSMENT PROCEDURE	33
7.2	POLLUTANT LINKAGE ASSESSMENT	35
8.	GEOTECHNICAL ASSESSMENT	37
8.1	INTRODUCTION	37
8.2	GEOTECHNICAL TESTS	37
8.3	GEOLOGICAL AND GEOTECHNICAL PARAMETERS.....	37
9.	FOUNDATION AND GROUND ENGINEERING	45
9.1	INTRODUCTION	45
9.2	SHALLOW FOUNDATIONS	45
9.3	FLOOR SLABS.....	50
9.4	HARDSTANDINGS & ACCESSWAYS.....	50
9.5	SOAKAWAY DRAINAGE	51
9.6	EXCAVATION STABILITY	51
9.7	CHEMICAL ATTACK ON BURIED CONCRETE.....	51

10. CONCLUSIONS AND RECOMMENDATIONS	52
10.1 CONTAMINATION	52
10.2 GEOTECHNICAL	53

List of Tables

Table 2.1. Data search results.....	15
Table 3.1. Exploratory hole location rationale	19
Table 4.1. Summary of encountered ground conditions	21
Table 4.2. Summary of Infiltration Test Results.....	23
Table 7.1. Sensitivity of receptor	33
Table 7.2. Magnitude of impact	33
Table 7.3. Level of severity for potential hazard.....	34
Table 7.4. Probability of risk definition.....	34
Table 7.5. Level of risk for potential hazard definition	34
Table 7.6. Pollutant Linkage Assessment	35
Table 8.1. Summary of Geotechnical Testing	37
Table 8.2. Results of the Standard Penetration Testing – Fine Grained RTD.....	38
Table 8.3. Results of the Atterberg Limits Tests – Undifferentiated Superficial Deposits	39
Table 8.4. Results of the UU Triaxial Compression Testing – Undifferentiated Superficial Deposits.....	40
Table 8.5. Results of the Direct Shear Tests – Undifferentiated White Chalk	42
Table 8.6. Summary of the results of chemical testing for concrete classification	43
Table 8.7. Results of the BRE SD1 testing.....	43
Table 8.8. Characteristic Geotechnical Parameters	44
Table 9.1. Minimum Depth of Foundations for Medium Volume Change Soil (after NHBC)	46
Table 9.2. Ground Model used in the Bearing Resistance Calculations	46
Table 9.3. Partial Factors Applied to the Bearing Resistance Analysis	47
Table 9.4. Summary of ULS Bearing Capacity Checks.....	47
Table 9.5. Revised ULS Bearing Resistance in after Groundwater Correction	48
Table 9.6. Results of Settlement Analyses.....	49
Table 9.7. Results of TRL Probe CBR Calculations	50

List of Figures and Appendices

FIGURE 1: SITE LOCATION PLAN

FIGURE 2: INVESTIGATION LOCATION PLAN

FIGURE 3: UNDRAINED SHEAR STRENGTH V DEPTH

APPENDIX 1: REPORT CONDITIONS

APPENDIX 2: ENGINEERING LOGS

APPENDIX 3: GENERIC ASSESSMENT CRITERIA

APPENDIX 4: SOIL SCREENING SUMMARY

APPENDIX 5: CHEMICAL LABORATORY TEST CERTIFICATES

APPENDIX 6: GROUNDWATER MONITORING RESULTS

APPENDIX 7: GEOTECHNICAL TEST CERTIFICATES

APPENDIX 8: GEOTECHNICAL CALCULATIONS

APPENDIX 9: DCP – CBR RESULTS

APPENDIX 10: INFILTRATION TEST CALCULATIONS

0. EXECUTIVE SUMMARY

Brief	The brief was to undertake a site investigation and assessment to identify any ground contamination issues and geotechnical conditions that may affect the proposed development.
Current Site Status	The study site is located to the north of Littlehampton Road (A259), Ferring, Worthing BN12 6PB (at approximate grid ref: 508929,103451) and currently comprises a car dealership, a residential property and former stables.
Site History	According to the Ordnance Survey maps provided and reviewed from 1876 to 2014 (scales 1:2,500, 1:10,000, 1:1,250, 1:10,560) the site appears to have been in agricultural use and residential use, prior to its current layout.
Geology	The 1:10,000 scale map indicates the site to directly overlie superficial Brickearth deposits (silt), whereas the 1:50,000 scale map indicates the site to directly overlie superficial River Terrace Deposits (sand, silt and clay). Both scales of mapping indicate bedrock geology of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (Undifferentiated).
Hydrogeology	The Environment Agency Groundwater Vulnerability Map extracts indicate the site to be overlying a bedrock Principal Aquifer, interpreted as the Chalk, with a superficial Secondary A aquifer, interpreted as the Brickearth/River Terrace Deposits.
Hydrology	The closest surface water feature to the site is Ferring Rife, located 210m to the southeast.
Investigation Scope	The site investigation works were undertaken by GCC between the 25th and 27th May 2018. The scope and rationale of the site investigation were specified by Paul Basham Associates and are presented below. • 5no. windowless sample boreholes (WS101 to WS105) to a maximum depth of 5.0mbgl. • 4no. foundation inspection pits • Trial pit soakaway testing at 2no. locations in accordance with BRE 365. • CBR testing (using a Dynamic Cone Penetrometer) at 6no. locations.
Conclusions and Recommendations (Contamination)	The conceptual model, based on information obtained as part of the Preliminary Risk Assessment and confirmed by the Generic Quantitative Risk Assessment, has identified potential risks in relation to the proposed development associated with the potential presence of asbestos containing material in soil across the site, associated with the construction and operation of the site buildings. These risks have been assessed to be Low/Moderate, based on the data currently available and on the assumption that ACM is encountered during the development. A localised hydrocarbon impact, suspected to be associated with heating oil, was also identified in the vicinity of WS104. While the contamination identified is not considered to present a significant risk to human health or controlled waters in the context of the proposed development, it may present a risk to water supply pipes and may incur additional disposal cost if excavated and disposed of off-site. As such, it is recommended that: • Vigilance by the groundworks contractor for asbestos containing material is recommended throughout the development with a discovery strategy in place should any asbestos containing material be encountered. • Any residual traces of ACM encountered during the development are removed from site and disposed of appropriately. • If any soil with a notable hydrocarbon odour is excavated as part of the construction of the foundations for the proposed building, it is recommended that this material is retained on site and placed beneath hard standing or the

	proposed building in favour of the disposal of unimpacted soil in order to minimise disposal costs as such material may not be considered as inert.
Conclusions and Recommendations (Geotechnical)	It is understood that the proposed development is to comprise commercial office accommodation and other facilities associated with a car dealership. No structural loadings have been supplied at the time of reporting so a detailed foundation assessment could not be carried out. Ground conditions beneath the site have been shown to comprise Undifferentiated Superficial Deposits overlying White Chalk. A ULS bearing resistance for foundations constructed at 0.90mbgl within the USD of 180kN/m² has been calculated for a pad foundation. Serviceability limit state settlement analysis has been carried out and indicates a total settlement of less than 25mm for a 1m x 1m pad foundation loaded to 180kN/m². However, increasing the pad dimensions increases the settlement and in order to limit settlements to less 25mm, the allowable foundation load on a 2m x 2m pad should be restricted to 125kN/m². Based on the low to medium volume change potential of the USD and the absence of evidence of desiccation a ground bearing floor slab is considered appropriate for this site. The slab should be constructed beneath any Made Ground and the founding stratum should be carefully inspected and proof-rolled prior to construction. Foundation excavations should remain stable in the short-term. However, it is recommended that foundation concrete is placed as soon after excavation as possible. Chemical testing of ground aggressivity has shown the ground to be consistent with Design Sulphate Classification DS-1 and an ACEC of AC-1s assuming static groundwater within the fine-grained USD. Based on the results of TRL probing a preliminary design CBR of 4% is recommended at the top of the USD. Infiltration rates recorded in the infiltration tests suggest the ground to be of low permeability and poor drainage conditions.
<i>This sheet is intended to provide a summary only of the initial indicative assessment study of the site in relation to ground contamination. It does not provide a definitive engineering analysis for the purposes of costing or construction, and is subject to the limitation of the agreed brief.</i>	

1. INTRODUCTION

1.1 INSTRUCTION

Ground Condition Consultants Ltd. (GCC) was commissioned by AKS Ward in June 2018 to undertake a Ground Condition Assessment of a site adjacent to and incorporating the Yeomans Peugeot dealership at Littlehampton Rd, Ferring, Worthing BN12 6PB.

The brief was to undertake a site investigation and assessment to identify any ground contamination issues and geotechnical conditions that may affect the proposed development and follows on from the Desk Top Study issued by GCC in February 2018. This report provides an assessment of the identified and potential ground conditions of the site, with regard to the proposed works in accordance with the Model Procedures for the Management of Land Contamination (CLR 11), published by the Environment Agency. In addition, the geotechnical sections of this report provide a detailed assessment of the materials present beneath the site and present characteristic parameters that should be used in design of all geotechnical facets of the proposed development.

This report is prepared in line with the agreed brief and is subject to the report conditions shown in Appendix 1.

1.2 LEGAL CONTEXT

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from land contamination. In accordance with the Act and the statutory guidance document 'The Contaminated Land (England) Regulations 2000', the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the Regulatory Authority, by reason of substances within or under the land, that:

- Significant harm is being caused, or there is a significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused."

Inherent in this definition is the requirement for contamination risk assessment to be undertaken on a site-specific basis, as the potential for harm is determined by the site's end use and its specific environmental setting.

The guidance defines "risk" as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

While Part IIA of the Environmental Protection Act provides a risk based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment, the regime does not take into account future uses. New developments are therefore controlled by the planning regime, with reference to the National Planning Policy Framework (NPPF), rather than directly by Part IIA of the Environmental Protection Act.

The NPPF is based on the principal that the site should be suitable for its new use, taking account of ground conditions, including from natural hazards or former activities and states that “Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner”. The NPPF also links the planning and Part IIA regimes by stating that “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990”. Key components of the Part IIA regime, such as the definition of Contaminated Land and the associated risk-based assessment approach, are therefore considered to also be applicable to the planning regime.

1.3 METHODOLOGY

This report has been prepared in accordance with published Environment Agency guidance (‘Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR) 11’). CLR 11 provides the technical framework for structured decision making about land contamination and builds on previous work carried out under the Contaminated Land Research Programme (of the former Department of the Environment). CLR 11 has adopted and refined the well recognised methodology and terminology that has been used in contaminated land risk assessment for a number of years.

1.3.1. Pollutant linkage concept

In the context of land contamination, there are three essential elements to any risk:

- A **contaminant source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.

- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant–pathway–receptor is described as a pollutant linkage.

1.3.2. Conceptual model

An important thread throughout the overall process of risk assessment is the need to formulate and develop a **conceptual model** for the site, which supports the identification and assessment of pollutant linkages. A conceptual model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

1.3.3. Risk assessment

CLR 11 advocates a phased approach to risk assessment comprising the following in order, as necessary:

Preliminary Risk Assessment – a desk study consisting of a review of documentary, anecdotal and site walk over evidence.

Generic Quantitative Risk Assessment (GQRA) - comparison of contaminant concentrations obtained from site investigation with generic assessment criteria.

Detailed Quantitative Risk Assessment (DQRA) - comparison of contaminant concentrations obtained from site investigation with site-specific assessment criteria.

This document constitutes a Preliminary and Generic Quantitative Risk Assessment. This report also comprises a Ground Investigation Report and Geotechnical Design Report in accordance with Eurocodes.

1.4 PROPOSED USE

It is currently understood that the existing Peugeot dealership is to be extended to include a Honda dealership and office accommodation for the Yeomans Group. The proposed layout comprises buildings and hard standing with minimal soft landscaping around the periphery. A change in the site use from that currently proposed may result in the need for reassessment of risk criteria and the conclusions and recommendations resulting from the risk assessment could therefore significantly change.

1.5 REPORT SCOPE AND LIMITATIONS

This report is based upon a review of readily available historical and current information and the recent site investigation data detailed herein. The report presents an interpretation of the borehole and laboratory data provided by the GCC site investigation undertaken between the 25th and 27th June 2018. In addition, this report outlines the basic ground conditions encountered in the exploratory holes and the results of any monitoring of ground installations.

This information has been collated, processed and used to provide an interpretation of the ground conditions, with recommendations on potential ground contamination risks and foundation design for the proposed development.

The recommendations and opinions expressed in this report are based on the strata observed in the exploratory holes, the results of the site and laboratory tests, and information obtained as part of the desk study or provided by others. GCC takes no responsibility for conditions that have not been revealed by the exploratory holes, or which occur between them.

Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative and liability cannot be accepted for its accuracy. Information provided from other sources is taken in good faith and GCC cannot guarantee its accuracy.

The information contained in this report is intended for the use of AKS Ward and Yeomans Ltd. and GCC can take no responsibility for the use of this information by any other party or for uses other than that described in this report.

2. PRELIMINARY RISK ASSESSMENT

2.1 SITE LOCATION AND DESCRIPTION

The study site is located to the north of Littlehampton Road (A259), Ferring, Worthing BN12 6PB (at approximate grid ref: 508929,103451). The east of the site currently is occupied by a car dealership building, comprising a showroom in the south and a workshop in the north, with a washdown area and bin store to the north and a separate workshop building beyond that to the north. A brick paved accessway to the workshops and a parking area are located to the east of the dealership building. The washdown area and bin store are surfaced with concrete. A three stage interceptor is present in the washdown area and an electrical substation is located in the southeast corner of the site. It is understood from the manager of the dealership that there is no bulk storage of fuel on site. Fresh and waste oil is stored in tanks within an elevated bund within the workshop to the rear of the showroom.

The south of the site comprises a brick paved forecourt and parking bays with peripheral soft landscaping.

The central north of the proposed development site could not be accessed during the walkover survey, although it was possible to view the area over the wall to the north and the fence to the south. This area of the site is occupied by a series of wooden stables type buildings in the north, surrounding a concrete covered courtyard. These buildings were noted to have suspected asbestos cement roofs. The south of this area was noted to be covered by dense vegetation. Access to this area appears to be via a concrete track along the north-western boundary of the proposed development area.

The northwest of the proposed development area comprises a residential property (Hill View) and its associated gardens and outbuildings. Again, access to this area was not possible during the walkover survey but the topographic survey of the site indicates the presence of the main residential property, various wooden sheds, a brick garage, a greenhouse and several mature trees.

2.2 SITE HISTORY

According to the Ordnance Survey maps provided and reviewed from 1876 to 2014 (scales 1:2,500, 1:10,000, 1:1,250, 1:10,560) the majority of the site appears to have been in agricultural use with what appears to be a farm building spanning the north-western boundary of the site on the earliest available map. This farm building appears to have been removed by 1896.

The east of the site was developed with residential properties in the late 1930s/early 1940s with Hill View and property (The Bungalow) constructed in the west of the site by 1962. The presence of a substation in the southeast of the site also appears to date from this period. The stable type buildings in the centre north of the site first appear on the 1983 map.

The main car dealership building first appears in the east of the site on the 2002 map and it is understood from the site manager that it dates from the late 1990s. The forecourt in the southwest of the site appears to have been a relatively recent addition with the former residential property in this area of the site (The Bungalow) first shown to be absent on the 2014 map.

The area surrounding the site has generally been used as plant nurseries, garden centres, agricultural land and residential properties.

2.3 DOCUMENTATED GROUND CONDITIONS

Ground conditions recorded in readily available sources are summarised below.

2.3.1. Geology

Reference to the British Geological Survey (BGS) Map extracts at 1:10,000 scale and 1:50,000 scale (see Desk Top Study) are contradictory in terms of the superficial geology. The 1:10,000 scale map indicates the site to directly overlie superficial Brickearth deposits (silt), whereas the 1:50,000 scale map indicates the site to directly overlie superficial River Terrace Deposits (sand, silt and clay). Head Deposits are shown to outcrop immediately to the north of the site.

Both scales of mapping indicate bedrock geology of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (Undifferentiated).

2.3.2. Hydrogeology

The Environment Agency Groundwater Vulnerability Map extracts (see Desk Top Study) indicate the site to be overlying a bedrock Principal Aquifer, interpreted as the Chalk, with a superficial Secondary A aquifer, interpreted as the Brickearth/River Terrace Deposits.

Secondary A Aquifers are 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

Principal Aquifers are geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers

The site is not located within a Groundwater Source Protection Zone.

2.3.3. Hydrology

The closest surface water feature to the site is Ferring Rife, located 210m to the southeast.

2.3.4. Radon

Radon is a naturally occurring radioactive gas which may be harmful to human health. Radon is generally released into the atmosphere in areas underlain by granite and limestone. Harmful concentrations of radon may build up if it becomes trapped in an enclosed space such as a building.

BGS/Public Health England data presented within the Groundsure Report indicates that the percentage of houses exceeding the Action Levels for Radon in this area is between 1% and 3%. Therefore the property is not in a Radon Affected Area, as defined by the Health Protection Agency (HPA), and radon protection measures are not necessary in new dwellings or extensions

2.4 ENVIRONMENTAL DATA SEARCH

A search of an environmental database was undertaken together with information from various other organisations as part of the desk study and is summarised in the following sections. The following summary is generally limited to locations within 250m of the site boundaries unless it is considered that installations or activities beyond that range could potentially have an impact on the site or be affected by the redevelopment of the site.

Table 2.1. Data search results

Discharge consents	There are 3no. current discharge consents located within 250m of the site, all relating to discharge of treated sewage effluent to land/groundwater.
Pollution incidents	There are no recorded pollution incidents within 250m of the site.
Water abstractions	There is 1no. recorded water abstraction located within 500m of the site. It is an historical general farming and domestic abstraction for Reynards Nursery, 77m north of the site an dates from 1971.
Fuel Stations	There are no recorded fuel stations within 250m of the site.
Landfill Sites	There are no historical or current landfill sites within 250m of the site.

2.5 MINING AND NATURAL GROUND HAZARDS

2.5.1. Mining

The Site is located in an area which may not be affected by coal mining. However, sporadic underground Chalk mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered.

2.5.2. Natural Ground Hazards

The following ground hazards were identified:

Compressible ground stability hazards – Negligible hazard

BGS Notes: No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

Collapsible ground stability hazards – Low hazard

BGS Notes: Slight possibility for collapsible deposit problems after major changes in loading or groundwater conditions. Normal maintenance to avoid large amounts of water entering the ground through pipe leakage or soak-aways should reduce the likelihood of problems due to collapsible deposits. For new build, assess the possibility of collapsible (loessic) deposits in ground investigation. For existing property, no significant increase in insurance risk from collapsible deposits is likely.

Ground dissolution stability hazards – Very Low hazard

BGS Notes: Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.

Landslide ground stability hazard – Very Low hazard

BGS Notes: Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

Shrinking or swelling clay ground stability hazard – Low hazard

BGS Notes: Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

Running sand ground stability hazards – Low hazard

BGS Notes: Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to Site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.

2.6 DEPARTMENT OF ENVIRONMENT – INDUSTRY PROFILES

The Department of the Environment Industry Profile for Road Vehicle Servicing and Repair: Garages and Filling Stations has been reviewed in relation to the use of the north east of the site for servicing cars.

As a result of this use, the following potential contaminants have a significant potential to be present:

- Metals
- Asbestos
- Inorganic chemicals
- Organic chemicals including oil and fuel hydrocarbons

2.7 CONCLUSIONS OF PRELIMINARY RISK ASSESSMENT

The following potential sources of contamination have been identified as part of the Preliminary Risk Assessment:

- Potential for asbestos cement fragments within the soil and on the ground surface in the centre north of the site, associated with the stable type buildings, and from demolition material associated with former buildings on site.
- Potential for a range of contaminants, including oil and fuel hydrocarbons, associated with the vehicle servicing and washdown area in the northeast of the site.
- Potential for PCBs in the soil and groundwater associated with the electrical substation in the southeast of the site.
- Potential for the current or past residential properties on site to have been fuelled by heating oil and for oil to have leaked from storage tanks.

It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

The risk of impact to identified receptors from the identified potential sources is generally considered to be **very low to low**. As such, an intrusive investigation is recommended for the development to further assess the risks associated with potential asbestos containing material in soil. It is also considered prudent to investigate the risks associated with the potential migration of other contaminants associated with the servicing of vehicles on site.

As an intrusive investigation is likely to be undertaken for geotechnical purposes, it is recommended that these risks are investigated as part of a combined contamination and geotechnical investigation.

3. FIELDWORK SUMMARY OF SCOPE AND RATIONALE

3.1 RATIONALE AND SUMMARY OF SCOPE

The site investigation works were undertaken by GCC between the 25th and 27th June 2018. The scope and rationale of the site investigation were specified by AKS Ward and are presented below.

- 5no. windowless sample boreholes (WS101 to WS105) to a maximum depth of 5.0mbgl.
- Hand excavation of 4no. foundation inspection pits (IP101-104).
- Trial pit soakaway testing at 2no. locations in accordance with BRE 365.
- CBR testing (using a Dynamic Cone Penetrometer) at 6no. locations.

Table 3.1. Exploratory hole location rationale

Location	Rationale	Max depth (mbgl)
WS101 to WS104	Windowless sample boreholes positioned within the vicinity of the proposed building to investigate the nature and stratigraphy of the subsurface materials and allow collection of representative samples for chemical and geotechnical laboratory analysis. Boreholes were also installed with gas and groundwater monitoring wells	5.00
WS105	Windowless sample borehole positioned within the vicinity of a heating oil storage tank associated with the on-site bungalow to investigate the potential for leaks or spills from the tank and allow collection of representative samples for chemical laboratory analysis.	3.00
IP101	Hand excavated pit to inspect the foundation construction of the on-site bungalow.	0.55
IP102 to IP104	Hand excavated pits to inspect the foundation construction of the existing car dealership building along the boundary with the proposed car dealership building.	1.20
SA101 to SA102	Hand excavated trial pits positioned within the proposed car parking area at locations agreed with the AKS Ward to undertake infiltration testing to inform soakaway design.	0.90

The layout of the exploratory hole positions is presented in Figure 2.

3.2 SAMPLING

Soil sampling of the near surface materials was undertaken to assess the contamination risks to human health and controlled waters. Soil samples were also taken from various depths in the boreholes for geotechnical testing purposes.

3.3 SITE INVESTIGATION STANDARDS

Methods employed during the site investigation were generally undertaken in accordance with BS10175, BS EN 1997-2 and BS5930.

4. GROUND CONDITIONS ENCOUNTERED

4.1 SOIL CONDITIONS

Ground conditions encountered during the site investigation differed from those presented in the published literature and comprised Topsoil overlying Undifferentiated Superficial Deposits over the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (Undifferentiated) subsequently referred to Undifferentiated White Chalk (UWC). Variations in strata thicknesses are summarised in Table 4.1 and engineering logs are presented in Appendix 2.

Table 4.1. Summary of encountered ground conditions

Location	Topsoil/Made Ground		Undifferentiated Superficial Deposits		Undifferentiated White Chalk	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
WS101	GL	0.10	0.10	2.40	2.50	>1.50
WS102	GL	0.40	0.40	1.70	2.10	>1.40
WS103	GL	0.30	0.30	1.30	1.60	>3.40
WS104	GL	0.10	0.10	1.70	1.80	>3.20
WS105	GL	0.20	0.20	>2.80	N/E	

4.2 TOPSOIL/MADE GROUND

Topsoil was encountered in investigation locations WS101-103 and generally comprised soft to stiff dark brown silty gravelly clay or clayey gravelly silt to depths of 0.1-0.4mbgl. While it is assumed that this Topsoil has been reworked as part of the operation of the site, no anthropogenic inclusions were noted. In WS102 and WS103, this stratum included a 0.35-0.4m surface layer of wood chippings.

Made Ground was encountered in the form of a 0.1m thick layer of surface concrete at WS104 and WS105 with an additional 0.1m thick layer of brown clay with brick and concrete fragments beneath the concrete in WS105.

4.3 UNDIFFERENTIATED SUPERFICIAL DEPOSITS

The distinction between the Brickearth, River Terrace Deposits and highly weathered Chalk was not clear during the investigation and these materials have therefore been grouped together. The Undifferentiated Superficial Deposits (USD) were encountered beneath the Topsoil or Made Ground in all locations and comprised variable combinations of clay, silt and gravel. The USD generally comprised a soft to stiff light brown silty gravelly clay where the gravel comprised flint and chalk.

The USD formed the basal stratum in WS105 only and achieved thicknesses of between 1.30m and >2.80m in the remainder of the investigation locations.

4.4 UNDIFFERENTIATED WHITE CHALK

Undifferentiated White Chalk (UWC) was encountered directly beneath the USD in investigation locations WS101-104 and achieved proven thicknesses of >3.40m, forming the basal stratum in all four of these locations. The UWC was recovered as CIRIA Grade Dm structureless Chalk comprising gravelly silt, although this is potentially in part a result of the percussive windowless sampling drilling technique.

4.5 EXCAVATION STABILITY

The investigation locations remained stable while open, which was a short duration for the windowless sample boreholes but three days for the infiltration test trial pits.

4.6 OBSTRUCTIONS

No obstructions were encountered within the boreholes although WS103 refused on the Chalk.

4.7 GROUNDWATER CONDITIONS

Groundwater was encountered during the investigation between 3.3m and 3.5mbgl in WS103 and between 3.6m and 3.7mbgl in WS104. Groundwater was subsequently recorded during the monitoring round on the 27th June and was recorded at between 2.44mbgl and 3.00mbgl. No groundwater was encountered during the excavation of the soakaway trial pits.

Although the monitoring wells had not been surveyed, approximate ground levels at the investigation location, taken from the topographic survey, have been used to estimate groundwater levels in mAOD: WS101 - 47.30mAOD, WS102 – 47.11mAOD, WS103 – 46.97mAOD and WS104 – 47.55mAOD. These levels indicate a general east or south-easterly groundwater flow direction.

4.8 VISUAL/OLFACTORY EVIDENCE OF CONTAMINATION

Hydrocarbon odour and staining was noted in WS103 between 2.8m and 3.0mbgl, which correlates with the groundwater level monitored at this location.

Hydrocarbon odour (suspected to be heating oil) was also noted in WS104 from near surface to approximately 3.7mbgl, where the borehole was noted to be wet during the investigation. No evidence of contamination was noted below the apparent groundwater level.

4.9 INFILTRATION TESTING

Infiltration testing was conducted in general accordance with the principals of BRE DG365. Infiltration testing comprises adding water into an open trial hole, the drop in measured head over time was then recorded to give an indication of soakage potential.

BRE DG365, 2016 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test is completed once 75% of the water present has drained away, in order to determine whether or not the underlying ground conditions may be suitable for surface water drainage.

A summary of the test results is present in Table 4.2 below. See full results in Appendix 10.

Table 4.2. Summary of Infiltration Test Results

Location	Stratum	Trial Pit Base Depth	Infiltration Rate (m/sec)	Notes
SA101 Test 1	Chalk	0.86	1.54×10^{-6}	Two tests conducted. Due to time constraints, the final data point on the first test was extrapolated.
SA101 Test 2	Chalk	0.85	2.71×10^{-6}	
SA101 Test 3	Chalk	0.83	2.42×10^{-6}	
SA102 Test 1	Chalk	0.90	7.87×10^{-7}	

Location	Stratum	Trial Pit Base Depth	Infiltration Rate (m/sec)	Notes
SA102 Test 2	Chalk	0.86	2.66×10^{-6}	Three tests conducted. Due to time constraints, the final data point on the third test was extrapolated.
SA102 Test 3	Chalk	0.86	1.81×10^{-6}	

5. GENERIC RISK ASSESSMENT

5.1 CONTAMINATION ASSESSMENT METHODOLOGY

In order to assess the human health and environmental risks posed by potential contaminants within the underlying soils and groundwater, GCC undertook an initial screen of the laboratory results from the recent investigation using generic assessment criteria. Generic assessment criteria (GAC) are conservative contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information

5.1.1. Soils

In order to assess the soil analyses results with regard to potential human health risks, GCC has adopted the LQM/CIEH Suitable 4 Use Levels (S4ULs), generic assessment criteria (GACs) derived in accordance with the UK framework set out in the most recent CLR (Contaminated Land Report) documents using the Contaminated Land Exposure Assessment (CLEA) Model.

S4ULs have been published for an extensive suite of contaminants, with assessment criteria derived for each contaminant for four different land use scenarios namely:

- Residential with homegrown produce;
- Residential without homegrown produce
- Allotments; and
- Commercial and industrial.

A full list of the GACs together with an indication of the method used for their derivation is provided in Appendix 3. GACs applicable to commercial/industrial end use have been used for the assessment of the site. Contaminant concentrations below the GACs are considered not to warrant further risk assessment. However, concentrations of contaminants above the GACs may require further consideration through statistical analysis, if appropriate, or further detailed assessment using site specific data.

This document does not constitute a Site Assessment Report (SAR) as outlined in the UKWIR Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (Ref: 10/WM/03/21, 2010). As such, the full generic suite of testing recommended in the UKWIR guidance may not have been undertaken for this site and may be required by some water companies. However, consideration has been given to the 'threshold' concentrations presented in Table 3.1 of the UKWIR guidance, where they are applicable to the analysis undertaken, to provide an indication of the potential risks to buried water supply pipes.

5.1.2. Assessment framework

In regards to human health, the CLEA model states that, 'the contamination is assumed to be at or within 1m of the surface' (CLR10 pg10). It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. Therefore, for the purposes of statistical analysis, data from the top 1.0 to 1.5m is used for assessment of risks to human health via direct contact pathways in accordance with the CLEA model, dependant on proposed future site levels.

5.1.3. Groundwater

Groundwater analyses, where undertaken, shall be assessed by direct comparison with the freshwater Environmental Quality Standards (EQS), or, in the absence of EQSs, UK or WHO Drinking Water Standards or other appropriate guidance values. For certain compounds, the EQS is quoted as a range of values based on the alkalinity of the water, where the measured concentration lies within this range, the results are interpreted qualitatively. The guideline values selected as appropriate GACs for each contaminant are presented in Appendix 3.

5.1.4. Leachate

Leachate analyses, where undertaken, shall be assessed in the same manner as the groundwater samples. The guideline values selected as appropriate GACs for each contaminant are presented in Appendix 3.

5.1.5. Ground Gas

The criteria used to assess the ground gas monitoring results, where monitored, have been taken from the following guidance documents:

- Assessing risks posed by ground gases to buildings, CIRIA Report C665, 2007
- Code of practice for the characterisation and remediation from ground gas in affected developments, British Standard BS 8576, 2013
- A Pragmatic Approach to Ground Gas Risk Assessment, CL:AIRE Research Bulletin RB17, 2012

The frequency and period of monitoring is assessed based on the gas generation potential of the source material and the sensitivity of the development, in accordance with Figure 6 of BS8576 and Table 5.5 of CIRIA C665. As BS8576 promotes a risk based approach to ground gas assessment, it recognises that ground gas monitoring might not be necessary if a viable pollutant linkages is not present, e.g. if a 'credible' source with significant ground gas generation potential and/or a 'credible' migration pathway are not present.

The Characteristic Situation for a monitoring location is determined using the worst case gas screening value for methane or carbon dioxide from all of the monitoring rounds at that location. Following the precautionary principal, the most stringent of the Characteristic Situations for the monitoring locations within the Site is generally used to classify the site as a whole.

5.2 SOIL ASSESSMENT

5.2.1. General

A total of 9no. soil samples collected during the site investigation of soil that could potentially be reused on site at or near surface during the proposed development works were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, phenols, speciated polycyclic aromatic hydrocarbons (PAHs), fractionated total petroleum hydrocarbons (TPH), BTEX compounds and several inorganic parameters. A further 2no. samples were submitted for Waste Acceptance Criteria (WAC) testing and laboratory waste classification assessment. The results of the laboratory analyses are summarised in Appendix 4, in which they are compared to the relevant generic assessment criteria. A full set of all the laboratory test certificates is presented as Appendix 5.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect both commonly found contaminants and others indicated by research to have a significant risk of being present. It is, however, possible that others may exist for which analyses have not been carried out or which were outside the scope of completed exploratory holes.

The decision to recommend acceptability or a requirement for remediation is based on the evaluation of a number of factors which when combined present a statutory or non-statutory risk that may require remedial action.

5.2.2. Heavy metals

The heavy metals included in the analysis of the samples from the site were identified at concentrations below the relevant GACs in all of the samples across the site. Therefore, heavy metals in the soils across the site are not considered to present a significant source of contamination with regard to human health or environmental receptors.

5.2.3. Petroleum hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were recorded to be well below GACs in all of the soil samples across the site. Therefore, TPH is not considered to represent a significant source of contamination with regard to human health

Total petroleum hydrocarbon (TPH) concentrations were also recorded to be predominantly below the laboratory detection limits, except for the samples from WS104 (0.4-0.5mbgl and 1.6-1.7mbgl) which contained slightly elevated TPH concentrations. These TPH concentrations in WS104 correlate with the hydrocarbon odour noted during the investigation at this location and demonstrate a reducing concentration with depth.

During the investigation, no evidence that a fuel storage tank had been present in the vicinity of WS104 could be observed but with hydrocarbon odour noted near surface, it is considered highly likely that the contamination entered the ground in the vicinity of WS104. A drain was noted close to WS104 and it is considered possible that the contamination may have entered the ground via this pathway.

The hydrocarbon odour noted from near surface to approximate groundwater level in WS104, the hydrocarbon odour noted in WS103 around the groundwater table and the indicative south-easterly groundwater flow direction suggest that the hydrocarbon contamination at WS104 historically travelled vertically to groundwater then laterally with groundwater towards WS103, without migrating deeper into the Chalk.

Considering groundwater as a receptor, it is noted that the groundwater locally appears to have been slightly impacted with hydrocarbon contamination already with no evidence of an on-going primary source of the contamination (fuel tank) and with the secondary soil source exhibiting low TPH concentrations.

Remediation of the secondary soil would therefore not prevent local contamination of the groundwater and it is considered that the existing low levels of contamination will reduce naturally with time with no ongoing primary source. Furthermore, the proposed building will be located over the impacted area, preventing water infiltration and therefore the predominant driver for further contaminant migration from the secondary soil source.

As there are no groundwater abstractions noted down gradient of the site within 500m and as the nearest surface water course down gradient is over 200m away, the slight hydrocarbon contamination on the groundwater is not considered likely to reach a sensitive down gradient receptor at a significant concentration.

Therefore, TPH is not considered to represent a significant source of contamination with regard to controlled waters.

Concentrations of TPH C11-C40 fractions were, however, recorded to exceed the UKWIR 'threshold' values for mineral oil. TPH is therefore considered to represent a potentially significant source of contamination to proposed water supply pipes in the vicinity of WS104. However, the designers of the water supply pipes for this site should review the data in this report to inform their decision-making process.

5.2.4. Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbon (PAH) compound concentrations were recorded to be well below the relevant GACs and generally below the laboratory detection limits in all the soil samples across the site. Therefore, PAHs are not considered to represent a significant source of contamination with regard to human health or environmental receptors.

5.2.5. BTEX compounds and MTBE

BTEX compounds and MTBE were not identified at concentrations in excess of the laboratory detection limits and were well below the relevant GACs in all of the samples from across the site. Therefore, BTEX compounds and MTBE are not considered to represent a significant source of contamination with regard to human health.

Concentrations of BTEX and MTBE were not recorded to exceed the UKWIR 'threshold' values. BTEX and MTBE are therefore not considered to represent a significant source of contamination to proposed water supply pipes.

5.2.6. Inorganics

The concentrations of free cyanide fell below laboratory detection limits in all of the soil samples analysed.

The pH of the soil samples analysed was within the 7-9 range, indicating neutral soils.

No asbestos containing materials were identified in any of the 9no samples analysed. However, as asbestos containing material were noted in the buildings on site, the potential remains for fragments of these material to be encountered in the soil during the development or even lining in-ground structures such as drain runs. Asbestos containing materials have also been know to be used as formwork for concrete slabs etc.

5.3 STATISTICAL ANALYSIS

Statistical analysis on the test results from this site was not considered to be appropriate.

5.4 WASTE ACCEPTANCE CRITERIA

The Waste Acceptance Criteria (WAC) testing indicated that the sample representative of the near surface clay with no visual or olfactory evidence of contamination, taken from WS102 at 0.5-0.6mbgl, has been classified by the laboratory a non-hazardous and it should also be possible to dispose of this material to Inert Landfill as no Inert Landfill WAC Threshold levels were exceeded.

However, the sample representative of the near surface clay with evidence of hydrocarbon contamination, taken from WS104 at 0.4-0.5mbgl, exceeded the inert waste landfill acceptance criteria for mineral oil (500 mg/kg) with a recorded concentration of 726 mg/kg. This material has therefore been classified by the laboratory as non-hazardous and it would not be possible to dispose of this sample to inert landfill without additional treatment as the mineral oil threshold level has been exceeded.

5.5 GROUND GAS ASSESSMENT

The Desk Top Study element of this assessment did not identify any potential substantial Made Ground or natural soils with a high organic matter content in the vicinity of the site with the potential for significant ground gas generation that might impact the site

The intrusive investigation of the study site went on to confirm the absence of substantial Made Ground or natural soils with a high organic content on site.

Therefore, based on the conceptual site model and with reference to CIRIA, C665, BS8485, BS8576 and CL:AIRE Research Bulletin RB17, further ground gas monitoring and ground gas protection measures were not considered to be necessary for this site as there is not considered to be a viable ground gas pollutant linkage present in relation to the proposed development. It is therefore considered that the site can be classified as Characteristic Situation 1.

6. CONCEPTUAL SITE MODEL

6.1 SOURCES

The conceptual model, based on information obtained as part of the preliminary risk assessment and intrusive ground investigation, identified the following potential contaminant sources:

6.1.1. On-Site – Historic and Current

- Potential for asbestos containing material fragments to be encountered across the site but particularly in the area of the former stables although none identified to date.

It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

6.1.2. Off-Site – Historic and Current

- None.

6.2 PATHWAYS

The key environmental pathways and exposure routes by which potentially toxic substances can reach the identified receptors are considered to be:

Indirect

- None

Direct

- Inhalation of dust,

6.3 RECEPTORS

Receptors that may be affected by the potential contamination are:

- Future users.
- Construction workers

7. RISK ASSESSMENT

7.1 RISK ASSESSMENT PROCEDURE

By considering the sources, pathways and receptors (pollutant linkages), an assessment of the human health/ environmental risks is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of major or minor significance.

The risk assessment has been undertaken with reference to BS10175 and CIRIA Document C552: Contaminated Land Risk assessment 'A Guide to Good Practice'. The risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential magnitude of the hazard and the sensitivity of the target, based on the categories given overleaf.

Table 7.1. Sensitivity of receptor

Category	Examples
High	Residential with gardens/Groundwater Source Protection Zone
Medium	Residential without gardens/Principal (Major) Aquifer/sensitive watercourse
Low	Commercial and industrial use/Secondary (Minor) Aquifer
Very Low	Construction and maintenance workers/non-sensitive watercourse

Table 7.2. Magnitude of impact

Category	Examples
Gross Impact	Heavily contaminated gasworks or industrial site, hazardous waste landfill
Moderate Impact	Major leaks and spills from fuel infrastructure (e.g. petrol stations), domestic waste landfill
Slight Impact	Minor leaks and spills from fuel infrastructure, 'inert' waste landfills
No Impact	No identified or suspected contamination

Table 7.3. Level of severity for potential hazard

Magnitude of Impact	Sensitivity of receptor			
	High	Medium	Low	Very Low
Gross Impact	Severe	Medium	Mild	Minor
Moderate Impact	Medium	Mild	Minor	Minor
Slight Impact	Mild	Minor	Minor	Minor
No Impact	Minor	Minor	Minor	Minor

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

Table 7.4. Probability of risk definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

Table 7.5. Level of risk for potential hazard definition

Probability of risk	Potential severity			
	Severe	Medium	Mild	Minor
High Likelihood	Very high	High	Moderate	Low/ Moderate
Likely	High	Moderate	Low/ Moderate	Low
Low likelihood	Moderate	Low/ Moderate	Low	Very low
Unlikely	Low/ Moderate	Low	Very low	Very low

The assessment is discussed below in terms of plausible pollutant linkages. A complete assessment of the pollutant linkages is presented in Table 7.6 overleaf.

A description of these risk classifications and likely action required are given in CIRIA 552 as:

Very high risk – High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk – Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk – It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk – It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk – It is a low possibility that harm could arise to a designated receptor. In the event of such harm being realised it is not likely to be severe.

7.2 POLLUTANT LINKAGE ASSESSMENT

Table 7.6. Pollutant Linkage Assessment

Source	Pathway	Receptor	Severity	Likelihood	Risk Level
Potential deposits of asbestos containing materials in east and northwest of site.	Inhalation	Future users	Medium	Unlikely	Low
		Construction workers	Medium	Low Likelihood	Low/ Moderate

7.2.1. Asbestos in Soil

While no asbestos containing materials were encountered in the soil during the investigation, it is understood that asbestos containing materials (ACM) were used in the existing buildings on the site with fragments therefore potentially present in the soil. There is a residual potential for asbestos containing materials to be encountered during the development of the site.

The above assessment has been based on these ACM or fragments of them being left on site following the proposed development. It is therefore recommended that any residual traces of ACM encountered during the development are removed from site.

Although no evidence of suspected asbestos containing material in soil has been identified on the site, vigilance by the groundworks contractor for asbestos containing material is recommended throughout the development with a discovery strategy in place should any asbestos containing material be encountered.

8. GEOTECHNICAL ASSESSMENT

8.1 INTRODUCTION

The geotechnical assessment and the subsequent foundation design recommendations will use the findings of the ground investigation and the results of the in-situ and geotechnical laboratory testing carried out in the boreholes and on representative samples of the material encountered.

8.2 GEOTECHNICAL TESTS

A programme of geotechnical laboratory testing was carried out on representative samples collected from the strata encountered during the ground investigation.

Details of the specific procedure used in each case are shown below in Table 8.1 and the geotechnical test certificates are presented in Appendix 7.

Table 8.1. Summary of Geotechnical Testing

Test	Standard (BS1377:1990) unless otherwise indicated	No.
Classification Tests		
Atterberg Limits	Part 2, Clauses 4.5 & 5.0	3
Total Shear Strength Tests		
Unconsolidated Undrained Triaxial Compression Test	Part 7, Clause 8.4	1
Effective Shear Strength Tests		
Consolidated Drained Direct Shear	Part 7, Clause 4.5	2
Chemical Tests		
Sulphate Content 2:1 soil water extract	Part 3, Clause 5.3	3
pH value	Part 3, Clause 9.0	3
BRE SD1	Various	2

8.3 GEOLOGICAL AND GEOTECHNICAL PARAMETERS

This section discusses the key geotechnical characteristics of each encountered stratum as determined from field observations, in-situ and laboratory geotechnical testing.

8.3.1. Topsoil / Made Ground

Topsoil was recorded in WS101 only and comprised 0.20m of brown silty slightly gravelly clay. Although not Topsoil, 0.30 to 0.40m of brown mulched wood chippings were identified at the location of exploratory holes WS102 and WS103.

Made Ground was identified in WS105 as stiff dark brown clay with brick and concrete fragments. In WS104 and WS105 a 0.10m thick concrete covering was identified cast directly onto the natural ground in WS104 and onto the Made Ground in WS105. The total thickness of the concrete cover and Made Ground was approximately 0.20m.

No geotechnical laboratory testing was undertaken on either the Topsoil or Made Ground as these materials will be stripped prior to construction.

8.3.2. Undifferentiated Superficial Deposits

Undifferentiated Superficial Deposits (USD) were identified immediately below the Topsoil / Made Ground in all exploratory hole positions. The USD comprised 1.30 to >2.80m of fine-grained materials ranging from soft dark brown slightly gravelly Clay to firm silty very gravelly Clay.

In-Situ Testing

Standard Penetration Testing

Standard penetration testing (SPT) was carried out throughout the USD. The SPT N values recorded from tests carried out entirely within the USD are presented in Table 8.2.

Table 8.2. Results of the Standard Penetration Testing – Fine Grained RTD

BH No.	Depth (mbgl)	SPT N Value	Major Constituent	BH No.	Depth (mbgl)	SPT N Value	Major Constituent
WS101	1.00	17	very silty gravelly Clay	WS103	1.00	11	silty gravelly Clay
	2.00	20		WS104	1.00	17	silty gravelly Clay
WS102	1.00	8	slightly gravelly Clay	WS105	1.00	14	slightly gravelly Clay
	2.00	25	very gravelly Clay				

The standard penetration testing returned a range of N-values, for tests undertaken entirely within the USD of 8 to 25 with the majority of the data lying within the range 11 to 20.

Therefore, a characteristic N value of 15 is considered appropriate for the Undifferentiated Superficial Deposits.

Classification Testing

Consistency Limits

Three representative samples of the USD underwent Atterberg limits testing to determine their consistency limits. The results of these analyses are presented in Table 8.3 and the laboratory test certificates are located in Appendix 7.

Table 8.3. Results of the Atterberg Limits Tests – Undifferentiated Superficial Deposits

Location	Depth (mbgl)	Natural Water Content, w (%)	Liquid Limit w _L (%)	Plastic Limit w _p (%)	Plasticity Index I _p (%)	Corrected Plasticity Index (%)
WS101	2.10-2.50	14	36	16	20	19
WS102	0.70-1.00	19	36	18	18	17
WS104	0.70-1.00	27	49	21	28	27

The results of the Atterberg limits testing give plasticity indices of between 18 and 28% which are consistent with an intermediate plasticity fine-grained material. After correction to account for the >425mm content the corrected plasticity indices are within the range 19 to 27% which is indicative of a material of low to medium volume change potential.

Calculations based on the results of the Atterberg limits tests (Table 8.3) give consistency indices of 0.78 and 1.10 which are indicative of a range of consistencies from stiff to very stiff.

Shear Strength

Undrained Shear Strength

one representative sample of the USD underwent laboratory unconsolidated undrained triaxial compression testing. The results of the laboratory testing are presented in Table 8.4; whilst the laboratory test certificates are located in Appendix 7.

Table 8.4. Results of the UU Triaxial Compression Testing – Undifferentiated Superficial Deposits

Location	Depth (mbgl)	Bulk Density (Mg/m ³)	Cell Pressure (kN/m ²)	Undrained Shear Strength c_u (kN/m ²)
WS102	1.50-2.00	2.34	35	110

The result of the UU triaxial testing gives a c_{uk} values of 110 kN/m² which is consistent with a high strength material.

The laboratory test result has been augmented with c_{uk} values derived from the widely accepted empirical relationship:

$$c_u = f_1 \times SPIN$$

Where f_1 is a correlation factor based on the I_P

Using a correlation factor of 5, all the undrained shear strength data has been plotted and reveals no easily identifiable trend (Figure 3). Based on all the shear strength data characteristic undrained shear strength parameters of $c_{uk} = 60\text{kN/m}^2$ and ϕ_{uk} of 0° are considered appropriate for the USD.

Drained (Effective) Shear Strength

The widely accepted relationship between drained shear strength and plasticity index for remoulded clays has been used to determine the effective shear strength parameters. In terms of effective stress, the shear strength of a fine-grained soil can be considered as frictional, such that $c'_k = 0\text{kN/m}^2$.

Taking the characteristic plasticity index of 20% will give a characteristic effective angle of shearing resistance (ϕ'_k) of 26° .

Other Geotechnical Parameters

Modulus of Deformation (E_k)

Butler (1975) showed that good estimates of soil stiffness could be got from the relationship:

$$E_{uk} = N$$

CIRIA R 143 suggests that the drained modulus (E'_k) should be taken as $0.75E_{uk}$. Therefore, an E_{uk} of 20MN/m^2 and E'_k of 15MN/m^2 have been ascribed to the USD

Coefficient of Volume Compressibility

The coefficient of volume compressibility (m_v) has been determined from the empirical relationship with the plasticity index (I_p) and published data for similar materials giving an m_{vk} of 0.13m²/MN which is indicative of a material of medium compressibility.

8.3.3. Undifferentiated White Chalk

Undifferentiated White Chalk (UWC) was identified beneath the USD at all exploratory hole locations except WS105 where the USD persisted to the full depth of the ground investigation. The UWC was recovered as a Grade Dm structureless Chalk comprising light brown to off-white sandy gravelly Silt with occasional chalk cobbles.

CIRIA C 574 states that Grade Dm Chalk should be treated as fine-grained soil for design purpose.

In-Situ Testing

Standard penetration testing was carried out throughout the Grade Dm Chalk and returned SPT N values of between 25 and 50 with a mean of 35.

Shear Strength

Undrained Shear Strength

Due to the effect that the natural water content has on the undrained shear strength of putty chalk, unlike other fine-grained soils there is no recognised relationship between SPT and undrained shear strength of the Grade Dm Chalk. Based on the relationship between water content and undrained shear strength (Clayton 1977) a lower bound value of 75kN/m² is considered appropriate for the range of water contents under consideration.

Drained Shear Strength

The drained shear strength parameters of the UWC were determined from two laboratory drained direct shear tests. A precis of the results of these two tests are presented in Table 8.5 and the laboratory test certificates are located in Appendix 7.

Table 8.5. Results of the Direct Shear Tests – Undifferentiated White Chalk

BH Location	Depth (mbgl)	Bulk Density (Mg/m ³)	Effective Shear Strength Parameters	
			c'	φ'
WS101	3.20	2.06	6.7	32.5
WS103	1.60	2.07	9.8	30.5

The result of the direct shear tests give effective cohesions of 6.7 and 9.8kN/m² because putty chalk can rapidly lose cohesion should moisture contents increase towards its liquid limit, CIRIA C 574 suggests cohesion should be set at 0kN/m² for design purposes. Therefore, characteristic shear strength parameters for the UWC are $c'_k = 0\text{kN/m}^2$ and $\phi'_k = 32^\circ$

Other Geotechnical Parameters

Short-Term and Long-Term Modulus of deformation (Edk)

Grade D Chalk can be subject to long-term or Creep settlement such that it is common practice to define a long- and short-term modulus of deformation. Based on the values published in CIRIA C574 a long-term modulus of deformation of 25MN/m² and short-term modulus of deformation of 6MN/m² are considered appropriate for the UWC.

8.4 AGGRESSIVE GROUND SOIL CHEMISTRY

Chemical testing was carried out on five representative samples of the materials encountered beneath the site in accordance with Box C10, BRE Special Digest 1. The results are summarised in Tables 8.6 and 8.7.

Table 8.6. Summary of the results of chemical testing for concrete classification

Determinand	WS101 0.50-0.70	WS103 2.50-3.00	WS104 1.80-2.10
	USD	UWC	USD
pH	7.70	7.59	7.68
Soluble Sulphate (g/l)	0.14	0.11	0.10

Table 8.7. Results of the BRE SD1 testing

BH	Depth (mbgl)	Stratum	pH	Total Sulphate AS (% SO ₄)	Total Sulphur TS (%)	Total Potential Sulphate TPS (%)	Oxidisable (Sulphate) (%)
WS101	2.10	USD	8.40	0.07	0.02	0.06	0
WS103	0.70		8.00	0.05	0.03	0.09	0.04

The amounts of oxidisable sulphides have been determined following the procedure documented in Paragraph C5.1.2 of BRE SD1. The results indicate that pyrite is unlikely to be present in significant amounts within the USD. Based on the maximum determined total potential sulphate and soluble sulphate content Table C1 of BRE SD1 gives a Design Sulphate Classification of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-1s assuming static groundwater conditions.

8.5 CHARACTERISTIC GEOTECHNICAL PARAMETERS

Based on the laboratory test results, in-situ testing and subsequent analysis a range of characteristic geotechnical parameters which should be used in all geotechnical and foundation design calculations are presented in Table 8.8.

Table 8.8. Characteristic Geotechnical Parameters

Geotechnical Parameter				Notes	Characteristic Value	
Not provided as material will be removed prior to construction						
Undifferentiated Superficial Deposits	Unit Weight γ			BS8004 & Laboratory Triaxial Testing	21kN/m ³	
	Shear strength	Undrained	C_{uk}	Laboratory testing & SPT Correlation	60kN/m ²	
			ϕ_{uk}		0°	
		Drained	c'_k	I_p and SPT Correlation	0 kN/m ²	
			ϕ'_k		26°	
	Deformation modulus	Undrained	E_{uk}	Correlation with N	20MN/m ²	
		Drained	E'_k	$0.75 \times E_{uk}$	15MN/m ²	
	Modulus of Compressibility			m_{vk}	Correlation with SPT	0.13m ² /MN
Undifferentiated White Chalk Grade Dm	Unit Weight	bulk γ		Laboratory Testing	20kN/m ³	
	Shear Strength	Undrained	C_{uk}	Published Lower Bound Value	75kN/m ²	
			ϕ_{uk}		0°	
		Drained	c'_k	Laboratory Direct Shear Test	0kN/m ²	
			ϕ'_k		32°	
	Deformation Modulus	E_k (MN/m ²)		Published Values	Short	25MN/m ²
					Long	6MN/m ²

9. FOUNDATION AND GROUND ENGINEERING

9.1 INTRODUCTION

The geotechnical assessment below relates to the details of the proposed development. It is understood that the development comprises the construction of office accommodation and other facilities associated with a car dealership.

Five windowless sample boreholes were undertaken across the site. The ground conditions encountered are presented in Table 4.1 and in brief comprise Topsoil / Made Ground overlying Undifferentiated Superficial Deposits (USD) overlying Undifferentiated White Chalk (UWC). The USD consist of soft to stiff very sandy gravelly to very gravelly Silt and Clay. Whilst the UWC was recovered as a CIRIA Grade Dm Chalk with some chalk cobbles. The potentially karstic nature of the chalk surface was demonstrated on site by the absence of the Chalk in WS105.

Groundwater was encountered during the investigation between 3.30m and 3.50mbgl in WS103 and between 3.60m and 3.70mbgl in WS104. Groundwater was subsequently recorded during the monitoring round on the 27th June 2018 at between 2.44mbgl and 3.00mbgl. No groundwater was encountered during the excavation of the soakaway trial pits. For foundation design purposes the groundwater will be set at 2.50mbgl across the site.

9.2 SHALLOW FOUNDATIONS

Based on the type of development under consideration and the ground conditions encountered a shallow foundation is considered appropriate at the current site.

Depth of Foundations

All foundations must be constructed below the Made Ground within the natural strata. The minimum depth of foundation will be controlled by the volume change potential of the underlying USD. Atterberg limits testing indicated the USD to be of medium volume change potential.

NHBC Guidance offers two foundation depth scenarios dependant on the planting regimes adopted on the site (Table 9.1).

Table 9.1. Minimum Depth of Foundations for Medium Volume Change Soil (after NHBC)

Depth of Foundation	Description	No Tree Planting Zone (m)		
		High Water Demand	Moderate Water Demand	Low Water Demand
0.90m	No tree planting within Zone of Influence	1.25 x mature height	0.75 x mature height	0.50 x mature height
1.25m	Restricted tree planting within zone of influence	1.00 x mature height	0.50 x mature height	0.20 x mature height

Therefore, a minimum foundation depth of 0.90m should be adopted across the site with restriction placed on the planting of any new trees or shrubs.

Ultimate Limit State Bearing Resistance

Bearing resistance analysis has been carried out in order to check the Ultimate Limit State (ULS) bearing resistance of the USD. A second ULS bearing resistance calculation has been carried to determine any advantage of deepening the foundations to construct upon the Grade Dm Chalk. All ULS bearing resistance calculations have been carried out in accordance with Eurocode 7.

The two ground models used in the ULS bearing resistance calculations are presented in Table 9.2.

Table 9.2. Ground Model used in the Bearing Resistance Calculations

Ground Model	Founding Stratum	Foundation Depth	Shear Strength Parameters			
			Total		Effective	
			c_{uk}	ϕ_{uk}	c'_k	ϕ'_k
GM1	USD	0.90	60kN/m ²	0	0	26°
GM2	UWC	1.60	75kN/m ²	0	0	32°
Groundwater at 2.50mbgl in both GM1 and GM2						

The UK has implemented Design Approach 1 (DA1) of BS EN1997-1:2004 (Eurocode 7: Geotechnical Design), which requires two design combinations to be satisfied:

Combination 1 (C1): A1 “+” M1 “+” R1

Combination 2 (C2): A2 “+” M2 “+” R1

Where A, M and R refer to groups of partial factors relating to actions, materials and resistance respectively.

Table 9.3. Partial Factors Applied to the Bearing Resistance Analysis

	Combination 1			Combination 2		
	A1	M1	R1	A2	M2	R1
Tangent of the Angle of Shearing Resistance ($\tan \phi$)		1.00			1.25	
Cohesion Intercept (c')		1.00			1.25	
Undrained Cohesion c_u		1.00			1.40	
Permanent Action	1.35			1.00		
Variable Action	1.50			1.30		
Resistance			1.00			1.00

The summary of the bearing checks is presented in Table 9.4 and the geotechnical calculation sheets are located in Appendix 8.

Table 9.4. Summary of ULS Bearing Capacity Checks

EC7 Calculation Method	Foundation Material	Design Approach 1	Bearing Resistance (kN/m^2)	
			Undrained	Drained
ULS Bearing Resistance (kN/m^2)	USD	C1	469	308
		C2	340	181
	UWC	C1	660	882
		C2	481	461

Given the proximity of the groundwater to the base of the foundation the calculated ULS bearing resistances require correction using the groundwater correction factor:

$$R_{w2} = 0.5 + 0.5 \left(\frac{b}{B} \right)$$

Where B is the breadth of the foundation; and

b is the depth of the groundwater table beneath the base of the foundation

Based on the depths to the Chalk recorded during the ground investigation it is likely that in some areas the based of the foundation will be coincident with the groundwater table. under these conditions the ULS bearing resistances for the UWC are halved. The revised ULS bearing resistances for the UWC are presented in Table 9.5.

Table 9.5. Revised ULS Bearing Resistance in after Groundwater Correction

EC7 Calculation Method	Foundation Material	Design Approach 1	Bearing Resistance (kN/m ²)	
			Undrained	Drained
ULS Bearing Resistance (kN/m ²)	USD	C1	469	308
		C2	340	181
	UWC	C1	330	441
		C2	241	230

It should be noted that the UWC was not encountered in WS105 to a depth of 3.00m and in other areas of the site the Chalk was encountered at between 1.60 and 2.50mbgl. Therefore, to construct the foundations on the Chalk will require deep excavations across of the site.

Serviceability Limit State

Eurocode 7 states that calculations of settlement must always be carried out on footings on soft clays - and should be carried out on footings on firm to stiff clays when the risk is anything other than negligible. Therefore, a full serviceability limit state settlement analysis has been carried out.

A foundation general arrangement drawing was supplied by the structural engineer and shows column loads to be supported on pad foundations. No loads have been supplied therefore the the maximum load that can be supported on a pad foundation will be assessed base on a serviceability limit state settlement (S_{Ed}) of 25mm.

Verification of serviceability limit state (SLS) is demonstrated by satisfying the inequality:

$$S_{Ed} = S_0 \leq S_{Cd}$$

where S_{Ed} is the total settlement; and

S_{Cd} is the limiting value of that settlement

The settlement analysis has been carried out using the Rockscience software programme Settle 3D. The results are presented in Appendix 8 and précised in Table 9.6.

For the SLS settlement analysis all partial factors have been taken as 1.00.

Table 9.6. Results of Settlement Analyses

Foundation Type	Depth (m)	BxL (m)	Applied Foundation Loading (kN/m ²)	Immediate Settlement (mm)	Consolidation Settlement (mm)	Total Settlement (mm)
Founding Stratum – USD						
Pad	0.90	1.00 x 1.00	180	13	9	22
		2.00 x 2.00	180	28	8	36
			125	19	6	25

The results of the settlement analyses show that a foundation load of 180kN/m² on a 1.00m x 1.00m pad foundation will achieve settlements less than the SLS limit state of 25mm. However, if the pad foundation dimensions are increased then the settlement increases to above the foundation serviceability limit state as a result of the the stressed soil zone extending deeper into the ground.

For a 2m x 2m pad foundation loads should be restricted to 125kN/m² and for pad dimensions between 1.00 and 2.00m it is appropriate to interpolate to determine allowable bearing pressures. It should be noted that when dimensioning foundations all loads should be factored in accordance with Table 9.3.

9.3 FLOOR SLABS

With no evidence of desiccation and low to medium volume change potential ground bearing floor slabs are considered appropriate at this site provided they are constructed beneath any Made Ground and the USD is carefully inspected and proof-rolled prior to construction.

9.4 HARDSTANDINGS & ACCESSWAYS

The Californian Bearing Resistance of the underlying strata has been determined using a TRL probe. The results of these tests are presented in Appendix 9 and a precis of the determined CBR values is shown in Table 9.7.

Table 9.7. Results of TRL Probe CBR Calculations

Location	Depth (mm)		
	Calculated CBR (%)		
CBR1	0 - 400	400 - 600	600 - 889
	Hit Obstruction		
CBR2	0 - 400	400 - 600	600 - 852
	17	10	6
CBR3	0 - 400	400 - 600	600 - 846
	9	7	6
CBR4	0 - 400	400 - 600	600 - 870
	5	4	4
CBR5	0 - 400	400 - 600	600 - 715
	2	2	6
CBR6	0 - 400	400 - 600	600 - 868
	24	15	6

The results confirm the variability of the underlying strata with CBR results in the upper 0.40m varying between 2 and 24% interpreted as the presence of gravel. However, for preliminary design purposes a CBR of 4% is considered appropriate for the whole site.

9.5 SOAKAWAY DRAINAGE

Two infiltration tests were undertaken on the site to assess its suitability for soakaway drainage. Slow infiltration was noted at the time of the tests which required the extrapolation of data at both locations.

The calculated infiltration rates ranged from 1.54×10^{-6} to 7.87×10^{-7} m/s which is indicative of low permeability and poor drainage conditions. A summary of the infiltration rates recorded in the trial pit soakaway testing is presented in Table 4.2 and the full test results are presented in Appendix 10.

9.6 EXCAVATION STABILITY

No collapse was reported during the construction of the windowless sample boreholes. Three soakaway test pits were excavated and remained stable throughout. Therefore, it is likely that foundation excavations will remain stable. However, it is advised in order to avoid deterioration of the founding stratum that foundation excavations are left open for the minimum amount of time prior to the placement of foundation concrete. If foundation excavations are to remain open it is recommended that either a blinding layer is placed or the excavations are left short of their final depths.

9.7 CHEMICAL ATTACK ON BURIED CONCRETE

Laboratory chemical testing of pH and sulphate concentrations has indicated a Design Sulphate Classification of DS-1 in accordance with BRE Special Digest 1. Given the soil conditions encountered and the fine-grained nature of the USD an ACEC classification of AC-1s is recommended.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 CONTAMINATION

The conceptual model, based on information obtained as part of the Preliminary Risk Assessment and confirmed by the Generic Quantitative Risk Assessment, has identified potential risks in relation to the proposed development associated with the potential presence of asbestos containing material in soil across the site, associated with the construction and operation of the site buildings.

These risks have been assessed to be Low/Moderate, based on the data currently available and on the assumption that ACM is encountered during the development.

A localised hydrocarbon impact, suspected to be associated with heating oil, was also identified in the vicinity of WS104. While the contamination identified is not considered to present a significant risk to human health or controlled waters in the context of the proposed development, it may present a risk to water supply pipes and may incur additional disposal cost if excavated and disposed of off-site.

As such, it is recommended that:

- Vigilance by the groundworks contractor for asbestos containing material is recommended throughout the development with a discovery strategy in place should any asbestos containing material be encountered.
- Any residual traces of ACM encountered during the development are removed from site and disposed of appropriately.
- If any soil with a notable hydrocarbon odour is excavated as part of the construction of the foundations for the proposed building, it is recommended that this material is retained on site and placed beneath hard standing or the proposed building in favour of the disposal of unimpacted soil in order to minimise disposal costs as such material may not be considered as inert.

Appropriate PPE is recommended during any redevelopment of the site to address any as yet unidentified contamination that may be identified during the works.

10.2 GEOTECHNICAL

The ground investigation has shown the site to be underlain by Topsoil / Made Ground overlying superficial deposits from various origins, collectively termed Undifferentiated Superficial Deposits, in turn overlying Undifferentiated White Chalk. Groundwater was encountered during the investigation between 3.30m and 3.50mbgl in WS103 and between 3.60m and 3.70mbgl in WS104. Groundwater was subsequently recorded during the monitoring round on the 27th June 2018 at between 2.44mbgl and 3.00mbgl.

A minimum foundation depth of 0.90m is required due to the medium volume change potential of the USD.

Ultimate limit state bearing resistance has been calculated for a 1m x 1m pad foundation at a minimum depth of 0.90m and gives a ULS bearing resistance of 180kN/m² in the USD. A second ULS bearing resistance calculation has been carried out to assess the advantage of placing the foundation upon the Grade Dm Chalk. However, due to the depth of the Chalk and the presence of groundwater at or close to the base of the foundation this is not considered feasible.

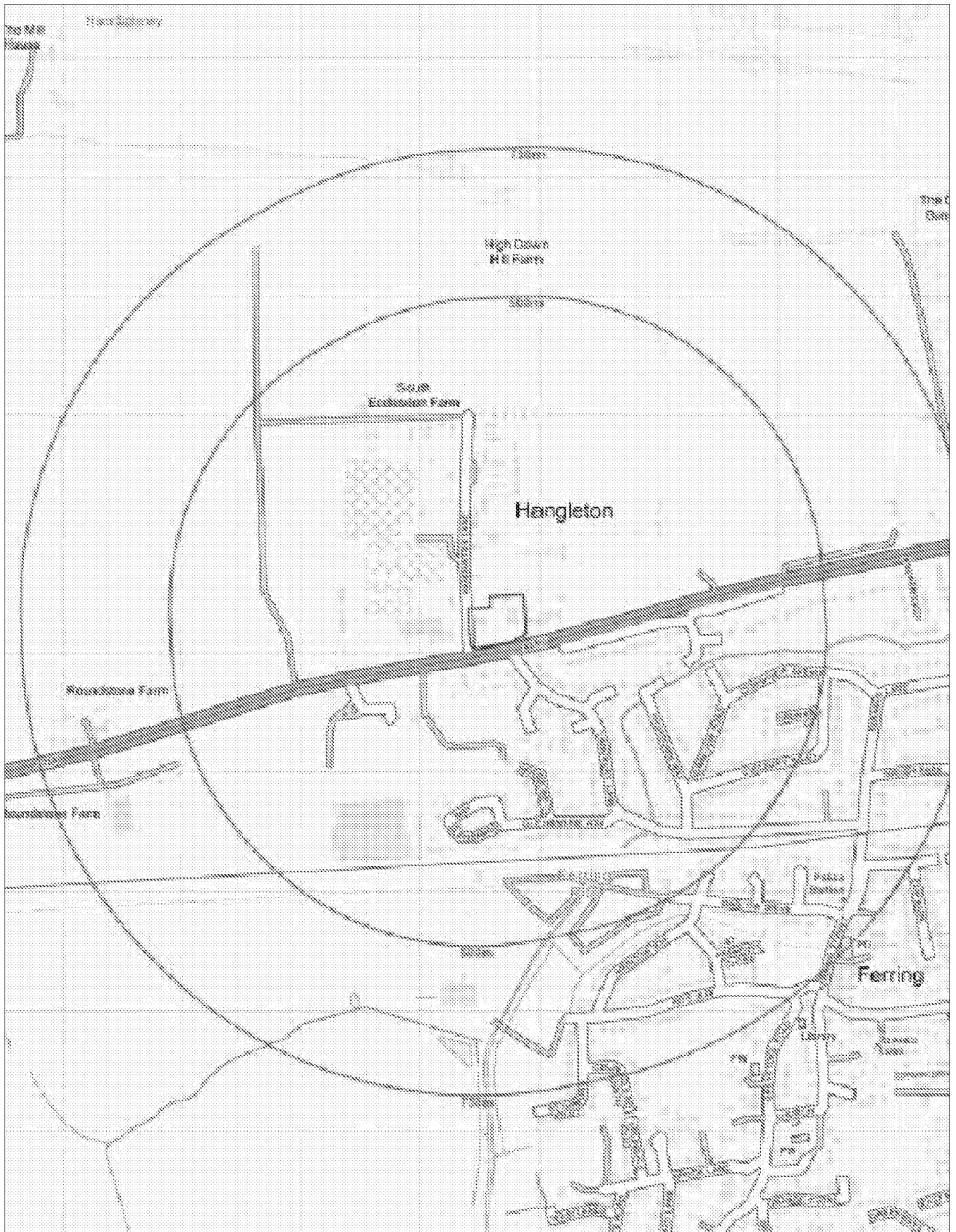
A settlement analysis of a 1.00m square pad foundation carrying a foundation load of 180kN/m² indicates settlement of the foundation will be less than the assumed serviceability limit state of 25mm. However, increasing the size of the pad foundation increases the magnitude of settlement such that the load on a 2m square pad should be restricted to 125kN/m² to achieve less than 25mm settlement. For intermediate pad dimensions it is possible to interpolate between these to settlement values.

It should be noted that when dimensioning the foundation the applied loads should be factored in accordance with Table 9.3.

A CBR Assessment has been carried out across the site using a TRL probe. The results are presented in Table 9.7 and reflect the variable nature of the underlying ground conditions with CBRs of between 2 and 24% being returned in the top 400mm. For preliminary design purposes it is recommended that a CBR of 4% is applied across the site.

Infiltration tests were undertaken at three locations across the site. Due to slow infiltration, the test results were extrapolated to achieve the final data points. Infiltration rates recorded in the modified tests ranged from 1.54×10^{-6} to 7.87×10^{-7} m/sec. The values recorded are consistent with low permeability and poor drainage conditions.

FIGURE 1: SITE LOCATION PLAN



Ground Condition Consultants Ltd
10 Waldegrave Close Southampton SO19 9RY
Telephone 07971 450113
ask@groundcc.co.uk www.groundcc.co.uk

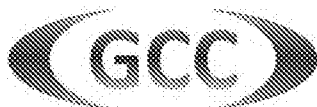
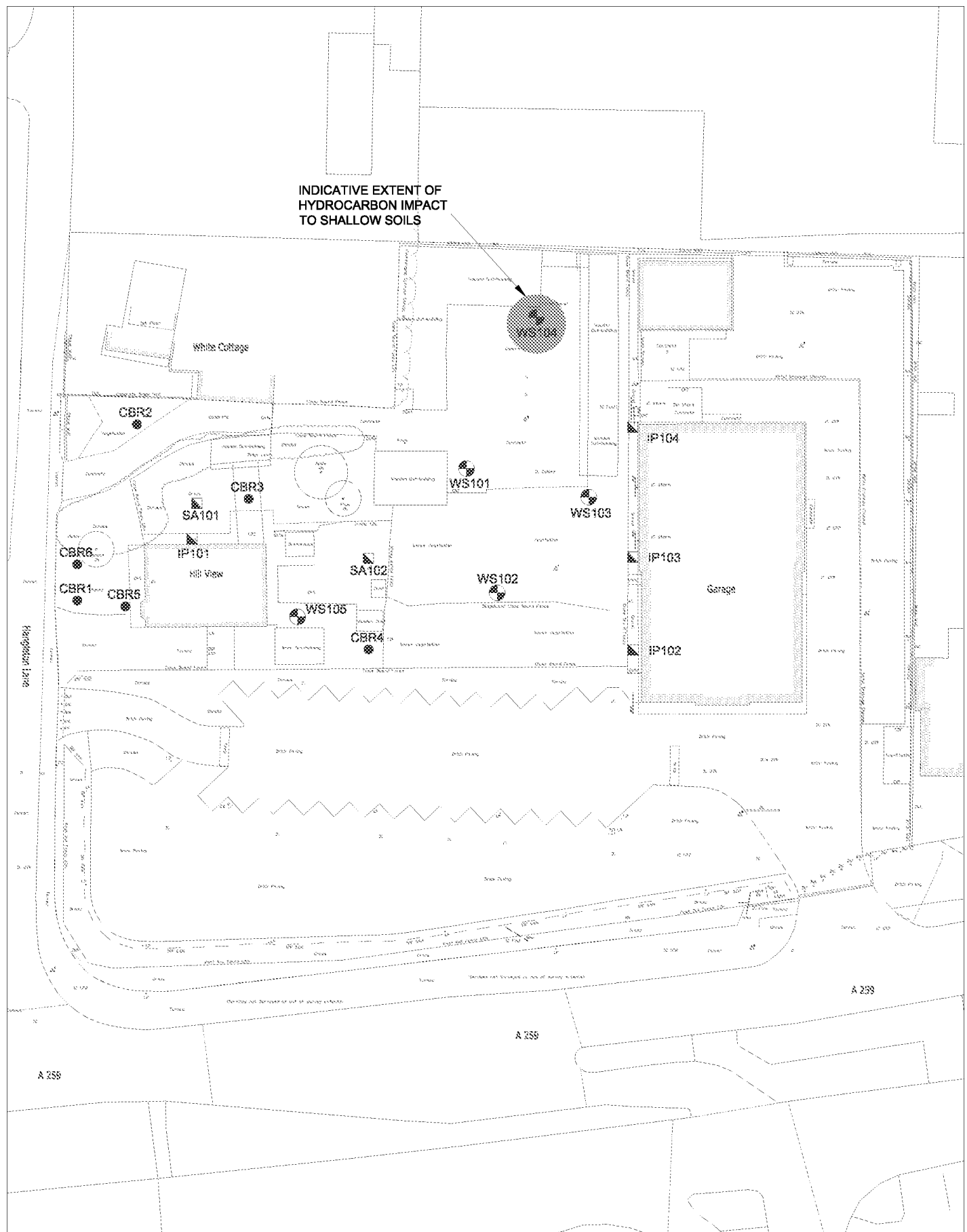
client
AKS WARD

site
YEOMANS HONDA, WORTHING

title
STUDY AREA LOCATION PLAN

scale	NTS	drawn by	AP	checked by	RP
date	28 JUN 2018	job no	J18-035		
drawing number	FIGURE 1			rev.	-

FIGURE 2: INVESTIGATION LOCATION PLAN



Ground Condition Consultants Ltd
10 Waldegrave Close Southampton SO19 9RY
Telephone 07971 450113
ask@groundcc.co.uk www.groundcc.co.uk

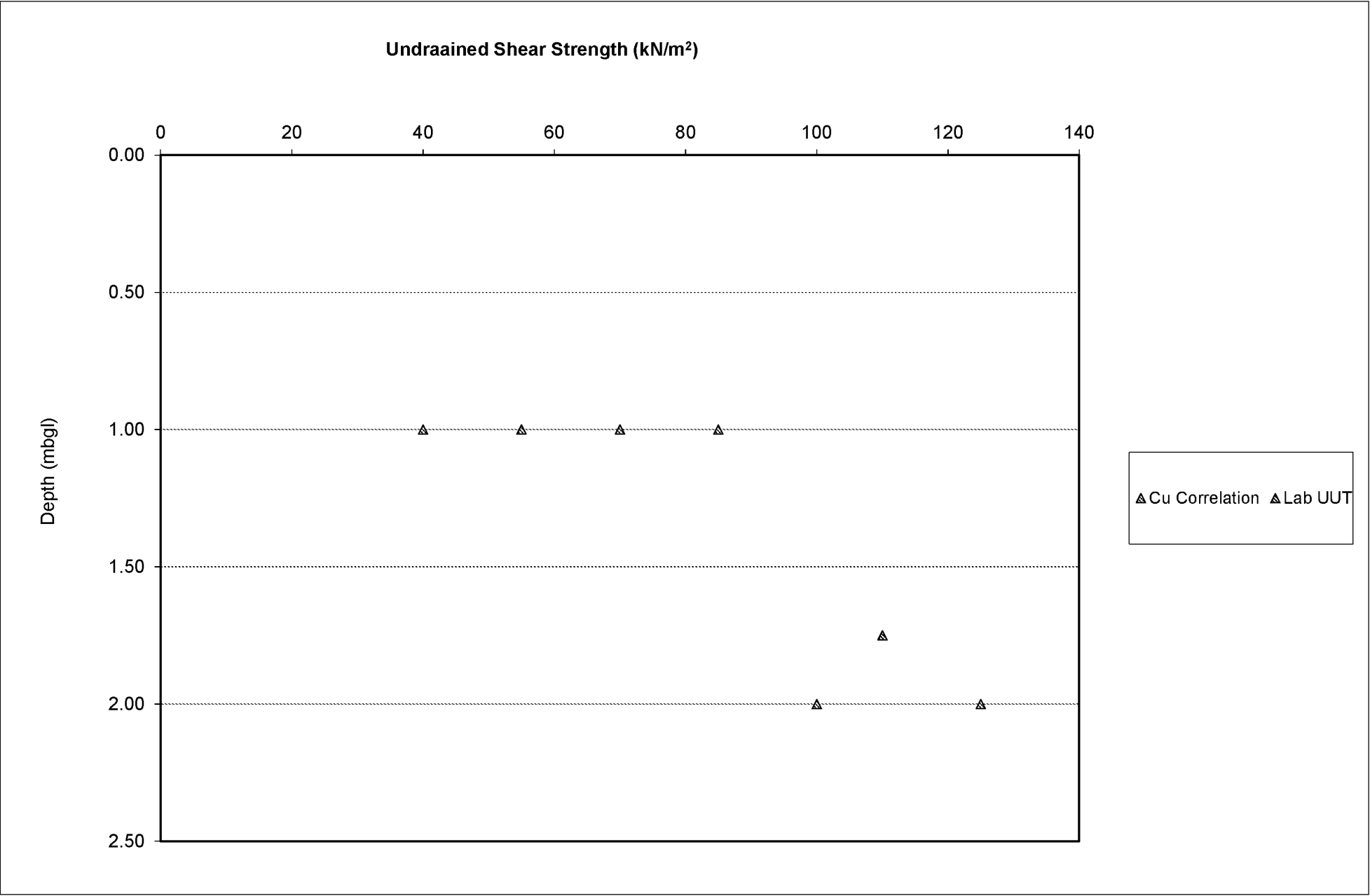
client
AKS WARD

site
YEOMANS HONDA, WORTHING

title
INVESTIGATION LOCATION PLAN

scale	NTS	drawn by	AP	checked by	RP
date	28 JUN 2018	job no	J18-035		
drawing number	FIGURE 2			rev.	-

FIGURE 3: UNDRAINED SHEAR STRENGTH V DEPTH



APPENDIX 1: REPORT CONDITIONS

This report is produced solely for the benefit of **AKS Ward and Yeomans Ltd** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the Site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the Site.

This report is based on a visual Site inspection, study of readily accessible referenced historical records, information supplied by those parties noted in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical Site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the Site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categorical assurances that they will be accepted by Authorities or Funds etc. without question, as such bodies may have unpublished, often more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ground Condition Consultants Ltd. In time improved practices or amended legislation may necessitate a re-assessment.

The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. 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 use and abuse of the Site and adjacent Sites. The report concentrates on the Site as defined in the report and provides an opinion on surrounding Sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off Site intrusive investigations and monitoring.

APPENDIX 2: ENGINEERING LOGS

BOREHOLE LOG WS101

PROJECT NUMBER J18-035
PROJECT NAME Yeomans Honda
CLIENT AKS Ward
ADDRESS Worthing
DRILLING DATE 26/06/18

DRILLING COMPANY South Coast Drilling
DRILLING METHOD Windowless Sampling
DRILL RIG Terrier Mk2
LOGGED BY RP

COMPLETION

CASING

COMMENTS

Depth (m)	Samples	SPT N	Water	Graphic Log	Material Description	Well Installation
0.2	ES1 - 0.2-0.4				Firm brown silty slightly gravelly CLAY. Gravel is fine to medium sub-angular chalk (TOPSOIL)	
0.4					Stiff dark brown very clayey slightly gravelly SILT. Gravel is fine to coarse sub-angular to rounded flint	
0.6	B1 - 0.5-0.7					
0.8						
1.0		N = 17				
1.2					Stiff light brown very silty very gravelly CLAY. Gravel is fine sub-angular chalk and fine to coarse angular to rounded flint.	
1.4						
1.6	ES2 - 1.5-1.6					
1.8						
2.0		N = 20				
2.2	B2 - 2.1-2.5					
2.4						
2.6					Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)	
2.8						
3.0		N = 27				
3.2	B3 - 3.2-4					
3.4						
3.6						
3.8						
4.0					Termination Depth at: 4.0 m	
4.2						
4.4						
4.6						
4.8						
5.0						
5.2						
5.4						

BOREHOLE LOG WS102

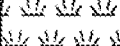
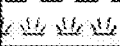
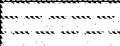
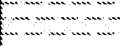
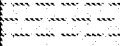
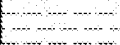
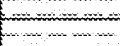
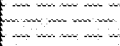
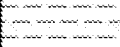
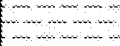
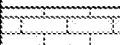
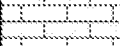
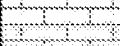
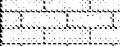
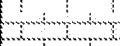
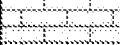
PROJECT NUMBER J18-035
PROJECT NAME Yeomans Honda
CLIENT AKS Ward
ADDRESS Worthing
DRILLING DATE 26/06/18

DRILLING COMPANY South Coast Drilling
DRILLING METHOD Windowless Sampling
DRILL RIG Terrier Mk2
LOGGED BY RP

COMPLETION

CASING

COMMENTS Refusal at 3.5m

Depth (m)	Samples	SPT N	Water	Graphic Log	Material Description	Well Installation
0.2					Brown mulched wood chippings	
0.4						
0.6	ES1 - 0.5-0.6				Soft to firm dark brown slightly silty gravelly CLAY. Gravel is fine to medium sub-angular chalk.	
0.8						
1.0		N = 8			Soft brown slightly silty slightly gravelly CLAY. Gravel is fine to coarse sub-angular to rounded flint	
1.2						
1.4						
1.6	L1 - 1.5-2.0				Firm light brown very silty very gravelly CLAY. Gravel is fine sub-angular chalk and fine to coarse angular to rounded flint.	
1.8						
2.0		N = 25				
2.2						
2.4					Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)	
2.6	B2 - 2.5-3.0					
2.8						
3.0		N = 50				
3.2						
3.4						
3.6					Termination Depth at. 3.5 m	
3.8						
4.0						
4.2						
4.4						
4.6						
4.8						
5.0						
5.2						
5.4						

BOREHOLE LOG WS103

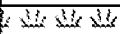
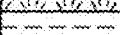
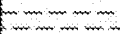
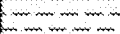
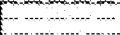
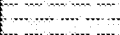
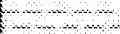
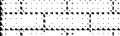
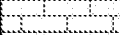
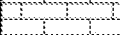
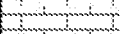
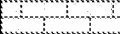
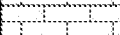
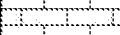
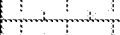
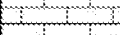
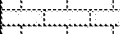
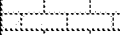
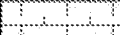
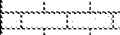
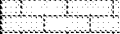
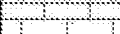
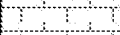
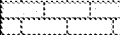
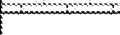
PROJECT NUMBER J18-035
PROJECT NAME Yeomans Honda
CLIENT AKS Ward
ADDRESS Worthing
DRILLING DATE 26/06/18

DRILLING COMPANY South Coast Drilling
DRILLING METHOD Windowless Sampling
DRILL RIG Terrier Mk2
LOGGED BY RP

COMPLETION

CASING

COMMENTS

Depth (m)	Samples	SPT N	Water	Graphic Log	Material Description	Well Installation
0.2					Brown mulched wood chippings	
0.4	ES1 - 0.4-0.5				Firm to stiff dark brown slightly silty gravelly CLAY. Gravel is fine to coarse sub-angular to rounded chalk.	
0.6						
0.8	B1 - 0.7-1.0					
1.0		N = 11				
1.2	ES2 - 1.2-1.3					
1.4						
1.6	B2 - 1.5-2.0				Soft light brown very silty slightly gravelly CLAY. Gravel is fine sub-angular chalk.	
1.8					Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)	
2.0		N = 25				
2.2					Hydrocarbon staining and slight odour at 2.8-3.0m	
2.4						
2.6						
2.8	ES3 - 2.8-3.0					
3.0		N = 40				
3.2						
3.4						
3.6	B3 - 3.5-4.0					
3.8						
4.0						
4.2	ES4 - 4.2-4.4					
4.4						
4.6						
4.8						
5.0					Termination Depth at: 5.0 m	
5.2						
5.4						

BOREHOLE LOG WS104

PROJECT NUMBER J18-035	DRILLING COMPANY South Coast Drilling
PROJECT NAME Yeomans Honda	DRILLING METHOD Windowless Sampling
CLIENT AKS Ward	DRILL RIG Terrier Mk2
ADDRESS Worthing	LOGGED BY RP
DRILLING DATE 26/06/18	

COMPLETION	CASING
-------------------	---------------

COMMENTS

Depth (m)	Samples	SPT N	Water	Graphic Log	Material Description	Well Installation
0.2					Concrete	
0.4	ES1 - 0.4-0.5				Soft to firm brown slightly silty gravelly CLAY with hydrocarbon odour. Gravel is fine to coarse sub-angular to rounded chalk.	
0.6						
0.8	B1 - 0.7-1.0					
1.0		N = 17				
1.2						
1.4	ES2 - 1.4-1.8				Firm brown grey slightly gravelly CLAY with hydrocarbon odour. Gravel is fine to coarse sub-angular chalk.	
1.6						
1.8	B2 - 1.8-2.1	N = 34			Structureless CHALK composed of light brown to grey and off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)	
2.0						
2.2						
2.4					Hydrocarbon staining and odour to 3.7m	
2.6						
2.8						
3.0						
3.2						
3.4						
3.6						
3.8						
4.0						
4.2						
4.4						
4.6						
4.8						
5.0					Termination Depth at: 5.0 m	
5.2						
5.4						

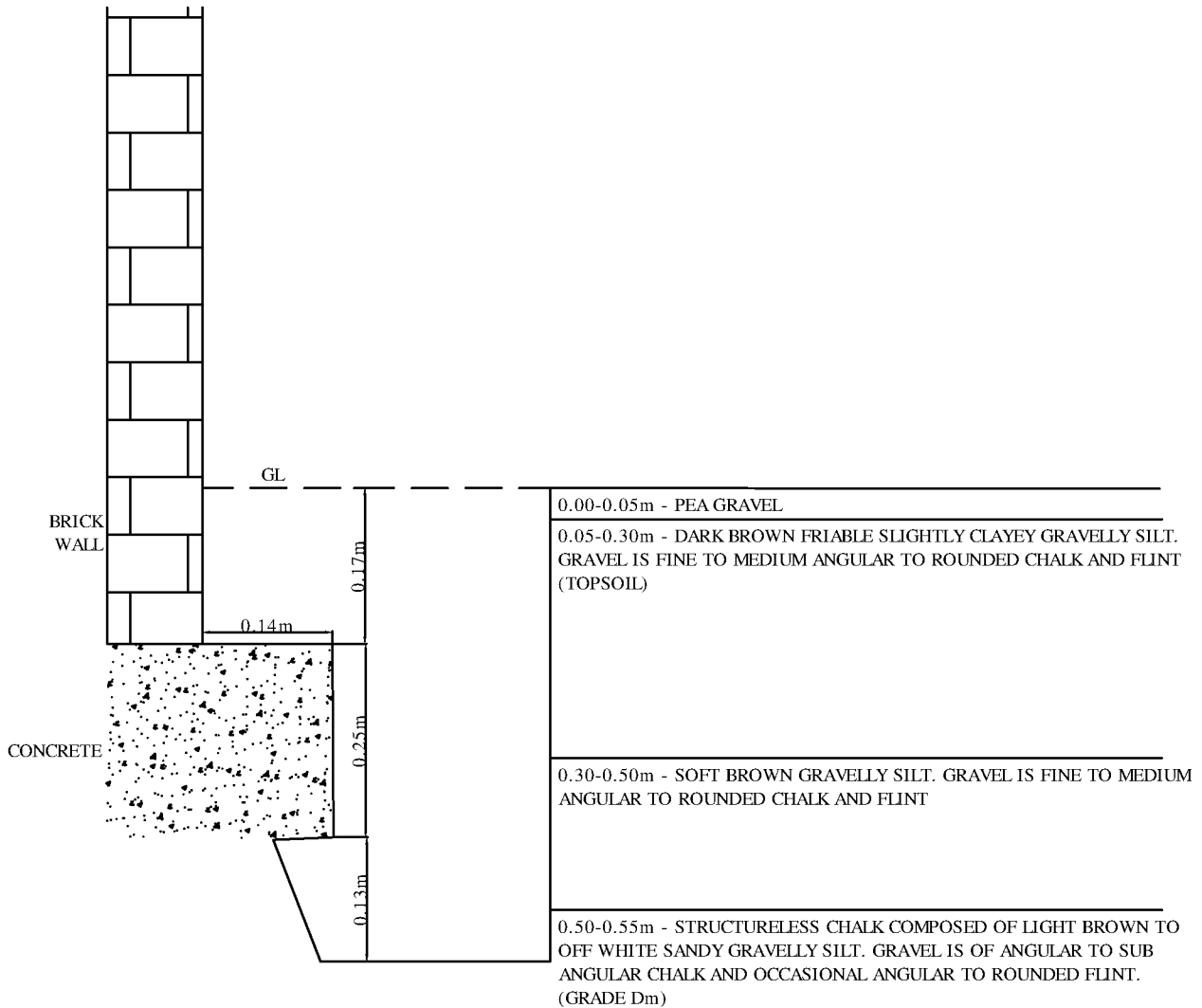
BOREHOLE LOG WS105

PROJECT NUMBER J18-035	DRILLING COMPANY South Coast Drilling
PROJECT NAME Yeomans Honda	DRILLING METHOD Windowless Sampling
CLIENT AKS Ward	DRILL RIG Terrier Mk2
ADDRESS Worthing	LOGGED BY RP
DRILLING DATE 26/06/18	

COMPLETION	CASING
-------------------	---------------

COMMENTS

Depth (m)	Samples	SPT N	Water	Graphic Log	Material Description	Well Installation
0.2					Concrete	
0.4	ES1 - 0.3-0.4				Stiff brown CLAY with brick and concrete fragments (Made Ground). Stiff dark brown slightly gravelly CLAY. Gravel is fine to coarse sub-angular chalk and flint.	
0.6						
0.8						
1.0		N = 14				
1.2	ES2 - 1.1-1.2				Firm to stiff light brown slightly silty gravelly CLAY. Gravel is fine to coarse sub rounded chalk.	
1.4						
1.6						
1.8						
2.0						
2.2						
2.4						
2.6						
2.8						
3.0					Termination Depth at: 3.0 m	
3.2						
3.4						
3.6						
3.8						
4.0						
4.2						
4.4						
4.6						
4.8						
5.0						
5.2						
5.4						



SECTION



Ground Condition Consultants Ltd
10 Waldegrave Close Southampton SO19 9RY
ARUN DISTRICT COUNCIL FG/1741480007971 450113
ask@groundcc.co.uk www.groundcc.co.uk

client
AKS WARD

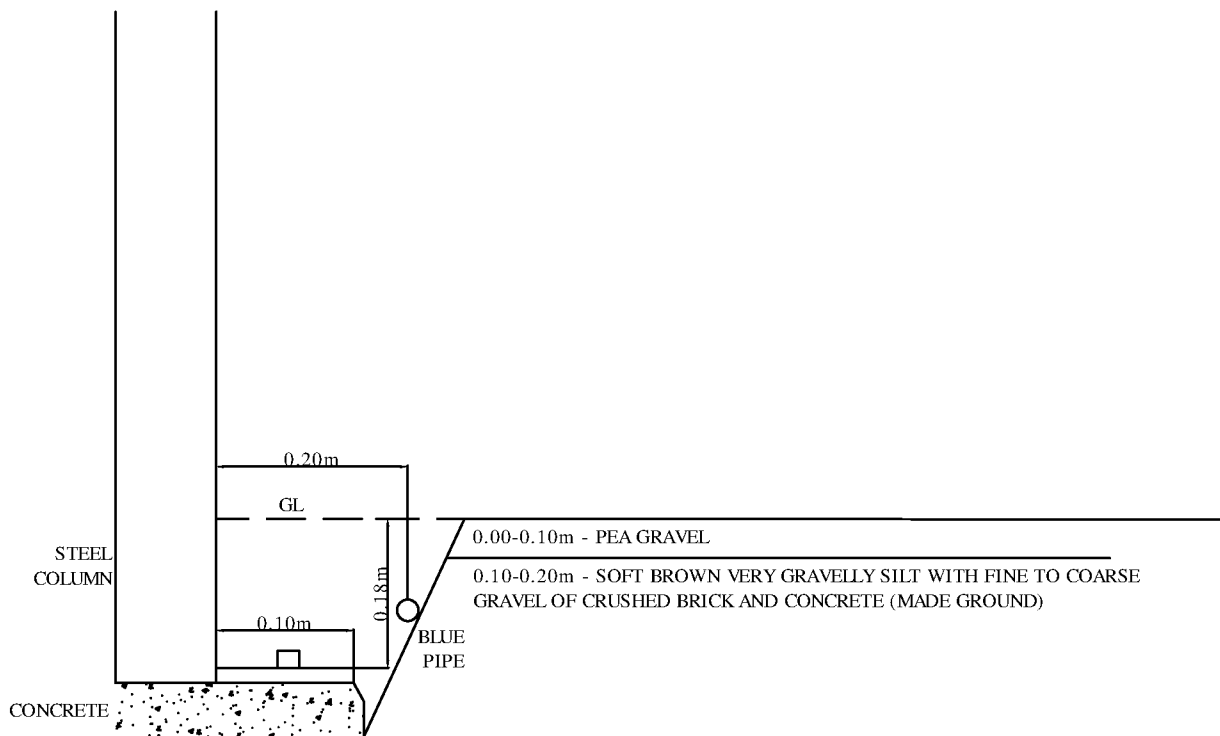
site
YEOMANS HONDA, WORTHING

title
INSPECTION PIT LOG

scale NTS | drawn by AP | checked by RP

date 25 JUN 2018 |

drawing number IP101 | rev. 0



SECTION



Ground Condition Consultants Ltd
10 Waldegrave Close Southampton SO19 9RY
Telephone 07971 450113
www.groundcc.co.uk

client
AKS WARD

site
YEOMANS HONDA, WORTHING

title
INSPECTION PIT LOG

scale NTS drawn by AP checked by RP

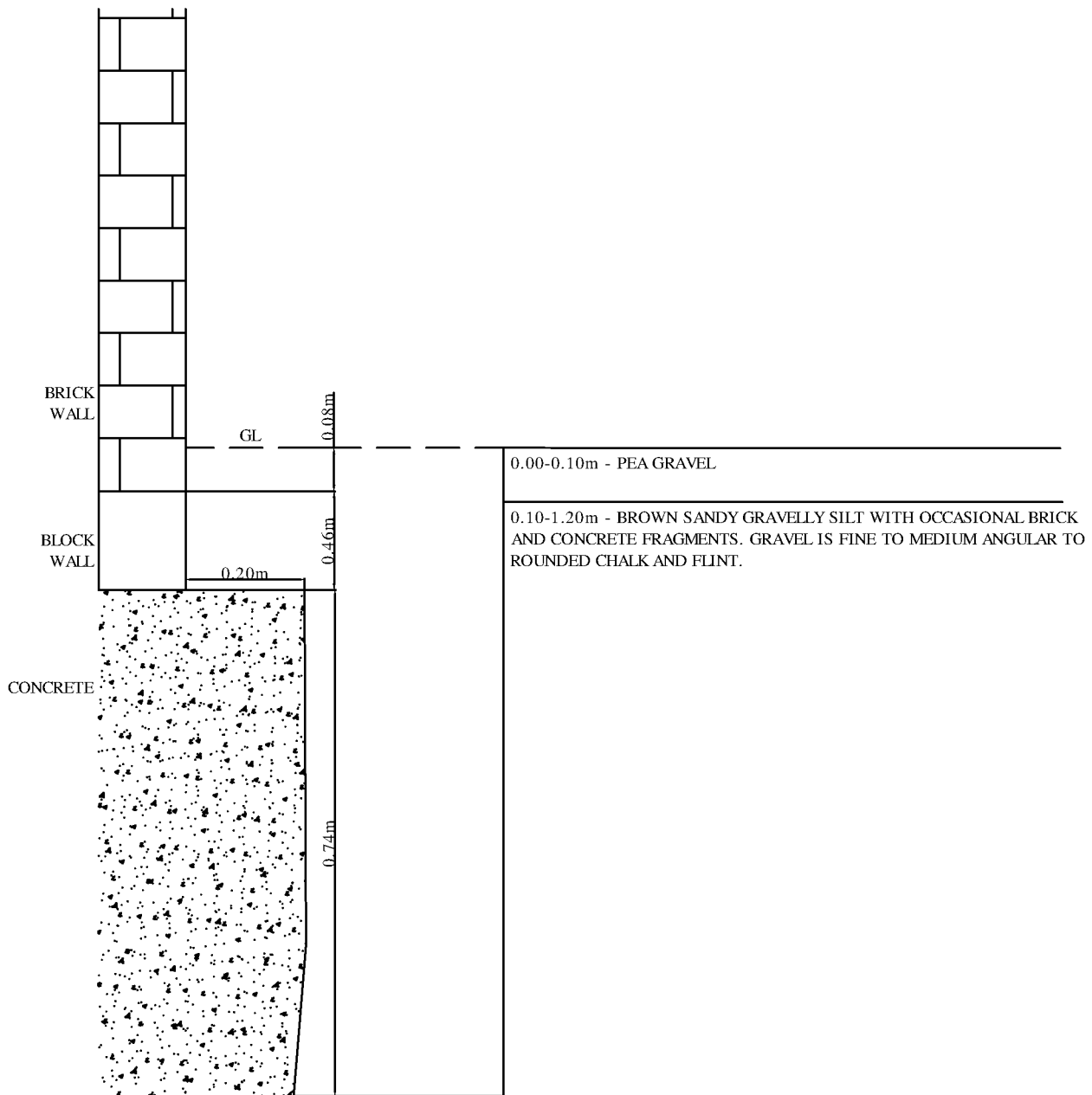
date 25 JUN 2018

drawing number

IP102

rev.

0



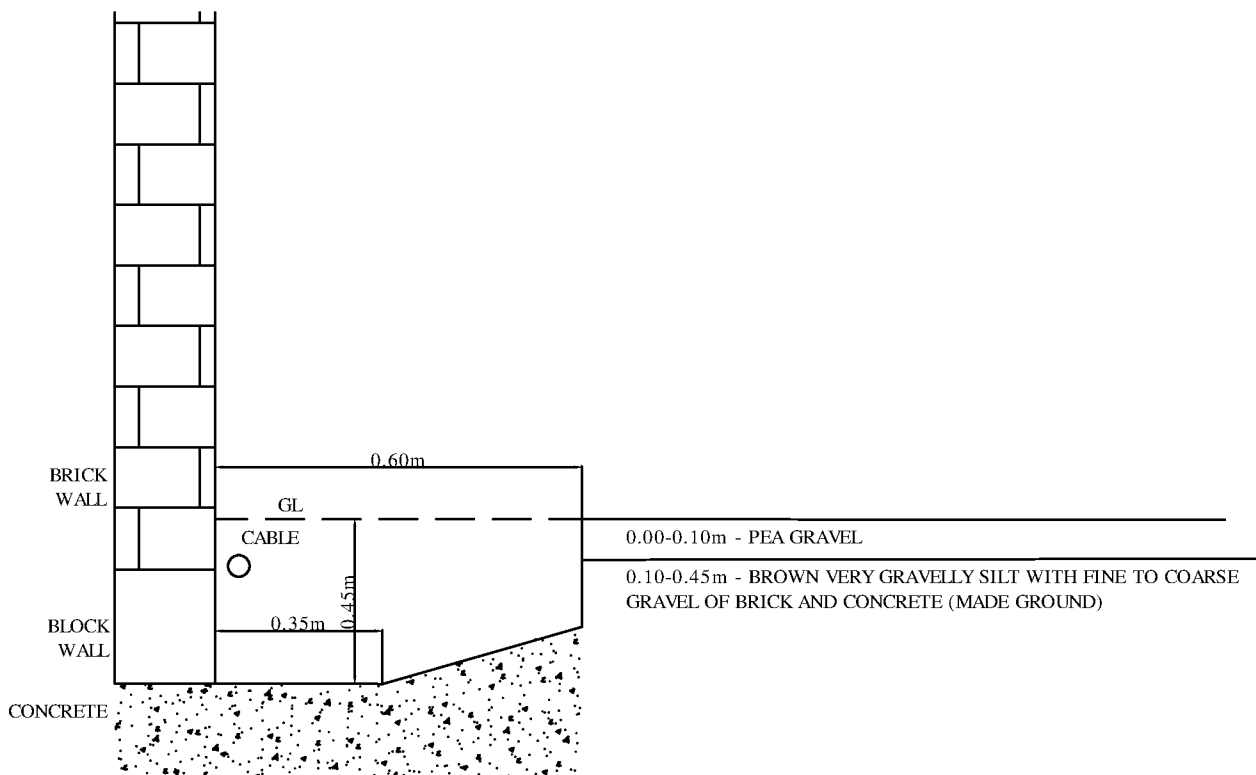
SECTION



Ground Condition Consultants Ltd
10 Waldegrave Close Southampton SO19 9RY
Telephone 07971 450113
www.groundcc.co.uk

client
AKS WARD
site
YEOMANS HONDA, WORTHING
title
INSPECTION PIT LOG

scale NTS drawn by AP checked by RP
date 25 JUN 2018
drawing number IP103 rev. 0



SECTION



Ground Condition Consultants Ltd
10 Waldegrave Close Southampton SO19 9RY
Telephone 07971 450113
www.groundcc.co.uk

client
AKS WARD

site
YEOMANS HONDA, WORTHING

title
INSPECTION PIT LOG

scale NTS drawn by AP checked by RP

date 25 JUN 2018

drawing number IP104

rev. 0

APPENDIX 3: GENERIC ASSESSMENT CRITERIA

SOIL - HUMAN HEALTH SCREENING VALUES

Status	End Use	Issue No	Issue Date	
ISSUE	Commercial / Industrial	1	June 2015	
	SOIL ORGANIC MATTER			
	1%	2.5%	6%	SOURCE
Determinand	Units			
pH		<5, >9		
Artesian	%	Presence		
HEAVY METALS/METALLOIDS				
Arsenic	mg/kg	500		S&JL
Cadmium	mg/kg	100		S&JL
Chromium (III)	mg/kg	8,500		S&JL
Chromium (VI)	mg/kg	35		S&JL
Cobalt	mg/kg	2300		C&S
Mercury (Elemental)	mg/kg	58		S&JL
Mercury (Inorganic)	mg/kg	1100		S&JL
Mercury (Methyl)	mg/kg	300		S&JL
Nickel	mg/kg	980		S&JL
Selenium	mg/kg	12000		S&JL
Silver	mg/kg	17		S&JL
Boron	mg/kg	240000		S&JL
Vanadium	mg/kg	9000		S&JL
Copper	mg/kg	68,000		S&JL
Zinc	mg/kg	730,000		S&JL
GENERAL INORGANICS				
Easily Liberatable Cyanide (free)	mg/kg			Acute effects infant 1 dose 3g soil
US EPA PRIORITY PAHs				
Acenaphthene	mg/kg	84,000	97,000	100,000 S&JL
Acenaphthylene	mg/kg	83,000	97,000	100,000 S&JL
Anthracene	mg/kg	520,000	540,000	560,000 S&JL
Benzo(a)anthracene	mg/kg	170	170	180 S&JL
Benzo(b)fluoranthene	mg/kg	44	44	45 S&JL
Benzo(k)fluoranthene	mg/kg	1,200	1,200	1,200 S&JL
Benzo(a,h)pyrene	mg/kg	3,900	4,000	4,000 S&JL
Benzo(a)pyrene	mg/kg	35	35	35 S&JL
Chrysene	mg/kg	350	350	350 S&JL
Dibenz(a,h)anthracene	mg/kg	3.5	4	4 S&JL
Fluoranthene	mg/kg	23,000	23,000	23,000 S&JL
Indeno(1,2,3-cd)pyrene	mg/kg	68,000	71,000	71,000 S&JL
Naphthalene	mg/kg	500	510	510 S&JL
Phenanthrene	mg/kg	150	150	150 S&JL
Pyrene	mg/kg	54,000	54,000	54,000 S&JL
Total PAHs	mg/kg	No Sum	No Sum	No Sum
Chlorinated Solvents				
1,2-Dichloroethane (DCE)	mg/kg	0.67	0.97	1.7 S&JL
1,1,1-Trichloroethane (111 TCA)	mg/kg	660	1,300	3,100 S&JL
1,1,1,2-Tetrachloroethane (1112 PCE)	mg/kg	110	250	560 S&JL
1,1,2,2-Tetrachloroethane (1122 PCE)	mg/kg	270	550	1,100 S&JL
Tetrachloroethene (CCL4)	mg/kg	19	43	95 S&JL
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	7.9	6.3	14 S&JL
Trichloroethene (TCE)	mg/kg	1.2	2.6	5.7 S&JL
Trichloromethane (Chloroform)	mg/kg	96	170	350 S&JL
Vinyl Chloride	mg/kg	0.059	0.077	0.17 S&JL
Chlorobenzene	mg/kg	56	130	290 S&JL
1,2-Dichlorobenzene	mg/kg	2000	4800	11000 S&JL
1,3-Dichlorobenzene	mg/kg	30	73	170 S&JL
1,4-Dichlorobenzene	mg/kg	4400	10000	25000 S&JL
1,2,3-Trichlorobenzene	mg/kg	127	300	690 S&JL
1,2,4-Trichlorobenzene	mg/kg	270	530	1300 S&JL
1,3,5-Trichlorobenzene	mg/kg	23	55	130 S&JL
1,2,3,4-Tetrachlorobenzene	mg/kg	120	340	840 S&JL
1,2,3,5-Tetrachlorobenzene	mg/kg	49	120	240 S&JL
1,2,4,5-Tetrachlorobenzene	mg/kg	42	72	96 S&JL
Pentachlorobenzene	mg/kg	600	770	830 S&JL
Hexachlorobenzene	mg/kg	110	120	120 S&JL
Carbon Disulphide	mg/kg	11	22	47 S&JL
Hexachlorocyclopentadiene	mg/kg	31	66	120 S&JL
Phenolics				
Phenol	mg/kg	760	1500	3200 S&JL
Chlorophenols	mg/kg	2500	4000	4300 S&JL
Pentachlorophenol	mg/kg	400	400	400 S&JL
Explosives				
2,4,6-Trinitrobenzene (TNT)	mg/kg	1000	1000	1000 S&JL
RDX	mg/kg	210000	210000	210000 S&JL
HMX	mg/kg	110000	110000	110000 S&JL
Insecticides/Herbicides				
Aldrin	mg/kg	170.0	170.0	170.0 S&JL
Dieldrin	mg/kg	170.0	170.0	170.0 S&JL
Atrazine	mg/kg	9300.0	9400.0	9400.0 S&JL
Dichlorvos	mg/kg	140.0	140.0	140.0 S&JL
Alpha-Endosulfan	mg/kg	5600	7400	8400 S&JL
Beta-Endosulfan	mg/kg	6300	7800	8700 S&JL
Alpha-Hexachlorocyclopentadiene	mg/kg	170	180	180 S&JL
Beta-Hexachlorocyclopentadiene	mg/kg	65	65	65 S&JL
Gamma-Hexachlorocyclopentadiene (Lindane)	mg/kg	67	69	70 S&JL
TPH				
TPH Aromatic <C5-6	mg/kg	3,200	5,900	12,000 S&JL
TPH Aromatic <C6-8	mg/kg	7,800	17,000	40,000 S&JL
TPH Aromatic <C9-10	mg/kg	1,600	4,800	11,000 S&JL
TPH Aromatic <C10-11	mg/kg	6,100	23,000	41,000 S&JL
TPH Aromatic <C12-14	mg/kg	59,000	82,000	90,000 S&JL
TPH Aromatic <C15-16	mg/kg	1,600,000	1,700,000	1,800,000 S&JL
TPH Aromatic <C17-19	mg/kg	1,600,000	1,700,000	1,800,000 S&JL
TPH Aromatic >EC5-7 (Benzene)	mg/kg	26,000	46,000	86,000 S&JL
TPH Aromatic >EC7-9	mg/kg	55,000	110,000	180,000 S&JL
TPH Aromatic >EC9-10	mg/kg	3,500	9,100	17,000 S&JL
TPH Aromatic >EC10-12	mg/kg	15,000	28,000	34,000 S&JL
TPH Aromatic >EC12-15	mg/kg	35,000	37,000	38,000 S&JL
TPH Aromatic >EC15-17	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC17-19	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC19-21	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC21-23	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC23-25	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC25-27	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC27-29	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC29-31	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC31-33	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC33-35	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC35-37	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC37-39	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC39-41	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC41-43	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC43-45	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC45-47	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC47-49	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC49-51	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC51-53	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC53-55	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC55-57	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC57-59	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC59-61	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC61-63	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC63-65	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC65-67	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC67-69	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC69-71	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC71-73	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC73-75	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC75-77	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC77-79	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC79-81	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC81-83	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC83-85	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC85-87	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC87-89	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC89-91	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC91-93	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC93-95	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC95-97	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC97-99	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC99-101	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC101-103	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC103-105	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC105-107	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC107-109	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC109-111	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC111-113	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC113-115	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC115-117	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC117-119	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC119-121	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC121-123	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC123-125	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC125-127	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC127-129	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC129-131	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC131-133	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC133-135	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC135-137	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC137-139	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC139-141	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC141-143	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC143-145	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC145-147	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC147-149	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC149-151	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC151-153	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC153-155	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC155-157	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC157-159	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC159-161	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC161-163	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC163-165	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC165-167	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC167-169	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC169-171	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC171-173	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC173-175	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC175-177	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC177-179	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC179-181	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC181-183	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC183-185	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC185-187	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC187-189	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC189-191	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC191-193	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC193-195	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC195-197	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC197-199	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC199-201	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC201-203	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC203-205	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC205-207	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC207-209	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC209-211	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC211-213	mg/kg	28,000	28,000	28,000 S&JL
TPH Aromatic >EC213-215	mg/kg			

APPENDIX 4: SOIL SCREENING SUMMARY

Sample ID	Units	GAC	WS101	WS101	WS102	WS103	WS103	WS104	WS104	WS105	WS105
Depth to Top			0.20	1.50	0.50	0.40	2.80	0.40	1.60	0.30	1.10
Depth to Bottom			0.40	1.60	0.60	0.50	2.90	0.50	1.70	0.40	1.20
Date Sampled			26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18
% Stones >10mm	% w/w		<0.1	<0.1	<0.1	15.2	13.8	<0.1	4.1	0.5	<0.1
pH	pH	5-9	8.61	8.34	7.97	8.02	8.46	7.92	8.45	8.01	8.37
Cyanide (free)	mg/kg		<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenols - Total by HPLC	mg/kg	760	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Organic matter	% w/w		2.5	0.3	2.5	1.9	0.3	1	0.2	1.9	0.3
Total Organic Carbon	% w/w		1.44	0.15	1.44	1.09	0.22	0.6	0.11	1.11	0.2
Antimony	mg/kg		<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic	mg/kg	640	7	5	6	8	<1	5	4	7	4
Cadmium	mg/kg	190	0.9	0.5	0.8	0.8	<0.5	0.8	<0.5	0.7	0.7
Copper	mg/kg	68000	35	8	20	25	3	11	5	13	7
Chromium	mg/kg		32	22	25	23	6	35	8	20	23
Chromium (hexavalent)	mg/kg	33	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	mg/kg	2300	41	7	32	36	3	16	3	26	10
Mercury	mg/kg	1100	0.31	0.56	0.17	0.27	0.65	<0.17	0.76	<0.17	0.25
Nickel	mg/kg	980	21	26	19	16	11	28	15	18	17
Selenium	mg/kg	12000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	mg/kg	730000	108	39	75	73	22	63	32	60	38
Asbestos in soil		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD
PAH-16MS											
Naphthalene	mg/kg	190	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Acenaphthylene	mg/kg	83000	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	mg/kg	84000	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01
Fluorene	mg/kg	63000	<0.01	<0.01	<0.01	<0.01	<0.01	0.08	0.09	<0.01	<0.01
Phenanthrene	mg/kg	22000	<0.03	<0.03	<0.03	0.09	<0.03	0.13	0.17	<0.03	<0.03
Anthracene	mg/kg	520000	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	mg/kg	23000	<0.08	<0.08	<0.08	0.31	<0.08	<0.08	<0.08	<0.08	<0.08
Pyrene	mg/kg	54000	<0.07	<0.07	<0.07	0.28	<0.07	<0.07	<0.07	<0.07	<0.07
Benzo(a)anthracene	mg/kg	170	<0.04	<0.04	<0.04	0.18	<0.04	<0.04	<0.04	<0.04	<0.04
Chrysene	mg/kg	350	<0.06	<0.06	<0.06	0.23	<0.06	<0.06	<0.06	<0.06	<0.06
Benzo(b)fluoranthene	mg/kg	44	<0.05	<0.05	<0.05	0.26	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg	1200	<0.07	<0.07	<0.07	0.1	<0.07	<0.07	<0.07	<0.07	<0.07
Benzo(a)pyrene	mg/kg	35	<0.04	<0.04	<0.04	0.22	<0.04	<0.04	<0.04	<0.04	<0.04
Indeno(123-cd)pyrene	mg/kg	500	<0.03	<0.03	<0.03	0.14	<0.03	<0.03	<0.03	<0.03	<0.03
D											

APPENDIX 5: CHEMICAL LABORATORY TEST CERTIFICATES

FINAL ANALYTICAL TEST REPORT

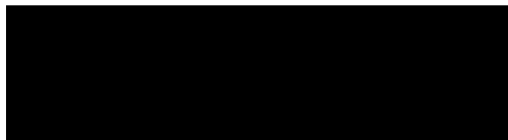
Envirolab Job Number: 18/05220
Issue Number: 1

Date: 13 July, 2018

Client: Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
SO19 9RY

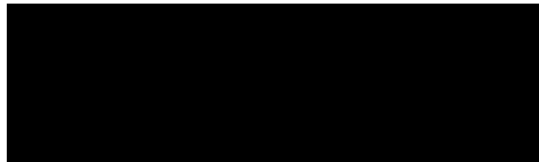
Project Manager: Antony Platt
Project Name: Worthing
Project Ref: J18-035
Order No: J18-035
Date Samples Received: 29/06/18
Date Instructions Received: 02/07/18
Date Analysis Completed: 13/07/18

Prepared by:



Kate Keningale
Sales Executive

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/1	18/05220/2	18/05220/3	18/05220/4	18/05220/6	18/05220/8	18/05220/9	18/05220/10	Units	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS103	WS103	WS104	WS104	WS105		
Depth to Top	0.20	1.50	0.50	0.40	2.80	0.40	1.60	0.30		
Depth To Bottom	0.40	1.60	0.60	0.50	2.90	0.50	1.70	0.40		
Date Sampled	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6E	5A	6	6A	5A	6	5A	6AE		
% Stones >10mm _A	<0.1	<0.1	<0.1	15.2	13.8	<0.1	4.1	0.5	% w/w	A-T-044
pH _D ^{M#}	8.61	8.34	7.97	8.02	8.46	7.92	8.45	8.01	pH	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	A-T-050s
Organic matter _D ^{M#}	2.5	0.3	2.5	1.9	0.3	1.0	0.2	1.9	% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	1.44	0.15	1.44	1.09	0.22	0.60	0.11	1.11	% w/w	A-T-032s
Antimony _D	<5	<5	<5	<5	<5	<5	<5	<5	mg/kg	A-T-024s
Arsenic _D ^{M#}	7	5	6	8	<1	5	4	7	mg/kg	A-T-024s
Cadmium _D ^{M#}	0.9	0.5	0.8	0.8	<0.5	0.8	<0.5	0.7	mg/kg	A-T-024s
Copper _D ^{M#}	35	8	20	25	3	11	5	13	mg/kg	A-T-024s
Chromium _D ^{M#}	32	22	25	23	6	35	8	20	mg/kg	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-040s
Lead _D ^{M#}	41	7	32	36	3	16	3	26	mg/kg	A-T-024s
Mercury _D	0.31	0.56	0.17	0.27	0.65	<0.17	0.76	<0.17	mg/kg	A-T-024s
Nickel _D ^{M#}	21	26	19	16	11	28	15	18	mg/kg	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-024s
Zinc _D ^{M#}	108	39	75	73	22	63	32	60	mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^A @										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD		A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/1	18/05220/2	18/05220/3	18/05220/4	18/05220/6	18/05220/8	18/05220/9	18/05220/10	Units	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS103	WS103	WS104	WS104	WS105		
Depth to Top	0.20	1.50	0.50	0.40	2.80	0.40	1.60	0.30		
Depth To Bottom	0.40	1.60	0.60	0.50	2.90	0.50	1.70	0.40		
Date Sampled	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6E	5A	6	6A	5A	6	5A	6AE		
PAH-16MS										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	0.08	0.09	<0.01	mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	0.09	<0.03	0.13	0.17	<0.03	mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	0.31	<0.08	<0.08	<0.08	<0.08	mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	0.28	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	0.18	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	0.23	<0.06	<0.06	<0.06	<0.06	mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	0.26	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	0.10	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	0.22	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	0.14	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	0.12	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	<0.08	<0.08	1.98	<0.08	0.21	0.29	<0.08	mg/kg	A-T-019s

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/1	18/05220/2	18/05220/3	18/05220/4	18/05220/6	18/05220/8	18/05220/9	18/05220/10	Units	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS103	WS103	WS104	WS104	WS105		
Depth to Top	0.20	1.50	0.50	0.40	2.80	0.40	1.60	0.30		
Depth To Bottom	0.40	1.60	0.60	0.50	2.90	0.50	1.70	0.40		
Date Sampled	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6E	5A	6	6A	5A	6	5A	6AE		
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.13	<0.01	mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	47.6	18.5	<0.1	mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	189	98.8	<0.1	mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	226	115	<0.1	mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	85.7	42.6	<0.1	mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	548	275	<0.1	mg/kg	A-T-023s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24	<0.01	mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	8.0	6.8	<0.1	mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	83.8	43.7	<0.1	mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	78.7	36.3	<0.1	mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	12.5	11.6	<0.1	mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	183	98.6	<0.1	mg/kg	A-T-023s
TPH (Ali & Aro) _A	<0.1	<0.1	<0.1	<0.1	<0.1	731	373	<0.1	mg/kg	A-T-023s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/11								Units	Method ref
Client Sample No										
Client Sample ID	WS105									
Depth to Top	1.10									
Depth To Bottom	1.20									
Date Sampled	26-Jun-18									
Sample Type	Soil									
Sample Matrix Code	5A									
% Stones >10mm _A	<0.1								% w/w	A-T-044
pH _D ^{M#}	8.37								pH	A-T-031s
Cyanide (free) _A ^{M#}	<1								mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2								mg/kg	A-T-050s
Organic matter _D ^{M#}	0.3								% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.20								% w/w	A-T-032s
Antimony _D	<5								mg/kg	A-T-024s
Arsenic _D ^{M#}	4								mg/kg	A-T-024s
Cadmium _D ^{M#}	0.7								mg/kg	A-T-024s
Copper _D ^{M#}	7								mg/kg	A-T-024s
Chromium _D ^{M#}	23								mg/kg	A-T-024s
Chromium (hexavalent) _D	<1								mg/kg	A-T-040s
Lead _D ^{M#}	10								mg/kg	A-T-024s
Mercury _D	0.25								mg/kg	A-T-024s
Nickel _D ^{M#}	17								mg/kg	A-T-024s
Selenium _D ^{M#}	<1								mg/kg	A-T-024s
Zinc _D ^{M#}	38								mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^A @										
Asbestos in soil _A [#]	NAD									A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A									

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/11								Units	Method ref
Client Sample No										
Client Sample ID	WS105									
Depth to Top	1.10									
Depth To Bottom	1.20									
Date Sampled	26-Jun-18									
Sample Type	Soil									
Sample Matrix Code	5A									
PAH-16MS										
Naphthalene _A ^{M#}	<0.03								mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01								mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01								mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01								mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03								mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02								mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08								mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07								mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04								mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06								mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05								mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07								mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04								mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03								mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04								mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05								mg/kg	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08								mg/kg	A-T-019s

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/11										
Client Sample No											
Client Sample ID	WS105										
Depth to Top	1.10										
Depth To Bottom	1.20										
Date Sampled	26-Jun-18										
Sample Type	Soil										
Sample Matrix Code	5A										
TPH CWG											
Ali >C5-C6 _A [#]	<0.01								mg/kg	A-T-022s	
Ali >C6-C8 _A [#]	<0.01								mg/kg	A-T-022s	
Ali >C8-C10 _A [#]	<0.01								mg/kg	A-T-022s	
Ali >C10-C12 _A [#]	<0.1								mg/kg	A-T-023s	
Ali >C12-C16 _A [#]	<0.1								mg/kg	A-T-023s	
Ali >C16-C21 _A [#]	<0.1								mg/kg	A-T-023s	
Ali >C21-C35 _A [#]	<0.1								mg/kg	A-T-023s	
Total Aliphatics _A	<0.1								mg/kg	A-T-023s	
Aro >C5-C7 _A [#]	<0.01								mg/kg	A-T-022s	
Aro >C7-C8 _A [#]	<0.01								mg/kg	A-T-022s	
Aro >C8-C9 _A [#]	<0.01								mg/kg	A-T-022s	
Aro >C9-C10 _A [#]	<0.01								mg/kg	A-T-022s	
Aro >C10-C12 _A [#]	<0.1								mg/kg	A-T-023s	
Aro >C12-C16 _A [#]	<0.1								mg/kg	A-T-023s	
Aro >C16-C21 _A [#]	<0.1								mg/kg	A-T-023s	
Aro >C21-C35 _A [#]	<0.1								mg/kg	A-T-023s	
Total Aromatics _A	<0.1								mg/kg	A-T-023s	
TPH (Ali & Aro) _A	<0.1								mg/kg	A-T-023s	
BTEX - Benzene _A [#]	<0.01								mg/kg	A-T-022s	
BTEX - Toluene _A [#]	<0.01								mg/kg	A-T-022s	
BTEX - Ethyl Benzene _A [#]	<0.01								mg/kg	A-T-022s	
BTEX - m & p Xylene _A [#]	<0.01								mg/kg	A-T-022s	
BTEX - o Xylene _A [#]	<0.01								mg/kg	A-T-022s	
MTBE _A [#]	<0.01								mg/kg	A-T-022s	

REPORT NOTES

General:

This report shall not be reproduced, except in full, without written approval from Envirolab.

All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

FINAL ANALYTICAL TEST REPORT SUPPLEMENT TO TEST REPORT 18/05220/1

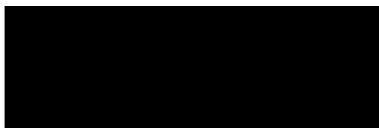
Envirolab Job Number: 18/05220
Issue Number: 2

Date: 20 July, 2018

Client: Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
SO19 9RY

Project Manager: Antony Platt
Project Name: Worthing
Project Ref: J18-035
Order No: J18-035
Date Samples Received: 29/06/18
Date Instructions Received: 02/07/18
Date Analysis Completed: 20/07/18

Prepared by:



Melanie Marshall
Laboratory Coordinator

Approved by:



Georgia King
Admin & Client Services Supervisor

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/1	18/05220/2	18/05220/3	18/05220/4	18/05220/6	18/05220/8	18/05220/9	18/05220/10	Units	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS103	WS103	WS104	WS104	WS105		
Depth to Top	0.20	1.50	0.50	0.40	2.80	0.40	1.60	0.30		
Depth To Bottom	0.40	1.60	0.60	0.50	2.90	0.50	1.70	0.40		
Date Sampled	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6E	5A	6	6A	5A	6	5A	6AE		
% Stones >10mm _A	<0.1	<0.1	<0.1	15.2	13.8	<0.1	4.1	0.5	% w/w	A-T-044
pH _D ^{M#}	8.61	8.34	7.97	8.02	8.46	7.92	8.45	8.01	pH	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	A-T-050s
Organic matter _D ^{M#}	2.5	0.3	2.5	1.9	0.3	1.0	0.2	1.9	% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	1.44	0.15	1.44	1.09	0.22	0.60	0.11	1.11	% w/w	A-T-032s
Antimony _D	<5	<5	<5	<5	<5	<5	<5	<5	mg/kg	A-T-024s
Arsenic _D ^{M#}	7	5	6	8	<1	5	4	7	mg/kg	A-T-024s
Cadmium _D ^{M#}	0.9	0.5	0.8	0.8	<0.5	0.8	<0.5	0.7	mg/kg	A-T-024s
Copper _D ^{M#}	35	8	20	25	3	11	5	13	mg/kg	A-T-024s
Chromium _D ^{M#}	32	22	25	23	6	35	8	20	mg/kg	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-040s
Lead _D ^{M#}	41	7	32	36	3	16	3	26	mg/kg	A-T-024s
Mercury _D	0.31	0.56	0.17	0.27	0.65	<0.17	0.76	<0.17	mg/kg	A-T-024s
Nickel _D ^{M#}	21	26	19	16	11	28	15	18	mg/kg	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-024s
Zinc _D ^{M#}	108	39	75	73	22	63	32	60	mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^A @										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD		A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/1	18/05220/2	18/05220/3	18/05220/4	18/05220/6	18/05220/8	18/05220/9	18/05220/10	Units	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS103	WS103	WS104	WS104	WS105		
Depth to Top	0.20	1.50	0.50	0.40	2.80	0.40	1.60	0.30		
Depth To Bottom	0.40	1.60	0.60	0.50	2.90	0.50	1.70	0.40		
Date Sampled	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6E	5A	6	6A	5A	6	5A	6AE		
PAH-16MS										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	0.08	0.09	<0.01	mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	0.09	<0.03	0.13	0.17	<0.03	mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	0.31	<0.08	<0.08	<0.08	<0.08	mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	0.28	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	0.18	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	0.23	<0.06	<0.06	<0.06	<0.06	mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	0.26	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	0.10	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	0.22	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	0.14	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	0.12	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	<0.08	<0.08	1.98	<0.08	0.21	0.29	<0.08	mg/kg	A-T-019s

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/1	18/05220/2	18/05220/3	18/05220/4	18/05220/6	18/05220/8	18/05220/9	18/05220/10	Units	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS103	WS103	WS104	WS104	WS105		
Depth to Top	0.20	1.50	0.50	0.40	2.80	0.40	1.60	0.30		
Depth To Bottom	0.40	1.60	0.60	0.50	2.90	0.50	1.70	0.40		
Date Sampled	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18	26-Jun-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6E	5A	6	6A	5A	6	5A	6AE		
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.13	<0.01	mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	47.6	18.5	<0.1	mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	189	98.8	<0.1	mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	226	115	<0.1	mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	85.7	42.6	<0.1	mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	548	275	<0.1	mg/kg	A-T-023s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24	<0.01	mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	8.0	6.8	<0.1	mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	83.8	43.7	<0.1	mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	78.7	36.3	<0.1	mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	12.5	11.6	<0.1	mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	183	98.6	<0.1	mg/kg	A-T-023s
TPH (Ali & Aro) _A	<0.1	<0.1	<0.1	<0.1	<0.1	731	373	<0.1	mg/kg	A-T-023s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/11								Units	Method ref
Client Sample No										
Client Sample ID	WS105									
Depth to Top	1.10									
Depth To Bottom	1.20									
Date Sampled	26-Jun-18									
Sample Type	Soil									
Sample Matrix Code	5A									
% Stones >10mm _A	<0.1								% w/w	A-T-044
pH _D ^{M#}	8.37								pH	A-T-031s
Cyanide (free) _A ^{M#}	<1								mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2								mg/kg	A-T-050s
Organic matter _D ^{M#}	0.3								% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.20								% w/w	A-T-032s
Antimony _D	<5								mg/kg	A-T-024s
Arsenic _D ^{M#}	4								mg/kg	A-T-024s
Cadmium _D ^{M#}	0.7								mg/kg	A-T-024s
Copper _D ^{M#}	7								mg/kg	A-T-024s
Chromium _D ^{M#}	23								mg/kg	A-T-024s
Chromium (hexavalent) _D	<1								mg/kg	A-T-040s
Lead _D ^{M#}	10								mg/kg	A-T-024s
Mercury _D	0.25								mg/kg	A-T-024s
Nickel _D ^{M#}	17								mg/kg	A-T-024s
Selenium _D ^{M#}	<1								mg/kg	A-T-024s
Zinc _D ^{M#}	38								mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^A @										
Asbestos in soil _A [#]	NAD									A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A									

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/11								Units	Method ref
Client Sample No										
Client Sample ID	WS105									
Depth to Top	1.10									
Depth To Bottom	1.20									
Date Sampled	26-Jun-18									
Sample Type	Soil									
Sample Matrix Code	5A									
PAH-16MS										
Naphthalene _A ^{M#}	<0.03								mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01								mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01								mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01								mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03								mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02								mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08								mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07								mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04								mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06								mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05								mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07								mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04								mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03								mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04								mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05								mg/kg	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08								mg/kg	A-T-019s

Envirolab Job Number: 18/05220

Client Project Name: Worthing

Client Project Ref: J18-035

Lab Sample ID	18/05220/11								Units	Method ref
Client Sample No										
Client Sample ID	WS105									
Depth to Top	1.10									
Depth To Bottom	1.20									
Date Sampled	26-Jun-18									
Sample Type	Soil									
Sample Matrix Code	5A									
TPH CWG										
Ali >C5-C6 _A [#]	<0.01								mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01								mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01								mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1								mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1								mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1								mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1								mg/kg	A-T-023s
Total Aliphatics _A	<0.1								mg/kg	A-T-023s
Aro >C5-C7 _A [#]	<0.01								mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01								mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01								mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01								mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1								mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1								mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1								mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1								mg/kg	A-T-023s
Total Aromatics _A	<0.1								mg/kg	A-T-023s
TPH (Ali & Aro) _A	<0.1								mg/kg	A-T-023s
BTEX - Benzene _A [#]	<0.01								mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01								mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01								mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01								mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01								mg/kg	A-T-022s
MTBE _A [#]	<0.01								mg/kg	A-T-022s

REPORT NOTES

General:

This report shall not be reproduced, except in full, without written approval from Envirolab.

All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Final Test Report

Envirolab Job Number: 18/05220
Issue Number: 1

Date: 13-Jul-18

Client: Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
SO19 9RY

Project Manager: Antony Platt
Project Name: Worthing
Project Ref: J18-035
Order No: J18-035

Date Samples Received: 29-Jun-18
Date Instructions Received: 2-Jul-18
Date Analysis Completed: 13-Jul-18

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts

Superscript "M" indicates method accredited to MCERTS.

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid

Predominant Matrix Codes: 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited

Secondary Matrix Codes: A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Superscript # indicates method accredited to ISO 17025.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Prepared by:



Kate Keningale
Sales Executive

Approved by:



Richard Wong
Client Manager



Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	18/05220/3				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				WS102				
Depth to Top				0.5				
Depth to Bottom				0.60				
Date Sampled				26/06/2018				
Sample Type				Soil				
Sample Matrix Code				6				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.97		-	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.06		-	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.01		-	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	N	6.1		-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.44		3	5	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08		100	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10		500	-	
Sum of 7 PCBs (mg/kg) _D	A-T-004	N	N	<0.007		1	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	Y	N	0.019	0.190	0.5	2	25
Barium	A-T-025	Y	N	0.025	0.250	20	100	300
Cadmium	A-T-025	Y	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	Y	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	Y	N	0.014	0.140	2	50	100
Mercury	A-T-025	Y	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	Y	N	0.002	0.020	0.5	10	30
Nickel	A-T-025	Y	N	0.003	0.030	0.4	10	40
Lead	A-T-025	Y	N	0.013	0.130	0.5	10	50
Antimony	A-T-025	Y	N	0.002	0.020	0.06	0.7	5
Selenium	A-T-025	Y	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	Y	N	0.042	0.420	4	50	200
Chloride	A-T-026	Y	N	3	33	800	15000	25000
Fluoride	A-T-026	Y	N	0.4	4.0	10	150	500
Sulphate as SO ₄	A-T-026	Y	N	8	77	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	67	670	4000	50000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	Y	7.4				
Conductivity (µS/cm)	A-T-037	N	N	134				
Mass Sample (kg)				0.218				
Dry Matter (%)	A-T-044	N	N	79.9				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits		
Lab Sample ID	Method	ISO17025	MCERTS	18/05220/8			
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Client Sample ID			WS104				
Depth to Top			0.4				
Depth to Bottom			0.50				
Date Sampled			26/06/2018				
Sample Type			Soil				
Sample Matrix Code			6				
Solid Waste Analysis							
pH (pH Units) _D	A-T-031	Y	Y	7.92	-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.03	-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.03	-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	N	3.2	-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.6	3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	0.2	100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	726	500	-	-
Sum of 7 PCBs (mg/kg) _D	A-T-004	N	N	<0.007	1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-
Eluate Analysis					10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)
Arsenic	A-T-025	Y	N	<0.001	<0.01	0.5	2
Barium	A-T-025	Y	N	0.059	0.590	20	100
Cadmium	A-T-025	Y	N	<0.001	<0.01	0.04	1
Chromium	A-T-025	Y	N	<0.001	<0.01	0.5	10
Copper	A-T-025	Y	N	0.006	0.060	2	50
Mercury	A-T-025	Y	N	<0.0005	<0.005	0.01	0.2
Molybdenum	A-T-025	Y	N	<0.001	<0.01	0.5	10
Nickel	A-T-025	Y	N	0.002	0.020	0.4	10
Lead	A-T-025	Y	N	0.005	0.050	0.5	10
Antimony	A-T-025	Y	N	<0.001	<0.01	0.06	0.7
Selenium	A-T-025	Y	N	<0.001	<0.01	0.1	0.5
Zinc	A-T-025	Y	N	0.022	0.220	4	50
Chloride	A-T-026	Y	N	2	16	800	15000
Fluoride	A-T-026	Y	N	0.1	1.0	10	150
Sulphate as SO ₄	A-T-026	Y	N	3	33	1000	20000
Total Dissolved Solids	A-T-035	N	N	39	390	4000	60000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800
Leach Test Information							
pH (pH Units)	A-T-031	N	Y	7.1			
Conductivity (µS/cm)	A-T-037	N	N	78			
Mass Sample (kg)				0.221			
Dry Matter (%)	A-T-044	N	N	79.2			
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation							



Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

HAZARDOUS WASTE CLASSIFICATION REPORT

Envirolab Job Number: 18/05220
Issue Number: 2

Date: 23/07/18

Client: Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
SO19 9RY

Project Manager: Antony Platt
Project Name: Worthing
Project Ref: J18-035
Order No: J18-035
Date Samples Received: 29/06/18
Date Instructions Received: 02/07/18

Prepared and Approved by:



Alex Murray

HAZARDOUS WASTE SUMMARY.

Samples WS102 (0.50-0.60m) and WS104 (0.40-0.50m) should be classified as Non-Hazardous Waste.

HAZARDOUS WASTE IN DETAIL.

Two soil samples were submitted for laboratory analysis.

Envirolab do not offer any advice with respect to the number of samples required for hazardous waste testing or the number of samples required for landfill compliance testing. It would be prudent to discuss with your chosen waste disposal facility any frequency of testing requirements for your waste.

It is assumed that a robust sampling plan has been undertaken to obtain enough representative samples for analysis and that the testing performed identifies fully the contaminants of concern on the site.

From 5th July-2018, waste classification is carried out using WM3 1st Edition v1.1 May 2018. Haswaste applies hazardous properties listed on Table 3 of the CLP Regulation, the CL Inventory, ATP updates when applicable, IARC and Concawe and also applies additional applicable classifications listed on, the ECHA/REACH database, Sigma Aldrich and Fisher MSDSs plus, the Pesticide Properties Database. Thus, Haswaste includes hazard classes not listed in Table 3 of the CLP, The CL Inventory, ATP updates to the CLP from "other information sources", a WM3 requirement. Haswaste also includes the POPs listed in WM3 1st Edition v1.1 May 2018.

Please note that Haswaste now therefore applies HP14 Ecotoxicity Hazard Statements in Table 3 as per current EA guidance. Previously, Ecotoxicity was assessed using risk phrases in Table 3.2.

Laboratory test results.

Inorganic soil Moisture, pH, metals including CrVI, petroleum and polyaromatic hydrocarbon data was available for assessment.

Some asbestos, cyanide and phenols data was also available for assessment.

Some leachate pH results were also available.

Some WAC data was also available.

Soils.

- Elevated metals, TPHs and PAHs were observed, not to hazardous waste contributing levels.
- Elevated pH results were not detected.
- No asbestos was identified in any of the samples analysed.
- There were no significant levels of cyanide or phenols detected.

WM3: Assessment of Hazardous Properties HP1-HP13, HP14, HP15 and POPs.

The waste does not contain significant levels of substances which would lead to the classification of the material as hazardous waste HP1 Explosive, HP2 Oxidising, HP3 Flammable, HP4 Irritant, HP5 Specific Target Organ Toxicity (STOT) / Aspiration Toxicity, HP6 Acute Toxicity, HP7 Carcinogenic, HP8 Corrosive, HP9 Infectious, HP10 Toxic for reproduction, HP11 Mutagenic, HP12 Produces toxic gases in contact with water, air or acid, HP13 Sensitising, HP14 Ecotoxic, HP15 Waste capable of exhibiting a hazardous property listed above but not directly displayed by the original waste or Persistent Organic Pollutants.

Waste Classification information.

Non-hazardous waste samples.

Using the data available for assessment, WS102 (0.50-0.60m) and WS104 (0.40-0.50m) can be classified as non-hazardous waste.

List Of Waste Code assignments.

We are not aware of the source of the material therefore we cannot assign the appropriate LOW code. However, if the material is CONSTRUCTION AND DEMOLITION WASTE (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES) it can be assigned the non hazardous waste List of Wastes (formerly the European Waste Catalogue (EWC)) code 17 05 04 soil and stones.

Recommendations for additional hazardous waste assessment testing.

Non-Hazardous Waste.

Using the data available for assessment, no additional hazardous waste testing is required.

Standard Industrial Classification (SIC) Code assignments.

We are not aware of the source of the material therefore we cannot assign the appropriate SIC code. It is our current understanding that SIC 2007 codes are applicable.

For full list, please see EA website

http://www.neighbourhood.statistics.gov.uk/HTMLDocs/SIC/ONS_SIC_hierarchy_view.html.

The following SIC 2007 codes, however, may possibly be of use.

Section F: Construction.

Division 42: Civil engineering

Group 42.1: Construction of roads and railways

Class 42.11: Construction of roads and motorways

Class 42.12: Construction of railways and underground railways

Class 42.13: Construction of bridges and tunnels

Division 43: Specialised construction activities

Group 43.1: Demolition and site preparation

Class 43.11: Demolition

Class 43.12: Site preparation

Class 43.13: Test drilling and boring

Requirement to Register as Hazardous Waste Producing Site with the Environment Agency.

It is our current understanding that:

Companies in Scotland and Northern Ireland don't need to register.

Companies in England don't need to register from 1st April 2016.

Companies in Wales still need to register after 1st April 2016.

Non-Hazardous Waste.

Using the data available for assessment, it is not necessary to register the site with the Environment Agency as a Hazardous Waste Producing Site.

Non-Landfill Disposal of (Non-)Hazardous Waste.

If the disposal route is other than landfill, for example, a soil treatment or recycling facility, no WAC testing is required.

Landfill Waste Acceptance Criteria (WAC).

Non-Hazardous Landfill.

If the disposal route for the non-hazardous waste is to non-hazardous landfill, no WAC testing is required.

Inert Landfill.

If the disposal route for the non-hazardous waste is to inert landfill, WAC testing is required.

WS102 (0.50-0.60m): No Inert Landfill WAC Threshold levels were exceeded, therefore, it should be possible to dispose of these samples to Inert Landfill.

WS104 (0.40-0.50m): However, it would not be possible to dispose of this sample to inert landfill without additional treatment as the MO threshold level has been exceeded.

Please also see note below regarding other landfill factors, prohibitive wastes to landfill, flammable.

Landfill Waste Acceptance Criteria (WAC) pre-treatment requirements.

At least one waste stream will most likely need to be diverted from landfill in order to satisfy possible pre-treatment requirements.

Controlled excavation is an acceptable pre-treatment process, so long as one of the separated waste streams identified on site is diverted from landfill, recycled or has its hazardous nature reduced in a waste treatment facility.

Prohibited wastes to landfill.

Regulation 9 of the Landfill (England and Wales) Regulations 2002, as updated, e.g. liquids (Please note that landfills often reject very wet solids/silts/sludges as they cannot have more than 250L or >10% free draining liquid), explosive/oxidising/**flammable**/corrosive waste, hospital or other clinical waste, chemicals from R+D or teaching activities, whole and shredded used tyres - apart from tyres used as engineering material, bicycle tyres, and tyres with an outside diameter of more than 1,400 mm.

Please check with your chosen landfill regarding their flammability testing acceptance criteria.

Please note, however, that we cannot guarantee that the testing and waste assessment will meet the requirements of the receiving disposal/treatment facility.

Should anyone have any queries regarding this report, please do not hesitate to be in touch.

Regards,



Alex Murray.



Please enter available data in the rows associated with the test (grey) cells. Calculation cells initially display either "0.0000" or "#DIV/0!".
If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Haswaste, developed by Dr. Iain Haslock.

Worthing J18-035									
TP/WS/BH Depth (m) Envirolab reference									
		WS102 0.50-0.59m 18/05/2003	WS104 0.40-0.59m 18/05/2006						
% Moisture	%	20.1	20.8						
pH (soil)		7.97	7.92						
pH (leachate)		7.40	7.10						
Arsenic	mg/kg	6	5						
Cadmium	mg/kg	0.8	0.8						
Copper	mg/kg	20	11						
CrVI or Chromium	mg/kg	1	1						
Lead	mg/kg	32	16						
Mercury	mg/kg	0.17	0.17						
Nickel	mg/kg	19	28						
Selenium	mg/kg	1	1						
Zinc	mg/kg	75	63						
Barium	mg/kg								
Beryllium	mg/kg								
Vanadium	mg/kg								
Cobalt	mg/kg								
Manganese	mg/kg								
Molybdenum	mg/kg								
Antimony	mg/kg	5	5						
Aluminium	mg/kg								
Bismuth	mg/kg								
Chill	mg/kg	20	35						
Iron	mg/kg								
Strontium	mg/kg								
Tellurium	mg/kg								
Thallium	mg/kg								
Titanium	mg/kg								
Tungsten	mg/kg								
Ammoniacal N	mg/kg								
ws Boron	mg/kg								
PAH (Input Total PAH OR individual PAH results)									
Acenaphthene	mg/kg	0.01	0.01						
Acenaphthylene	mg/kg	0.01	0.01						
Anthracene	mg/kg	0.02	0.02						
Benzo(a)anthracene	mg/kg	0.04	0.04						
Benzo(a)pyrene	mg/kg	0.04	0.04						
Benzo(b)fluoranthene	mg/kg	0.05	0.05						
Benzo(ghi)perylene	mg/kg	0.05	0.05						
Benzo(k)fluoranthene	mg/kg	0.07	0.07						
Chrysene	mg/kg	0.06	0.06						
Dibenzo(ah)anthracene	mg/kg	0.04	0.04						
Fluoranthene	mg/kg	0.08	0.08						
Fluorene	mg/kg	0.01	0.08						
Indeno(123cd)pyrene	mg/kg	0.03	0.03						
Naphthalene	mg/kg	0.03	0.03						
Phenanthrene	mg/kg	0.03	0.13						
Pyrene	mg/kg	0.07	0.07						
Coronene	mg/kg								
Total PAHs (16 or 17)	mg/kg								
TPH									
Petrol	mg/kg								
Diesel	mg/kg								
Lube Oil	mg/kg								
Crude Oil									
White Spirit / Kerosene	mg/kg								
Creosote	mg/kg								
Unknown TPH with ID	mg/kg								
Unknown TPHCWG	mg/kg	0.1	731.0						
Total Sulphide	mg/kg								
Complex Cyanide	mg/kg								
Free (or Total) Cyanide	mg/kg	1	1						
Thiocyanate	mg/kg								
Elemental/Free Sulphur	mg/kg								
Phenols Input Total Phenols HPLC OR individual Phenol results									
Phenol	mg/kg								
Cresols	mg/kg								
Xylenols	mg/kg								
Resorcinol	mg/kg								
Phenols Total by HPLC	mg/kg	0.2	0.2						
BTEX Input Total BTEX OR individual BTEX results									
Benzene	mg/kg	0.01	0.01						
Toluene	mg/kg	0.01	0.01						
Ethylbenzene	mg/kg	0.01	0.01						
Xylenes	mg/kg	0.01	0.01						
Total BTEX	mg/kg								
PCBs (POPs)									
PCBs Total (eg EC7A/WHO12)	mg/kg								
PBBs (POPs)									
Hexabromobiphenyl (Total or PBB153, 2,2',4,4',5,5'- if only available)	mg/kg								



Haswaste, developed by Dr. Iain Haslock.

Worthing
J18-035

TPWS/BH

Depth (m)

Envirolab reference

WS102	WS104							
0.50-0.95m	0.40-0.55m							
18/05/2003	18/05/2006							

POPs Dioxins and Furans Input Total Dioxins and Furans

OR individual Dioxin and Furan results.

2,3,7,8-TeCDD	mg/kg							
1,2,3,7,8-PeCDD	mg/kg							
1,2,3,4,7,8-HxCDD	mg/kg							
1,2,3,6,7,8-HxCDD	mg/kg							
1,2,3,7,8,9-HxCDD	mg/kg							
1,2,3,4,6,7,8-HpCDD	mg/kg							
OCDD	mg/kg							
2,3,7,8-TeCDF	mg/kg							
1,2,3,7,8-PeCDF	mg/kg							
2,3,4,7,8-PeCDF	mg/kg							
1,2,3,4,7,8-HxCDF	mg/kg							
1,2,3,6,7,8-HxCDF	mg/kg							
2,3,4,6,7,8-HxCDF	mg/kg							
1,2,3,7,8,9-HxCDF	mg/kg							
1,2,3,4,6,7,8-HpCDF	mg/kg							
1,2,3,4,7,8,9-HpCDF	mg/kg							
OCDF	mg/kg							
Total Dioxins and Furans	mg/kg							

Some Pesticides (POPs unless otherwise stated)

Aldrin	mg/kg							
α Hexachlorocyclohexane (alpha-HCH) (leave empty if total HCH results used)	mg/kg							
β Hexachlorocyclohexane (beta-HCH) (leave empty if total HCH results used)	mg/kg							
α Cis-Chlordane (alpha) OR Total Chlordane	mg/kg							
δ Hexachlorocyclohexane (delta-HCH) (leave empty if total HCH results used)	mg/kg							
Dieldrin	mg/kg							
Endrin	mg/kg							
γ Hexachlorocyclohexane (gamma-HCH) (lindane) OR Total LSCV	mg/kg							
Heptachlor	mg/kg							
Hexachlorobenzene	mg/kg							
o,p'-DDT (leave empty if total DDT results used)	mg/kg							
p,p'-DDT OR Total DDT	mg/kg							
γ Trans-Chlordane (gamma) (leave empty if total Chlordane results used)	mg/kg							
Chlordecone (kepone)	mg/kg							
Pentachlorobenzene	mg/kg							
Mirex	mg/kg							
Toxaphene (camphenchlor)	mg/kg							

Tin

Tin (leave empty if Organotin and Tin excl Organotin results used)	mg/kg							
--	-------	--	--	--	--	--	--	--

Organotin

Dibutyltin, DiBT	mg/kg							
Tributyltin, TriBT	mg/kg							
Triphenyltin, TriPT	mg/kg							
Tetrabutyltin, TeBT	mg/kg							

Tin excluding Organotin

Tin excl Organotin	mg/kg							
--------------------	-------	--	--	--	--	--	--	--



Haswaste, developed by Dr. Iain Haslock.

Worthing
J18-035

TPWS/BH
Depth (m)
Envirolab reference

WS102	WS104								
0.50-0.99m	0.40-0.59m								
18/05220/3	18/05220/6								

Asbestos in Soil	Thresholds
Asbestos detected in Soil (enter Y or N)	?

Asbestos % Composition in Soil (Matrix Loose Fibres or Microscopic Identifiable Pieces only)	see "Carc HP7 % Asbestos in Soil (Fibres)" below
Carcinogenic HP7 % Asbestos in Soil (fibres or micro pieces)	≤0.1%
<i>Please be advised, if the calculation cell is "0.0000" DOES NOT MEAN asbestos testing has been undertaken and the result is zero.</i>	

Asbestos Identifiable Pieces visible with the naked eye detected in the Soil (enter Y or N)	Y
---	---

n	n								
---	---	--	--	--	--	--	--	--	--

If Asbestos in Soil above is "Y", the soil is Hazardous Waste HP5 and HP7

0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

If Asbestos in Soil above is "Y", but Asbestos % above is "≤0.1%", the soil is Non Hazardous Waste. You can only use Asbestos % results where loose fibres or micro pieces are only present. You cannot use Asbestos % results when visual identifiable pieces are present.

--	--	--	--	--	--	--	--	--	--

If visual identifiable pieces of asbestos are present, you cannot use Asbestos % results and the whole soil sample is Hazardous Waste HP5 and HP7 Construction material containing Asbestos 17 06 05. Therefore, if Asbestos in Soil above is "Y", the Asbestos % above is "≤0.1%", but the Asbestos Identifiable Pieces visible with the naked eye is "Y", the soil is Hazardous Waste.

Identifiable Pieces are Cement, Fragments, Board, Rope etc. ie anything ACM that is not Loose Fibres.

All visual asbestos pieces need to be removed leaving only fibres (or micro pieces) with an Asbestos % Composition in Soil result of <0.1% for the soil to become non-hazardous waste.

Hazardous Property	Thresholds	Cut Off Value
Corrosive HP8	≤5%	<1%
Irritant HP4	≤10%	<1%
Irritant HP4	≤20%	<1%
Specific Target Organ Toxicity HP5	≤1%	
Specific Target Organ Toxicity HP5	≤20%	
Specific Target Organ Toxicity HP5	≤1%	
Specific Target Organ Toxicity HP5	≤10%	
Aspiration Toxicity HP5	≤10%	
Acute Toxicity HP6	≤0.1%	<0.1%
Acute Toxicity HP6	≤0.25%	<0.1%
Acute Toxicity HP6	≤0.05%	<0.1%
Acute Toxicity HP6	≤5%	<0.1%
Acute Toxicity HP6	≤25%	<1%
Acute Toxicity HP6	≤0.25%	<0.1%
Acute Toxicity HP6	≤2.5%	<0.1%
Acute Toxicity HP6	≤10%	<0.1%
Acute Toxicity HP6	≤50%	<1%
Acute Toxicity HP6	≤0.1%	<0.1%
Acute Toxicity HP6	≤0.05%	<1%
Acute Toxicity HP6	≤0.1%	<0.1%
Acute Toxicity HP6	≤0.5%	<0.1%
Acute Toxicity HP6	≤2.5%	<1%
Carcinogenic HP7	≤0.1%	
Carcinogenic HP7	≤1%	
Carcinogenic HP7 Unknown TPH with ID	≤1,000mg/kg	
Carcinogenic HP7 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≤0.01%	
pH Corrosive HP8 pH (soil or leachate)	HS ≤11.5	
pH Corrosive HP8 pH (soil or leachate)	HS ≤2	
Toxic for Reproduction HP10	≤0.3%	
Toxic for Reproduction HP10	≤1%	
Mutagenic HP11	≤0.1%	
Mutagenic HP11 Unknown TPH with ID	≤1,000mg/kg	
Mutagenic HP11 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≤0.01%	
Mutagenic HP11	≤1%	
Produces Toxic Gases HP12 Sulphide	≤1,000mg/kg	
Produces Toxic Gases HP12 Cyanide	≤1,000mg/kg	
Produces Toxic Gases HP12 Thiocyanate	≤2,000mg/kg	
HP13 Sensitising	≤10%	

If cells below turn yellow and the text turns red, the samples should be classified as Hazardous Waste.

0.00080	0.00059	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00245	0.00152	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00490	0.00550	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00015	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00000	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00307	0.00448	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00256	0.05790	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00001	0.05790	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00015	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00065	0.00054	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00028	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00800	0.00731	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00016	0.00016	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00015	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00002	0.00002	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00054	0.00054	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00015	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00023	0.00023	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00013	0.00013	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00743	0.00673	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00307	0.05790	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
0.00048	0.00048	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
7.97	7.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.40	7.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00307	0.00448	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00015	0.05790	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00015	0.05790	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0.00307	0.00448	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.00307	0.00448	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000



Please enter available data in the rows associated with the test (grey) cells. Calculation cells initially display either "0.0000" or "#DIV/0!".
If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Haswaste, developed by Dr. Iain Haslock.

Worthing
J18-035

TPWS/BH
Depth (m)
Envirolab reference

WS102	WS104								
0.50-0.99m	0.40-0.59m								
18/05/2003	18/05/2006								

Ecotoxic HP14 amended v6	<25%	<0.1%	0.01611	0.01405	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Ecotoxic HP14 amended v6	<25%	<0.1% (except Be, V, Te, Ti, Petrol, Diesel, Crude Oil, Kerosene, White Spirit, Cresote, TPH, TPHCWG, Phenol, Cresols, Xylenols, T- Phenols, CompCN, Thiocyanate, Toluene, Ethylbenzene , Xylene + BTEX 1%).	0.01612	0.07195	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Ecotoxic HP14 amended v6	<25%	<0.1% (except Be, V, Te, Ti, Petrol, Diesel, Crude Oil, Kerosene, White Spirit, Cresote, TPH, TPHCWG, Phenol, Cresols, Xylenols, T- Phenols, CompCN, Thiocyanate, Toluene, Ethylbenzene , Xylene + BTEX 1%).	1.60967	1.98325	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Persistent Organic Pollutant (PCB, PBB or POP Pesticides)	<0.05%		0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
Persistent Organic Pollutant (Total Dioxins+Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
Persistent Organic Pollutant (Individual Dioxins+ Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000

If other contaminants need adding to Haswaste, please contact Envirolab.

APPENDIX 6: GROUNDWATER MONITORING RESULTS

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Yeomans Honda						General Site comments									
DATE: 27/06/2018		1... of1...													
OPERATOR(S): AP															
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)				PID (ppm)						
Before Monitoring							EQUIPMENT								
After Monitoring															
Atmospheric Pressure Trend:							Instrument / Model Type			Serial Number			Comments		
Ground Conditions:		Dry					Standard Dipmeter			79301					
Weather Conditions:		Sunny and warm													

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					EH	EC	pH	DO	Temp			
WS101	2.69	2.94										
WS102	2.81	3.59										
WS103	3.00	5.00										
WS104	2.44	4.93										Slight HC odour

Well volume (l) = $(3.14 \times (\text{hole diameter (m)} / 2)^2 \times (\text{base dip (m)} - \text{standing water level (m)})) \times 1000$ (2l/m in 50mm well)

Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - millibars; l/hr - litres per hour; vv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

APPENDIX 7: GEOTECHNICAL TEST CERTIFICATES



2683



Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY



THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 18-18621

Issue: 1

Date of Issue: 23/07/2018

Contact: James Phaure

Customer Details: K4 Soils Laboratory Ltd
Unit 8
Watford
Hertfordshire
WD18 9RU

Quotation No: Q16-00568

Order No: Not Supplied

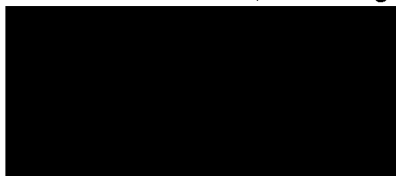
Customer Reference: 24819

Date Received: 18/07/2018

Date Approved: 23/07/2018

Details: Yeomans Honda, Worthing

Approved by:



Mike Varley, Technical Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)



Sample Summary

Report No.: 18-18621

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
143693	WS1 B2 2.10	Not Provided	18/07/2018	Silty clayey loam	a
143694	WS3 B1 0.70	Not Provided	18/07/2018	Silty clayey loam	a



2683



Results Summary

Report No.: 18-18621

ELAB Reference	143693	143694
Customer Reference	B2	B1
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	WS1	WS3
Sample Depth (m)	2.10	0.70
Sampling Date	Not Provided	Not Provided

Determinand	Codes	Units	LOD		
Anions					
Water Soluble Chloride	M	mg/kg	40	64	43
Water Soluble Nitrate	M	mg/kg	40	< 40	< 40
Water Soluble Sulphate	M	g/l	0.02	0.03	< 0.02
Water Soluble Sulphate	M	mg/kg	40	56	< 40
Inorganics					
Ammonia as NH ₄	N	mg/kg	0.1	1.5	3.2
Total Sulphur	N	%	0.01	0.02	0.03
Acid Soluble Sulphate (SO ₄)	U	%	0.02	0.07	0.05
Miscellaneous					
Moisture Content	N	%	0.1	16.3	23.2
pH	M	pH units	0.1	8.4	8.0
Stones Content	N	%	0.1	< 0.1	< 0.1



Method Summary

Report No.: 18-18621

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Ammonia in soil	N	As submitted sample	19/07/2018		
pH	M	Air dried sample	20/07/2018	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	22/07/2018	115	Ion Chromatography
Water soluble anions	M	Air dried sample	19/07/2018	172	Ion Chromatography
Total organic carbon/Total sulphur	N	Air dried sample	19/07/2018	216	IR

Tests marked N are not UKAS accredited



Report Information

Report No.: 18-18621

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis (dried at < 30°C)

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

-
- | | |
|---|--|
| a | No date of sampling supplied |
| b | No time of sampling supplied (Waters Only) |
| c | Sample not received in appropriate containers |
| d | Sample not received in cooled condition |
| e | The container has been incorrectly filled |
| f | Sample age exceeds stability time (sampling to receipt) |
| g | Sample age exceeds stability time (sampling to analysis) |

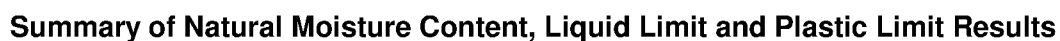
Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage

[illegible]

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

**Checked and
Approved**

Initials J.P

Date: 25/07/2018

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R1(b)

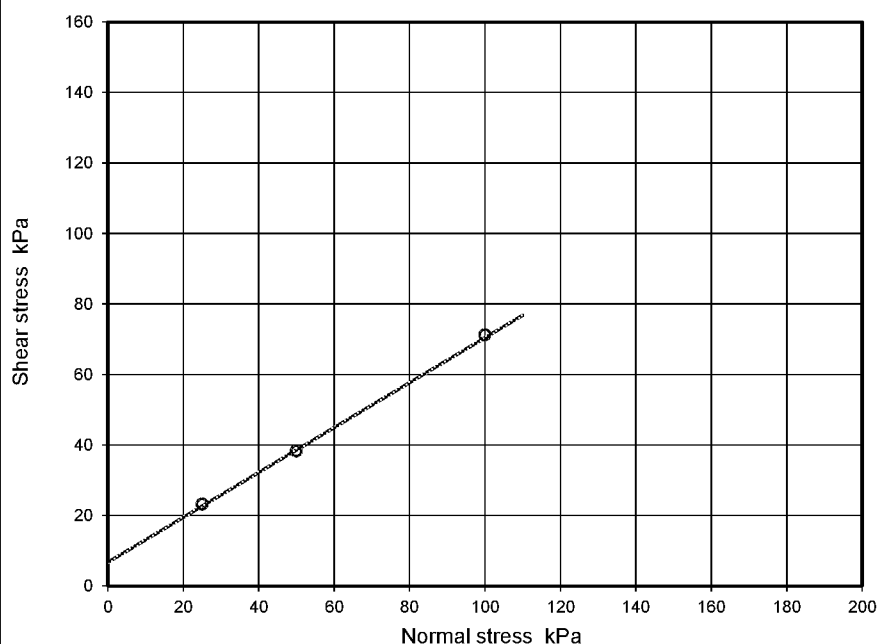
	Determination of shear strength using the Small Shearbox Apparatus			Job Ref	24819
				Borehole/Pit No.	WS1
Site Name	Yeomans Honda, Worthing			Sample No.	3
Soil Description	Off white slightly sandy silty clayey CHALK with fmc intact chalk fragments			Depth m	3.20
				Sample Type	B
Project No.	-	Client	GCC	Sample received	05/07/2018
				Schedule received	05/07/2018
Test Method	BS1377 : Part 7 : 1990, clause 4			Date test started	27/07/2018
				Date completed	01/08/2018

Preparation Details

Specimen Details		Test No.	1	2	3			
Initial	Height		20.0	20.0	20.0			mm
	Bulk Density		2.07	2.05	2.06			Mg/m³
	Moisture Content		14.5	14.5	14.5			%
	Dry density		1.81	1.79	1.80			Mg/m³
	Voids ratio		0.492	0.508	0.500			
	Degree of Saturation		80	77	78			%
Consolidation	Consolidation / Normal Stress applied		25	50	100			kPa
	Change in height during consolidation*		-0.106	-0.422	-0.488			mm
	Voids ratio after consolidation		0.484	0.476	0.463			
After test	Final Moisture content		18.4	18.3	17.2			

Shearing stage(s)

Rate of displacement	Peak		0.01200	0.01200	0.01200			mm/min
	Residual							mm/min
Peak values, (o)	Relative horizontal displacement		1.20	6.90	3.20			mm
	Shear stress		23.2	38.3	71.2			kPa
	Vertical Movement at peak shear stress*		-0.14	-0.51	-0.62			mm
Residual values, (x)	No. of traverses (including peak run)							
	Relative horizontal displacement							mm
	Shear stress							kPa
	Vertical movement at residual shear stress*							mm



Shear Strength Parameters

Peak strength, (o)		Regression	Manual
c'	kPa	6.7	-
Ø'	degrees	32.5	-

Residual strength, (x)			
c'R	kPa	[0.0]	-
Ø'R	degrees	[]	-

Remarks :

	K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU 		Checked and Approved Initials kp
	Sheet 1 of 2		Date 02/08/2018
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)		MSF-5-R14 (Rev. 0)



Determination of shear strength using the Small Shearbox Apparatus

Job Ref 24819

Borehole/Pit No. WS1

Site Name Yeomans Honda, Worthing

Sample No. 3

Soil Description Off white slightly sandy silty clayey CHALK with fmc intact chalk fragments

Depth m 3.20

Sample Type B

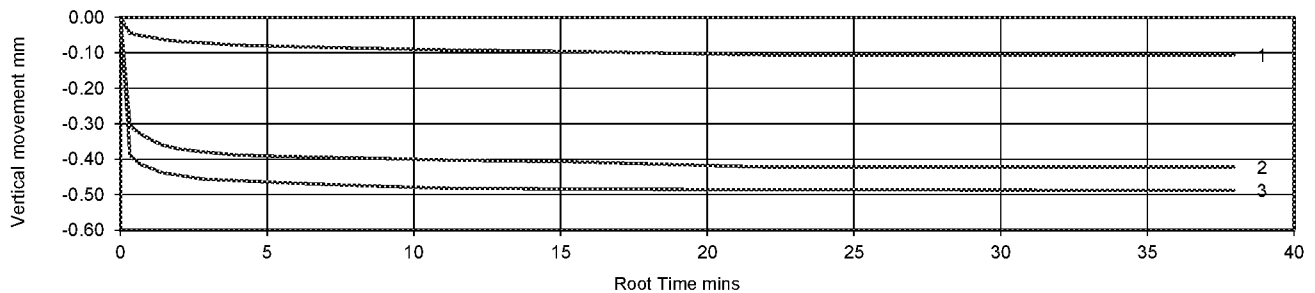
Project No. -

Client

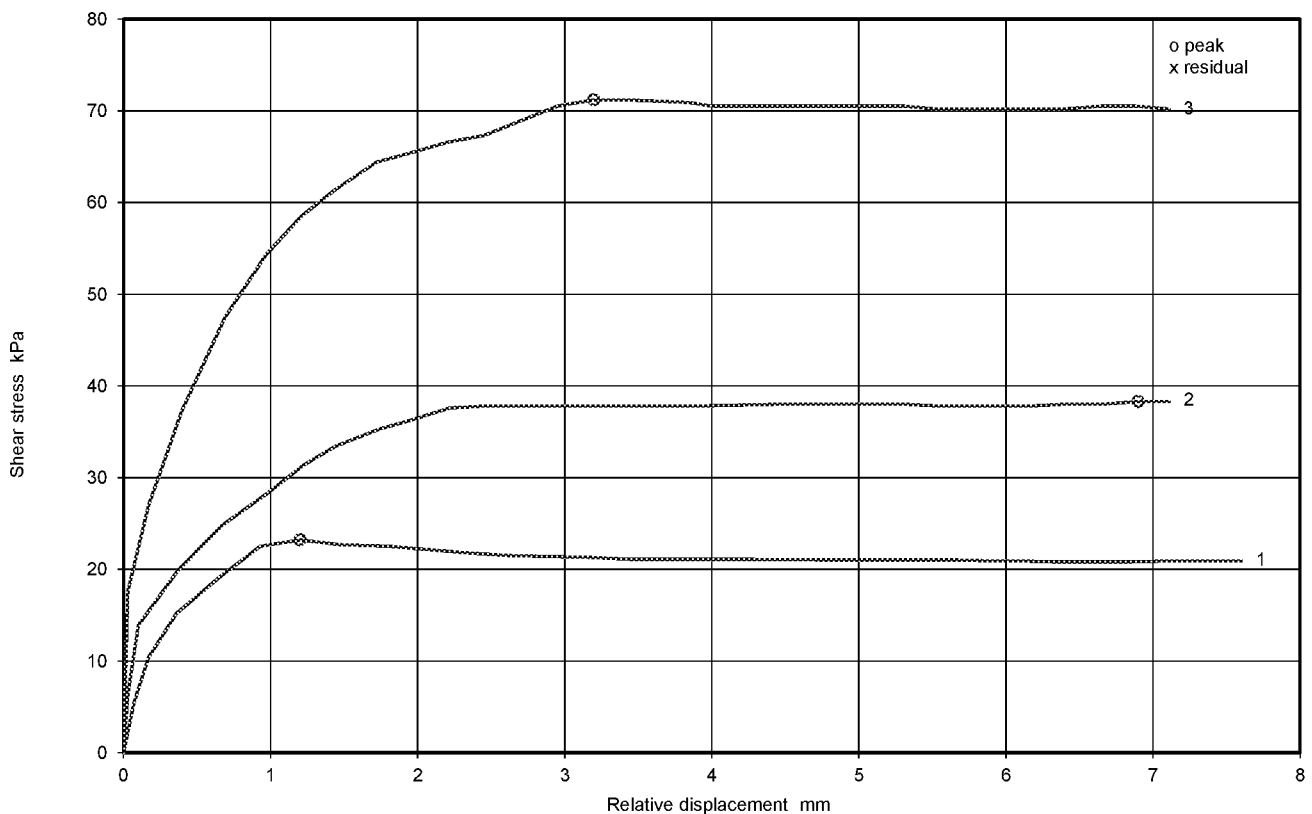
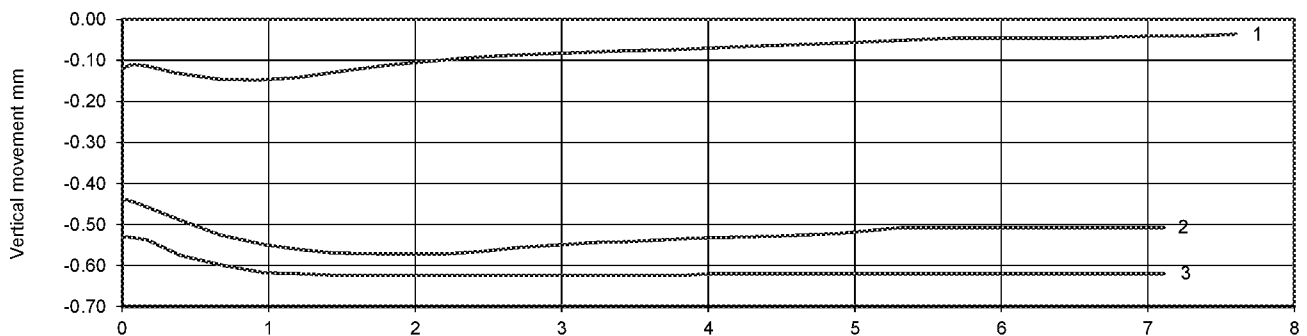
GCC

Date of Test 27/07/2018

Consolidation stage(s)



Shearing stage(s)



*Note : Vertical movement/change in height is recorded as negative for reduced height (settlement) and positive for increased height (swell).



K4 SOILS LABORATORY Unit 8 Olds Close
Olds Approach Watford Herts WD18 9RU

Sheet 2 of 2

Checked and Approved
Initials kp

Date 02/08/2018

MSF-5-R14

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

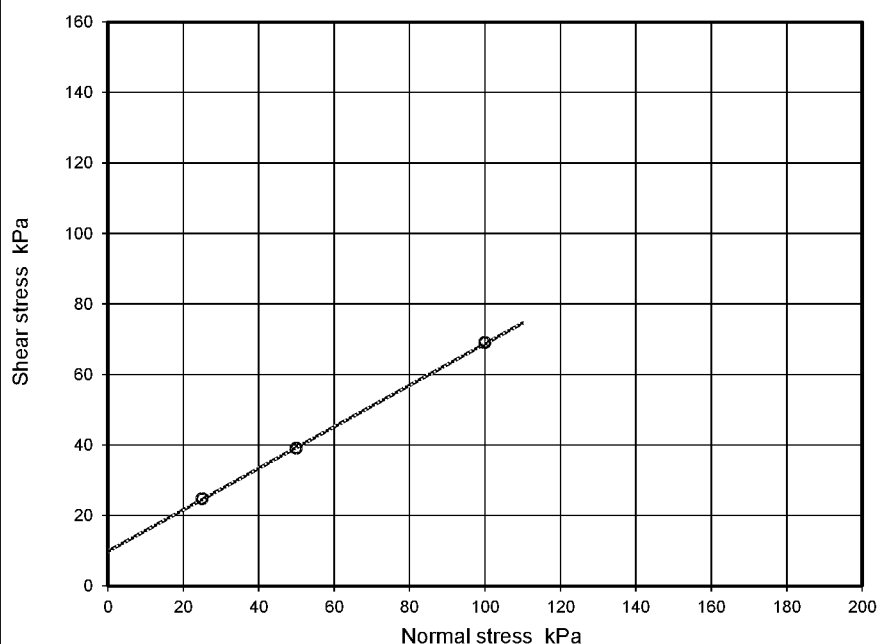
	Determination of shear strength using the Small Shearbox Apparatus		Job Ref	24819	
			Borehole/Pit No.	WS3	
Site Name	Yeomans Honda, Worthing		Sample No.	2	
Soil Description	Off white slightly gravelly slightly sandy silty chalky CLAY with abundant fmc intact chalk fragments (gravel is medium to coarse and sub-angular)		Depth m	1.60	
			Sample Type	B	
Project No.	-	Client	GCC	Sample received	05/07/2018
				Schedule received	05/07/2018
Test Method	BS1377 : Part 7 : 1990, clause 4		Date test started	27/07/2018	
			Date completed	01/08/2018	

Preparation Details

Specimen Details		Test No.	1	2	3			
Initial	Height		20.0	20.0	20.0			mm
	Bulk Density		2.07	2.07	2.06			Mg/m³
	Moisture Content		14.7	14.7	14.7			%
	Dry density		1.80	1.80	1.80			Mg/m³
	Voids ratio		0.489	0.489	0.489			
	Degree of Saturation		81	81	81			%
Consolidation	Consolidation / Normal Stress applied		25	50	100			kPa
	Change in height during consolidation*		-0.100	-0.376	-0.801			mm
	Voids ratio after consolidation		0.482	0.461	0.429			
After test	Final Moisture content		18.4	18.2	17.0			

Shearing stage(s)

Rate of displacement	Peak	0.01200	0.01200	0.01200				mm/min
	Residual							mm/min
Peak values, (o)	Relative horizontal displacement	1.02	1.21	3.30				mm
	Shear stress	24.7	39.1	69.0				kPa
	Vertical Movement at peak shear stress*	-0.08	-0.42	-1.00				mm
Residual values, (x)	No. of traverses (including peak run)							
	Relative horizontal displacement							mm
	Shear stress							kPa
	Vertical movement at residual shear stress*							mm



Shear Strength Parameters

Peak strength, (o)		Regression	Manual
c'	kPa	9.8	-
Ø'	degrees	30.5	-

Residual strength, (x)			
c'R	kPa	[0.0]	-
Ø'R	degrees	[]	-

Remarks :

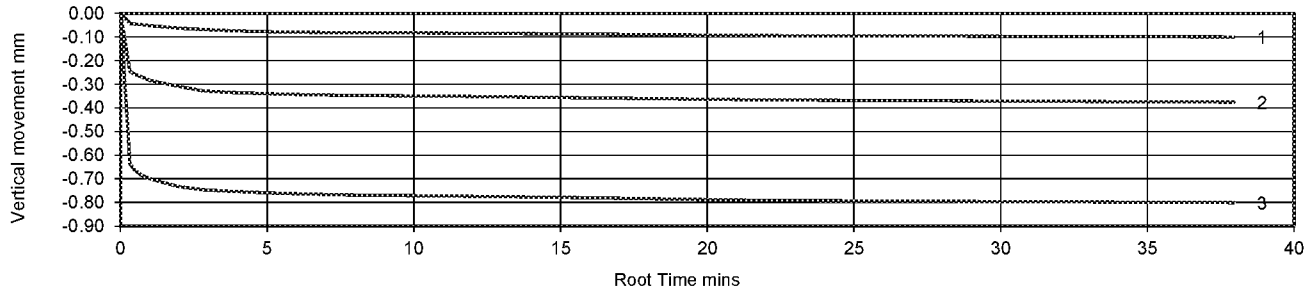
	K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU 		Checked and Approved Initials kp
	Sheet 1 of 2		Date 02/08/2018
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)		MSF-5-R14 (Rev. 0)



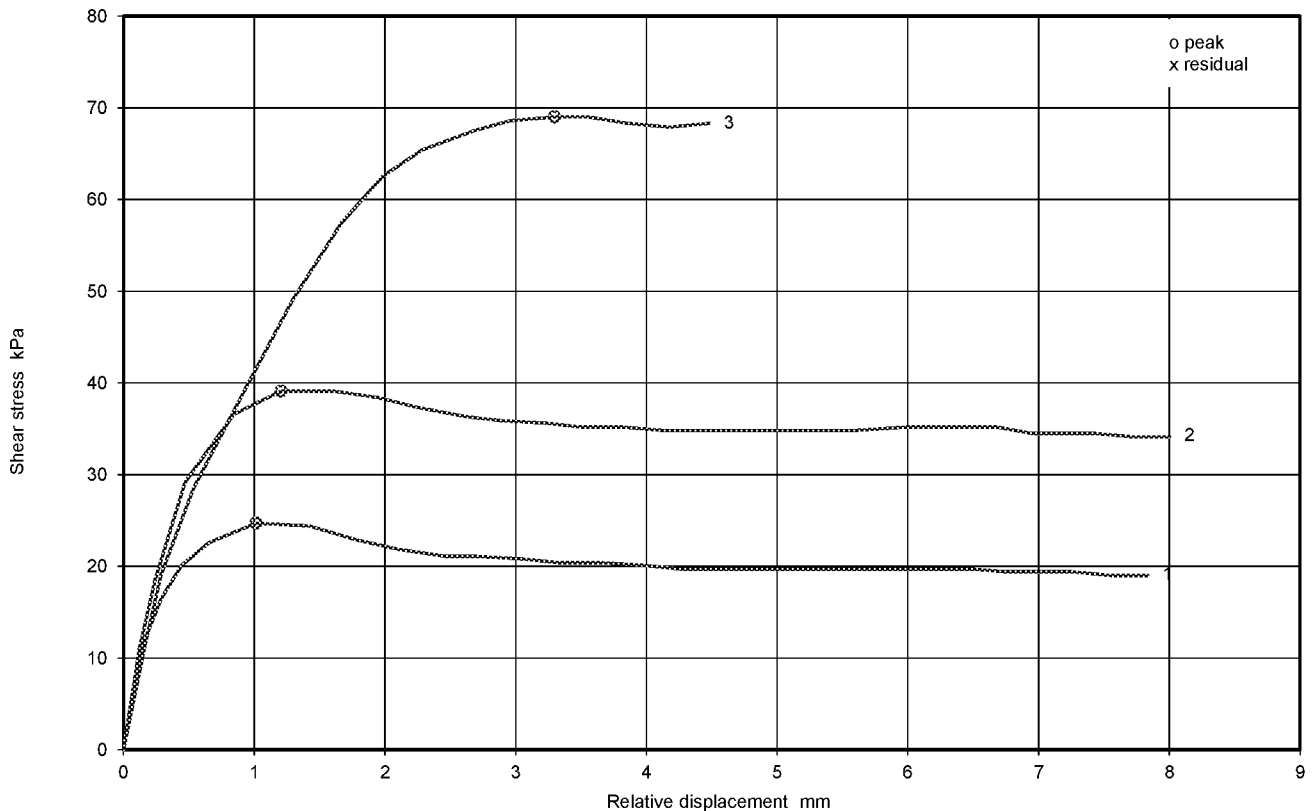
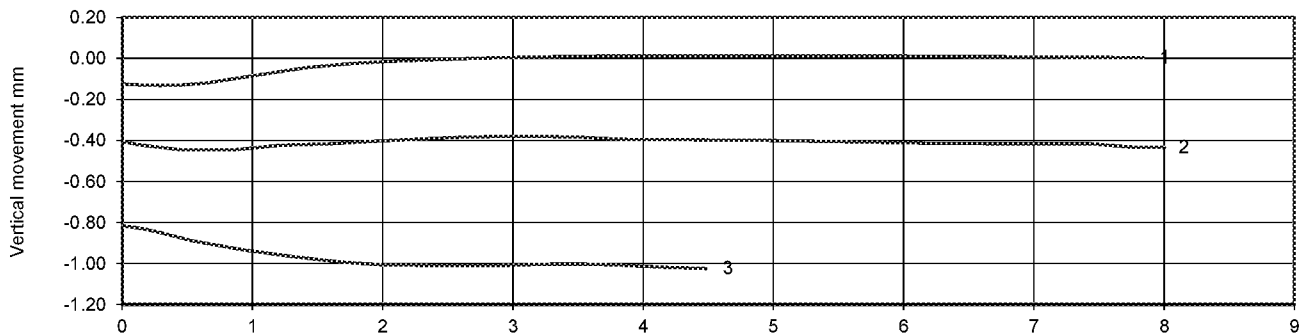
Determination of shear strength using the Small Shearbox Apparatus

Job Ref	24819		
	Borehole/Pit No.		
Site Name	Yeomans Honda, Worthing		
Soil Description	Off white slightly gravelly slightly sandy silty chalky CLAY with abundant fmc intact chalk fragments (gravel is medium to coarse and sub-angular)		
Project No.	-	Client	GCC
Date of Test		27/07/2018	

Consolidation stage(s)



Shearing stage(s)



*Note : Vertical movement/change in height is recorded as negative for reduced height (settlement) and positive for increased height (swell).



K4 SOILS LABORATORY Unit 8 Olds Close
Olds Approach Watford Herts WD18 9RU

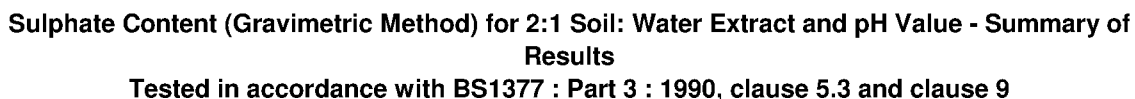
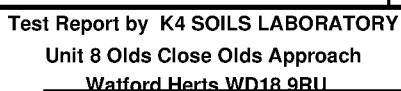
Checked and Approved
Initials kp

Date 02/08/2018

Sheet 2 of 2

MSF-5-R14

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

[illegible]

Checked and Approved	
Initials	J.P
Date:	25/07/2018

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R29

	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	24819
				Borehole/Pit No.	WS2
Site Name	Yeomans Honda, Worthing			Sample No.	1
Project No.	-	Client	GCC	Depth Top	1.50 m
Soil Description	High strength slightly fissured light brown slightly sandy slightly gravelly silty CLAY (gravel is fine and angular)			Depth Base	2.00 m
				Sample Type	L
				Samples received	05/07/2018
				Schedules received	05/07/2018
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	18/07/2018

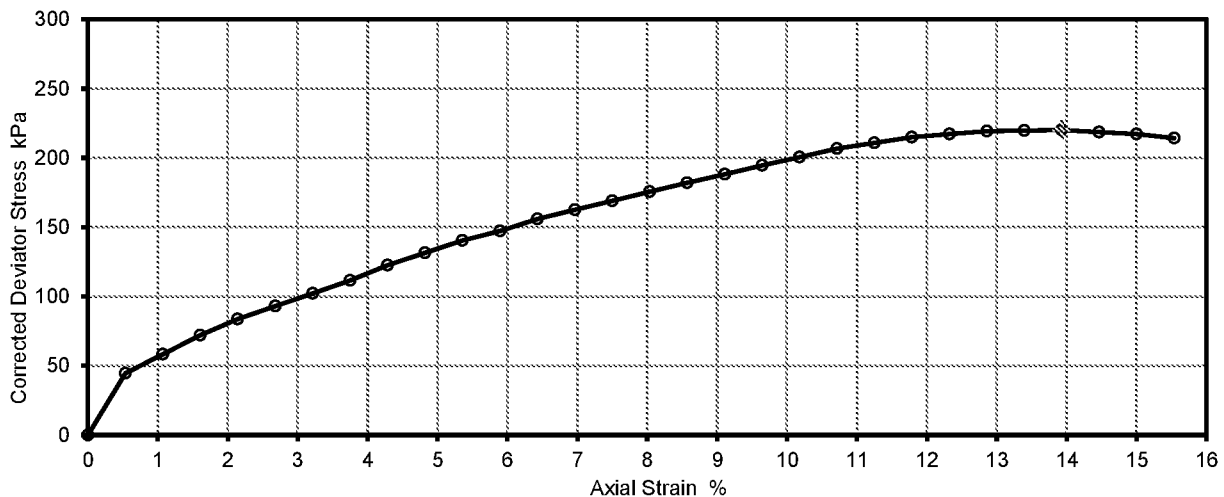
Remarks

Disturbed

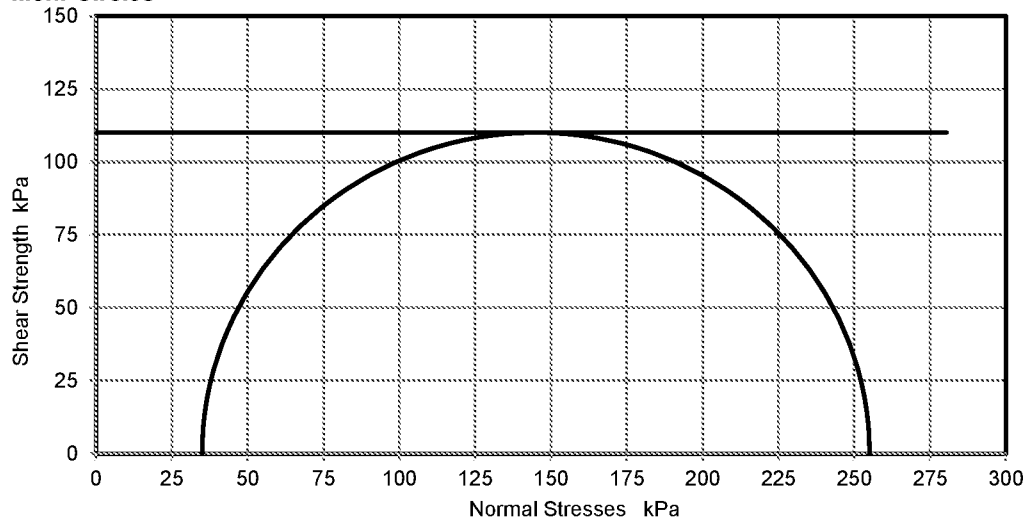
Position within sample

Test Number	1	
Length	140.0	mm
Diameter	70.0	mm
Bulk Density	2.34	Mg/m3
Moisture Content	19	%
Dry Density	1.97	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	35	kPa
Axial Strain	13.9	%
Deviator Stress, ($\sigma_1 - \sigma_3$)f	220	kPa
Undrained Shear Strength, cu	110	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Compound	

Deviator Stress v Axial Strain



Mohr Circles



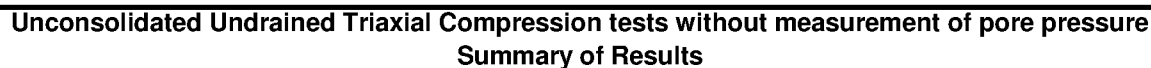
Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.



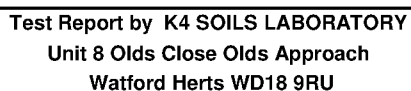
Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Checked and Approved
Initials: J.P
Date 25/07/2018



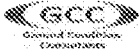
Job No.	Project Name	Programme	
24819	Yeomans Honda, Worthing	Samples received	05/07/2018
		Schedule received	05/07/2018
Project No.	Client	Project started	06/07/2018
-	GCC	Testing Started	18/07/2018

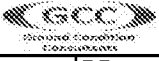
Legend	UU - single stage test (single and multiple specimens)	σ_3	Cell pressure	Mode of failure ;	B - Brittle
	UUM - Multistage test on a single specimen	$\sigma_1 - \sigma_3$	Maximum corrected deviator stress		P - Plastic
	suffix R - remoulded or recompacted	cu	Undrained shear strength, $\frac{1}{2} (\sigma_1 - \sigma_3)$		C - Compound



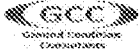
Date: 25/07/2018

APPENDIX 8: GEOTECHNICAL CALCULATIONS

Project Title: Worthing		 Geotechnical Consulting Civil Engineers		
Shallow Foundation Pad Foundation				
Determination of Bearing Resistance	Calcs by	DF	Checked by	RP
Undifferentiated Superficial Deposits				
Design Approach 1		Characteristic Geotechnical Parameters		
Combination 1 A1 + M1 + R1		Unit Weight	21	
		Undrained Cohesion	60	
		Cohesion	0	
		Shearing Resistance	26	
<u>Material Properties and Resistance</u>		Foundation Size		
Partial factors set M1: $\gamma_{cu} = 1$ $\gamma_\phi = 1$ and $\gamma_c = 1$		depth	0.90	
		breadth	1	
$c_{ud} = \frac{c_{uk}}{\gamma_{cu}} = 60$				
Design shearing resistance is		$\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_\phi} \right) = 26$		
Design cohesion is		$c'_d = \frac{c_k}{\gamma_c} = 0$		
<u>Drained Bearing Capacity Factors</u>				
For overburden		$N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] = 11.84$		
For cohesion		$N_c = [(N_q - 1) \times \cot(\phi_d)] = 22.24$		
For self-weight		$N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] = 10.58$		
<u>Depth and Shape Factors</u>				
Sorgado's depth factor for undrained loading:		$d_c = 1 + 0.27 \sqrt{\frac{d}{B}} = 1.26$		
Ignore depth factors for drained loading				
Sorgado's shape factor for undrained loading:		$s_c = 1 + 0.17 \sqrt{\frac{d}{B}} = 1.16$		
Shape factors are all 1.0 for drained loading and so can be ignored				
<u>Undrained Bearing Resistance</u>				
Total overburden at foundation base is		$\sigma_{vk,b} = \gamma_k \times d = 18.9$		
Partial factors set R1: $\gamma_{Rv} = 1$				
Ultimate resistance is		$q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} = 469$		
Design Resistance is		$q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 469$		

Project Title:		Worthing		 Geotechnical Consulting Engineers	
Shallow Foundation		Pad Foundation			
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP
<u>Drained Bearing Resistance</u>		Depth to Groundwater		2.5	
Effective overburden at foundation base is $\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} = 21.00$					
From overburden $q'_{ult_1} = N_q \times \sigma'_{vk,b} = 249$					
From cohesion $q'_{ult_2} = N_c \times c'_d = 0$					
From self-weight $q'_{ult_3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right] = 59$					
Total resistance is $q'_{ult} = \sum_{i=1}^3 q'_{ult_i} = 308$					
Design resistance is $q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} = 308$					
<u>Design Approach 1</u>					
Combination 2 A2 + M2 + R1					
<u>Material Properties and Resistance</u>					
Partial factors set M2: $\gamma_{cu} = 1.4$ $\gamma_\phi = 1.25$ and $\gamma_c = 1.25$					
Design undrained strength is $c_{ud} = \frac{c_{uk}}{\gamma_{cu}} = 43$					
Design shearing resistance is $\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_\phi} \right) = 21$					
Design cohesion is $c'_d = \frac{c_k}{\gamma_c} = 0$					
<u>Drained Bearing Capacity Factors</u>					
For overburden $N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] = 7.29$					
For cohesion $N_c = [(N_q - 1) \times \cot(\phi_d)] = 16.13$					
For self-weight $N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] = 4.91$					

Project Title:		Worthing		 Geotechnical Condition Computations																
Shallow Foundation		Pad Foundation																		
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP															
<u>Depth and Shape Factors</u> Solgado's depth factor for undrained loading: $d_c = 1 + 0.27\sqrt{\frac{d}{B}} = 1.26$ Ignore depth factors for drained loading Solgado's shape factor for undrained loading: $s_c = 1 + 0.17\sqrt{\frac{d}{B}} = 1.16$ Shape factors are all 1.0 for drained loading and so can be ignored <u>Undrained Bearing Resistance</u> Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 18.9$ Partial factors set R1: $\gamma_{Rv} = 1$ Ultimate resistance is $q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} = 340$ Design Resistance is $q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 340$ <u>Drained Bearing Resistance</u> Effective overburden at foundation base is $\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} = 21.00$ From overburden $q'_{ult1} = N_q \times \sigma'_{vk,b} = 153$ From cohesion $q'_{ult2} = N_c \times c'_d = 0$ From self-weight $q'_{ult3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right] = 27$ Total resistance is $q'_{ult} = \sum_{i=1}^3 q'_{ult_i} = 181$ Design Resistance is $q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} = 181$ <table border="1" data-bbox="288 1503 1031 1659"> <thead> <tr> <th rowspan="3">Design Approach</th> <th rowspan="3">Combination</th> <th colspan="2">Design Resistance</th> </tr> <tr> <th colspan="2">ULS (kN/m²)</th> </tr> <tr> <th>undrained</th> <th>drained</th> </tr> </thead> <tbody> <tr> <td rowspan="2">DA1</td> <td>Combination 1</td> <td>469</td> <td>308</td> </tr> <tr> <td>Combination 2</td> <td>340</td> <td>181</td> </tr> </tbody> </table>						Design Approach	Combination	Design Resistance		ULS (kN/m ²)		undrained	drained	DA1	Combination 1	469	308	Combination 2	340	181
Design Approach	Combination	Design Resistance																		
		ULS (kN/m ²)																		
		undrained	drained																	
DA1	Combination 1	469	308																	
	Combination 2	340	181																	

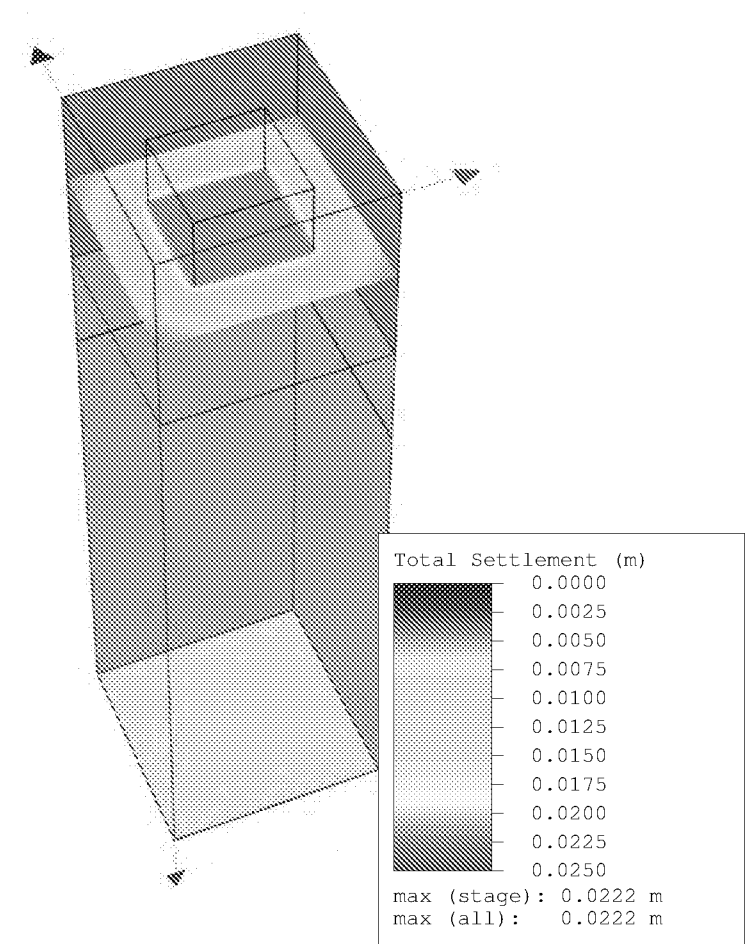
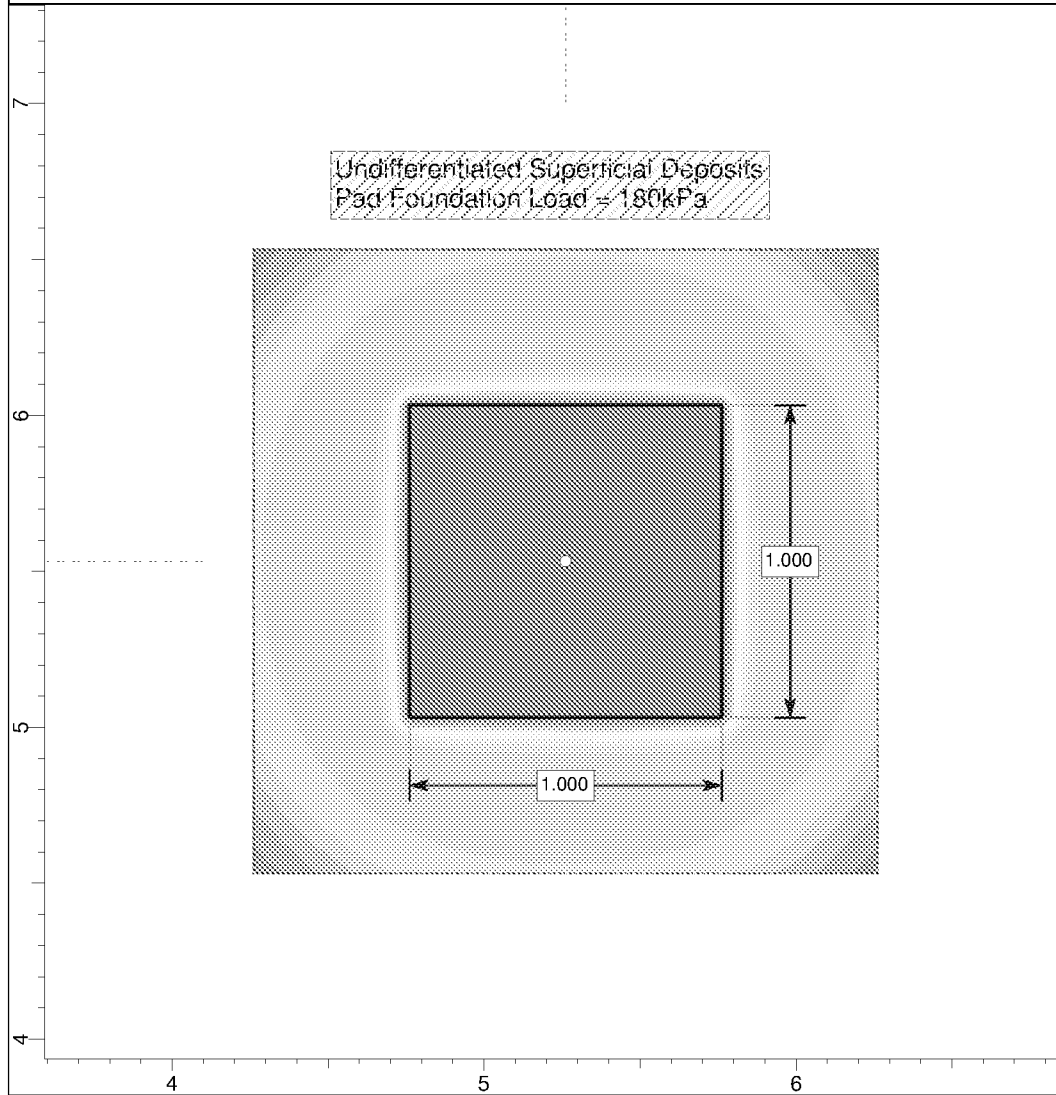
Project Title: Worthing		 Geotechnical Consulting	
Shallow Foundation Pad Foundation			
Determination of Bearing Resistance	Calcs by	DF	Checked by RP
Undifferentiated White Chalk			
Design Approach 1		Characteristic Geotechnical Parameters	
Combination 1 A1 + M1 + R1		Unit Weight	20
		Undrained Cohesion	75
		Cohesion	0
		Shearing Resistance	32
<u>Material Properties and Resistance</u>		Foundation Size	
Partial factors set M1: $\gamma_{cu} = 1$ $\gamma_\phi = 1$ and $\gamma_c = 1$		depth	1.60
		breadth	1
$c_{ud} = \frac{c_{uk}}{\gamma_{cu}} = 75$			
Design shearing resistance is		$\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_\phi} \right) = 32$	
Design cohesion is		$c'_d = \frac{c_k}{\gamma_c} = 0$	
<u>Drained Bearing Capacity Factors</u>			
For overburden		$N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] = 23.15$	
For cohesion		$N_c = [(N_q - 1) \times \cot(\phi_d)] = 35.45$	
For self-weight		$N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] = 27.69$	
<u>Depth and Shape Factors</u>			
Sorgado's depth factor for undrained loading:		$d_c = 1 + 0.27 \sqrt{\frac{d}{B}} = 1.34$	
Ignore depth factors for drained loading			
Sorgado's shape factor for undrained loading:		$s_c = 1 + 0.17 \sqrt{\frac{d}{B}} = 1.22$	
Shape factors are all 1.0 for drained loading and so can be ignored			
<u>Undrained Bearing Resistance</u>			
Total overburden at foundation base is		$\sigma_{vk,b} = \gamma_k \times d = 32$	
Partial factors set R1: $\gamma_{Rv} = 1$			
Ultimate resistance is		$q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} = 660$	
Design Resistance is		$q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 660$	

Project Title: Worthing				
Shallow Foundation Pad Foundation				
Determination of Bearing Resistance	Calcs by	DF	Checked by	RP
<u>Drained Bearing Resistance</u>		Depth to Groundwater	2.5	
Effective overburden at foundation base is $\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} = 32.00$				
From overburden	$q'_{ult_1} = N_q \times \sigma'_{vk,b} =$		741	
From cohesion	$q'_{ult_2} = N_c \times c'_d =$		0	
From self-weight	$q'_{ult_3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right] =$		141	
Total resistance is	$q'_{ult} = \sum_{i=1}^3 q'_{ult_i} =$		882	
Design resistance is	$q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} =$		882	
<u>Design Approach 1</u>				
Combination 2 A2 + M2 + R1				
<u>Material Properties and Resistance</u>				
Partial factors set M2: $\gamma_{cu} = 1.4$ $\gamma_\phi = 1.25$ and $\gamma_c = 1.25$				
Design undrained strength is	$c_{ud} = \frac{c_{uk}}{\gamma_{cu}} =$		54	
Design shearing resistance is	$\phi_d = \text{TAN}^{-1} \left(\frac{\text{TAN } \phi_K}{\gamma_\phi} \right) =$		27	
Design cohesion is	$c'_d = \frac{c_k}{\gamma_c} =$		0	
<u>Drained Bearing Capacity Factors</u>				
For overburden	$N_q = \left[e^{(\pi \times \text{TAN}(\phi_d))} \times \left(\text{TAN} \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] =$ 12.58			
For cohesion	$N_c = [(N_q - 1) \times \text{COT}(\phi_d)] =$ 23.16			
For self-weight	$N_\gamma = [2(N_q - 1) \times \text{TAN}(\phi_d)] =$ 11.58			

Project Title:		Worthing		 Ground Condition Consultants																
Shallow Foundation		Pad Foundation																		
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP															
<u>Depth and Shape Factors</u> Solgado's depth factor for undrained loading: $d_c = 1 + 0.27\sqrt{\frac{d}{B}} = 1.34$ Ignore depth factors for drained loading Solgado's shape factor for undrained loading: $s_c = 1 + 0.17\sqrt{\frac{d}{B}} = 1.22$ Shape factors are all 1.0 for drained loading and so can be ignored <u>Undrained Bearing Resistance</u> Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 32$ Partial factors set R1: $\gamma_{Rv} = 1$ Ultimate resistance is $q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} = 481$ Design Resistance is $q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 481$ <u>Drained Bearing Resistance</u> Effective overburden at foundation base is $\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} = 32.00$ From overburden $q'_{ult1} = N_q \times \sigma'_{vk,b} = 402$ From cohesion $q'_{ult2} = N_c \times c'_d = 0$ From self-weight $q'_{ult3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right] = 59$ Total resistance is $q'_{ult} = \sum_{i=1}^3 q'_{ult_i} = 461$ Design Resistance is $q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} = 461$ <table border="1" data-bbox="288 1503 1031 1659"> <thead> <tr> <th rowspan="3">Design Approach</th> <th rowspan="3">Combination</th> <th colspan="2">Design Resistance</th> </tr> <tr> <th colspan="2">ULS (kN/m²)</th> </tr> <tr> <th>undrained</th> <th>drained</th> </tr> </thead> <tbody> <tr> <td rowspan="2">DA1</td> <td>Combination 1</td> <td>660</td> <td>882</td> </tr> <tr> <td>Combination 2</td> <td>481</td> <td>461</td> </tr> </tbody> </table>						Design Approach	Combination	Design Resistance		ULS (kN/m ²)		undrained	drained	DA1	Combination 1	660	882	Combination 2	481	461
Design Approach	Combination	Design Resistance																		
		ULS (kN/m ²)																		
		undrained	drained																	
DA1	Combination 1	660	882																	
	Combination 2	481	461																	

Stage 1

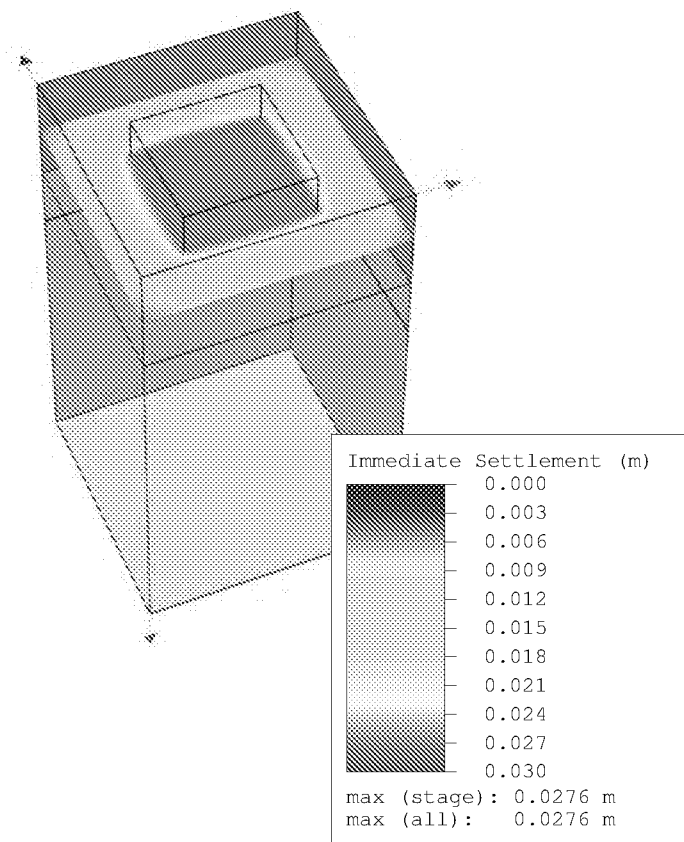
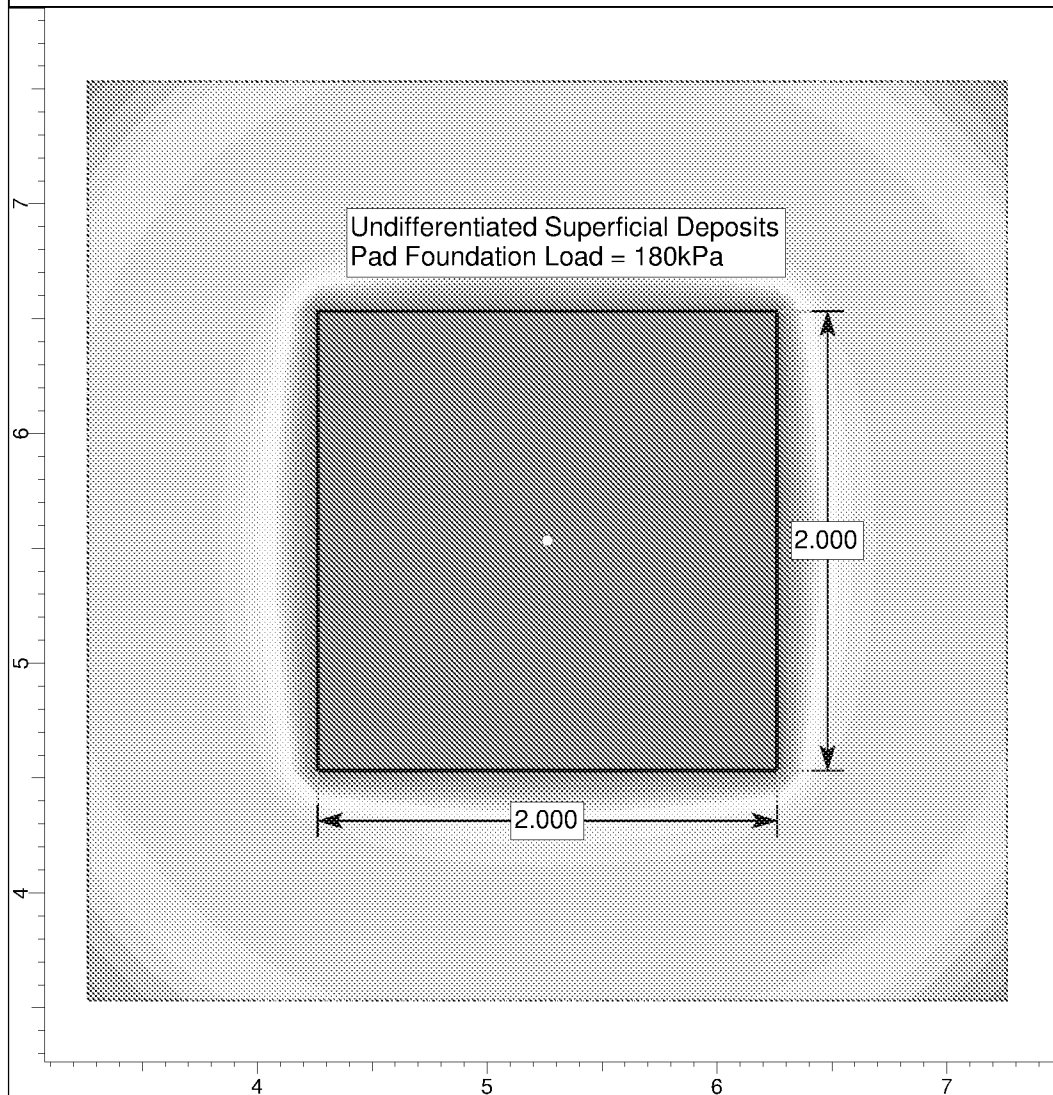
Data Type: Total Settlement



Project	Yeomans Honda Worthing		
Analysis Description	Pad Foundation		
Drawn By	Dr David Fall	Company	GCC
Date	08/08/2018	File Name	Strip Foundation 1.s3z

Stage 1

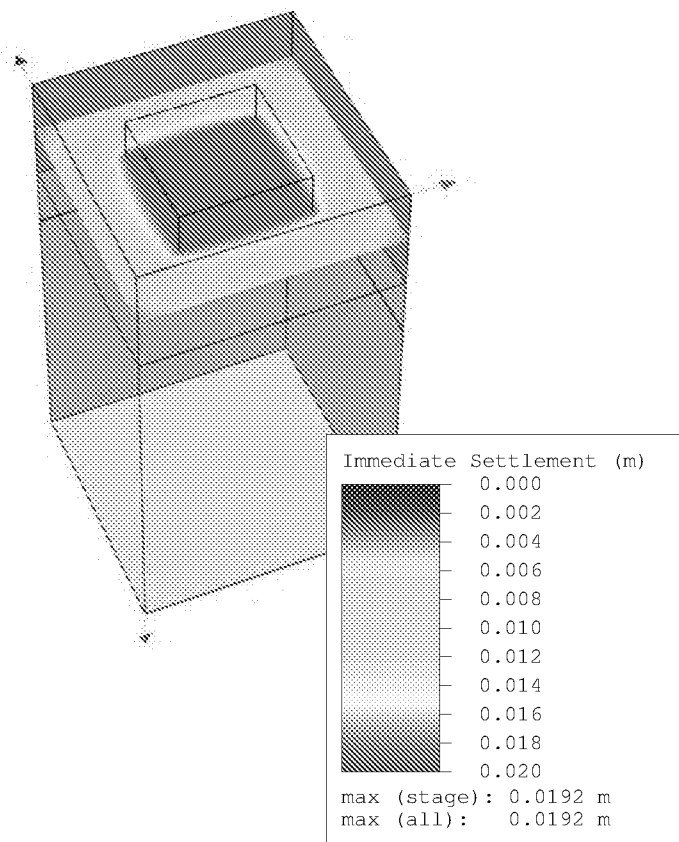
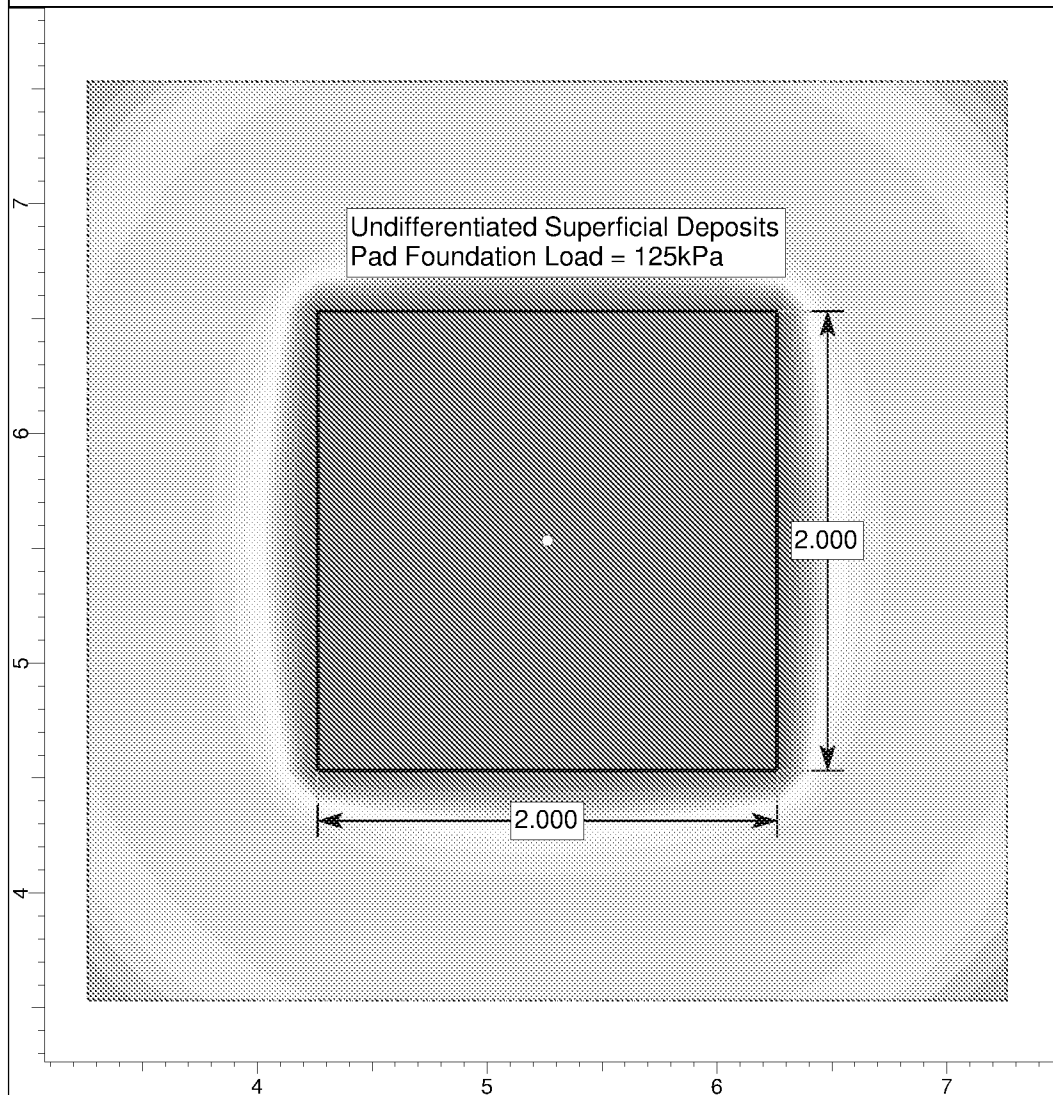
Data Type: Immediate Settlement



Project	Yeomans Honda Worthing		
Analysis Description	Pad Foundation		
Drawn By	Dr David Fall	Company	GCC
Date	08/08/2018	File Name	Strip Foundation 1.s3z

Stage 1

Data Type: Immediate Settlement



Project

Yeomans Honda Worthing

Analysis Description

Pad Foundation

Drawn By

Dr David Fall

Company

GCC

Date

08/08/2018

File Name

Strip Foundation 1.s3z

APPENDIX 9: DCP – CBR RESULTS

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Yeomans Honda
Client: Paul Basham Associates

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

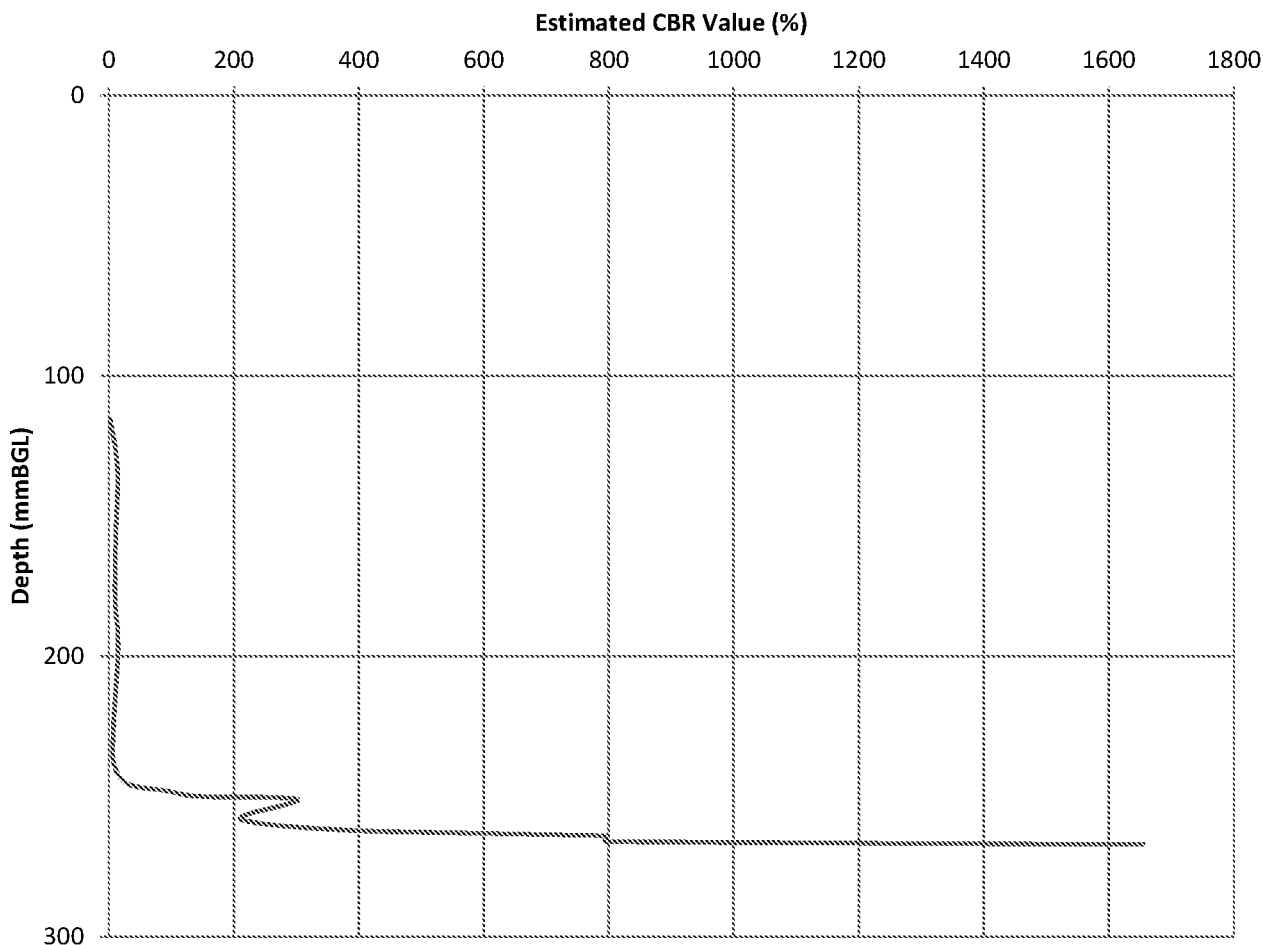


Project Number: J18-035
Location ID: CBR1

Date: 28/06/2018 **Engineer:** AP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 267

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	35	35	11.43	23.00
400	600	35	0	#DIV/0!	#DIV/0!
600	267	35	0	#DIV/0!	#DIV/0!

Comments:

Checked By:
AP

Date:
28/06/2018

Approved By:
RP

Date:
28/06/2018

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Yeomans Honda
Client: Paul Basham Associates

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

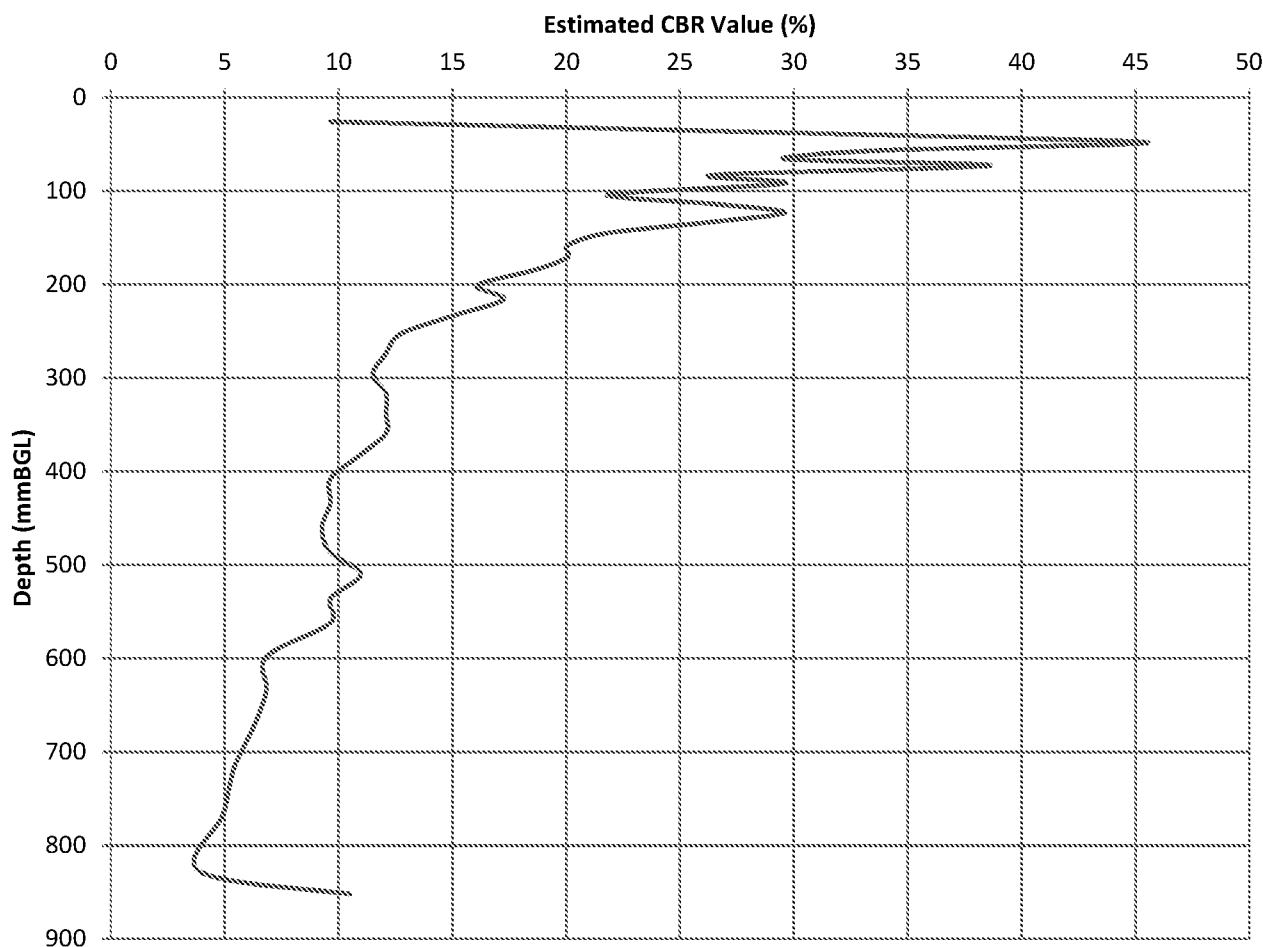


Project Number: J18-035
Location ID: CBR2

Date: 28/06/2018 **Engineer:** AP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 852

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	27	27	14.81	17.48
400	600	35	8	25.00	10.05
600	852	41	6	42.00	5.81

Comments:

Checked By:
AP

Date:
28/06/2018

Approved By:
RP

Date:
28/06/2018

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Yeomans Honda
Client: Paul Basham Associates

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

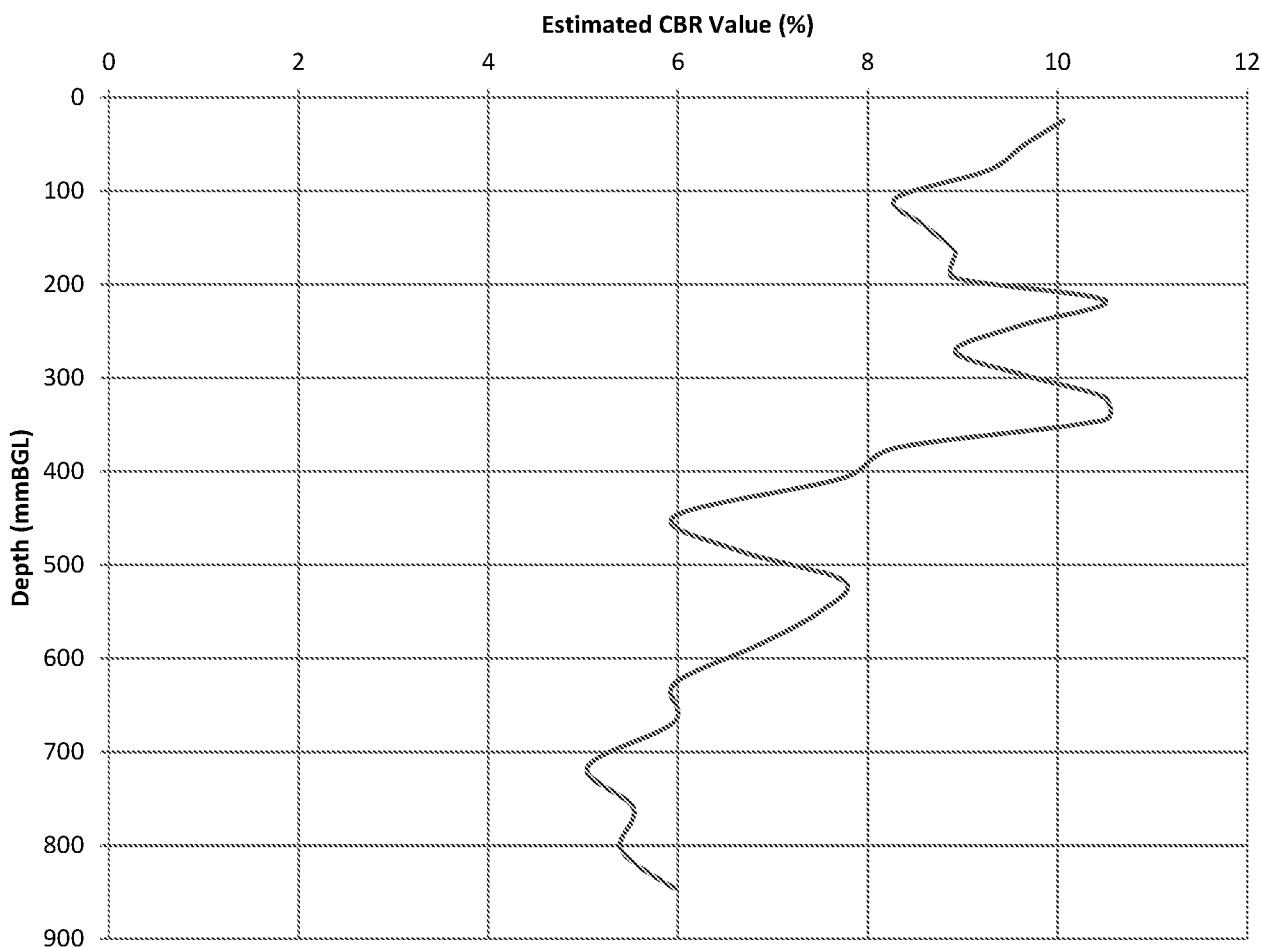


Project Number: J18-035
Location ID: CBR3

Date: 28/06/2018 **Engineer:** AP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 846

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	14	14	28.57	8.73
400	600	20	6	33.33	7.42
600	846	26	6	41.00	5.96

Comments:

Checked By:
 AP

Date:
 28/06/2018

Approved By:
 RP

Date:
 28/06/2018

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Yeomans Honda
Client: Paul Basham Associates

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

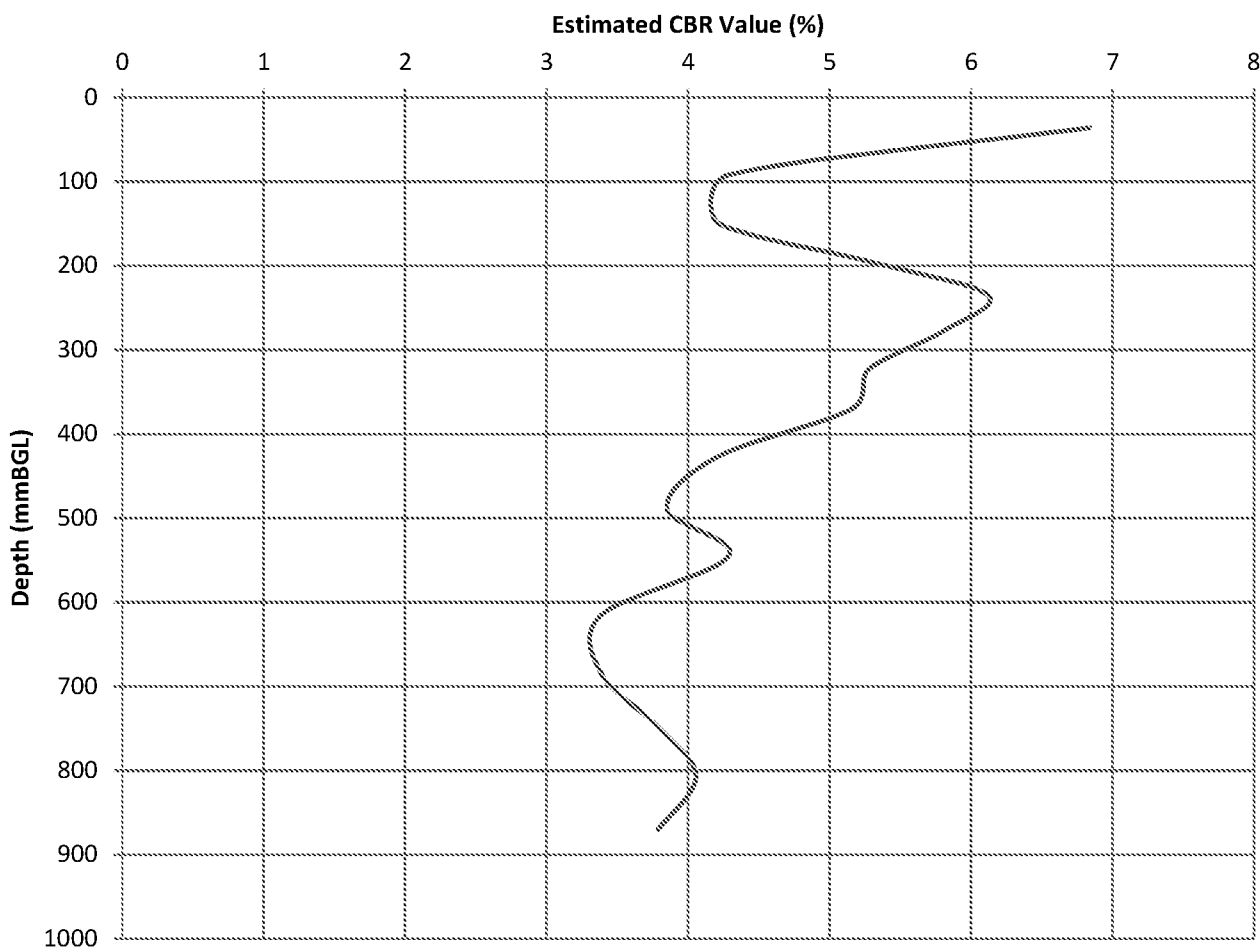


Project Number: J18-035
Location ID: CBR4

Date: 28/06/2018 **Engineer:** AP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 870

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	8	8	50.00	4.83
400	600	11	3	66.67	3.57
600	870	16	5	54.00	4.46

Comments:

Checked By:
AP

Date:
28/06/2018

Approved By:
RP

Date:
28/06/2018

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Yeomans Honda
Client: Paul Basham Associates

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

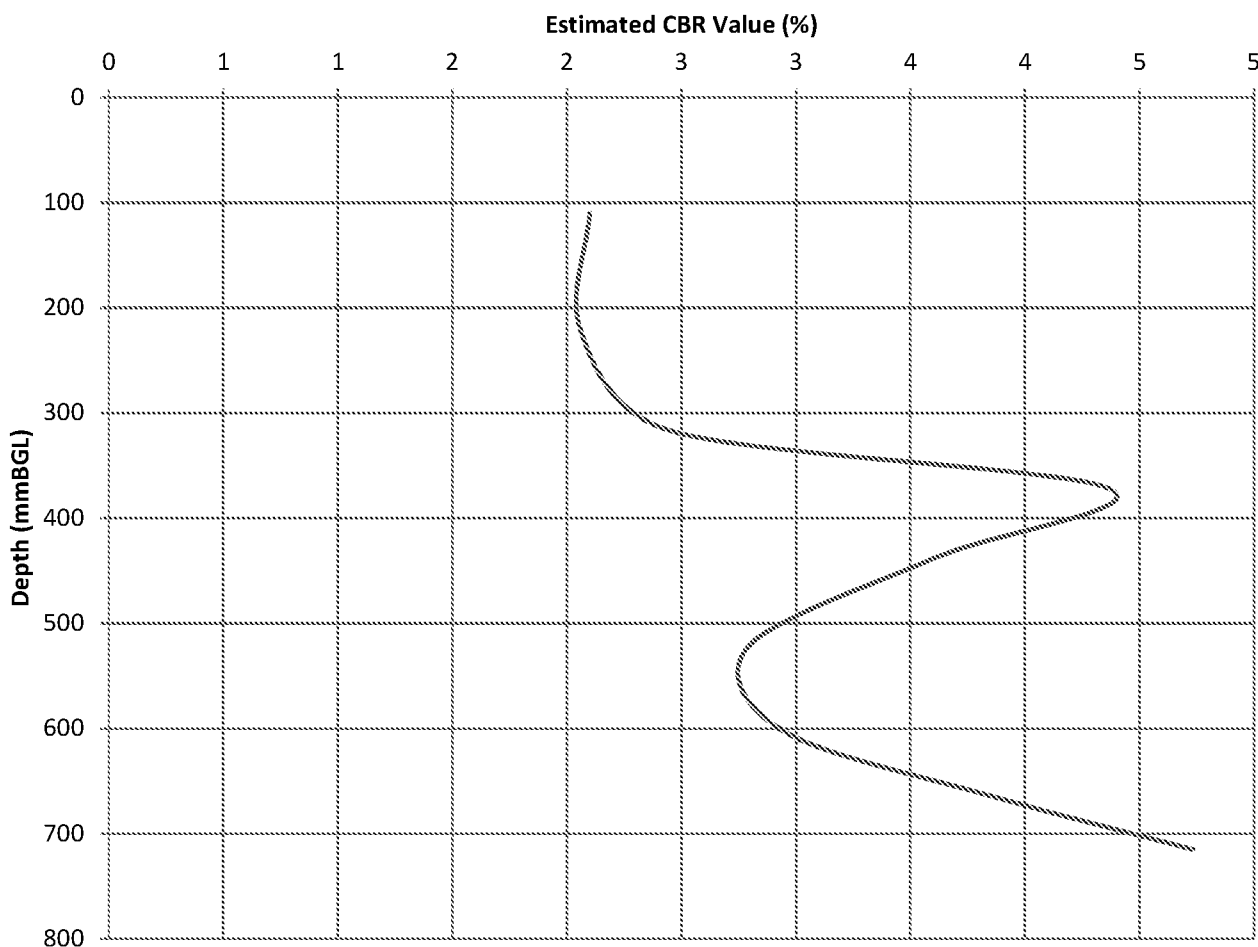


Project Number: J18-035
Location ID: CBR5

Date: 28/06/2018 **Engineer:** AP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 715

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	4	4	100.00	2.32
400	600	6	2	100.00	2.32
600	715	9	3	38.33	6.40

Comments:

Checked By:
AP

Date:
28/06/2018

Approved By:
RP

Date:
28/06/2018

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Yeomans Honda
Client: Paul Basham Associates

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

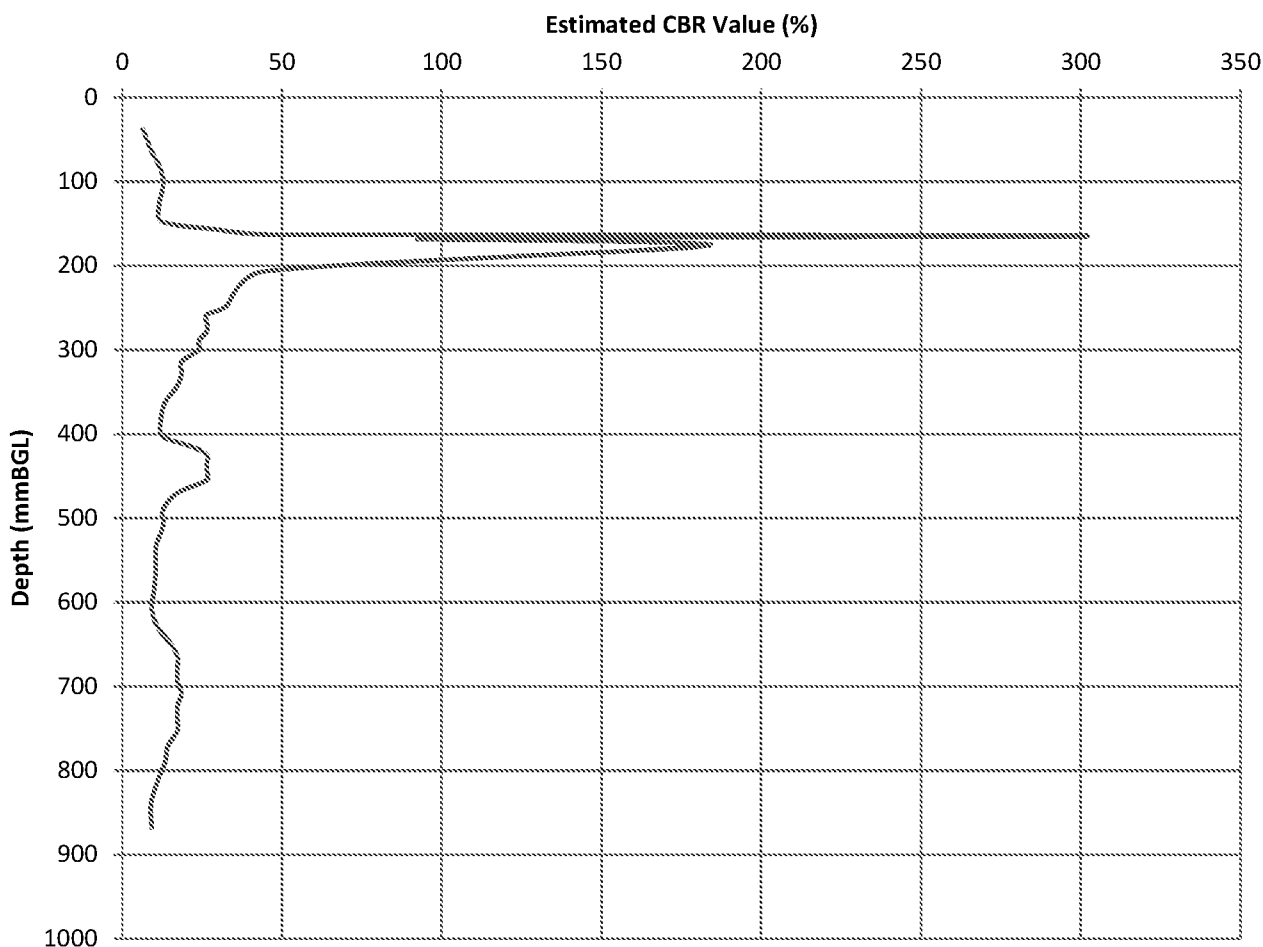


Project Number: J18-035
Location ID: CBR6

Date: 28/06/2018 **Engineer:** AP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 868

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	36	36	11.11	23.69
400	600	48	12	16.67	15.43
600	868	55	7	38.29	6.41

Comments:

Checked By:
AP

Date:
28/06/2018

Approved By:
RP

Date:
28/06/2018

APPENDIX 10: INFILTRATION TEST CALCULATIONS

Soakaway Calculations

Soakaway Test No. SA101 - Test 1
Contract: Yeoman's Honda
Contract No. J18-035

Field Test

Depth of Pit 0.86 m
Width of Pit 0.25 m
Length of Pit 0.30 m
Depth of Pit Soaked 0.40 m

ap50 0.295 m²
Vp75-25 0.015 m³
t75-25 549.5 min
water used 0.0300 m³
f 1.542E-06 m/sec.

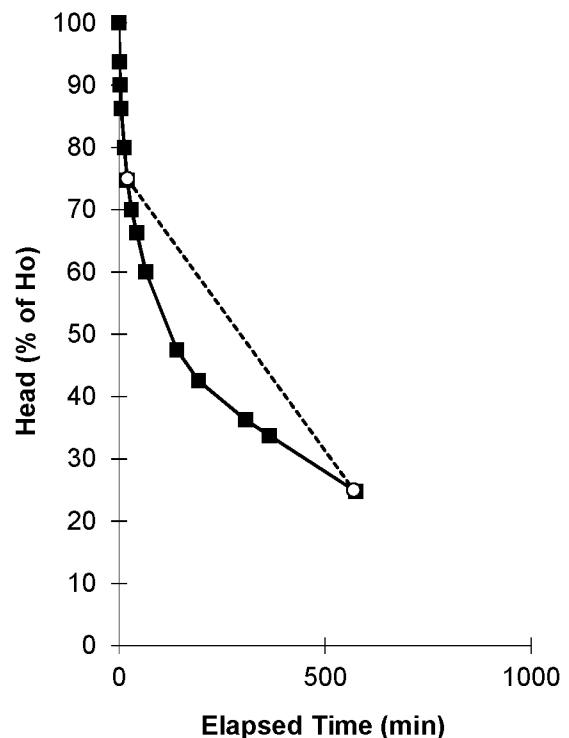
Trial Pit Log (include details of groundwater):

0.0-0.47m - Brown friable slightly clayey sandy gravelly SILT. Gravel is fine to medium angular chalk and angular to rounded flint.
0.47-0.85m - Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.46	0	100	0.40
0.49	1	94	0.38
0.50	3	90	0.36
0.52	5	86	0.35
0.54	13	80	0.32
0.56	20	75	0.30
0.58	30	70	0.28
0.60	43	66	0.27
0.62	65.0	60	0.24
0.67	140.0	48	0.19
0.69	193.0	43	0.17
0.72	307.0	36	0.15
0.73	365.0	34	0.14
0.76	575.0	25	0.10

T75 19.667 75
T25 569.167 25
T75-25 549.500 Derived from Best Fit



Comments

Final data point extrapolated due to slow infiltration. Therefore f value is indicative only.

GROUND CONDITION CONSULTANTS LTD

10 Waldegrave Close
Southampton, SO19 9RY

Soakaway Calculations

Soakaway Test No. SA101 - Test 2
Contract: Yeoman's Honda
Contract No. J18-035

Field Test

Depth of Pit 0.85 m
Width of Pit 0.25 m
Length of Pit 0.30 m
Depth of Pit Soaked 0.28 m

ap50 0.229 m²
Vp75-25 0.0105 m³
t75-25 282.3 min
water used 0.0210 m³
f 2.707E-06 m/sec.

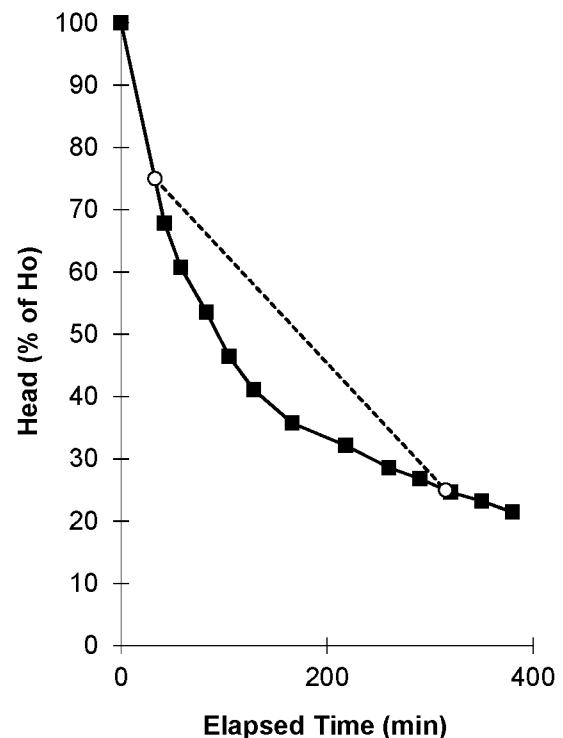
Trial Pit Log (include details of groundwater):

0.0-0.47m - Brown friable slightly clayey sandy gravelly SILT. Gravel is fine to medium angular chalk and angular to rounded flint.
0.47-0.85m - Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.57	0	100	0.28
0.66	42	68	0.19
0.68	58	61	0.17
0.70	83	54	0.15
0.72	105	46	0.13
0.74	129	41	0.12
0.75	166	36	0.10
0.76	218	32	0.09
0.77	260.0	29	0.08
0.78	290.0	27	0.08
0.78	320.0	25	0.07
0.79	350.0	23	0.06
0.79	380.0	21	0.06

T75 32.667 75
T25 315.000 25
T75-25 282.333 Derived from Best Fit



Comments

GROUND CONDITION CONSULTANTS LTD

10 Waldegrave Close
Southampton, SO19 9RY

Soakaway Calculations

Soakaway Test No. SA101 - Test 3
Contract: Yeoman's Honda
Contract No. J18-035

Field Test

Depth of Pit 0.83 m
Width of Pit 0.25 m
Length of Pit 0.30 m
Depth of Pit Soaked 0.26 m

ap50 0.21525 m²
Vp75-25 0.0095625 m³
t75-25 306.3 min
water used 0.0191 m³
f 2.418E-06 m/sec.

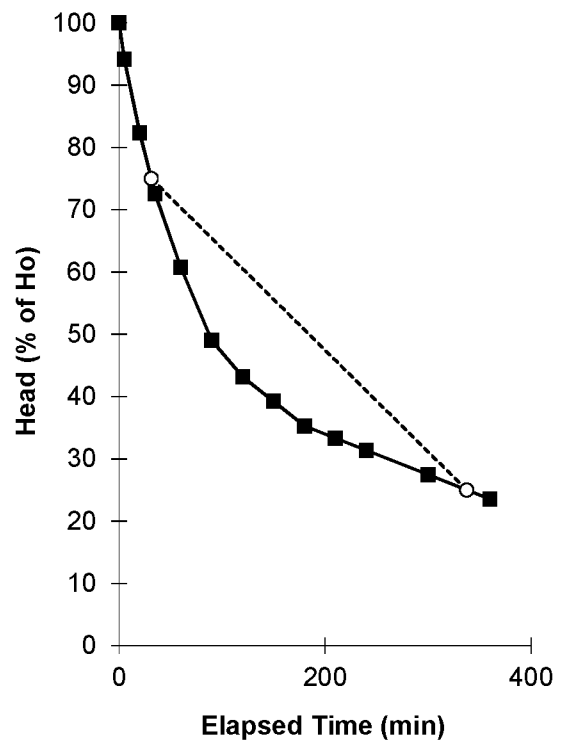
Trial Pit Log (include details of groundwater):

0.0-0.47m - Brown friable slightly clayey sandy gravelly SILT. Gravel is fine to medium angular chalk and angular to rounded flint.
0.47-0.85m - Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint.
(Grade Dm)

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.58	0	100	0.26
0.59	5	94	0.24
0.62	20	82	0.21
0.65	35	73	0.19
0.68	60	61	0.16
0.71	90	49	0.13
0.72	120	43	0.11
0.73	150	39	0.10
0.74	180.0	35	0.09
0.75	210.0	33	0.09
0.75	240.0	31	0.08
0.76	300.0	27	0.07
0.77	360.0	24	0.06

T75 31.250 75
T25 337.500 25
T75-25 306.250 Derived from Best Fit



Comments

GROUND CONDITION CONSULTANTS LTD

10 Waldegrave Close
Southampton, SO19 9RY

Soakaway Calculations

Soakaway Test No. SA102 - Test 1
Contract: Yeoman's Honda
Contract No. J18-035

Field Test

Depth of Pit 0.90 m
Width of Pit 0.30 m
Length of Pit 0.35 m
Depth of Pit Soaked 0.37 m

ap50 0.34225 m²
Vp75-25 0.0191625 m³
t75-25 1186.5 min
water used 0.0383 m³
f 7.865E-07 m/sec.

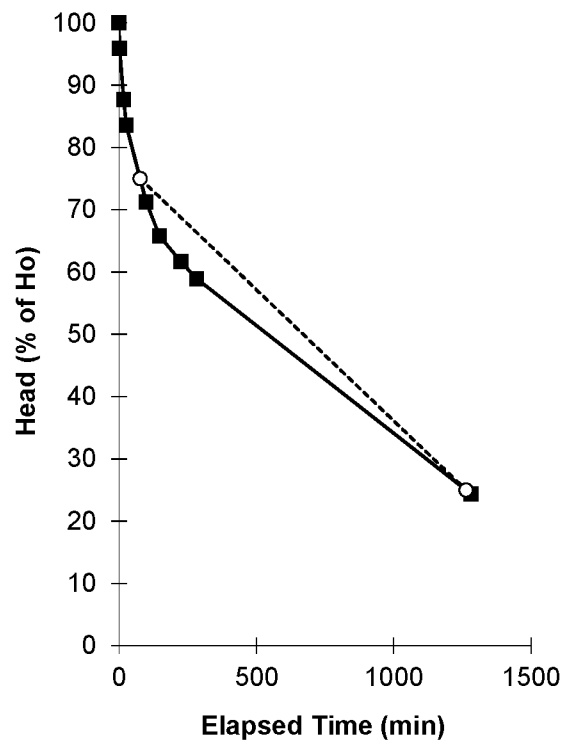
Trial Pit Log (include details of groundwater):

0.0-0.40m - Brown friable slightly clayey sandy gravelly SILT. Gravel is fine to medium angular chalk and angular to rounded flint. 0.40
0.60m - Light brown sandy gravelly SILT. Gravel is fine to medium subangular to rounded chalk and flint.
0.60-0.90m - Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.54	0	100	0.37
0.55	2	96	0.35
0.58	17	88	0.32
0.60	26	84	0.31
0.64	99	71	0.26
0.66	148	66	0.24
0.68	226	62	0.23
0.69	283	59	0.22
0.81	1281.0	24	0.09

T75 76.694 75
T25 1263.179 25
T75-25 1186.484 Derived from Best Fit



Comments

GROUND CONDITION CONSULTANTS LTD

10 Waldegrave Close
Southampton, SO19 9RY

Soakaway Calculations

Soakaway Test No. SA102 - Test 2
Contract: Yeoman's Honda
Contract No. J18-035

Field Test

Depth of Pit 0.86 m
Width of Pit 0.30 m
Length of Pit 0.35 m
Depth of Pit Soaked 0.42 m

ap50 0.378 m²
Vp75-25 0.02205 m³
t75-25 365.9 min
water used 0.0441 m³
f 2.657E-06 m/sec.

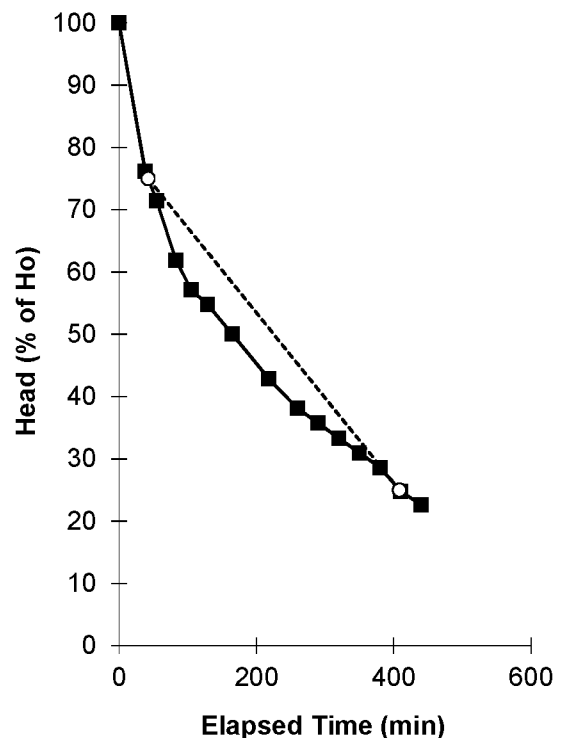
Trial Pit Log (include details of groundwater):

0.0-0.40m - Brown friable slightly clayey sandy gravelly SILT. Gravel is fine to medium angular chalk and angular to rounded flint. 0.40
0.60m - Light brown sandy gravelly SILT. Gravel is fine to medium subangular to rounded chalk and flint.
0.60-0.90m - Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.44	0	100	0.42
0.54	38	76	0.32
0.56	55	71	0.30
0.60	83	62	0.26
0.62	105	57	0.24
0.63	129	55	0.23
0.65	165	50	0.21
0.68	218	43	0.18
0.70	260.0	38	0.16
0.71	290.0	36	0.15
0.72	320.0	33	0.14
0.73	350.0	31	0.13
0.74	380.0	29	0.12
0.76	410.0	25	0.10
0.77	440.0	23	0.10

T75 42.250 75
T25 408.125 25
T75-25 365.875 Derived from Best Fit



Comments

GROUND CONDITION CONSULTANTS LTD

10 Waldegrave Close
Southampton, SO19 9RY

Soakaway Calculations

Soakaway Test No. SA102 - Test 3
Contract: Yeoman's Honda
Contract No. J18-035

Field Test

Depth of Pit 0.86 m
Width of Pit 0.30 m
Length of Pit 0.35 m
Depth of Pit Soaked 0.34 m

ap50 0.326 m²
Vp75-25 0.01785 m³
t75-25 505.0 min
water used 0.0357 m³
f 1.807E-06 m/sec.

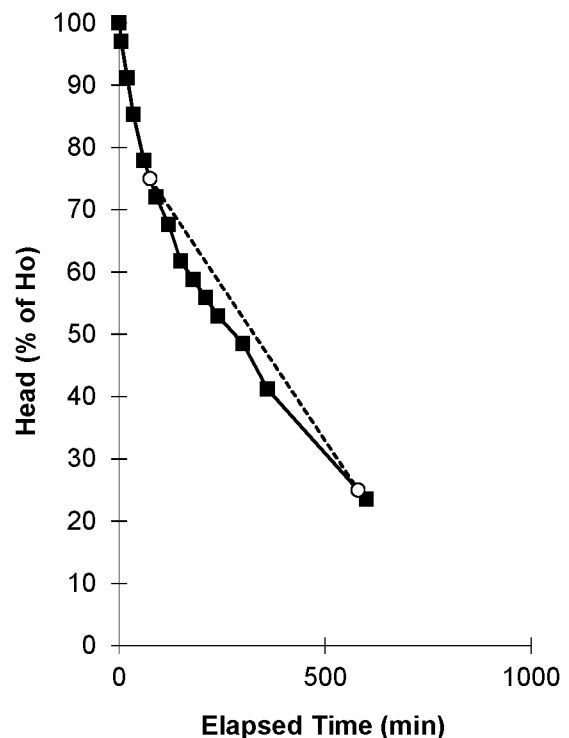
Trial Pit Log (include details of groundwater):

0.0-0.40m - Brown friable slightly clayey sandy gravelly SILT. Gravel is fine to medium angular chalk and angular to rounded flint. 0.40
0.60m - Light brown sandy gravelly SILT. Gravel is fine to medium subangular to rounded chalk and flint.
0.60-0.90m - Structureless CHALK composed of light brown to off-white sandy gravelly SILT with occasional cobbles. Gravel and cobbles are of angular to sub angular chalk and occasional angular to rounded flint. (Grade Dm)

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.52	0	100	0.34
0.53	5	97	0.33
0.55	20	91	0.31
0.57	35	85	0.29
0.60	60	78	0.27
0.62	90	72	0.25
0.63	120	68	0.23
0.65	150	62	0.21
0.66	180.0	59	0.20
0.67	210.0	56	0.19
0.68	240.0	53	0.18
0.70	300.0	49	0.17
0.72	360.0	41	0.14
0.78	600.0	24	0.08

T75 75.000 75
T25 580.000 25
T75-25 505.000 Derived from Best Fit



Comments

Final data point extrapolated due to slow infiltration. Therefore f value is indicative only.

GROUND CONDITION CONSULTANTS LTD

10 Waldegrave Close
Southampton, SO19 9RY